Classification of American English Vowels

Part of the Tongue Involved

Tongue Height	FRONT ⟵	CENTRAL	⟶ BACK	
HIGH	**i** b**ee**t		b**oo**t **u**	
↑	**ɪ** b**i**t		p**u**t **ʊ**	ROUNDED
MID	**e** b**ai**t		b**oa**t **o**	
	ɛ b**e**t	**ə** Ros**a**		
↓		**ʌ** b**u**tt	b**o**re **ɔ**	
LOW	**æ** b**a**t		b**o**mb **a**	

A Phonetic Alphabet for English Pronunciation

Consonants						Vowels			
p	**p**ill	t	**t**ill	k	**k**ill	i	b**ee**t	ɪ	b**i**t
b	**b**ill	d	**d**ill	g	**g**ill	e	b**ai**t	ɛ	b**e**t
m	**m**ill	n	**n**il	ŋ	ri**ng**	u	b**oo**t	ʊ	f**oo**t
f	**f**eel	s	**s**eal	h	**h**eal	o	b**oa**t	ɔ	b**o**re
v	**v**eal	z	**z**eal	l	**l**eaf	æ	b**a**t	a	p**o**t/b**a**r
θ	**th**igh	tʃ	**ch**ill	r	**r**eef	ʌ	b**u**tt	ə	sof**a**
ð	**th**y	dʒ	**g**in	j	**y**ou	aɪ	b**i**te	aʊ	b**ou**t
ʃ	**sh**ill	ʍ	**wh**ich	w	**w**itch	ɔɪ	b**oy**		
ʒ	mea**s**ure								

1

What Is Language?

> When we study human language, we are approaching what some might call the "human essence," the distinctive qualities of mind that are, so far as we know, unique to man.
>
> **NOAM CHOMSKY,** *Language and Mind*, 1968

Whatever else people do when they come together—whether they play, fight, make love, or make automobiles—they talk. We live in a world of language. We talk to our friends, our associates, our wives and husbands, our lovers, our teachers, our parents, our rivals, and even our enemies. We talk to bus drivers and total strangers. We talk face-to-face and over the telephone, and everyone responds with more talk. Television and radio further swell this torrent of words. Hardly a moment of our waking lives is free from words, and even in our dreams we talk and are talked to. We also talk when there is no one to answer. Some of us talk aloud in our sleep. We talk to our pets and sometimes to ourselves.

The possession of language, perhaps more than any other attribute, distinguishes humans from other animals. To understand our humanity, one must understand the nature of language that makes us human. According to the philosophy expressed in the myths and religions of many peoples, language is the source of human life and power. To some people of Africa, a newborn child is a *kintu*, a "thing," not yet a *muntu*, a "person." Only by the act of learning language does the child become a human being. According to this tradition, we all become "human" because we all know at least one language. But what does it mean to "know" a language?

Linguistic Knowledge

> Do we know only what we see, or do we see what we somehow already know?
>
> **CYNTHIA OZICK,** "What Helen Keller Saw," *New Yorker*, June 16 & 23, 2003

When you know a language, you can speak and be understood by others who know that language. This means you have the capacity to produce sounds that signify certain meanings and to understand or interpret the sounds produced by others. But language is much more than speech. Deaf people produce and understand sign languages just as hearing persons produce and understand spoken languages. The languages of the deaf communities throughout the world are equivalent to spoken languages, differing only in their modality of expression.

Most everyone knows at least one language. Five-year-old children are nearly as proficient at speaking and understanding as their parents. Yet the ability to carry out the simplest conversation requires profound knowledge that most speakers are unaware of. This is true for speakers of all languages, from Albanian to Zulu. A speaker of English can produce a sentence having two relative clauses without knowing what a relative clause is, such as

> My goddaughter who was born in Sweden and who now lives in Iowa is named Disa, after a Viking queen.

In a parallel fashion, a child can walk without understanding or being able to explain the principles of balance and support or the neurophysiological control mechanisms that permit one to do so. The fact that we may know something unconsciously is not unique to language.

What, then, do speakers of English or Quechua or French or Mohawk or Arabic know?

Knowledge of the Sound System

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Part of knowing a language means knowing what sounds (or signs[1]) are in that language and what sounds are not. One way this unconscious knowledge is revealed is by the way speakers of one language pronounce words from another

[1]The sign languages of the deaf will be discussed throughout the book. A reference to "language," then, unless speech sounds or spoken languages are specifically mentioned, includes both spoken and signed languages.

language. If you speak only English, for example, you may substitute an English sound for a non-English sound when pronouncing "foreign" words like French *ménage à trois*. If you pronounce it as the French do you are using sounds outside the English sound system.

French people speaking English often pronounce words like *this* and *that* as if they were spelled *zis* and *zat*. The English sound represented by the initial letters *th* in these words is not part of the French sound system, and the French mispronunciation reveals the speaker's unconscious knowledge of this fact.

Knowing the sound system of a language includes more than knowing the inventory of sounds. It means also knowing which sounds may start a word, end a word, and follow each other. The name of a former president of Ghana was *Nkrumah*, pronounced with an initial sound like the sound ending the English word *sink*. While this is an English sound, no word in English begins with the *nk* sound. Speakers of English who have occasion to pronounce this name often mispronounce it (by Ghanaian standards) by inserting a short vowel sound, like *Nekrumah* or *Enkrumah*. Children who learn English recognize that *nk* cannot begin a word, just as Ghanaian children learn that words in their language can and do begin with the *nk* sound.

We will learn more about sounds and sound systems in chapters 6 and 7.

Knowledge of Words

Knowing the sounds and sound patterns in our language constitutes only one part of our linguistic knowledge. Knowing a language means also knowing that certain sequences of sounds signify certain concepts or **meanings**. Speakers of English know what *boy* means, and that it means something different from *toy* or *girl* or *pterodactyl*. You also know that *toy* and *boy* are words, but *moy* is not. When you know a language, you know words in that language, that is, which sequences of sounds are related to specific meanings and which are not.

Arbitrary Relation of Form and Meaning

> The minute I set eyes on an animal I know what it is. I don't have to reflect a moment; the right name comes out instantly. I seem to know just by the shape of the creature and the way it acts what animal it is. When the dodo came along he [Adam] thought it was a wildcat. But I saved him. I just spoke up in a quite natural way and said, "Well, I do declare if there isn't the dodo!"
>
> **MARK TWAIN,** *Eve's Diary*, 1906

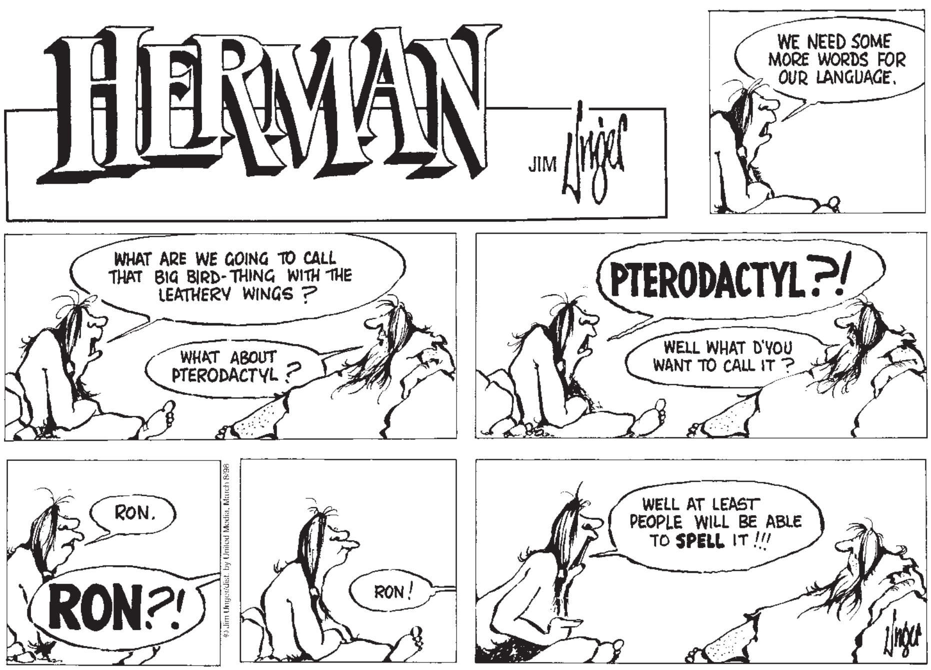
If you do not know a language, the words (and sentences) of that language will be mainly incomprehensible, because the relationship between speech sounds and the meanings they represent is, for the most part, an **arbitrary** one. When you are acquiring a language you have to learn that the sounds represented by the letters *house* signify the concept ; if you know French, this same meaning is represented by *maison*; if you know Russian, by *dom*; if you know Spanish, by *casa*. Similarly,  is represented by *hand* in English, *main* in French, *nsa* in Twi, and *ruka* in Russian.

The following are words in some different languages. How many of them can you understand?

a. kyinii
b. doakam
c. odun
d. asa
e. toowq
f. bolna
g. wartawan
h. inaminatu
i. yawwa

People who know the languages from which these words are taken understand that they have the following meanings:

a. a large parasol (in Twi, a Ghanaian language)
b. living creature (in Tohono O'odham, an American Indian language)
c. wood (in Turkish)
d. morning (in Japanese)
e. is seeing (in Luiseño, a California Indian language)
f. to speak (in Hindi-Urdu); aching (in Russian)
g. reporter (in Indonesian)
h. teacher (in Warao, a Venezuelan Indian language)
i. right on! (in Hausa, a Nigerian language)



These examples show that the words of a particular language have the meanings they do only by convention. Despite what Eve says in Mark Twain's satire *Eve's Diary*, a pterodactyl could have been called *ron*, *blick*, or *kerplunkity*.

As Juliet says in Shakespeare's *Romeo and Juliet*:

> What's in a name? That which we call a rose
> By any other name would smell as sweet.

This **conventional** and arbitrary relationship between the **form** (sounds) and **meaning** (concept) of a word is also true in sign languages. If you see someone using a sign language you do not know, it is doubtful that you will understand the message from the signs alone. A person who knows Chinese Sign Language (CSL) would find it difficult to understand American Sign Language (ASL), and vice versa, as illustrated in Figure 1.1.

Many signs were originally like miming, where the relationship between form and meaning is not arbitrary. Bringing the hand to the mouth to mean "eating," as in miming, would be nonarbitrary as a sign. Over time these signs may change, just as the pronunciation of words changes, and the miming effect is lost. These signs become conventional, so that knowing the shape or movement of the hands does not reveal the meaning of the gestures in sign languages, as also shown in Figure 1.1.

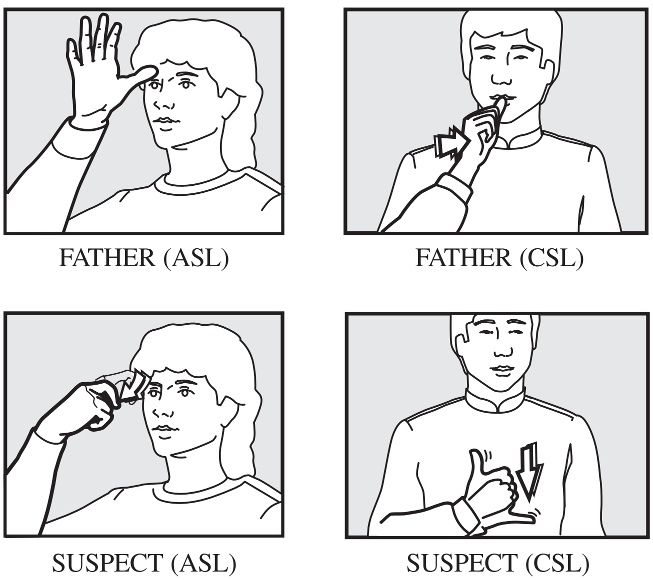


FIGURE 1.1 | Arbitrary relation between gestures and meanings of the signs for *father* and *suspect* in ASL and CSL.[2]

[2]From Poizner, Howard, Edward Klima, and Ursula Bellugi. "What the Hands Reveal about the Brain" figure: "Arbitrary relationship between gestures and meanings in ASL and CSL," Copyright © 1987 Massachusetts Institute of Technology, by permission of The MIT Press.

There is some **sound symbolism** in language—that is, words whose pronunciation suggests the meaning. Most languages contain **onomatopoeic** words like *buzz* or *murmur* that imitate the sounds associated with the objects or actions they refer to. But even here, the sounds differ from language to language, reflecting the particular sound system of the language. In English *cock-a-doodle-doo* is an onomatopoeic word whose meaning is the crow of a rooster, whereas in Finnish the rooster's crow is *kukkokiekuu*. Forget *gobble gobble* when you're in Istanbul; a turkey in Turkey goes *glu-glu*.

Sometimes particular sound sequences seem to relate to a particular concept. In English many words beginning with *gl* relate to sight, such as *glare*, *glint*, *gleam*, *glitter*, *glossy*, *glaze*, *glance*, *glimmer*, *glimpse*, and *glisten*. However, *gl* words and their like are a very small part of any language, and *gl* may have nothing to do with "sight" in another language, or even in other words in English, such as *gladiator*, *glucose*, *glory*, *glutton*, *globe*, and so on.

English speakers know the *gl* words that relate to sight and those that do not; they know the onomatopoeic words and all the words in the basic vocabulary of the language. No speaker of English knows all 472,000 entries in *Webster's Third New International Dictionary*. And even if someone did know all the words in *Webster's*, that person would still not know English. Imagine trying to learn a foreign language by buying a dictionary and memorizing words. No matter how many words you learned, you would not be able to form the simplest phrases or sentences in the language, or understand a native speaker. No one speaks in isolated words. Of course, you could search in your traveler's dictionary for individual words to find out how to say something like "car—gas—where?" After many tries, a native might understand this question and then point in the direction of a gas station. If he answered you with a sentence, however, you probably would not understand what was said or be able to look it up, because you would not know where one word ended and another began. Chapter 4 will discuss how words are put together to form phrases and sentences, and chapter 5 will explore word and sentence meanings.

The Creativity of Linguistic Knowledge

ALBERT: So are you saying that you were the best friend of the woman who was married to the man who represented your husband in divorce?

ANDRÉ: In the history of speech, that sentence has never been uttered before.

NEIL SIMON, *The Dinner Party*, 2000

Knowledge of a language enables you to combine sounds to form words, words to form phrases, and phrases to form sentences. You cannot buy a dictionary or phrase book of any language with all the sentences of the language. No dictionary can list all the possible sentences, because the number of sentences in a language is infinite. Knowing a language means being able to produce new sentences never spoken before and to understand sentences never heard before. The linguist Noam Chomsky, one of the people most responsible for the modern revolution in language and cognitive science, refers to this ability as part of the **creative aspect** of language use. Not every speaker of a language can create great literature, but everybody who knows a language can and does create new sentences when speaking and understands new sentences created by others, a fact expressed more than 400 years ago by Huarte de San Juan (1530–1592): "Normal human minds are such that . . . without the help of anybody, they will produce 1,000 (sentences) they never heard spoke of . . . inventing and saying such things as they never heard from their masters, nor any mouth."

In pointing out the creative aspect of language, Chomsky made a powerful argument against the behaviorist view of language that prevailed in the first half of the twentieth century, which held that language is a set of learned responses to stimuli. While it is true that if someone steps on your toes you may automatically respond with a scream or a grunt, these sounds are not part of language. They are involuntary reactions to stimuli. After we reflexively cry out, we can then go on to say: "Thank you very much for stepping on my toe, because I was afraid I had elephantiasis and now that I can feel the pain I know I don't," or any one of an infinite number of sentences, because the particular sentences we produce are not controlled by any stimulus.

Even some involuntary cries like "ouch" are constrained by our own language system, as are the filled pauses that are sprinkled through conversational speech, such as *er*, *uh*, and *you know* in English. They contain only the sounds found in the language. French speakers, for example, often fill their pauses with the vowel sound that starts their word for egg—*oeuf*—a sound that does not occur in English.

Our creative ability is reflected not only in what we say but also includes our understanding of new or novel sentences. Consider the following sentence: "Daniel Boone decided to become a pioneer because he dreamed of pigeon-toed giraffes and cross-eyed elephants dancing in pink skirts and green berets on the wind-swept plains of the Midwest." You may not believe the sentence; you may question its logic; but you can understand it, although you have probably never heard or read it before now.

Knowledge of a language, then, makes it possible to understand and produce new sentences. If you counted the number of sentences in this book that you have seen or heard before, the number would be small. Next time you write an essay or a letter, see how many of your sentences are new. Few sentences are stored in your brain, to be pulled out to fit some situation or matched with some sentence that you hear. Novel sentences never spoken or heard before cannot be stored in your memory.

Simple memorization of all the possible sentences in a language is impossible in principle. If for every sentence in the language a longer sentence can be formed, then there is no limit to the number of sentences. In English you can say:

This is the house.

or

This is the house that Jack built.

or

This is the malt that lay in the house that Jack built.

or

> This is the dog that worried the cat that killed the rat that ate the malt that lay in the house that Jack built.

And you need not stop there. How long, then, is the longest sentence? A speaker of English can say:

> The old man came.

or

> The old, old, old, old, old man came.

How many "olds" are too many? Seven? Twenty-three?

It is true that the longer these sentences become, the less likely we would be to hear or to say them. A sentence with 276 occurrences of "old" would be highly unusual in either speech or writing, even to describe Methuselah. But such a sentence is theoretically possible. If you know English, you have the knowledge to add any number of adjectives as modifiers to a noun and to form sentences with an indefinite number of clauses, as in "the house that Jack built."

All human languages permit their speakers to increase the length and complexity of sentences in these ways; creativity is a universal property of human language.

Knowledge of Sentences and Nonsentences

To memorize and store an infinite set of sentences would require an infinite storage capacity. However, the brain is finite, and even if it were not, we could not store novel sentences, which are, well, novel. When you learn a language you must learn something finite—your vocabulary is finite (however large it may be)—and that can be stored. If sentences were formed simply by placing one word after another in any order, then a language could be defined simply as a set of words. But you can see that knowledge of words is not enough by examining the following strings of words:

1. **a.** John kissed the little old lady who owned the shaggy dog.
   b. Who owned the shaggy dog John kissed the little old lady.
   c. John is difficult to love.
   d. It is difficult to love John.
   e. John is anxious to go.
   f. It is anxious to go John.
   g. John, who was a student, flunked his exams.
   h. Exams his flunked student a was who John.

If you were asked to put an asterisk or star before the examples that seemed ill formed or ungrammatical or "no good" to you, which ones would you mark? Our intuitive knowledge about what is or is not an allowable sentence in English convinces us to star *b*, *f*, and *h*. Which ones did you star?

Would you agree with the following judgments?

2. a. What he did was climb a tree.
   b. *What he thought was want a sports car.[3]
   c. Drink your beer and go home!
   d. *What are drinking and go home?
   e. I expect them to arrive a week from next Thursday.
   f. *I expect a week from next Thursday to arrive them.
   g. Linus lost his security blanket.
   h. *Lost Linus security blanket his.

If you find the starred sentences unacceptable, as we do, you see that not every string of words constitutes a well-formed sentence in a language. Our knowledge of a language determines which strings of words are well-formed sentences and which are not. Therefore, in addition to knowing the words of the language, linguistic knowledge includes *rules* for forming sentences and making the kinds of judgments you made about the examples in (1) and (2). These rules must be finite in length and finite in number so that they can be stored in our finite brains. Yet, they must permit us to form and understand an infinite set of new sentences. They are not rules determined by a judge or a legislature, or even rules taught in a grammar class. They are unconscious rules that we acquire as young children as we develop language.

A language, then, consists of all the sounds, words, and infinitely many possible sentences. When you know a language, you know the sounds, the words, and the rules for their combination.

Linguistic Knowledge and Performance

> "What's one and one and one and one and one and one and one and one and one and one?" "I don't know," said Alice. "I lost count." "She can't do Addition," the Red Queen interrupted.
>
> **LEWIS CARROLL,** *Through the Looking-Glass*, 1871

Our linguistic knowledge permits us to form longer and longer sentences by joining sentences and phrases together or adding modifiers to a noun. Whether we stop at three, five, or eighteen adjectives, it is impossible to limit the number we could add if desired. Very long sentences are theoretically possible, but they are highly improbable. Evidently, there is a difference between having the knowledge necessary to produce sentences of a language and applying this knowledge. It is a difference between what we know, which is our **linguistic competence**, and how we use this knowledge in actual speech production and comprehension, which is our **linguistic performance**.

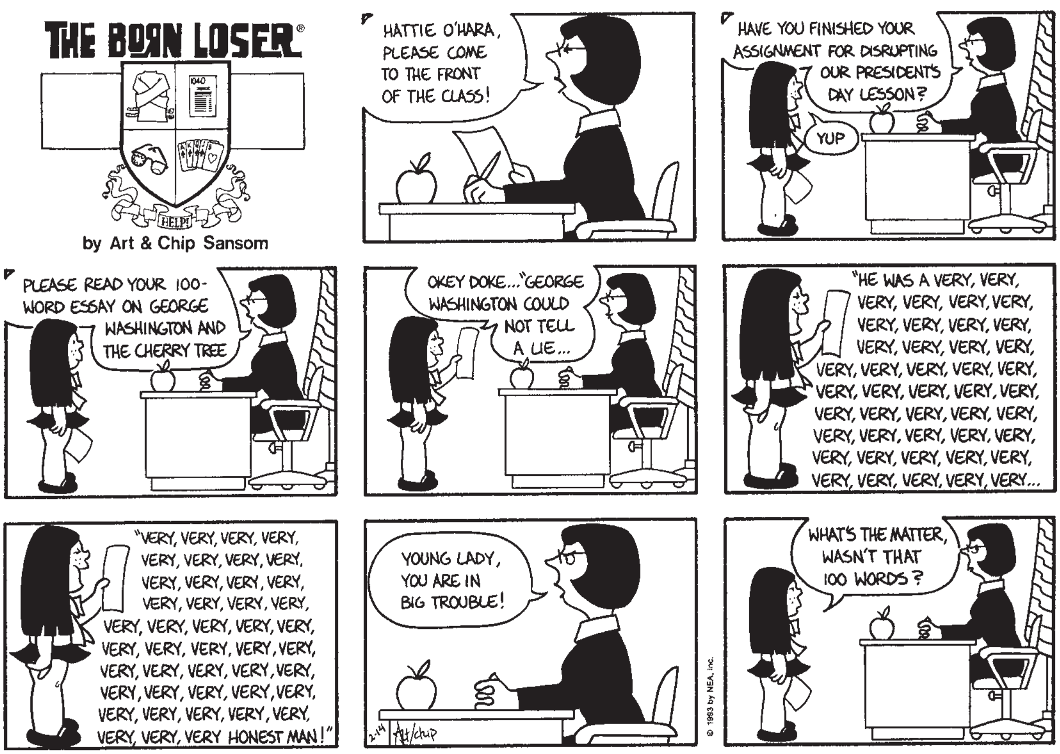
Speakers of all languages have the knowledge to understand or produce sentences of any length. Here is an example from the ruling of a federal judge:

[3]The asterisk is used before examples that speakers find ungrammatical. This notation will be used throughout the book.

> We invalidate the challenged lifetime ban because we hold as a matter of federal constitutional law that a state initiative measure cannot impose a severe limitation on the people's fundamental rights when the issue of whether to impose such a limitation on these rights is put to the voters in a measure that is ambiguous on its face and that fails to mention in its text, the proponent's ballot argument, or the state's official description, the severe limitation to be imposed.

However, there are physiological and psychological reasons that limit the number of adjectives, adverbs, clauses, and so on that we actually produce and understand. Speakers may run out of breath, lose track of what they have said, or die of old age before they are finished. Listeners may become confused, tired, bored, or disgusted.

When we speak, we usually wish to convey some message. At some stage in the act of producing speech, we must organize our thoughts into strings of words. Sometimes the message is garbled. We may stammer, or pause, or produce **slips of the tongue**. We may even sound like Hattie in the cartoon, who illustrates the difference between linguistic knowledge and the way we use that knowledge in performance.



"The Born Loser" © Newspaper Enterprise Association, Inc.

For the most part, linguistic knowledge is unconscious knowledge. The linguistic system—the sounds, structures, meanings, words, and rules for putting them all together—is acquired with no conscious awareness. Just as we may not be conscious of the principles that allow us to stand or walk, we are unaware of the rules of language. Our ability to speak, to understand, and to make judgments about the grammaticality of sentences reveals our knowledge of the rules of our language. This knowledge represents a complex cognitive system. The nature of this system is what this book is all about.

What Is Grammar?

> We use the term "grammar" with a systematic ambiguity. On the one hand, the term refers to the explicit theory constructed by the linguist and proposed as a description of the speaker's competence. On the other hand, it refers to this competence itself.
>
> **NOAM CHOMSKY AND MORRIS HALLE,** *The Sound Pattern of English*, 1968

Descriptive Grammars

> There are no primitive languages. The great and abstract ideas of Christianity can be discussed even by the wretched Greenlanders.
>
> **JOHANN PETER SUESSMILCH,** in a paper delivered before the Prussian Academy, 1756

The way we are using the word *grammar* differs from most common usages. In our sense, the grammar is the knowledge speakers have about the units and rules of their language—rules for combining sounds into words (called phonology), rules of word formation (called morphology), rules for combining words into phrases and phrases into sentences (called syntax), as well as the rules for assigning meaning (called semantics). The grammar, together with a mental dictionary (called a lexicon) that lists the words of the language, represents our linguistic competence. To understand the nature of language we must understand the nature of grammar.

Every human being who speaks a language knows its grammar. When linguists wish to describe a language, they make explicit the rules of the grammar of the language that exist in the minds of its speakers. There will be some differences among speakers, but there must be shared knowledge too. The shared knowledge—the common parts of the grammar—makes it possible to communicate through language. To the extent that the linguist's description is a true model of the speakers' linguistic capacity, it is a successful description of the grammar and of the language itself. Such a model is called a **descriptive grammar**. It does not tell you how you *should* speak; it describes your basic linguistic knowledge. It explains how it is possible for you to speak and understand and make judgments about well-formedness, and it tells what you know about the sounds, words, phrases, and sentences of your language.

When we say in later chapters that a sentence is **grammatical** we mean that it conforms to the rules of the mental grammar (as described by the linguist); when we say that it is **ungrammatical**, we mean it deviates from the rules in some way. If, however, we posit a rule for English that does not agree with your intuitions as a speaker, then the grammar we are describing differs in some way from the mental grammar that represents your linguistic competence; that is, your language is not the one described. No language or variety of a language (called a **dialect**) is superior to any other in a linguistic sense. Every grammar is equally complex, logical, and capable of producing an infinite set of sentences to express any thought. If something can be expressed in one language or one dialect, it can be expressed in any other language or dialect. It might involve different means and different words, but it can be expressed. We will have more to say about dialects in chapter 10. This is true as well for languages of technologically underdeveloped cultures. The grammars of these languages are not primitive or ill formed in any way. They have all the richness and complexity of the grammars of languages spoken in technologically advanced cultures.

Prescriptive Grammars

> It is certainly the business of a grammarian to find out, and not to make, the laws of a language.
>
> **JOHN FELL,** *Essay towards an English Grammar*, 1784

> Just read the sentence aloud, Amanda, and listen to how it sounds. If the sentence sounds OK, go with it. If not, rearrange the pieces. Then throw out the rule books and go to bed.
>
> **JAMES KILPATRICK,** "Writer's Art" (syndicated newspaper column), 1998

> Any fool can make a rule
> And every fool will mind it
>
> **HENRY DAVID THOREAU,** journal entry, 1860

Not all grammarians, past or present, share the view that all grammars are equal. Language "purists" of all ages believe that some versions of a language are better than others, that there are certain "correct" forms that all educated people should use in speaking and writing, and that language change is corruption. The Greek Alexandrians in the first century, the Arabic scholars at Basra in the eighth century, and numerous English grammarians of the eighteenth and nineteenth centuries held this view. They wished to *prescribe* rather than *describe* the rules of grammar, which gave rise to the writing of **prescriptive grammars**.

In the Renaissance a new middle class emerged who wanted their children to speak the dialect of the "upper" classes. This desire led to the publication of many prescriptive grammars. In 1762 Bishop Robert Lowth wrote *A Short Introduction to English Grammar with Critical Notes*. Lowth prescribed a number of new rules for English, many of them influenced by his personal taste. Before the publication of his grammar, practically everyone—upper-class, middle-class, and lower-class—said *I don't have none* and *You was wrong about that*. Lowth, however, decided that "two negatives make a positive" and therefore one should say *I don't have any*; and that even when *you* is singular it should be followed by the plural *were*. Many of these prescriptive rules were based on Latin grammar and made little sense for English. Because Lowth was influential and because the rising new class wanted to speak "properly," many of these new rules were legislated into English grammar, at least for the **prestige dialect**—that variety of the language spoken by people in positions of power.

The view that dialects that regularly use double negatives are inferior cannot be justified if one looks at the standard dialects of other languages in the world. Romance languages, for example, use double negatives, as the following examples from French and Italian show:

French:	Je	ne	veux	parler	avec	personne.
	I	not	want	speak	with	no-one.

Italian:	Non	voglio	parlare	con	nessuno.
	not	I-want	speak	with	no-one.

English translation: "I don't want to speak with anyone."

Prescriptive grammars such as Lowth's are different from the descriptive grammars we have been discussing. Their goal is not to describe the rules people know, but to tell them what rules they should follow. The great British Prime Minister Winston Churchill is credited with this response to the "rule" against ending a sentence with a preposition: "This is the sort of nonsense up with which I will not put."

Today our bookstores are populated with books by language purists attempting to "save the English language." They criticize those who use *enormity* to mean "enormous" instead of "monstrously evil." But languages change in the course of time and words change meaning. Language change is a natural process, as we discuss in chapter 11. Over time *enormity* was used more and more in the media to mean "enormous," and we predict that now that President Barack Obama has used it that way (in his victory speech of November 4, 2008), that usage will gain acceptance. Still, the "saviors" of the English language will never disappear. They will continue to blame television, the schools, and even the National Council of Teachers of English for failing to preserve the standard language, and are likely to continue to dis (oops, we mean disparage) anyone who suggests that African American English (AAE)[4] and other dialects are viable, complete languages.

In truth, human languages are without exception fully expressive, complete, and logical, as much as they were two hundred or two thousand years ago. Hopefully (another frowned-upon usage), this book will convince you that all languages and dialects are rule-governed, whether spoken by rich or poor, powerful or weak, learned or illiterate. Grammars and usages of particular groups

[4]AAE is also called African American Vernacular English (AAVE), Ebonics, and Black English (BE). It is spoken by some (but by no means all) African Americans. It is discussed in chapter 10.

in society may be dominant for social and political reasons, but from a linguistic (scientific) perspective they are neither superior nor inferior to the grammars and usages of less prestigious members of society.

Having said all this, it is undeniable that the **standard** dialect (defined in chapter 10) may indeed be a better dialect for someone wishing to obtain a particular job or achieve a position of social prestige. In a society where "linguistic profiling" is used to discriminate against speakers of a minority dialect, it may behoove those speakers to learn the prestige dialect rather than wait for social change. But linguistically, prestige and standard dialects do not have superior grammars.

Finally, all of the preceding remarks apply to *spoken* language. Writing (see chapter 12) is not acquired naturally through simple exposure to others speaking the language (see chapter 8), but must be taught. Writing follows certain prescriptive rules of grammar, usage, and style that the spoken language does not, and is subject to little, if any, dialectal variation.

Teaching Grammars

I don't want to talk grammar. I want to talk like a lady.

G. B. SHAW, *Pygmalion*, 1912

The descriptive grammar of a language attempts to describe the rules internalized by a speaker of that language. It is different from a **teaching grammar**, which is used to learn another language or dialect. Teaching grammars can be helpful to people who do not speak the standard or prestige dialect, but find it would be advantageous socially and economically to do so. They are used in schools in foreign language classes. This kind of grammar gives the words and their pronunciations, and explicitly states the rules of the language, especially where they differ from the language of instruction.

It is often difficult for adults to learn a second language without formal instruction, even when they have lived for an extended period in a country where the language is spoken. (Second language acquisition is discussed in more detail in chapter 8.) Teaching grammars assume that the student already knows one language and compares the grammar of the target language with the grammar of the native language. The meaning of a word is provided by a **gloss**—the parallel word in the student's native language, such as *maison*, "house" in French. It is assumed that the student knows the meaning of the gloss "house," and so also the meaning of the word *maison*.

Sounds of the target language that do not occur in the native language are often described by reference to known sounds. Thus the student might be aided in producing the French sound *u* in the word *tu* by instructions such as "Round your lips while producing the vowel sound in *tea*."

The rules on how to put words together to form grammatical sentences also refer to the learner's knowledge of their native language. For example, the teaching grammar *Learn Zulu* by Sibusiso Nyembezi states that "The difference between singular and plural is not at the end of the word but at the beginning of it," and warns that "Zulu does not have the indefinite and definite articles 'a' and 'the.'" Such statements assume students know the rules of their own grammar, in this case English. Although such grammars might be considered prescriptive in the sense that they attempt to teach the student what is or is not a grammatical construction in the new language, their aim is different from grammars that attempt to change the rules or usage of a language that is already known by the speaker.

This book is not primarily concerned with either prescriptive or teaching grammars. However, these kinds of grammars are considered in chapter 10 in the discussion of standard and nonstandard dialects.

Language Universals

> In a grammar there are parts that pertain to all languages; these components form what is called the general grammar. In addition to these general (universal) parts, there are those that belong only to one particular language; and these constitute the particular grammars of each language.
>
> **CÉSAR CHESNEAU DU MARSAIS,** c. 1750

There are rules of particular languages, such as English, Swahili, and Zulu, that form part of the individual grammars of these languages, and then there are rules that hold in all languages. Those rules representing the universal properties that all languages share constitute a universal grammar. The linguist attempts to uncover the "laws" of particular languages, and also the laws that pertain to all languages. The universal laws are of particular interest because they give us a window into the workings of the human mind in this cognitive domain.

In about 1630, the German philosopher Johann Heinrich Alsted first used the term *general grammar* as distinct from *special grammar*. He believed that the function of a general grammar was to reveal those features "which relate to the method and etiology of grammatical concepts. They are common to all languages." Pointing out that "general grammar is the pattern 'norma' of every particular grammar whatsoever," he implored "eminent linguists to employ their insight in this matter." Three and a half centuries before Alsted, the scholar Robert Kilwardby held that linguists should be concerned with discovering the nature of language in general. So concerned was Kilwardby with Universal Grammar that he excluded considerations of the characteristics of particular languages, which he believed to be as "irrelevant to a science of grammar as the material of the measuring rod or the physical characteristics of objects were to geometry." Kilwardby was perhaps too much of a universalist. The particular properties of individual languages are relevant to the discovery of language universals, and they are of interest for their own sake.

People attempting to study Latin, Greek, French, or Swahili as a second language are so focused on learning those aspects of the second language that are different from their native language that they may be skeptical of assertions that there are universal laws of language. Yet the more we investigate this question, the more evidence accumulates to support Chomsky's view that there is a **Universal Grammar (UG)** that is part of the biologically endowed human language faculty. We can think of UG as the basic blueprint that all languages follow. It specifies the different components of the grammar and their relations, how the different rules of these components are constructed, how they interact, and so on. It is a major aim of **linguistic theory** to discover the nature of UG. The linguist's goal is to reveal the "laws of human language" as the physicist's goal is to reveal the "laws of the physical universe." The complexity of language, a product of the human brain, undoubtedly means this goal will never be fully achieved. All scientific theories are incomplete, and new hypotheses must be proposed to account for new data. Theories are continually changing as new discoveries are made. Just as physics was enlarged by Einstein's theories of relativity, so grows the linguistic theory of UG as new discoveries shed new light on the nature of human language. The comparative study of many different languages is of central importance to this enterprise.

The Development of Grammar

> How comes it that human beings, whose contacts with the world are brief and personal and limited, are nevertheless able to know as much as they do know?
>
> **BERTRAND RUSSELL,** *Human Knowledge: Its Scope and Limits*, 1948

Linguistic theory is concerned not only with describing the knowledge that an adult speaker has of his or her language, but also with explaining how that knowledge is acquired. All normal children acquire (at least one) language in a relatively short period with apparent ease. They do this despite the fact that parents and other caregivers do not provide them with any specific language instruction. Indeed, it is often remarked that children seem to "pick up" language just from hearing it spoken around them. Children are language learning virtuosos—whether a child is male or female, from a rich family or a disadvantaged one, grows up on a farm or in the city, attends day care or has home care—none of these factors fundamentally affects the way language develops. Children can acquire any language they are exposed to with comparable ease—English, Dutch, French, Swahili, Japanese—and even though each of these languages has its own peculiar characteristics, children learn them all in very much the same way. For example, all children go through a babbling stage; their babbles gradually give way to words, which then combine into simple sentences. When children first begin to produce sentences, certain elements may be missing. For example, the English-speaking two-year-old might say *Cathy build house* instead of *Cathy is building the house*. On the other side of the world, a Swahili-speaking child will say *mbuzi kula majani*, which translates as "goat eat grass," and which also lacks many required elements. They pass through other linguistic stages on their way to adultlike competence, and by about age five children speak a language that is almost indistinguishable from the language of the adults around them.

In just a few short years, without the benefit of explicit guidance and regardless of personal circumstances, the young child—who may be unable to tie her shoes or do even the simplest arithmetic computation—masters the complex grammatical structures of her language and acquires a substantial lexicon. Just how children accomplish this remarkable cognitive feat is a topic of intense interest to linguists. The child's inexorable path to adult linguistic knowledge and the uniformity of the acquisition process point to a substantial innate component to language development. Chomsky, following the lead of the early rationalist philosophers, proposed that human beings are born with an innate "blueprint" for language, what we referred to earlier as Universal Grammar. Children acquire language as quickly and effortlessly as they do because they do not have to figure out all the grammatical rules, only those that are specific to their particular language. The universal properties—the laws of language—are part of their biological endowment. Linguistic theory aims to uncover those principles that characterize all human languages and to reveal the innate component of language that makes language acquisition possible. In chapter 8 we will discuss language acquisition in more detail.

Sign Languages: Evidence for the Innateness of Language

> It is not the want of organs that [prevents animals from making] . . . known their thoughts . . . for it is evident that magpies and parrots are able to utter words just like ourselves, and yet they cannot speak as we do, that is, so as to give evidence that they think of what they say. On the other hand, men who, being born deaf and mute . . . are destitute of the organs which serve the others for talking, are in the habit of themselves inventing certain signs by which they make themselves understood.
>
> **RENÉ DESCARTES,** *Discourse on Method*, 1637

The sign languages of deaf communities provide some of the best evidence to support the notion that humans are born with the ability to acquire language, and that all languages are governed by the same universal properties.

Because deaf children are unable to hear speech, they do not acquire spoken languages as hearing children do. However, deaf children who are exposed to sign languages acquire them just as hearing children acquire spoken languages. Sign languages do not use sounds to express meanings. Instead, they are visual-gestural systems that use hand, body, and facial gestures as the forms used to represent words and grammatical rules. Sign languages are fully developed languages, and signers create and comprehend unlimited numbers of new sentences, just as speakers of spoken languages do. Current research on sign languages has been crucial to understanding the biological underpinnings of human language acquisition and use.

About one in a thousand babies is born deaf or with a severe hearing deficiency. Deaf children have difficulty learning a spoken language because normal speech depends largely on auditory feedback. To learn to speak, a deaf child requires extensive training in special schools or programs designed especially for deaf people.

Although deaf people can be taught to speak a language intelligibly, they can never understand speech as well as a hearing person. Seventy-five percent of spoken English words cannot be read on the lips accurately. The ability of many deaf individuals to comprehend spoken language is therefore remarkable; they combine lip reading with knowledge of the structure of language, the meaning redundancies that language has, and context.

If, however, human language is a biologically based ability and all human beings have the innate ability (or as Darwin suggested, instinct) to acquire a language, it is not surprising that nonspoken languages have developed among nonhearing individuals. The more we learn about the human linguistic knowledge, the clearer it becomes that language acquisition and use are not dependent on the ability to produce and hear sounds, but on a far more abstract cognitive capacity that accounts for the similarities between spoken and sign languages.

American Sign Language

The major language of the deaf community in the United States is **American Sign Language** (**ASL**). ASL is an outgrowth of the sign language used in France and brought to the United States in 1817 by the great educator Thomas Hopkins Gallaudet.

Like all languages, ASL has its own grammar with phonological, morphological, syntactic, and semantic rules, and a mental lexicon of signs, all of which is encoded through a system of gestures, and is otherwise equivalent to spoken languages.

Signers communicate ideas at a rate comparable to spoken communication. Moreover, language arts are not lost to the deaf community. Poetry is composed in sign language, and stage plays such as Richard Brinsley Sheridan's *The Critic* have been translated into sign language and acted by the National Theatre of the Deaf.

Deaf children acquire sign language much in the way that hearing children acquire a spoken language, going through the same linguistic stages including the babbling stage. Deaf children babble with their hands, just as hearing children babble with their vocal tract. Deaf children often sign themselves to sleep just as hearing children talk themselves to sleep. Deaf children report that they dream in sign language as French-speaking children dream in French and Hopi-speaking children dream in Hopi. Deaf children sign to their dolls and stuffed animals. Slips of the hand occur similar to slips of the tongue; finger fumblers amuse signers as tongue twisters amuse speakers. Sign languages resemble spoken languages in all major aspects, showing that there truly are universals of language despite differences in the modality in which the language is performed. This universality is predictable because regardless of the modality in which it is expressed, language is a biologically based ability.

In the United States there are several signing systems that educators have created in an attempt to represent spoken and/or written English. Unlike ASL, these languages are artificial, consisting essentially in the replacement of each spoken English word (and grammatical elements such as the *-s* ending for plurals and the *-ed* ending for past tense) by a sign. So the syntax and semantics of these manual codes for English are approximately the same as those of spoken English. The result is unnatural—similar to trying to speak French by translating every English word or ending into its French counterpart. Difficulties arise because there are not always corresponding forms in the two languages. The problem is even greater with sign languages because they use multidimensional space while spoken languages are sequential.

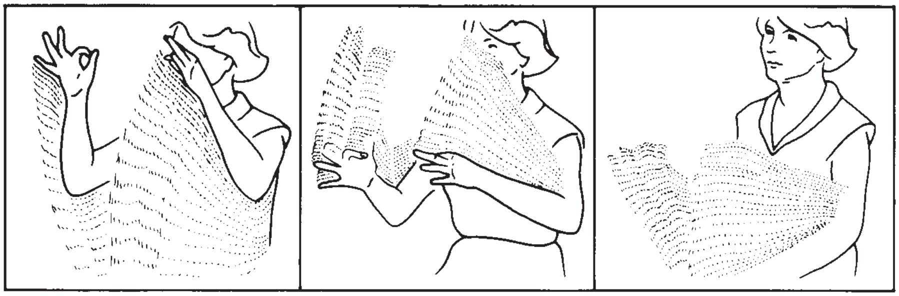


FIGURE 1.2 | The ASL sign DECIDE: (a) and (c) show transitions from the sign; (b) illustrates the single downward movement of the sign.

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There are occasions when signers need to represent a word or concept for which there is no sign. New coinages, foreign words, acronyms, certain proper nouns, technical vocabulary, or obsolete words as might be found in a signed interpretation of a play by Shakespeare are among some of these. For such cases ASL provides a series of hand shapes and movements that represent the letters of the English alphabet, permitting all such words and concepts to be expressed through finger spelling.

Signs, however, are produced differently from finger-spelled words. As Klima and Bellugi observe, "The sign DECIDE cannot be analyzed as a sequence of distinct, separable configurations of the hand. Like all other lexical signs in ASL, but unlike the individual finger-spelled letters in D-E-C-I-D-E taken separately, the ASL sign DECIDE does have an essential movement but the hand shape occurs simultaneously with the movement. In appearance, the sign is a continuous whole."[5] This sign is shown in Figure 1.2.

Animal "Languages"

> A dog cannot relate his autobiography; however eloquently he may bark, he cannot tell you that his parents were honest though poor.
>
> **BERTRAND RUSSELL,** *Human Knowledge: Its Scope and Limits*, 1948

Is language the exclusive property of the human species? The idea of talking animals is as old and as widespread among human societies as language itself. All cultures have legends in which some animal plays a speaking role. All over West Africa, children listen to folktales in which a "spider-man" is the hero. "Coyote" is a favorite figure in many Native American tales, and many an animal takes

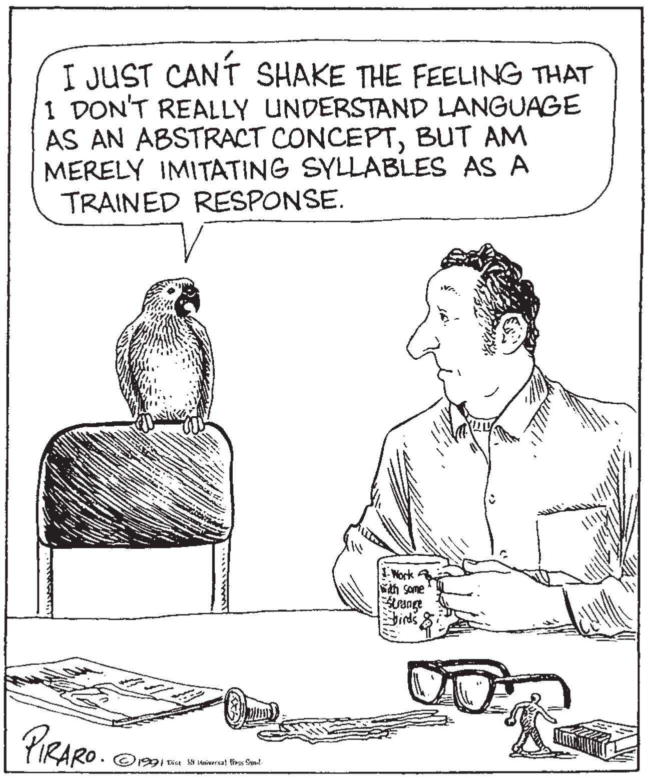
[5]Klima, E. S., and U. Bellugi. 1979. *The signs of language*. Cambridge, MA: Harvard University Press.

the stage in Aesop's famous fables. The fictional Doctor Doolittle's forte was communicating with all manner of animals, from giant snails to tiny sparrows.

If language is viewed only as a system of communication, then many species communicate. Humans also use systems other than language to relate to each other and to send and receive "messages," like so-called body language. The question is whether the communication systems used by other species are at all like human linguistic knowledge, which is acquired by children with no instruction, and which is used creatively rather than in response to internal or external stimuli.

"Talking" Parrots

> Words learned by rote a parrot may rehearse; but talking is not always to converse.
>
> **WILLIAM COWPER,** *Poems by William Cowper, of the Inner Temple, Esq.*, 1782



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Most humans who acquire language use speech sounds to express meanings, but such sounds are not a necessary aspect of language, as evidenced by the sign languages. The use of speech sounds is therefore not a basic part of what we have been calling language. The chirping of birds, the squeaking of dolphins, and the dancing of bees may potentially represent systems similar to human languages. If animal communication systems are not like human language, it is not because of a lack of speech.

Conversely, when animals vocally imitate human utterances, it does not mean they possess language. Language is a system that relates sounds or gestures to meanings. Talking birds such as parrots and mynahs are capable of faithfully reproducing words and phrases of human language that they have heard, but their utterances carry no meaning. They are speaking neither English nor their own language when they sound like us.

Talking birds do not dissect the sounds of their imitations into discrete units. *Polly* and *Molly* do not rhyme for a parrot. They are as different as *hello* and *good-bye*. One property of all human languages (which will be discussed further in chapter 6) is the discreteness of the speech or gestural units, which are ordered and reordered, combined and split apart. Generally, a parrot says what it is taught, or what it hears, and no more. If Polly learns "Polly wants a cracker" and "Polly wants a doughnut" and also learns to imitate the single words *whiskey* and *bagel*, she will not spontaneously produce, as children do, "Polly wants whiskey" or "Polly wants a bagel" or "Polly wants whiskey and a bagel." If she learns *cat* and *cats*, and *dog* and *dogs*, and then learns the word *parrot*, she will not be able to form the plural *parrots* as children do by the age of three; nor can a parrot form an unlimited set of utterances from a finite set of units, or understand utterances never heard before. Reports of an African gray parrot named Alex suggest that new methods of training animals may result in more learning than was previously believed possible. When the trainer uses words in context, Alex seems to relate some sounds with their meanings. This is more than simple imitation, but it is not how children acquire the complexities of the grammar of any language. It is more like a dog learning to associate certain sounds with meanings, such as *heel*, *sit*, *fetch*, and so on. Indeed, a recent study in Germany reports on a nine-year-old border collie named Rico who has acquired a 200-word vocabulary (containing both German and English words). Rico did not require intensive training but was able to learn many of these words quite quickly.

However impressive these feats, the ability of a parrot to produce sounds similar to those used in human language, even if meanings are related to these sounds, and Rico's ability to understand sequences of sounds that correspond to specific objects, cannot be equated with the child's ability to acquire the complex grammar of a human language.

The Birds and the Bees

> The birds and animals are all friendly to each other, and there are no disputes about anything. They all talk, and they all talk to me, but it must be a foreign language for I cannot make out a word they say.
>
> **MARK TWAIN,** *Eve's Diary*, 1906

Most animals possess some kind of "signaling" communication system. Among certain species of spiders there is a complex system for courtship. The male spider, before he approaches his ladylove, goes through an elaborate series of gestures to inform her that he is indeed a spider and a suitable mate, and not a crumb or a fly to be eaten. These gestures are invariant. One never finds a creative spider changing or adding to the courtship ritual of his species.

A similar kind of gestural language is found among the fiddler crabs. There are forty species, and each uses its own claw-waving movement to signal to another member of its "clan." The timing, movement, and posture of the body never change from one time to another or from one crab to another within the particular variety. Whatever the signal means, it is fixed. Only one meaning can be conveyed.

The imitative sounds of talking birds have little in common with human language, but the natural calls and songs of many species of birds do have a communicative function. They also resemble human languages in that there are "regional dialects" within the same species, and as with humans, these dialects are transmitted from parents to offspring. Indeed, researchers have noted that dialect differences may be better preserved in songbirds than in humans because there is no homogenization of regional accents due to radio or TV.

Birdcalls (consisting of one or more short notes) convey messages associated with the immediate environment, such as danger, feeding, nesting, flocking, and so on. **Bird songs** (more complex patterns of notes) are used to stake out territory and to attract mates. There is no evidence of any internal structure to these songs, nor can they be segmented into independently meaningful parts as words of human language can be. In a study of the territorial song of the European robin, it was discovered that the rival robins paid attention only to the alternation between high-pitched and low-pitched notes, and which came first did not matter. The message varies only to the extent of how strongly the robin feels about his possession and to what extent he is prepared to defend it and start a family in that territory. The different alternations therefore express intensity and nothing more. The robin is creative in his ability to sing the same thing in many ways, but not creative in his ability to use the same units of the system to express many different messages with different meanings.

As we will discuss in chapter 2, some species of birds can only acquire their song during a specific period of development. In this respect bird songs are similar to human language, for which there is also a critical period for acquisition. Although this is an important aspect of both bird song and human language, birdcalls and songs are fundamentally different kinds of communicative systems. The kinds of messages that birds can convey are limited, and messages are stimulus controlled.

This distinction is also true of the system of communication used by honeybees. A forager bee is able to return to the hive and communicate to other bees where a source of food is located. It does so by performing a dance on a wall of the hive that reveals the location and quality of the food source. For one species of Italian honeybee, the dancing behavior may assume one of three possible patterns: *round* (which indicates locations near the hive, within 20 feet or so); *sickle* (which indicates locations at 20 to 60 feet from the hive); and *tail-wagging* (for distances that exceed 60 feet). The number of repetitions per minute of the basic pattern in the tail-wagging dance indicates the precise distance; the slower the repetition rate, the longer the distance.

The bees' dance is an effective system of communication for bees. It is capable, in principle, of infinitely many different messages, like human language; but unlike human language, the system is confined to a single subject—food source. An experimenter who forced a bee to walk to the food source showed the inflexibility. When the bee returned to the hive, it indicated a distance twenty-five times farther away than the food source actually was. The bee had no way of communicating the special circumstances in its message. This absence of creativity makes the bee's dance qualitatively different from human language.

In the seventeenth century, the philosopher and mathematician René Descartes pointed out that the communication systems of animals are qualitatively different from the language used by humans:

> It is a very remarkable fact that there are none so depraved and stupid, without even excepting idiots, that they cannot arrange different words together, forming of them a statement by which they make known their thoughts; while, on the other hand, there is no other animal, however perfect and fortunately circumstanced it may be, which can do the same.

Descartes goes on to state that one of the major differences between humans and animals is that human use of language is not just a response to external, or even internal, stimuli, as are the sounds and gestures of animals. He warns against confusing human use of language with "natural movements which betray passions and may be . . . manifested by animals."

To hold that animals communicate by systems qualitatively different from human language systems is not to claim human superiority. Humans are not inferior to the one-celled amoeba because they cannot reproduce by splitting in two; they are just different sexually. They are not inferior to hunting dogs, whose sense of smell is far better than that of human animals. As we will discuss in the next chapter, the human language ability is rooted in the human brain, just as the communication systems of other species are determined by their biological structure. All the studies of animal communication systems, including those of primates, provide evidence for Descartes' distinction between other animal communication systems and the linguistic creative ability possessed by the human animal.

Can Chimps Learn Human Language?

> It is a great baboon, but so much like man in most things. . . . I do believe it already understands much English; and I am of the mind it might be taught to speak or make signs.
>
> **ENTRY IN SAMUEL PEPYS'S DIARY,** 1661

In their natural habitat, chimpanzees, gorillas, and other nonhuman primates communicate with each other through visual, auditory, olfactory, and tactile signals. Many of these signals seem to have meanings associated with the animals' immediate environment or emotional state. They can signal danger and can communicate aggressiveness and subordination. However, the natural sounds and gestures produced by all nonhuman primates are highly stereotyped and limited in the type and number of messages they convey, consisting mainly of emotional responses to particular situations. They have no way of expressing the anger they felt yesterday or the anticipation of tomorrow.

Even though the natural communication systems of these animals are quite limited, many people have been interested in the question of whether they have the latent capacity to acquire complex linguistic systems similar to human language. Throughout the second half of the twentieth century, there were a number of studies designed to test whether nonhuman primates could learn human language.

In early experiments researchers raised chimpanzees in their own homes alongside their children, in order to recreate the natural environment in which human children acquire language. The chimps were unable to vocalize words despite the efforts of their caretakers, though they did achieve the ability to understand a number of individual words.

One disadvantage suffered by primates is that their vocal tracts do not permit them to pronounce many different sounds. Because of their manual dexterity, primates might better be taught sign language as a test of their cognitive linguistic ability. Starting with a chimpanzee named Washoe, and continuing over the years with a gorilla named Koko and another chimp ironically named Nim Chimpsky (after Noam Chomsky), efforts were made to teach them American Sign Language. Though the primates achieved small successes such as the ability to string two signs together, and to occasionally show flashes of creativity, none achieved the qualitative linguistic ability of a human child.

Similar results were obtained in attempting to teach primates artificial languages designed to resemble human languages in some respects. Sarah, Lana, Sherman, Austin, and other chimpanzees were taught languages whose "words" were plastic chips, or keys on a keyboard, that could be arranged into "sentences." The researchers were particularly interested in the ability of primates to communicate using such abstract symbols.

These experiments also came under scrutiny. Questions arose over what kind of knowledge Sarah and Lana were showing with their symbol manipulations. The conclusion was that the creative ability that is so much a part of human language was not evidenced by the chimps' use of the artificial languages.

More recently, psychologists Patricia Greenfield and Sue Savage-Rumbaugh studied a different species of chimp, a male bonobo (or pygmy chimpanzee) named Kanzi. They used the same plastic symbols and computer keyboard that were used with Lana. They claimed that Kanzi not only learned, but also invented, grammatical rules. One rule they described is the use of a symbol designating an object such as "dog" followed by a symbol meaning "go." After combining these symbols, Kanzi would then go to an area where dogs were located to play with them. Greenfield and Savage-Rumbaugh claimed that this "ordering" rule was not an imitation of his caretakers' utterances, who they said used an opposite ordering, in which "go" was followed by "dogs."

Kanzi's acquisition of grammatical skills was slower than that of children, taking about three years (starting when he was five and a half years old). Most of Kanzi's "sentences" are fixed formulas with little if any internal structure. Kanzi has not yet exhibited the linguistic knowledge of a human three-year-old, whose complexity level includes knowledge of sentence structure. Moreover, unlike Kanzi's use of a different word order from his caretakers, children rapidly adopt the correct word order of the surrounding language.

As often happens in science, the search for the answers to one kind of question leads to answers to other questions. The linguistic experiments with primates have led to many advances in our understanding of primate cognitive ability. Researchers have gone on to investigate other capacities of the chimp mind, such as causality; Savage-Rumbaugh and Greenfield are continuing to study the ability of chimpanzees to use symbols. These studies also point out how remarkable it is that human children, by the ages of three and four, without explicit teaching or overt reinforcement, create new and complex sentences never spoken and never heard before.

In the Beginning: The Origin of Language

> Nothing, no doubt, would be more interesting than to know from historical documents the exact process by which the first man began to lisp his first words, and thus to be rid forever of all the theories on the origin of speech.
>
> **MAX MÜLLER,** *Lectures on the Science of Language*, 1874

All religions and mythologies contain stories of language origin. Philosophers through the ages have argued the question. Scholarly works have been written on the subject. Prizes have been awarded for the "best answer" to this eternally perplexing problem. Theories of divine origin, language as a human invention, and evolutionary development have all been put forward.

Linguistic history suggests that spoken languages of the kind that exist today have been around for tens of thousands of years at the very least, but the earliest deciphered written records are barely six thousand years old. (The origin of writing is discussed in chapter 12.) These records appear so late in the history of the development of language that they provide no clue to its origin.

Despite the difficulty of finding scientific evidence, speculations on language origin have provided valuable insights into the nature and development of language, which prompted the great Danish linguist Otto Jespersen to state that "linguistic science cannot refrain forever from asking about the whence (and about the whither) of linguistic evolution." A brief look at some of these speculative notions will reveal this point.

Divine Gift

> And out of the ground the Lord God formed every beast of the field, and every fowl of the air; and brought them unto Adam to see what he would call them: and whatsoever Adam called every living creature, that was the name thereof.
>
> **GENESIS 2:19,** *The Bible*, King James Version

According to Judeo-Christian beliefs, the one deity gave Adam the power to name all things. Similar beliefs are found throughout the world. According to the Egyptians, the creator of speech was the god Thoth. Babylonians believed that the language giver was the god Nabu, and the Hindus attributed our unique language ability to a female god: Brahma was the creator of the universe, but his wife Sarasvati gave language to us. Plato held that at some ancient time, a "legislator" gave the correct, natural name to everything, and that words echoed the essence of their meanings.

Belief in the divine origin of language is intertwined with the supernatural properties that have been associated with the spoken word. In many religions only special languages may be used in prayers and rituals, such as Latin in the Catholic Church for many centuries. The Hindu priests of the fifth century B.C.E. believed that the original pronunciation of Vedic Sanskrit was sacred and must be preserved. This led to important linguistic study because their language had already changed greatly since the hymns of the Vedas had been written. The first linguist known to us is Panini, who wrote a descriptive grammar of Sanskrit in the fourth century B.C.E. that revealed the earlier pronunciation, which could then be used in religious worship. Even today Panini's deep insights into the workings of language are highly revered by linguists.

Although myths, customs, and superstitions do not tell us very much about language origin, they do tell us about the importance ascribed to language. There is no way to prove or disprove the divine origin of language, just as one cannot argue scientifically for or against the existence of deities.

The First Language

> Imagine the Lord talking French! Aside from a few odd words in Hebrew, I took it completely for granted that God had never spoken anything but the most dignified English.
>
> **CLARENCE DAY,** *Life with Father*, 1935

For millennia, "scientific" experiments have reportedly been devised to verify particular theories of the first language. The Egyptian pharaoh Psammetichus (664–610 B.C.E.) sought to determine the most primitive language by isolating two infants in a mountain hut, to be cared for by a mute servant, in the belief that their first words would be in the original language. They weren't! History is replete with similar stories, but as we shall see in chapter 2, all such "experimentation" on children is unspeakably cruel and utterly worthless.

Nearly all "theories" of language origin, however silly and superstitious, contain the implicit belief that all languages originated from a single source—the **monogenetic theory of language origin**. Opposing this is the proposition that language arose in several places, or at several times, in the course of history. Which of these is true is still debated by linguists.

Human Invention or the Cries of Nature?

> Language was born in the courting days of mankind; the first utterances of speech I fancy to myself like something between the nightly love lyrics of puss upon the tiles and the melodious love songs of the nightingale.
>
> **OTTO JESPERSEN,** *Language, Its Nature, Development, and Origin*, 1922

Despite all evidence to the contrary, the idea that the earliest form of language was imitative, or echoic, was proposed up to the twentieth century. A parallel view states that language at first consisted of emotional ejaculations of pain, fear, surprise, pleasure, anger, and so on. French philosopher Jean-Jacques Rousseau proposed that the earliest manifestations of language were "cries of nature."

Other hypotheses suggested that language arose out of the rhythmical grunts of men and women working together, or more charming, that language originated from song as an expressive rather than a communicative need. Just as with the beliefs in a divine origin of language, these proposed origins are not verifiable by scientific means.

Language most likely evolved with the human species, possibly in stages, possibly in one giant leap. Research by linguists, evolutionary biologists, and neurologists support this view and the view that from the outset the human animal was genetically equipped to learn language. We'll have more to say on this topic in chapter 2.

Language and Thought

> It was intended that when Newspeak had been adopted once and for all and Oldspeak forgotten, a heretical thought—that is, a thought diverging from the principles of IngSoc—should be literally unthinkable, at least so far as thought is dependent on words.
>
> **GEORGE ORWELL,** appendix to *1984*, 1949

Many people are fascinated by the question of how language relates to thought. It is natural to imagine that something as powerful and fundamental to human nature as language would influence how we think about or perceive the world around us. This is clearly reflected in the appendix of George Orwell's masterpiece *1984*, quoted above. Over the years there have been many claims made regarding the relationship between language and thought. The claim that the structure of a language influences how its speakers perceive the world around them is most closely associated with the linguist Edward Sapir and his student Benjamin Whorf, and is therefore referred to as the **Sapir-Whorf hypothesis**. In 1929 Sapir wrote:

> Human beings do not live in the objective world alone, nor in the world of social activity as ordinarily understood, but are very much at the mercy of the particular language which has become the medium of expression for their society . . . we see and hear and otherwise experience very largely as we do because the language habits of our community predispose certain choices of interpretation.[6]

Whorf made even stronger claims:

> The background linguistic system (in other words, the grammar) of each language is not merely the reproducing instrument for voicing ideas but rather is itself the shaper of ideas, the program and guide for the individual's mental activity, for his analysis of impressions, for his synthesis of his mental stock in trade . . . We dissect nature along lines laid down by our native languages.[7]

The strongest form of the Sapir-Whorf hypothesis is called **linguistic determinism** because it holds that the language we speak *determines* how we perceive and think about the world. On this view language acts like a filter on reality. One of Whorf's best-known claims in support of linguistic determinism was that the Hopi Indians do not perceive time in the same way as speakers of European languages because the Hopi language does not make the grammatical distinctions of tense that, for example, English does with words and word endings such as *did*, *will*, *shall*, *-s*, *-ed*, and *-ing*.

A weaker form of the hypothesis is **linguistic relativism**, which says that different languages encode different categories and that speakers of different languages therefore think about the world in different ways. For example, languages break up the color spectrum at different points. In Navaho, blue and green are one word. Russian has different words for dark blue (*siniy*) and light blue (*goluboy*), while in English we need to use the additional words *dark* and *light* to express the difference. The American Indian language Zuni does not distinguish between the colors yellow and orange. Languages also differ in how they express locations. For example, in Italian you ride "in" a bicycle and you go "in" a country while in English you ride "on" a bicycle and you go "to" a country. In English we say that a ring is placed "on" a finger and a finger is placed "in" the ring. Korean, on the other hand, has one word for both situations, *kitta*, which expresses the idea of a tight-fitting relation between the two objects. Spanish has two different words for the inside of a corner (*esquina*) and the outside of a corner (*rincon*). The Whorfian claim that is perhaps most

[6]Sapir, E. 1929. *Language*. New York: Harcourt, Brace & World, p. 207.

[7]Whorf, B. L., and J. B. Carroll. 1956. *Language, thought, and reality: Selected writings*. Cambridge, MA: MIT Press.

familiar is that the Eskimo language Inuit has many more words than English for snow and that this affects the world view of the Inuit people.

"At the store today, the computer wasn't ON line, we stood IN line, and Billy was OUT of line."

That languages show linguistic distinctions in their lexicons and grammar is certain, and we will see many examples of this in later chapters. The question is to what extent—if at all—such distinctions determine or influence the thoughts and perceptions of speakers. The Sapir-Whorf hypothesis is controversial, but it is clear that the strong form of this hypothesis is false. Peoples' thoughts and perceptions are not determined by the words and structures of their language. We are not prisoners of our linguistic systems. If speakers were unable to think about something for which their language had no specific word, translations would be impossible, as would learning a second language. English may not have a special word for the inside of a corner as opposed to the outside of a corner, but we are perfectly able to express these concepts using more than one word. In fact, we just did. If we could not think about something for which we do not have words, how would infants ever learn their first word, much less a language?

Many of the specific claims of linguistic determinism have been shown to be wrong. For example, the Hopi language may not have words and word endings for specific tenses, but the language has other expressions for time, including words for the days of the week, parts of the day, yesterday and tomorrow, lunar phases, seasons, etc. The Hopi people use various kinds of calendars and various devices for time-keeping based on the sundial. Clearly, they have a sophisticated concept of time despite the lack of a tense system in the language. The Munduruku, an indigenous people of the Brazilian Amazon, have no words in their language for triangle, square, rectangle, or other geometric concepts, except circle. The only terms to indicate direction are words for upstream, downstream, sunrise, and sunset. Yet Munduruku children understand many principles of geometry as well as American children, whose language is rich in geometric and spatial words.

Similarly, though languages differ in their color words, speakers can readily perceive colors that are not named in their language. Grand Valley Dani is a language spoken in New Guinea with only two color words, black and white (dark and light). In experimental studies, however, speakers of the language showed recognition of the color red, and they did better with fire-engine red than off-red. This would not be possible if their color perceptions were fixed by their language. Our perception of color is determined by the structure of the human eye, not by the structure of language. A source of dazzling linguistic creativity is to be found at the local paint store where literally thousands of colors are given names like *soft pumpkin*, *Durango dust*, and *lavender lipstick*.

Anthropologists have shown that Inuit has no more words for snow than English does: around a dozen, including *sleet*, *blizzard*, *slush*, and *flurry*. But even if it did, this would not show that language conditions the Inuits' experience of the world, but rather that experience with a particular world creates the need for certain words. In this respect the Inuit speaker is no different from the computer programmer, who has a technical vocabulary for Internet protocols, or the linguist, who has many specialized words regarding language. In this book we will introduce you to many new words and linguistic concepts, and surely you will learn them! This would be impossible if your thoughts about language were determined by the linguistic vocabulary you now have.

These studies show that our perceptions and thoughts are not determined by the words or word endings of our language. But what about the linguistic structures we are accustomed to using? Could these be a strong determinant? In a recent study, psychologist Susan Goldin-Meadow and colleagues asked whether the word order of a particular language influences the way its speakers describe an event nonverbally, either with gestures or with pictures. Languages differ in how they encode events, such as a person twisting a knob. Speakers of languages like English, Chinese, and Spanish typically use the word order *actor—action—object* (person—twist—knob), whereas speakers of languages like Turkish and Japanese use the order *actor—object—action* (person—knob—twist). Word order is one of the earliest aspects of language structure that children acquire and it is a fundamental aspect of our linguistic knowledge. Therefore if language structure strongly influences how we interpret events, then these ordering patterns might show up in the way we describe events even when we are not talking. Goldin-Meadow and colleagues asked adult speakers of English, Turkish, and Chinese (Mandarin) to describe vignettes shown on a computer screen using only their hands, and also using a set of pictures. Their results showed that all the speakers—irrespective of their language—used the same order in the non-verbal tasks. The predominant gesture order was *actor—action—object*, and the same results were found in the picture-ordering task. Goldin-Meadow and colleagues suggest that there is a universal, natural order in which people cognitively represent events, and that this is not affected by the language they happen to speak.

Similar results have been observed between English and Greek speakers. These languages differ in how their verbs encode motion. When describing movement, English speakers will commonly use verbs that focus on the *manner* of motion such as *slide*, *skip*, and *walk*. Greek speakers, on the other hand, use verbs that focus on the *direction* of the motion, as in *approach* and *ascend*. Measurements of eye movements of these speakers as they verbally describe an event show that they focus on the aspect of the event encoded by their language. However, when freely observing an event but not describing it verbally, they attend to the event in the same ways regardless of what language they speak. These results show that speakers' attention to events is not affected by their language except as they are preparing to speak.

In our understanding of the world we are certainly not "at the mercy of whatever language we speak," as Sapir suggested. However, we may ask whether the language we speak *influences* our cognition in some way. In the domain of color categorization, for example, it has been shown that if a language lacks a word for *red*, say, then it's harder for speakers to reidentify red objects. In other words, having a label seems to make it easier to store or access information in memory. Similarly, experiments show that Russian speakers are better at discriminating light blue (*goluboy*) and dark blue (*siniy*) objects than English speakers, whose language does not make a lexical distinction between these categories. These results show that words can influence simple perceptual tasks in the domain of color discrimination. Upon reflection, this may not be a surprising finding. Colors exist on a continuum, and the way we segment into "different" colors happens at arbitrary points along this spectrum. Because there is no physical motivation for these divisions, this may be the kind of situation where language could show an effect.

The question has also been raised regarding the possible influence of grammatical gender on how people think about objects. Many languages, such as Spanish and German, classify nouns as masculine or feminine; Spanish "key" is *la llave* (feminine) and "bridge" is *el puente* (masculine). Some psychologists have suggested that speakers of gender-marking languages think about objects as having gender, much like people or animals have. In one study, speakers of German and Spanish were asked to describe various objects using English adjectives (the speakers were proficient in English). In general, they used more masculine adjectives—independently rated as such—to describe objects that are grammatically masculine in their language. For example, Spanish speakers described bridges (el puente) as *big*, *dangerous*, *long*, *strong*, and *sturdy*. In German the word for bridge is feminine (die Brücke) and German speakers used more feminine adjectives such as *beautiful*, *elegant*, *fragile*, *peaceful*, *pretty*, and *slender*. Interestingly, it has been noted that English speakers, too, make consistent judgments about the gender of objects (ships are "she") even though English has no grammatical gender on common nouns. It may be, then, that regardless of the language spoken, humans have a tendency to anthropomorphize objects and this tendency is somehow enhanced if the language itself has grammatical gender. Though it is too early to come to any firm conclusions, the results of these and similar studies seem to support a weak version of linguistic relativism.

Politicians and marketers certainly believe that language can influence our thoughts and values. One political party may refer to an inheritance tax as the "estate tax," while an opposing party refers to it as the "death tax." One politician may refer to "tax breaks for the wealthy" while another refers to "tax relief." In the abortion debate, some refer to the "right to choose" and others to the "right to life." The terminology reflects different ideologies, but the choice of expression is primarily intended to sway public opinion. Politically correct (PC) language also reflects the idea that language can influence thought. Many people believe that by changing the way we talk, we can change the way we think; that if we eliminate racist and sexist terms from our language, we will become a less racist and sexist society. As we will discuss in chapter 10, language itself is not sexist or racist, but people can be, and because of this particular words take on negative meanings. In his book *The Language Instinct*, Steven Pinker uses the expression *euphemism treadmill* to describe how the euphemistic terms that are created to replace negative words often take on the negative associations of the words they were coined to replace. For example, *handicapped* was once a euphemism for the offensive term *crippled*, and when *handicapped* became politically incorrect it was replaced by the euphemism *disabled*. And as we write, *disabled* is falling into disrepute and is often replaced by yet another euphemism, *challenged*. Nonetheless, in all such cases, changing language has not resulted in a new world view of the speakers.

Prescient as Orwell was with respect to how language could be used for social control, he was more circumspect with regard to the relation between language and thought. He was careful to qualify his notions with the phrase "at least so far as thought is dependent on words." Current research shows that language does not determine how we think about and perceive the world. Future research should show the extent to which language influences other aspects of cognition such as memory and categorization.

What We Know about Human Language

Much is unknown about the nature of human languages, their grammars and use. The science of linguistics is concerned with these questions. Investigations of linguists and the analyses of spoken languages date back at least to 1600 B.C.E. in Mesopotamia. We have learned a great deal since that time. A number of facts pertaining to all languages can be stated.

1. Wherever humans exist, language exists.
2. There are no "primitive" languages—all languages are equally complex and equally capable of expressing any idea. The vocabulary of any language can be expanded to include new words for new concepts.

3. All languages change through time.
4. The relationships between the sounds and meanings of spoken languages and between the gestures and meanings of sign languages are for the most part arbitrary.
5. All human languages use a finite set of discrete sounds or gestures that are combined to form meaningful elements or words, which themselves may be combined to form an infinite set of possible sentences.
6. All grammars contain rules of a similar kind for the formation of words and sentences.
7. Every spoken language includes discrete sound segments, like *p*, *n*, or *a*, that can all be defined by a finite set of sound properties or features. Every spoken language has both vowel sounds and consonant sounds.
8. Similar grammatical categories (for example, noun, verb) are found in all languages.
9. There are universal semantic properties like *entailment* (one sentence inferring the truth of another) found in every language in the world.
10. Every language has a way of negating, forming questions, issuing commands, referring to past or future time, and so on.
11. All languages permit abstractions like *goodness*, *spherical*, and *skillful*.
12. All languages have slang, epithets, taboo words, and euphemisms for them, such as *john* for "toilet."
13. All languages have hypothetical, counterfactual, conditional, unreal, and fictional utterances; e.g., "If I won the lottery, I would buy a Ferrari," or "Harry Potter battled Voldemort with his wand by Hogwarts castle."
14. All languages exhibit freedom from stimulus; a person can choose to say anything at any time under any circumstances, or can choose to say nothing at all.
15. Speakers of all languages are capable of producing and comprehending an infinite set of sentences. Syntactic universals reveal that every language has a way of forming sentences such as:

    Linguistics is an interesting subject.
    I know that linguistics is an interesting subject.
    You know that I know that linguistics is an interesting subject.
    Cecelia knows that you know that I know that linguistics is an interesting subject.
    Is it a fact that Cecelia knows that you know that I know that linguistics is an interesting subject?

16. The ability of human beings to acquire, know, and use language is a biologically based ability rooted in the structure of the human brain, and expressed in different modalities (spoken or signed).
17. Any normal child, born anywhere in the world, of any racial, geographical, social, or economic heritage, is capable of learning any language to which he or she is exposed. The differences among languages are not due to biological reasons.

It seems that the universalists from all ages were not spinning idle thoughts. We all possess human language.

Summary

We are all intimately familiar with at least one language, our own. Yet few of us ever stop to consider what we know when we know a language. No book contains, or could possibly contain, the English or Russian or Zulu language. The words of a language can be listed in a dictionary, but not all the sentences can be; and a language consists of these sentences as well as words. Speakers use a finite set of rules to produce and understand an infinite set of possible sentences.

These rules are part of the **grammar** of a language, which develops when you acquire the language and includes the sound system (the **phonology**), the structure and properties of words (the **morphology** and **lexicon**), how words may be combined into phrases and sentences (the **syntax**), and the ways in which sounds and meanings are related (the **semantics**). The sounds and meanings of individual words are related in an **arbitrary** fashion. If you had never heard the word *syntax* you would not know what it meant by its sounds. The gestures used by signers are also arbitrarily related to their meanings. Language, then, is a system that relates sounds (or hand and body gestures) with meanings. When you know a language, you know this system.

This knowledge (**linguistic competence**) is different from behavior (**linguistic performance**). If you woke up one morning and decided to stop talking (as the Trappist monks did after they took a vow of silence), you would still have knowledge of your language. This ability or competence underlies linguistic behavior. If you do not know the language, you cannot speak it; but if you know the language, you may choose not to speak.

There are different kinds of "grammars." The **descriptive grammar** of a language represents the unconscious linguistic knowledge or capacity of its speakers. Such a grammar is a model of the **mental grammar** every speaker of the language knows. It does not teach the rules of the language; it describes the rules that are already known. A grammar that attempts to legislate what your grammar should be is called a **prescriptive grammar**. It prescribes. It does not describe, except incidentally. **Teaching grammars** are written to help people learn a foreign language or a dialect of their own language.

The more that linguists investigate the thousands of languages of the world and describe the ways in which they differ from each other, the more they discover that these differences are limited. There are linguistic universals that pertain to each of the parts of grammars, the ways in which these parts are related, and the forms of rules. These principles compose **Universal Grammar**, which provides a blueprint for the grammars of all possible human languages. Universal Grammar constitutes the innate component of the human language faculty that makes normal language development possible.

Strong evidence for Universal Grammar is found in the way children acquire language. Children learn language by exposure. They need not be deliberately taught, though parents may enjoy "teaching" their children to speak or sign. Children will learn any human language to which they are exposed, and they learn it in definable stages, beginning at a very early age. By four or five years of age, children have acquired nearly the entire adult grammar. This suggests that children are born with a genetically endowed faculty to learn and use human language, which is part of the Universal Grammar.

The fact that deaf children learn **sign language** shows that the ability to hear or produce sounds is not a prerequisite for language learning. All the sign languages in the world, which differ as spoken languages do, are visual-gestural systems that are as fully developed and as structurally complex as spoken languages. The major sign language used in the United States is **American Sign Language** (ASL).

If language is defined merely as a system of communication, or the ability to produce speech sounds, then language is not unique to humans. There are, however, certain characteristics of human language not found in the communication systems of any other species. A basic property of human language is its **creativity**—a speaker's ability to combine the basic linguistic units to form an infinite set of "well-formed" grammatical sentences, most of which are novel, never before produced or heard.

For many years researchers were interested in the question of whether language is unique to the human species. There have been many attempts to teach nonhuman primates communication systems that are supposed to resemble human language in certain respects. Overall, results have been disappointing: Chimpanzees like Sarah and Lana learned to manipulate symbols for rewards, and others, like Washoe and Nim Chimpsky, learned a number of ASL signs. But a careful examination of their multisign utterances reveals that unlike in children, the language of the chimps shows little spontaneity, is highly imitative (echoic), and has little syntactic structure. It has been suggested that the pygmy chimp Kanzi shows grammatical ability greater than the other chimps studied, but he still does not have the ability of even a three-year-old child.

At present we do not know if there was a single original language—the **monogenetic** hypothesis—or whether language arose independently in several places, or at several times, in human history. Myths of language origin abound; divine origin and various modes of human invention are the source of these myths. Language most likely evolved with the human species, possibly in stages, possibly in one giant leap.

The **Sapir-Whorf hypothesis** holds that the particular language we speak determines or influences our thoughts and perceptions of the world. Much of the early evidence in support of this hypothesis has not stood the test of time. More recent experimental studies suggest that the words and grammar of a language may affect aspects of cognition, such as memory and categorization.

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2

Brain and Language

> The functional asymmetry of the human brain is unequivocal, and so is its anatomical asymmetry. The structural differences between the left and the right hemispheres are visible not only under the microscope but to the naked eye. The most striking asymmetries occur in language-related cortices. It is tempting to assume that such anatomical differences are an index of the neurobiological underpinnings of language.
>
> **ANTONIO AND HANNA DAMÁSIO,** University of Southern California, Brain and Creativity Institute and Department of Neuroscience

Attempts to understand the complexities of human cognitive abilities and especially the acquisition and use of language are as old and as continuous as history itself. What is the nature of the brain? What is the nature of human language? And what is the relationship between the two? Philosophers and scientists have grappled with these questions and others over the centuries. The idea that the brain is the source of human language and cognition goes back more than two thousand years. The philosophers of ancient Greece speculated about the brain/mind relationship, but neither Plato nor Aristotle recognized the brain's crucial function in cognition or language. However, others of the same period showed great insight, as illustrated in the following quote from the Hippocratic Treatises on the Sacred Disease, written c. 377 B.C.E.:

> [The brain is] the messenger of the understanding [and the organ whereby] in an especial manner we acquire wisdom and knowledge.

The study of language has been crucial to understanding the brain/mind relationship. Conversely, research on the brain in humans and other primates is helping to answer questions concerning the neurological basis for language. The study of the biological and neural foundations of language is called **neurolinguistics**. Neurolinguistic research is often based on data from atypical or impaired language and uses such data to understand properties of human language in general.

The Human Brain

> "Rabbit's clever," said Pooh thoughtfully.
> "Yes," said Piglet, "Rabbit's clever."
> "And he has Brain."
> "Yes," said Piglet, "Rabbit has Brain."
> There was a long silence.
> "I suppose," said Pooh, "that that's why he never understands anything."
>
> **A. A. MILNE,** *The House at Pooh Corner*, 1928

The brain is the most complex organ of the body. It lies under the skull and consists of approximately 100 billion nerve cells (neurons) and billions of fibers that interconnect them. The surface of the brain is the **cortex**, often called "gray matter," consisting of billions of neurons. The cortex is the decision-making organ of the body. It receives messages from all of the sensory organs, initiates all voluntary and involuntary actions, and is the storehouse of our memories. Somewhere in this gray matter resides the grammar that represents our knowledge of language.

The brain is composed of **cerebral hemispheres**, one on the right and one on the left, joined by the **corpus callosum**, a network of more than 200 million fibers (see Figure 2.1). The corpus callosum allows the two hemispheres of the brain to communicate with each other. Without this system of connections, the

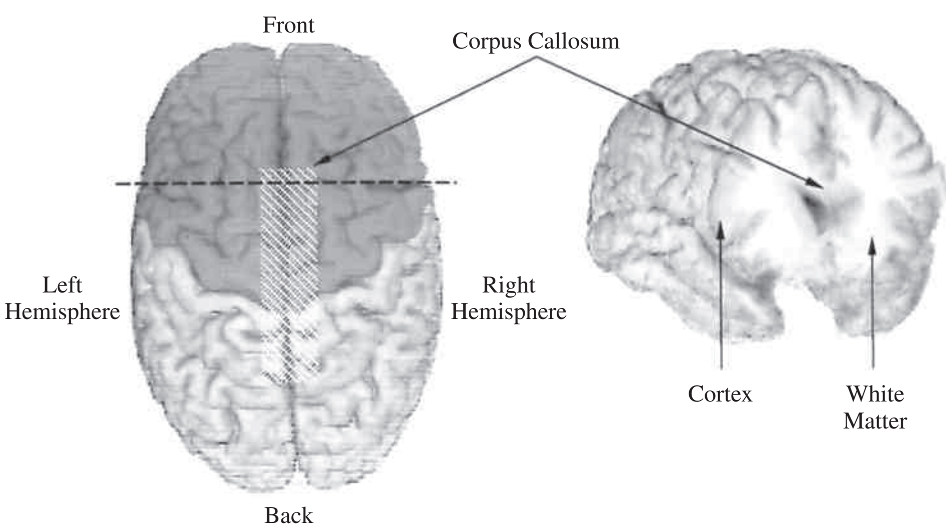
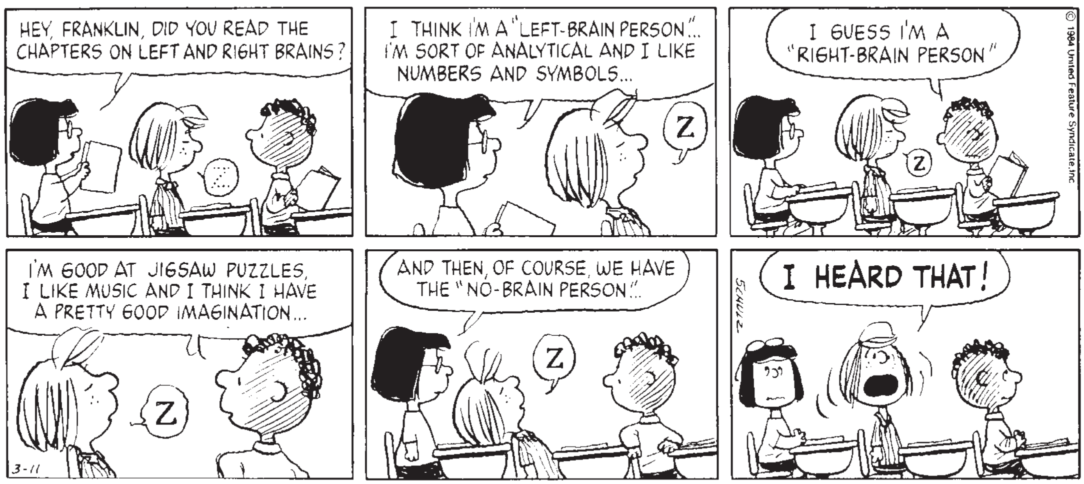


FIGURE 2.1 | Three-dimensional reconstruction of the normal living human brain. The images were obtained from magnetic resonance data using the Brainvox technique. *Left panel* = view from top. *Right panel* = view from the front following virtual coronal section at the level of the dashed line.
Courtesy of Hanna Damásio.

two hemispheres would operate independently. In general, the left hemisphere controls the right side of the body, and the right hemisphere controls the left side. If you point with your right hand, the left hemisphere is responsible for your action. Similarly, sensory information from the right side of the body (e.g., right ear, right hand, right visual field) is received by the left hemisphere of the brain, and sensory input to the left side of the body is received by the right hemisphere. This is referred to as **contralateral** brain function.

The Localization of Language in the Brain



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An issue of central concern has been to determine which parts of the brain are responsible for human linguistic abilities. In the early nineteenth century, Franz Joseph Gall proposed the theory of **localization**, which is the idea that different human cognitive abilities and behaviors are localized in specific parts of the brain. In light of our current knowledge about the brain, some of Gall’s particular views are amusing. For example, he proposed that language is located in the frontal lobes of the brain because as a young man he had noticed that the most articulate and intelligent of his fellow students had protruding eyes, which he believed reflected overdeveloped brain material. He also put forth a pseudoscientific theory called “organology” that later came to be known as **phrenology**, which is the practice of determining personality traits, intellectual capacities, and other matters by examining the “bumps” on the skull. A disciple of Gall’s, Johann Spurzheim, introduced phrenology to America, constructing elaborate maps and skull models such as the one shown in Figure 2.2, in which language is located directly under the eye.

Gall was a pioneer and a courageous scientist in arguing against the prevailing view that the brain was an unstructured organ. Although phrenology has long been discarded as a scientific theory, Gall’s view that the brain is not a uniform mass, and that linguistic and other cognitive capacities are functions of localized

FIGURE 2.2 | Phrenology skull model.

brain areas, has been upheld by scientific investigation of brain disorders, and, over the past two decades, by numerous studies using sophisticated technologies.

Aphasia

The study of **aphasia** has been an important area of research in understanding the relationship between brain and language. Aphasia is the neurological term for any language disorder that results from brain damage caused by disease or trauma. In the second half of the nineteenth century, significant scientific advances were

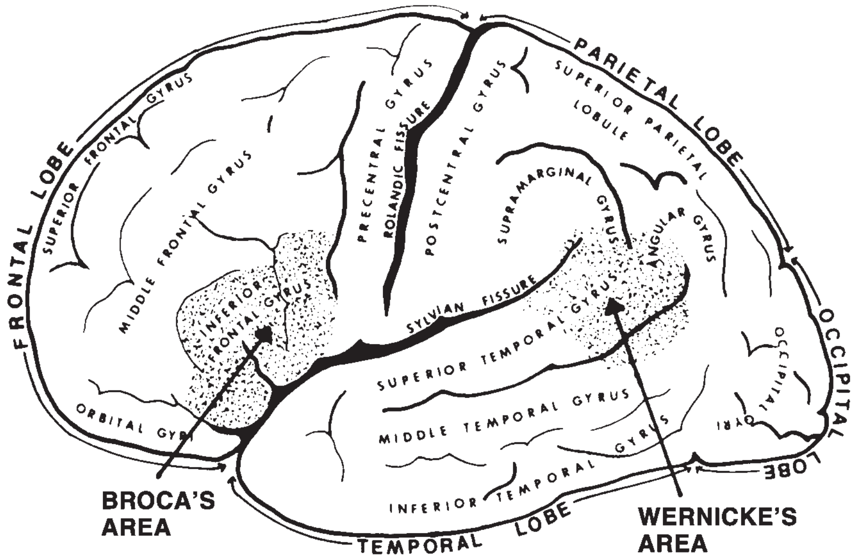


FIGURE 2.3 | Lateral (*external*) view of the left hemisphere of the human brain, showing the position of Broca's and Wernicke's areas—two key areas of the cortex related to language processing.

made in localizing language in the brain based on the study of people with aphasia. In the 1860s the French surgeon Paul Broca proposed that language is localized to the left hemisphere of the brain, and more specifically to the front part of the left hemisphere (now called **Broca's area**). At a scientific meeting in Paris, he claimed that we speak with the left hemisphere. Broca's finding was based on a study of his patients who suffered language deficits after brain injury to the left frontal lobe. A decade later Carl Wernicke, a German neurologist, described another variety of aphasia that occurred in patients with lesions in areas of the left hemisphere temporal lobe, now known as **Wernicke's area**. Language, then, is lateralized to the left hemisphere, and the left hemisphere appears to be the language hemisphere from infancy on. **Lateralization** is the term used to refer to the localization of function to one hemisphere of the brain. Figure 2.3 is a view of the left side of the brain that shows Broca's and Wernicke's areas.

The Linguistic Characterization of Aphasic Syndromes

Most aphasics do not show total language loss. Rather, different aspects of language are selectively impaired, and the kind of impairment is generally related to the location of the brain damage. Because of this damage-deficit correlation, research on patients with aphasia has provided a great deal of information about how language is organized in the brain.

Patients with injuries to Broca's area may have **Broca's aphasia**, as it is often called today. Broca's aphasia is characterized by labored speech and certain kinds of word-finding difficulties, but it is primarily a disorder that affects a person's ability to form sentences with the rules of syntax. One of the most notable characteristics of Broca's aphasia is that the language produced is often **agrammatic**, meaning that it frequently lacks articles, prepositions, pronouns, auxiliary verbs, and other grammatical elements that we will call "function words" for now. Broca's aphasics also typically omit inflections such as the past tense suffix *-ed* or the third person singular verb ending *-s*. Here is an excerpt of a conversation between a patient with Broca's aphasia and a doctor:

DOCTOR: Could you tell me what you have been doing in the hospital?
PATIENT: Yes, sure. Me go, er, uh, P.T. [physical therapy] none o'cot, speech . . . two times . . . read . . . r . . . ripe . . . rike . . . uh write . . . practice . . . get . . . ting . . . better.
DOCTOR: And have you been going home on weekends?
PATIENT: Why, yes . . . Thursday uh . . . uh . . . uh . . . no . . . Friday . . . Bar . . . ba . . . ra . . . wife . . . and oh car . . . drive . . . purpike . . . you know . . . rest . . . and TV.

Broca's aphasics (also often called **agrammatic aphasics**) may also have difficulty understanding complex sentences in which comprehension depends exclusively on syntactic structure and where they cannot rely on their real-world knowledge. For example, an agrammatic aphasic may have difficulty knowing who kissed whom in questions like:

Which girl did the boy kiss?

where it is equally plausible for the boy or the girl to have done the kissing; or might be confused as to who is chasing whom in passive sentences such as:

The cat was chased by the dog.

where it is plausible for either animal to chase the other. But they have less difficulty with:

Which book did the boy read?

or

The car was chased by the dog.

where the meaning can be determined by nonlinguistic knowledge. It is implausible for books to read boys or for cars to chase dogs, and aphasic people can use that knowledge to interpret the sentence.

Unlike Broca's patients, people with **Wernicke's aphasia** produce fluent speech with good intonation, and they may largely adhere to the rules of syntax. However, their language is often semantically incoherent. For example, one patient replied to a question about his health with:

I felt worse because I can no longer keep in mind from the mind of the minds to keep me from mind and up to the ear which can be to find among ourselves.

Another patient described a fork as "a need for a schedule" and another, when asked about his poor vision, replied, "My wires don't hire right."

People with damage to Wernicke's area have difficulty naming objects presented to them and also in choosing words in spontaneous speech. They may make numerous lexical errors (word substitutions), often producing **jargon** and **nonsense words**, as in the following example:

> The only thing that I can say again is madder or modder fish sudden fishing sewed into the accident to miss in the purdles.

Another example is from a patient who was a physician before his aphasia. When asked if he was a doctor, he replied:

> Me? Yes sir. I'm a male demaploze on my own. I still know my tubaboys what for I have that's gone hell and some of them go.

Severe Wernicke's aphasia is often referred to as **jargon aphasia**. The linguistic deficits exhibited by people with Broca's and Wernicke's aphasia point to a **modular** organization of language in the brain. We find that damage to different parts of the brain results in different kinds of linguistic impairment (e.g., syntactic versus semantic). This supports the hypothesis that the mental grammar, like the brain itself, is not an undifferentiated system, but rather consists of distinct components or modules with different functions.

The kind of word substitutions that aphasic patients produce also tell us about how words are organized in the mental lexicon. Sometimes the substituted words are similar to the intended words in their sounds. For example, *pool* might be substituted for *tool*, *sable* for *table*, or *crucial* for *crucible*. Sometimes they are similar in meaning (e.g., *table* for *chair* or *boy* for *girl*). These errors resemble the speech errors that anyone might make, but they occur far more frequently in people with aphasia. The substitution of semantically or phonetically related words tells us that neural connections exist among semantically related words and among words that sound alike. Words are not mentally represented in a simple list but rather in an organized network of connections.

Similar observations pertain to reading. The term dyslexia refers to reading disorders. Many word substitutions are made by people who become dyslexic after brain damage. They are called **acquired dyslexics** because before their brain lesions they were normal readers (unlike developmental dyslexics, who have difficulty learning to read). One group of these patients, when reading words printed on cards aloud, produced the kinds of substitutions shown in the following examples.

Stimulus	Response 1	Response 2
act	*play*	*play*
applaud	*laugh*	*cheers*
example	*answer*	*sum*
heal	*pain*	*medicine*
south	*west*	*east*

The omission of function words in the speech of agrammatic aphasics shows that this class of words is mentally distinct from content words like nouns. A similar phenomenon has been observed in acquired dyslexia. The patient who produced the semantic substitutions cited previously was also agrammatic and was not able to read function words at all. When presented with words like *which* or *would*, he just said, "No" or "I hate those little words." However, he could read homophonous nouns and verbs, though with many semantic mistakes, as shown in the following:

Stimulus	Response	Stimulus	Response
witch	*witch*	which	*no!*
hour	*time*	our	*no!*
eye	*eyes*	I	*no!*
hymn	*bible*	him	*no!*
wood	*wood*	would	*no!*

All these errors provide evidence that the mental dictionary has content words and function words in different compartments, and that these two classes of words are processed in different brain areas or by different neural mechanisms, further supporting the view that both the brain and language are structured in a complex, modular fashion.

Additional evidence regarding hemispheric specialization is drawn from Japanese readers. The Japanese language has two main writing systems. One system, *kana*, is based on the sound system of the language; each symbol corresponds to a syllable. The other system, *kanji*, is ideographic; each symbol corresponds to a word. (More about this in chapter 12 on writing systems.) *Kanji* is not based on the sounds of the language. Japanese people with left-hemisphere damage are impaired in their ability to read *kana*, whereas people with right-hemisphere damage are impaired in their ability to read *kanji*. Also, experiments with unimpaired Japanese readers show that the right hemisphere is better and faster than the left hemisphere at reading *kanji*, and vice versa.

Most of us have experienced word-finding difficulties in speaking if not in reading, as Alice did in "Wonderland" when she said:

> "And now, who am I? I will remember, if I can. I'm determined to do it!" But being determined didn't help her much, and all she could say, after a great deal of puzzling, was "L, I know it begins with L."

This **tip-of-the-tongue phenomenon** (often referred to as **TOT**) is not uncommon. But if you could *rarely* find the word you wanted, imagine how frustrated you would be. This is the fate of many aphasics whose impairment involves severe **anomia**—the inability to find the word you wish to speak.

It is important to note that the language difficulties suffered by aphasics are not caused by any general cognitive or intellectual impairment or loss of motor or sensory controls of the nerves and muscles of the speech organs or hearing apparatus. Aphasics can produce and hear sounds. Whatever loss they suffer has to do only with the language faculty (or specific parts of it).

Deaf signers with damage to the left hemisphere show aphasia for sign language similar to the language breakdown in hearing aphasics, even though sign language is a visual-spatial language. Deaf patients with lesions in Broca's area show language deficits like those found in hearing patients, namely severely dysfluent, agrammatic sign production. Likewise, those with damage to Wernicke's area have fluent but often semantically incoherent sign language, filled with made-up signs. Although deaf aphasic patients show marked sign language deficits, they have no difficulty producing nonlinguistic gestures or sequences of nonlinguistic gestures, even though both nonlinguistic gestures and linguistic signs are produced by the same "articulators"—the hands and arms. Deaf aphasics also have no difficulty in processing nonlinguistic visual-spatial relationships, just as hearing aphasics have no problem with processing nonlinguistic auditory stimuli. These findings are important because they show that the left hemisphere is lateralized for language—an abstract system of symbols and rules—and not simply for hearing or speech. Language can be realized in different modalities, spoken or signed, but will be lateralized to the left hemisphere regardless of modality.

The kind of selective impairments that we find in people with aphasia has provided important information about the organization of different language and cognitive abilities, especially grammar and the lexicon. It tells us that language is a separate cognitive module—so aphasics can be otherwise cognitively normal—and also that within language, separate components can be differentially affected by damage to different regions of the brain.

Historical Descriptions of Aphasia

Interest in aphasia has a long history. Greek Hippocratic physicians reported that loss of speech often occurred simultaneously with paralysis of the right side of the body. Psalm 137 states: "If I forget thee, Oh Jerusalem, may my right hand lose its cunning and my tongue cleave to the roof of my mouth." This passage also shows that a link between loss of speech and paralysis of the right side was recognized.

Pliny the Elder (C.E. 23–79) refers to an Athenian who "with the stroke of a stone fell presently to forget his letters only, and could read no more; otherwise, his memory served him well enough." Numerous clinical descriptions of patients like the Athenian with language deficits, but intact nonlinguistic cognitive systems, were published between the fifteenth and eighteenth centuries. The language difficulties were not attributed to either general intellectual deficits or loss of memory, but to a specific impairment of language.

Carl Linnaeus in 1745 published a case study of a man suffering from jargon aphasia, who spoke "as if it were a foreign language, having his own names for all words." Another physician of that century reported on a patient's word substitution errors:

> After an illness, she was suddenly afflicted with a forgetting, or, rather, an incapacity or confusion of speech. . . . If she desired a *chair*, she would ask for a *table*. . . . Sometimes she herself perceived that she misnamed objects; at other times, she was annoyed when a *fan*, which she had asked for, was brought to her, instead of the *bonnet*, which she thought she had requested.

Physicians of the day described other kinds of linguistic breakdown in detail, such as a priest who, following brain damage, retained his ability to read Latin but lost the ability to read German.

The historical descriptions of language loss following brain damage foreshadow the later controlled scientific studies of aphasia that have provided substantial evidence that language is predominantly and most frequently a left-hemisphere function. In most cases lesions to the left hemisphere result in aphasia, but injuries to the right do not (although such lesions result in deficits in facial recognition, pattern recognition, and other cognitive abilities). Still, caution must be taken. The ability to understand intonation connected with various emotional states and also to understand metaphors (e.g., *The walls have ears*), jokes, puns, double entendres, and the like can be affected in patients with right hemisphere damage. If such understanding has a linguistic component, then we may have to attribute some language cognition to the right hemisphere.

Studies of aphasia have provided not only important information regarding where and how language is localized in the brain, but also data bearing on the properties and principles of grammar that have been hypothesized for non-brain-damaged adults. For example, the study of aphasia has provided empirical evidence concerning theories of word structure (chapter 3), sentence formation (chapter 4), meaning (chapter 5), and sound systems (chapters 6 and 7).

Brain Imaging Technology

The historical descriptions of aphasia illustrate that people have long been fascinated by the brain-language connection. Today we no longer need to rely on surgery or autopsy to locate brain lesions or to identify the language regions of the brain. Noninvasive brain recording technologies such as computer tomography (CT) scans and **magnetic resonance imaging (MRI)** can reveal lesions in the living brain shortly after the damage occurs. In addition, **positron emission tomography (PET)** scans, functional MRI (fMRI) scans, and single photon emission CT (SPECT) scans provide images of the brain in action. It is now possible to detect changes in brain activity and to relate these changes to localized brain damage and specific linguistic and nonlinguistic cognitive tasks.

Figures 2.4 and 2.5 show MRI scans of the brains of a Broca's aphasic patient and a Wernicke's aphasic patient. The black areas show the sites of the lesions. Each diagram represents a slice of the left side of the brain.

A variety of scanning techniques permit us to measure metabolic activity in particular areas of the brain. Areas of greater activity are those most involved in the mental processes at the moment of the scan. Supplemented by magnetic encephalography (MEG), which measures magnetic fields in the living brain, these techniques can show us how the healthy brain reacts to particular linguistic stimuli. For example, the brains of normal adults are observed when they are asked to listen to two or more sounds and determine if they are the same. Or they may be asked to listen to strings of sounds or read a string of letters and determine if they are real or possible words, or listen to or read sequences of words and say whether they form grammatical or ungrammatical sentences. The results of these studies reaffirm the earlier findings that language resides in specific areas of the left hemisphere.

Dramatic evidence for a differentiated and structured brain is also provided by studies of both normal individuals and patients with lesions in regions of the brain other than Broca's and Wernicke's areas. Some patients have difficulty speaking a person's name; others have problems naming animals; and still oth-

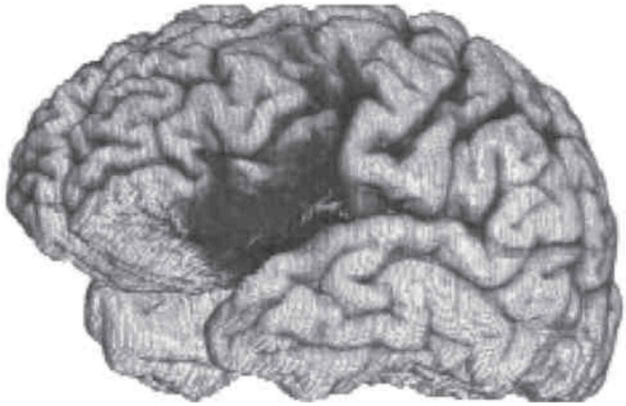


FIGURE 2.4 | Three-dimensional reconstruction of the brain of a living patient with Broca's aphasia. Note area of damage in left frontal region (*dark gray*), which was caused by a stroke.
Courtesy of Hanna Damásio.

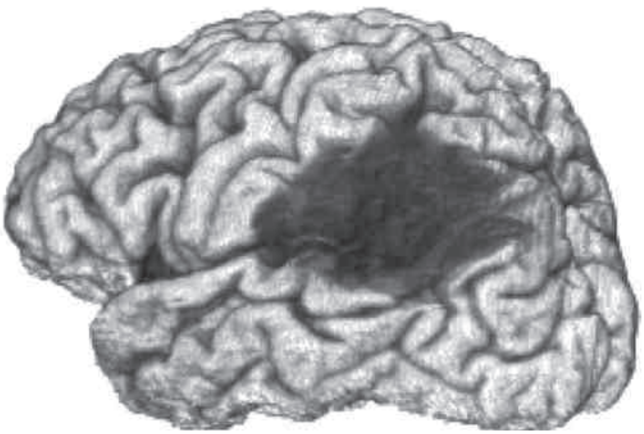


FIGURE 2.5 | Three-dimensional reconstruction of the brain of a living patient with Wernicke's aphasia. Note area of damage in left posterior temporal and lower parietal region (*dark gray*), which was caused by a stroke.
Courtesy of Hanna Damásio.

ers cannot name tools. fMRI studies have revealed the shape and location of the brain lesions in each of these types of patients. The patients in each group had brain lesions in distinct, nonoverlapping regions of the left temporal lobe. In a follow-up PET scan study, normal subjects were asked to name persons, animals, or tools. Experimenters found that there was differential activation in the normal brains in just those sites that were damaged in the aphasics who were unable to name persons, animals, or tools.

Further evidence for the separation of cognitive systems is provided by the neurological and behavioral findings that follow brain damage. Some patients lose the ability to recognize sounds or colors or familiar faces while retaining all other functions. A patient may not be able to recognize his wife when she walks into the room until she starts to talk. This suggests the differentiation of many aspects of visual and auditory processing.

Brain Plasticity and Lateralization in Early Life

It takes only one hemisphere to have a mind.

A. L. WIGAN, *The Duality of the Mind*, 1844

Lateralization of language to the left hemisphere is a process that begins very early in life. Wernicke's area is visibly distinctive in the left hemisphere of the fetus by the twenty-sixth gestational week. Infants as young as one week old show a greater electrical response in the left hemisphere to language and in the right hemisphere to music. A recent study videotaped the mouths of babies between the ages of five and twelve months when they were smiling and when they were babbling in syllables (producing sequences like *mamama* or *gugugu*). The study found that during smiling, the babies had a greater opening of the left side of the mouth (the side controlled by the right hemisphere), whereas during babbling, they had a greater opening of the *right* side (controlled by the left hemisphere). This indicates more left hemisphere involvement even at this very early stage of productive language development (see chapter 8).

While the left hemisphere is innately predisposed to specialize for language, there is also evidence of considerable *plasticity* (i.e., flexibility) in the system during the early stages of language development. This means that under certain circumstances, the right hemisphere can take over many of the language functions that would normally reside in the left hemisphere. An impressive illustration of plasticity is provided by children who have undergone a procedure known as **hemispherectomy**, in which one hemisphere of the brain is surgically removed. This procedure is used to treat otherwise intractable cases of epilepsy. In cases of left hemispherectomy after language acquisition has begun, children experience an initial period of aphasia and then reacquire a linguistic system that is virtually indistinguishable from that of normal children. They also show many of the developmental patterns of normal language acquisition. UCLA professor Susan Curtiss and colleagues have studied many of these children. They hypothesize that the latent linguistic ability of the right hemisphere is "freed" by the removal of the diseased left hemisphere, which may have had a strong inhibitory effect before the surgery.

In adults, however, surgical removal of the left hemisphere inevitably results in severe loss of language function (and so is done only in life-threatening circumstances), whereas adults (and children who have already acquired language) who have had their right hemispheres removed retain their language abilities. Other cognitive losses may result, such as those typically lateralized to the right hemisphere. The plasticity of the brain decreases with age and with the increasing specialization of the different hemispheres and regions of the brain.

Despite strong evidence that the left hemisphere is predetermined to be the language hemisphere in most humans, some evidence suggests that the right hemisphere also plays a role in the earliest stages of language acquisition. Children with prenatal, perinatal, or childhood brain lesions in the right hemisphere can show delays and impairments in babbling and vocabulary learning, whereas children with early left hemisphere lesions demonstrate impairments in their ability to form phrases and sentences. Also, many children who undergo right hemispherectomy before two years of age do not develop language, even though they still have a left hemisphere.

Various findings converge to show that the human brain is essentially designed to specialize for language in the left hemisphere but that the right hemisphere is involved in early language development. They also show that, under the right circumstances, the brain is remarkably resilient and that if brain damage or surgery occurs early in life, normal left hemisphere functions can be taken over by the right hemisphere.

Split Brains

People suffering from intractable epilepsy may be treated by severing communication between their two hemispheres. Surgeons cut through the corpus callosum (see Figure 2.1), the fibrous network that connects the two halves. When this pathway is severed, there is no communication between the "two brains." Such **split-brain** patients also provide evidence for language lateralization and for understanding contralateral brain functions.

The psychologist Michael Gazzaniga states:

> With [the corpus callosum] intact, the two halves of the body have no secrets from one another. With it sectioned, the two halves become two different conscious mental spheres, each with its own experience base and

> control system for behavioral operations. . . . Unbelievable as this may seem, this is the flavor of a long series of experimental studies first carried out in the cat and monkey.[1]

When the brain is surgically split, certain information from the left side of the body is received only by the right side of the brain, and vice versa. To illustrate, suppose that a monkey is trained to respond with both its hands to a certain visual stimulus, such as a flashing light. After the training is complete, the brain is surgically split. The stimulus is then shown only to the left visual field (the right hemisphere). Because the right hemisphere controls the left side of the body, the monkey will perform only with the left hand.

In humans who have undergone split-brain operations, the two hemispheres appear to be independent, and messages sent to the brain result in different responses, depending on which side receives the message. For example if a pencil is placed in the left hand of a split-brain person whose eyes are closed, the person can use the pencil appropriately but cannot name it because only the left hemisphere can speak. The right brain senses the pencil but the information cannot be relayed to the left brain for linguistic naming because the connections between the two halves have been severed. By contrast, if the pencil is placed in the right hand, the subject is immediately able to name it as well as to describe it because the sensory information from the right hand goes directly to the left hemisphere, where the language areas are located.

Various experiments of this sort have provided information on the different capabilities of the two hemispheres. The right brain does better than the left in pattern-matching tasks, in recognizing faces, and in spatial tasks. The left hemisphere is superior for language, rhythmic perception, temporal-order judgments, and arithmetic calculations. According to Gazzaniga, "the right hemisphere as well as the left hemisphere can emote and while the left can tell you why, the right cannot."

Studies of human split-brain patients have also shown that when the interhemispheric visual connections are severed, visual information from the right and left visual fields becomes confined to the left and right hemispheres, respectively. Because of the crucial endowment of the left hemisphere for language, written material delivered to the right hemisphere cannot be read aloud if the brain is split, because the information cannot be transferred to the left hemisphere. An image or picture that is flashed to the right visual field of a split-brain patient (and therefore processed by the left hemisphere) can be named. However, when the picture is flashed in the left visual field and therefore "lands" in the right hemisphere, it cannot be named.

Other Experimental Evidence of Brain Organization

Dichotic listening is an experimental technique that uses auditory signals to observe the behavior of the individual hemispheres of the human brain. Subjects hear two different sound signals simultaneously through earphones. They may hear *curl* in one ear and *girl* in the other, or a cough in one ear and a laugh in the other. When asked to state what they heard in each ear, subjects are more fre-

[1]Gazzaniga, M. S. 1970. *The bisected brain*. New York: Appleton-Century-Crofts.

quently correct in reporting linguistic stimuli (words, nonsense syllables, and so on) delivered directly to the right ear, but are more frequently correct in reporting nonverbal stimuli (musical chords, environmental sounds, and so on) delivered to the left ear. Such experiments provide strong evidence of lateralization.

Both hemispheres receive signals from both ears, but the contralateral stimuli prevail over the **ipsilateral** (same-side) stimuli because they are processed more robustly. The contralateral pathways are anatomically thicker (think of a four-lane highway versus a two-lane road) and are not delayed by the need to cross the corpus callosum. The accuracy with which subjects report what they hear is evidence that the left hemisphere is superior for linguistic processing, and the right hemisphere is superior for nonverbal information.

These experiments are important because they show not only that language is lateralized, but also that the left hemisphere is not superior for processing all sounds; it is only better for those sounds that are linguistic. The left side of the brain is specialized for language, not sound, as we also noted in connection with sign language research discussed earlier.

Other experimental techniques are also being used to map the brain and to investigate the independence of different aspects of language and the extent of the independence of language from other cognitive systems. Even before the advances in imaging technology of the 1980s and more recently, researchers were taping electrodes to different areas of the skull and investigating the electrical activity of the brain related to perceptual and cognitive information. In such experiments scientists measure **event-related brain potentials (ERPs)**, which are the electrical signals emitted from the brain in response to different stimuli.

For example, ERP differences result when the subject hears speech sounds versus nonspeech sounds, with a greater response from the left hemisphere to speech. ERP experiments also show variations in timing, pattern, amplitude, and hemisphere of response when subjects hear sentences that are meaningless, such as

The man admired Don's headache of the landscape.

as opposed to meaningful sentences such as

The man admired Don's sketch of the landscape.

Such experiments show that neuronal activity varies in location within the brain according to whether the stimulus is language or nonlanguage, with a left hemisphere preference for language. Even jabberwocky sentences—sentences that are grammatical but contain nonsense words, such as Lewis Carroll's *'Twas brillig, and the slithy toves*—elicit an asymmetrical left hemisphere ERP response, demonstrating that the left hemisphere is sensitive to grammatical structure even in the absence of meaning. Moreover, because ERPs also show the timing of neuronal activity as the brain processes language, they can provide insight into the mechanisms that allow the brain to process language quickly and efficiently, on the scale of milliseconds.

ERP and imaging studies of newborns and very young infants show that from birth onward, the left hemisphere differentiates between nonlinguistic acoustic processing and linguistic processing of sounds, and does so via the same neural pathways that adults use. These results indicate that at birth the left hemisphere is primed to process language, and to do so in terms of the specific localization of language functions we find in the adult brain.

What is more, these studies have shown that early stages of phonological and syntactic processing do not require attentional resources but are automatic, very much like reflexes. For example, even *sleeping* infants show the asymmetrical and distinct processing of phonological versus equally different but nonlinguistic acoustic signals; and adults are able to perform a completely unrelated task, one that takes up considerable attentional resources, at the same time they are listening to sentences, without affecting the nature or degree of the brain activity that is the neural reflex of automatic, mandatory early syntactic processing.

Experimental evidence from these various neurolinguistic techniques has provided empirical confirmation for theories of language structure. For example, ERP, fMRI, PET, and MEG studies provide measurable confirmation of discrete speech sounds and their phonetic properties. These studies also substantiate linguistic evidence that words have an internal structure consisting of *morphemes* (chapter 3) and belong to categories such as nouns and verbs. Neurolinguistic experiments also support the mental reality of many of the syntactic structures proposed by linguists. Thus neurolinguistic experimentation provides data for both aspects of neurolinguistics: for helping to determine where and how language is represented and processed in the brain, and for providing empirical support for concepts and hypotheses in linguistic theory.

The results of neurolinguistic studies, which use different techniques and different subject populations, both normal and brain damaged, are converging to provide the information we seek on the relationship between the brain and various language and nonlanguage cognitive systems. However, as pointed out by Professors Colin Phillips and Kuniyoshi Sakai,

> . . . knowing where language is supported in the human brain is just one step on the path to finding what are the special properties of those brain regions that make language possible. . . . An important challenge for coming years will be to find whether the brain areas implicated in language studies turn out to have distinctive properties at the neuronal level that allow them to explain the special properties of human language.[2]

The Autonomy of Language

In addition to brain-damaged individuals who have lost their language ability, there are children without brain lesions who nevertheless have difficulties in acquiring language or are much slower than the average child. They show no other cognitive deficits, they are not autistic or retarded, and they have no perceptual problems. Such children are suffering from **specific language impairment**

[2]Phillips, C., and K. L. Sakai. 2005. Language and the brain. *Yearbook of science and technology 2005*. Boston: McGraw-Hill Publishers.

(**SLI**). Only their linguistic ability is affected, and often only specific aspects of grammar are impaired.

Children with SLI have problems with the use of function words such as articles, prepositions, and auxiliary verbs. They also have difficulties with inflectional suffixes on nouns and verbs such as markers of tense and agreement. Several examples from a four-year-old boy with SLI illustrate this:

Meowmeow chase mice.
Show me knife.
It not long one.

An experimental study of several SLI children showed that they produced the past tense marker on the verb (as in *danc**ed***) about 27 percent of the time, compared with 95 percent by the normal control group. Similarly, the SLI children produced the plural marker *-s* (as in *boy**s***) only 9 percent of the time, compared with 95 percent by the normal children.

Other studies of children with SLI reveal broader grammatical impairments, involving difficulties with many grammatical structures and operations. However, most investigations of SLI children show that they have particular problems with verbal inflection, especially with producing tensed verbs (*walk**s***, *walk**ed***), and also with syntactic structures involving certain kinds of word reorderings such as *Mother is hard to please*, a rearrangement of *It is hard to please Mother.* In many respects these difficulties resemble the impairments demonstrated by aphasics. Recent work on SLI children also shows that the different components of language (phonology, syntax, lexicon) can be selectively impaired or spared. As is the case with aphasia, these studies of SLI provide important information about the nature of language and help linguists develop theories about the underlying properties of language and its development in children.

SLI children show that language may be impaired while general intelligence stays intact, supporting the view of a grammatical faculty that is separate from other cognitive systems. But is it possible for language to develop normally when general intelligence is impaired? If such individuals can be found, it argues strongly for the view that language does not derive from some general cognitive ability.

Other Dissociations of Language and Cognition

[T]he human mind is not an unstructured entity but consists of components which can be distinguished by their functional properties.

NEIL SMITH AND IANTHI-MARIA TSIMPLI, *The Mind of a Savant: Language, Learning, and Modularity*, 1995

There are numerous cases of intellectually handicapped individuals who, despite their disabilities in certain spheres, show remarkable talents in others. There are superb musicians and artists who lack the simple abilities required to take care of themselves. Such people are referred to as **savants**. Some of the most famous savants are human calculators who can perform arithmetic computations at phenomenal speed, or calendrical calculators who can tell you without pause on which day of the week any date in the last or next century falls.

Until recently, most such savants have been reported to be linguistically handicapped. They may be good mimics who can repeat speech like parrots, but they show meager creative language ability. Nevertheless, the literature reports cases of language savants who have acquired the highly complex grammar of their language (as well as other languages in some cases) but who lack nonlinguistic abilities of equal complexity. Laura and Christopher are two such cases.

Laura

Laura was a retarded young woman with a nonverbal IQ of 41 to 44. She lacked almost all number concepts, including basic counting principles, and could draw only at a preschool level. She had an auditory memory span limited to three units. Yet, when at the age of sixteen she was asked to name some fruits, she responded with *pears*, *apples*, and *pomegranates*. In this same period she produced syntactically complex sentences like *He was saying that I lost my battery-powered watch that I loved*, and *She does paintings, this really good friend of the kids who I went to school with and really loved*, and *I was like 15 or 19 when I started moving out of home . . .*

Laura could not add 2 + 2. She didn't know how old she was or how old she was when she moved away from home, nor whether 15 is before or after 19. Nevertheless, Laura produced complex sentences with multiple phrases and sentences with other sentences inside them. She used and understood passive sentences, and she was able to inflect verbs for number and person to agree with the subject of the sentence. She formed past tenses in accord with adverbs that referred to past time. She could do all this and more, but she could neither read nor write nor tell time. She did not know who the president of the United States was or what country she lived in. Her drawings of humans resembled potatoes with stick arms and legs. Yet, in a sentence imitation task, she both detected and corrected grammatical errors.

Laura is but one of many examples of children who display well-developed grammatical abilities, less-developed abilities to associate linguistic expressions with the objects they refer to, and severe deficits in nonlinguistic cognition.

In addition, any notion that linguistic competence results simply from communicative abilities, or develops to serve communicative functions, is belied by studies of children with good linguistic skills, but nearly no or severely limited communicative skills. The acquisition and use of language seem to depend on cognitive skills different from the ability to communicate in a social setting.

Christopher

Christopher has a nonverbal IQ between 60 and 70 and must live in an institution because he is unable to take care of himself. The tasks of buttoning a shirt, cutting his fingernails, or vacuuming the carpet are too difficult for him. However, his linguistic competence is as rich and as sophisticated as that of any native speaker. Furthermore, when given written texts in some fifteen to twenty languages, he translates them quickly, with few errors, into English. The languages include Germanic languages such as Danish, Dutch, and German; Romance languages such as French, Italian, Portuguese, and Spanish; as well as Polish, Finnish, Greek, Hindi, Turkish, and Welsh. He learned these languages from speakers who used them in his presence, or from grammar books. Christopher loves to study and learn languages. Little else is of interest to him. His situation strongly suggests that his linguistic ability is independent of his general intellectual ability.

The question as to whether the language faculty is a separate cognitive system or whether it is derivative of more general cognitive mechanisms is controversial and has received much attention and debate among linguists, psychologists, neuropsychologists, and cognitive scientists. Cases such as Laura and Christopher argue against the view that linguistic ability derives from general intelligence because these two individuals (and others like them) developed language despite other pervasive intellectual deficits. A growing body of evidence supports the view that the human animal is biologically equipped from birth with an autonomous language faculty that is highly specific and that does not derive from general human intellectual ability.

Genetic Basis of Language

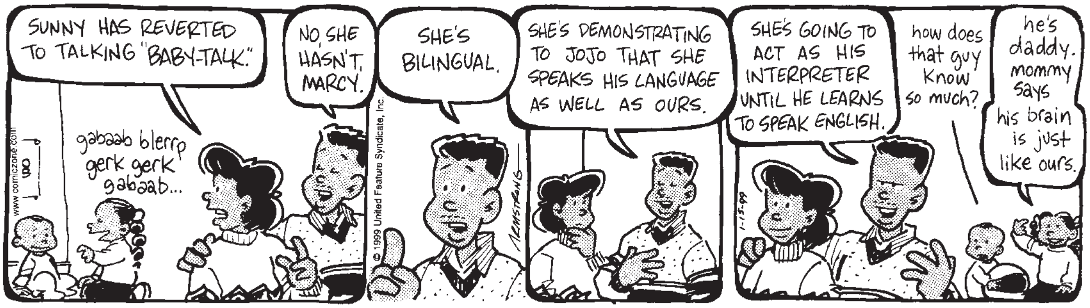
Studies of genetic disorders also reveal that one cognitive domain can develop normally along with abnormal development in other domains, and they also underscore the strong biological basis of language. Children with Turner syndrome (a chromosomal anomaly) have normal language and advanced reading skills along with serious nonlinguistic (visual and spatial) cognitive deficits. Similarly, studies of the language of children and adolescents with Williams syndrome reveal a unique behavioral profile in which certain linguistic functions seem to be relatively preserved in the face of visual and spatial cognitive deficits and moderate retardation. In addition, developmental dyslexia and SLI also appear to have a genetic basis. And recent studies of Klinefelter syndrome (another chromosomal anomaly) show quite selective syntactic and semantic deficits alongside intact intelligence.

Epidemiological and familial aggregation studies show that SLI runs in families. One such study is of a large multigenerational family, half of whom are language impaired. The impaired members of this family have a very specific grammatical problem: They do not reliably use word-endings or "irregular" verbs correctly. In particular, they often fail to indicate the tense of the verb. They routinely produce sentences such as the following:

She remembered when she hurts herself the other day.
He did it then he fall.
The boy climb up the tree and frightened the bird away.

These and similar results show that a large proportion of SLI children have language-impaired family members, pointing to SLI as a heritable disorder. Studies also show that monozygotic (identical) twins are more likely to both suffer from SLI than dizygotic (fraternal) twins. Thus evidence from SLI and other genetic disorders, along with the asymmetry of abilities in linguistic savants, strongly supports the view that the language faculty is an autonomous, genetically determined module of the brain.

Language and Brain Development



Language and the brain are intimately connected. Specific areas of the brain are devoted to language, and injury to these areas disrupts language. In the young child, injury to or removal of the left hemisphere has severe consequences for language development. Conversely, increasing evidence shows that normal brain development depends on early and regular exposure to language. (See chapter 8.)

The Critical Period

Under normal circumstances, a child is introduced to language virtually at the moment of birth. Adults talk to him and to each other in his presence. Children do not require explicit language instruction, but they do need exposure to language in order to develop normally. Children who do not receive linguistic input during their formative years do not achieve nativelike grammatical competence. Moreover, behavioral tests and brain imaging studies show that late exposure to language alters the fundamental organization of the brain for language.

The **critical-age hypothesis** assumes that language is biologically based and that the ability to learn a native language develops within a fixed period, from birth to middle childhood. During this **critical period**, language acquisition proceeds easily, swiftly, and without external intervention. After this period, the acquisition of grammar is difficult and, for most individuals, never fully achieved. Children deprived of language during this critical period show atypical patterns of brain lateralization.

The notion of a critical period is true of many species and seems to pertain to species-specific, biologically triggered behaviors. Ducklings, for example, during the period from nine to twenty-one hours after hatching, will follow the first moving object they see, whether or not it looks or waddles like a duck. Such behavior is not the result of conscious decision, external teaching, or intensive practice. It unfolds according to what appears to be a maturationally determined schedule that is universal across the species. Similarly, as discussed in a later section, certain species of birds develop their bird song during a biologically determined window of time.

Instances of children reared in environments of extreme social isolation constitute "experiments in nature" for testing the critical-age hypothesis. The most dramatic cases are those described as "wild" or "feral" children. A celebrated case, documented in François Truffaut's film *The Wild Child*, is that of Victor, "the wild boy of Aveyron," who was found in 1798. It was ascertained that he had been left in the woods when very young and had somehow survived. In 1920 two children, Amala and Kamala, were found in India, supposedly having been reared by wolves.

Other children have been isolated because of deliberate efforts to keep them from normal social intercourse. In 1970, a child called Genie in the scientific reports was discovered. She had been confined to a small room under conditions of physical restraint and had received only minimal human contact from the age of eighteen months until nearly fourteen years.

None of these children, regardless of the cause of isolation, was able to speak or knew any language at the time they were reintroduced into society. This linguistic inability could simply be caused by the fact that these children received no linguistic input, showing that language acquisition, though an innate, neurologically based ability, must be triggered by input from the environment. In the documented cases of Victor and Genie, however, these children were unable to acquire grammar even after years of exposure, and despite the ability to learn many words.

Genie was able to learn a large vocabulary, including colors, shapes, objects, natural categories, and abstract as well as concrete terms, but her grammatical skills never fully developed. The UCLA linguist Susan Curtiss, who worked with Genie for several years, reported that Genie's utterances were, for the most part, "the stringing together of content words, often with rich and clear meaning, but with little grammatical structure." Many utterances produced by Genie at the age of fifteen and older, several years after her emergence from isolation, are like those of two-year-old children, and not unlike utterances of Broca's aphasia patients and people with SLI, such as the following:

Man motorcycle have.
Genie full stomach.
Genie bad cold live father house.
Want Curtiss play piano.
Open door key.

Genie's utterances lacked articles, auxiliary verbs like *will* or *can*, the third-person singular agreement marker *-s*, the past-tense marker *-ed*, question words like *who*, *what*, and *where*, and pronouns. She had no ability to form more complex types of sentences such as questions (e.g., *Are you feeling hungry?*). Genie started learning language after the critical period and was therefore never able to fully acquire the grammatical rules of English.

Tests of lateralization (dichotic listening and ERP experiments) showed that Genie's language was lateralized to the *right* hemisphere. Her test performance was similar to that found in split-brain and left hemispherectomy patients, yet Genie was not brain damaged. Curtiss speculates that after the critical period, the usual language areas functionally atrophy because of inadequate linguistic stimulation. Genie's case also demonstrates that language is not the same as communication, because Genie was a powerful nonverbal communicator, despite her limited ability to acquire language.

Chelsea, another case of linguistic isolation, is a woman whose situation also supports the critical-age hypothesis. She was born deaf but was wrongly diagnosed as retarded. When she was thirty-one, her deafness was finally diagnosed, and she was fitted with hearing aids. For years she has received extensive language training and therapy and has acquired a large vocabulary. However, like Genie, Chelsea has not been able to develop a grammar. ERP studies of the localization of language in Chelsea's brain have revealed an equal response to language in both hemispheres. In other words, Chelsea also does not show the normal asymmetric organization for language.

More than 90 percent of children who are born deaf or become deaf before they have acquired language are born to hearing parents. These children have also provided information about the critical age for language acquisition. Because most of their parents do not know sign language at the time these children are born, most receive delayed language exposure. Several studies have investigated the acquisition of American Sign Language (ASL) among deaf signers exposed to the language at different ages. Early learners who received ASL input from birth and up to six years of age did much better in the production and comprehension of complex signs and sign sentences than late learners who were not exposed to ASL until after the age of twelve, even though all of the subjects in these studies had used sign for more than twenty years. There was little difference, however, in vocabulary or knowledge of word order.

Another study compared patterns of lateralization in the brains of adult native speakers of English, adult native signers, and deaf adults who had not been exposed to sign language. The nonsigning deaf adults did not show the same cerebral asymmetries as either the hearing adults or the deaf signers. In recent years there have been numerous studies of late learners of sign language, all with similar results.

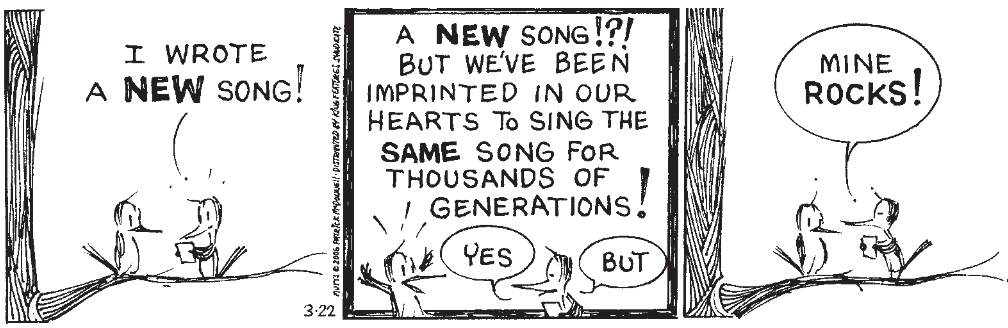
The cases of Genie and other isolated children, as well as deaf late learners of ASL, show that children cannot fully acquire language unless they are exposed to it within the critical period—a biologically determined window of opportunity during which time the brain is prepared to develop language. Moreover, the critical period is linked to brain lateralization. The human brain is primed to develop language in specific areas of the left hemisphere, but the normal process of brain specialization depends on early and systematic experience with language. Language acquisition plays a critical role in, and may even be *the* trigger for, the realization of normal cerebral lateralization for higher cognitive functions in general, not just for language.

Beyond the critical period, the human brain seems unable to acquire the grammatical aspects of language, even with substantial linguistic training or many years of exposure. However, it is possible to acquire words and various conversational skills after this point. This evidence suggests that the critical period holds for the acquisition of grammatical abilities, but not necessarily for all aspects of language.

The selective acquisition of certain components of language that occurs beyond the critical period is reminiscent of the selective impairment that occurs in various language disorders, where specific linguistic abilities are disrupted. This selectivity in both acquisition and impairment points to a strongly modularized language faculty. Language is separate from other cognitive systems and autonomous, and is itself a complex system with various components. In the chapters that follow, we will explore these different language components.

A Critical Period for Bird Song

> That's the wise thrush; he sings each song twice over
> Lest you should think he never could recapture
> The first fine careless rapture!
>
> **ROBERT BROWNING,** "Home-thoughts, from Abroad," 1845



Mutts © Patrick McDonnell, King Features Syndicate

Bird song lacks certain fundamental characteristics of human language, such as discrete sounds and creativity. However, certain species of birds show a critical period for acquiring their "language" similar to the critical period for human language acquisition.

Calls and songs of the chaffinch vary depending on the geographic area that the bird inhabits. The message is the same, but the form or "pronunciation" is different. Usually, a young bird sings a simplified version of the song shortly after hatching. Later, it undergoes further learning in acquiring the fully complex version. Because birds from the same brood acquire different chaffinch songs depending on the area in which they finally settle, part of the song must be learned. On the other hand, because the fledging chaffinch sings the song of its species in a simple degraded form, even if it has never heard it sung, some aspect of it is biologically determined, that is, innate.

The chaffinch acquires its fully developed song in several stages, just as human children acquire language. There is also a critical period in the song learning of chaffinches as well as white-crowned sparrows, zebra finches, and many other species. If these birds are not exposed to the songs of their species during certain fixed periods after their birth—the period differs from species to species—song acquisition does not occur. The chaffinch is unable to learn new song elements after ten months of age. If it is isolated from other birds before attaining the full complexity of its song and is then exposed again after ten months, its song will not develop further. If white-crowned sparrows lose their hearing during a critical period after they have learned to sing, they produce a song that differs from other white crowns. They need to hear themselves sing in order to produce particular whistles and other song features. If, however, the deafness occurs after the critical period, their songs are normal. Similarly, baby nightingales in captivity may be trained to sing melodiously by another nightingale, a "teaching bird," but only before their tail feathers are grown. After that period, they know only the less melodious calls of their parents, and nothing more can be done to further their musical development.

On the other hand, some bird species show no critical period. The cuckoo sings a fully developed song even if it never hears another cuckoo sing. These communicative messages are entirely innate. For other species, songs appear to be at least partially learned, and the learning may occur throughout the bird's lifetime. The bullfinch, for example, will learn elements of songs it is exposed to, even those of another species, and incorporate those elements into its own quiet warble. In a more recent example of unconstrained song learning, Danish ornithologists report that birds have begun to copy the ring tones of cellular phones.

From the point of view of human language research, the relationship between the innate and learned aspects of bird song is significant. Apparently, the basic nature of the songs of some species is present from birth, which means that it is biologically and genetically determined. The same holds true for human language: Its basic nature is innate. The details of bird song and of human language are both acquired through experience that must occur within a critical period.

The Development of Language in the Species

> As the voice was used more and more, the vocal organs would have been strengthened and perfected through the principle of the inherited effects of use; and this would have reacted on the power of speech. But the relation between the continued use of language and the development of the brain has no doubt been far more important. The mental powers in some early progenitor of man must have been more highly developed than in any existing ape, before even the most imperfect form of speech could have come into use.
>
> **CHARLES DARWIN,** *The Descent of Man,* 1871

There is much interest today among biologists as well as linguists in the relationship between the development of language and the evolutionary development of the human species. Some view language as species specific; some do not. Some view language ability as a difference in degree between humans and other primates—a continuity view; others see the onset of language ability as a qualitative leap—the discontinuity view.

In trying to understand the development of language, scholars past and present have debated the role played by the vocal tract and the ear. For example, it has been suggested that speech could not have developed in nonhuman primates because their vocal tracts were anatomically incapable of producing a large enough inventory of speech sounds. According to this hypothesis, the development of language is linked to the evolutionary development of the speech production and perception apparatus. This, of course, would be accompanied by changes in the brain and the nervous system toward greater complexity. Such a view implies that the languages of our human ancestors of millions of years ago may have been syntactically and phonologically simpler than any language known to us today. The notion "simpler" is left undefined, although it has been suggested that this primeval language had a smaller inventory of sounds.

One evolutionary step must have resulted in the development of a vocal tract capable of producing the wide variety of sounds of human language, as well as the mechanism for perceiving and distinguishing them. However, the existence of mynah birds and parrots is evidence that this step is insufficient to explain the origin of language, because these creatures have the ability to imitate human speech, but not the ability to acquire language.

More important, we know from the study of humans who are born deaf and learn sign languages that are used around them that the ability to hear speech sounds is not a necessary condition for the acquisition and use of language. In addition, the lateralization evidence from ERP and imaging studies of people using sign language, as well as evidence from sign language aphasia, show that sign language is organized in the brain like spoken language. Certain auditory locations within the cortex are activated during signing even though no sound is involved, supporting the contention that the brain is neurologically equipped for language rather than speech. The ability to produce and hear a wide variety of sounds therefore appears to be neither necessary nor sufficient for the development of language in the human species.

A major step in the development of language most probably relates to evolutionary changes in the brain. The linguist Noam Chomsky expresses this view:

> It could be that when the brain reached a certain level of complexity it simply automatically had certain properties because that's what happens when you pack 10^{10} neurons into something the size of a basketball.[3]

The biologist Stephen Jay Gould expresses a similar view:

> The Darwinist model would say that language, like other complex organic systems, evolved step by step, each step being an adaptive solution. Yet language is such an integrated "all or none" system, it is hard to imagine it evolving that way. Perhaps the brain grew in size and became capable of all kinds of things which were not part of the original properties.[4]

Other linguists, however, support a more Darwinian natural selection development of what is sometimes called "the language instinct":

> All the evidence suggests that it is the precise wiring of the brain's microcircuitry that makes language happen, not gross size, shape, or neuron packing.[5]

The attempt to resolve this controversy clearly requires more research. Another point that is not yet clear is what role, if any, hemispheric lateralization

[3]Chomsky, N., in Searchinger, G. 1994. The human language series, program 3. Video. New York: Equinox Film/Ways of Knowing, Inc.

[4]Gould, S. J., in Searchinger, G. 1994. The human language series, program 3. Video. New York: Equinox Film/Ways of Knowing, Inc.

[5]Pinker, S. 1995. *The language instinct*. New York: William Morrow.

played in language evolution. Lateralization certainly makes greater specialization possible. Research conducted with birds and monkeys, however, shows that lateralization is not unique to the human brain. Thus, while it may constitute a necessary step in the evolution of language, it is not a sufficient one.

We do not yet have definitive answers to the origin of language in the human brain. The search for these answers goes on and provides new insights into the nature of language and the nature of the human brain.

Summary

The attempt to understand what makes the acquisition and use of language possible has led to research on the brain-mind-language relationship. **Neurolinguistics** is the study of the brain mechanisms and anatomical structures that underlie linguistic competence and performance. Much neurolinguistic research is centered on experimental and behavioral data from people with impaired or atypical language. These results greatly enhance our understanding of language structure and acquisition.

The brain is the most complex organ of the body, controlling motor and sensory activities and thought processes. Research conducted for more than a century has shown that different parts of the brain control different body functions. The nerve cells that form the surface of the brain are called the **cortex**, which serves as the intellectual decision maker, receiving messages from the sensory organs and initiating all voluntary actions. The brain of all higher animals is divided into two parts called the **cerebral hemispheres**, which are connected by the **corpus callosum**, a network that permits the left and right hemispheres to communicate.

Each hemisphere exhibits **contralateral** control of functions. The left hemisphere controls the right side of the body, and the right hemisphere controls the left side. Despite the general symmetry of the human body, much evidence suggests that the brain is asymmetric, with the left and right hemispheres **lateralized** for different functions.

Neurolinguists have many tools for studying the brain, among them **dichotic listening** experiments and many types of scans and electrical measurements. These techniques permit the study of the living brain as it processes language. By studying **split-brain** patients and **aphasics**, localized areas of the brain can be associated with particular language functions. For example, lesions in the part of the brain called **Broca's area** may suffer from **Broca's aphasia**, which results in impaired syntax and **agrammatism**. Damage to **Wernicke's area** may result in **Wernicke's aphasia**, in which fluent speakers produce semantically anomalous utterances, or even worse, **jargon aphasia**, in which speakers produce nonsense forms that make their utterance uninterpretable. Damage to yet different areas can produce **anomia**, a form of aphasia in which the patient has word-finding difficulties.

Deaf signers with damage to the left hemisphere show aphasia for sign language similar to the language breakdown in hearing aphasics, even though sign language is a visual-spatial language.

Other evidence supports the lateralization of language. Children who undergo a left **hemispherectomy** show specific linguistic deficits, whereas other cognitive abilities remain intact. If the right brain is damaged or removed after the first two or three years, however, language is unimpaired, but other cognitive disorders may result.

The language faculty is **modular**. It is independent of other cognitive systems with which it interacts. Evidence for modularity is found in studies of aphasia, of children with **specific language impairment (SLI)**, of linguistic **savants**, and of children who learn language past the **critical period**. The genetic basis for an independent language module is supported by studies of SLI in families and twins and by studies of genetic anomalies associated with language disorders.

The **critical-age hypothesis** states that there is a window of opportunity between birth and middle childhood for learning a first language. The imperfect language learning of persons exposed to language after this period supports the hypothesis. Some songbirds also appear to have a critical period for the acquisition of their calls and songs.

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2

Grammatical Aspects of Language

> The theory of grammar is concerned with the question: What is the nature of a person's knowledge of his language, the knowledge that enables him to make use of language in the normal, creative fashion? A person who knows a language has mastered a system of rules that assigns sound and meaning in a definite way for an infinite class of possible sentences.
>
> **NOAM CHOMSKY,** *Language and Mind*, 1968

3

Morphology: The Words of Language

> A word is dead
> When it is said,
> Some say.
> I say it just
> Begins to live
> That day.
>
> **EMILY DICKINSON,** "A Word Is Dead," *Complete Poems*, 1924

Every speaker of every language knows tens of thousands of words. Unabridged dictionaries of English contain nearly 500,000 entries, but most speakers don't know all of these words. It has been estimated that a child of six knows as many as 13,000 words and the average high school graduate about 60,000. A college graduate presumably knows many more than that, but whatever our level of education, we learn new words throughout our lives, such as the many words in this book that you will learn for the first time.

Words are an important part of linguistic knowledge and constitute a component of our mental grammars, but one can learn thousands of words in a language and still not know the language. Anyone who has tried to communicate in a foreign country by merely using a dictionary knows this is true. On the other hand, without words we would be unable to convey our thoughts through language or understand the thoughts of others.

Someone who doesn't know English would not know where one word begins or ends in an utterance like *Thecatsatonthemat*. We separate written words by spaces, but in the spoken language there are no pauses between most words.

Without knowledge of the language, one can't tell how many words are in an utterance. Knowing a word means knowing that a particular sequence of sounds is associated with a particular meaning. A speaker of English has no difficulty in segmenting the stream of sounds into six individual words—*the*, *cat*, *sat*, *on*, *the*, and *mat*—because each of these words is listed in his or her mental dictionary, or lexicon (the Greek word for *dictionary*), that is part of a speaker's linguistic knowledge. Similarly, a speaker knows that *uncharacteristically*, which has more letters than *Thecatsatonthemat*, is nevertheless a single word.

The lack of pauses between words in speech has provided humorists with much material. The comical hosts of the show *Car Talk*, aired on National Public Radio, close the show by reading a list of credits that includes the following cast of characters:

Copyeditor:	Adeline Moore (add a line more)
Accounts payable:	Ineeda Czech (I need a check)
Pollution control:	Maury Missions (more emissions)
Purchasing:	Lois Bidder (lowest bidder)
Statistician:	Marge Innovera (margin of error)
Russian chauffeur:	Picov Andropov (pick up and drop off)
Legal firm:	Dewey, Cheetham, and Howe[1] (Do we cheat 'em? And how!)

In all these instances, you would have to have knowledge of English words to make sense of and find humor in such plays on words.

The fact that the same sound sequences (Lois Bidder—lowest bidder) can be interpreted differently shows that the relation between sound and meaning is an arbitrary pairing, as discussed in chapter 1. For example, *Un petit d'un petit* in French means "a little one of a little one," but in English the sounds resemble the name *Humpty Dumpty*.

When you know a word, you know its sound (pronunciation) and its meaning. Because the sound-meaning relation is arbitrary, it is possible to have words with the same sound and different meanings (*bear* and *bare*) and words with the same meaning and different sounds (*sofa* and *couch*).

Because each word is a sound-meaning unit, each word stored in our mental lexicon must be listed with its unique phonological representation, which determines its pronunciation, and with a meaning. For literate speakers, the spelling, or **orthography**, of most of the words we know is included.

Each word in your mental lexicon includes other information as well, such as whether it is a noun, a pronoun, a verb, an adjective, an adverb, a preposition, or a conjunction. That is, the mental lexicon also specifies the **grammatical category** or **syntactic class** of the word. You may not consciously know that a form like *love* is listed as both a verb and a noun, but as a speaker you have such knowledge, as shown by the phrases *I love you* and *You are the love of my life*. If such information were not in the mental lexicon, we would not know how to form grammatical sentences, nor would we be able to distinguish grammatical from ungrammatical sentences.

[1]"Car Talk"™ from National Public Radio. Dewey, Cheetham & Howe, 2006, all rights reserved.

Dictionaries

> Dictionary, n. A malevolent literary device for cramping the growth of a language and making it hard and inelastic.
>
> **AMBROSE BIERCE,** *The Devil's Dictionary*, 1911

The dictionaries that one buys in a bookstore contain some of the information found in our mental dictionaries. However, the aim of most early **lexicographers**, or dictionary makers, was to *prescribe* rather than *describe* the words of a language. They strove to be, as stated in *Webster's* dictionaries, the "supreme authority" of the "correct" pronunciation and meaning of a word. To Samuel Johnson, whose seminal *Dictionary of the English Language* was published in 1755, the aim of a dictionary was to "register" (describe) the language, not to "construct" (prescribe) it.

All dictionaries, from the gargantuan twenty-volume *Oxford English Dictionary* (OED) to the more commonly used "collegiate" dictionaries, provide the following information about each word: (1) spelling, (2) the "standard" pronunciation, (3) definitions to represent the word's one or more meanings, and (4) parts of speech (e.g., noun, verb, preposition). Other information may include the etymology or history of the word, whether the word is nonstandard (such as *ain't*) or slang, vulgar, or obsolete. Many dictionaries provide quotations from published literature to illustrate the given definitions, as was first done by Dr. Johnson.

Owing to the increasing specialization in science and the arts, specialty and subspecialty dictionaries are proliferating. Dictionaries of slang and jargon (see chapter 10) have existed for many years; so have multilingual dictionaries. In addition to these, the shelves of bookstores and libraries are now filled with dictionaries written specifically for biologists, engineers, agriculturists, economists, artists, architects, printers, gays and lesbians, transsexuals, runners, tennis players, and almost any group that has its own set of words to describe what they think and what they do. Our own mental dictionaries include only a small set of the entries in all of these dictionaries, but each word is in someone's lexicon.

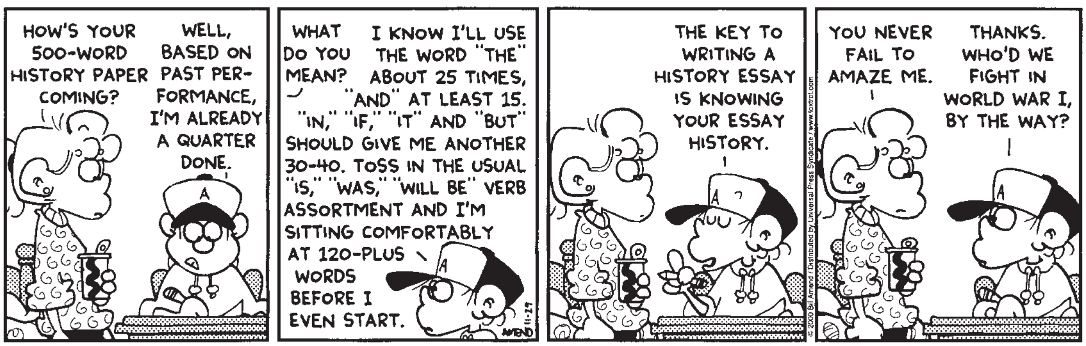
Content Words and Function Words

> ". . . and even . . . the patriotic archbishop of Canterbury found it advisable—"
> "Found what?" said the Duck.
> "Found it," the Mouse replied rather crossly; "of course you know what 'it' means."
> "I know what 'it' means well enough, when I find a thing," said the Duck; "it's generally a frog or a worm. The question is, what did the archbishop find?"
>
> **LEWIS CARROLL,** *Alice's Adventures in Wonderland*, 1865

Languages make an important distinction between two kinds of words—content words and function words. Nouns, verbs, adjectives, and adverbs are the

content words. These words denote concepts such as objects, actions, attributes, and ideas that we can think about like *children*, *anarchism*, *soar*, and *purple*. Content words are sometimes called the **open class** words because we can and regularly do add new words to these classes, such as *Bollywood*, *blog*, *dis*, and *24/7*, pronounced "twenty-four seven."

Other classes of words do not have clear lexical meanings or obvious concepts associated with them, including conjunctions such as *and*, *or*, and *but*; prepositions such as *in* and *of*; the articles *the* and *a/an*, and pronouns such as *it*. These kinds of words are called **function words** because they specify grammatical relations and have little or no semantic content. For example, the articles indicate whether a noun is definite or indefinite—*the* boy or *a* boy. The preposition *of* indicates possession, as in "the book of yours," but this word indicates many other kinds of relations too. The *it* in *it's raining* and *the archbishop found it advisable* are further examples of words whose function is purely grammatical—they are required by the rules of syntax, and as the cartoon suggests, we can hardly do without them.



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Function words are sometimes called **closed class** words. It is difficult to think of any conjunctions, prepositions, or pronouns that have recently entered the language. The small set of personal pronouns such as *I*, *me*, *mine*, *he*, *she*, and so on are part of this class. With the growth of the feminist movement, some proposals have been made for adding a genderless singular pronoun. If such a pronoun existed, it might have prevented the department head in a large university from making the incongruous statement: "We will hire the best person for the job regardless of his sex." Various proposals such as "e" have been put forward, but none are likely to gain acceptance because the closed classes are unreceptive to new membership. Rather, speakers prefer to recruit existing pronouns such as *they* and *their* for this job, as in "We will hire the best person for the job regardless of **their** sex."

The difference between content and function words is illustrated by the following test that has circulated over the Internet:

Count the number of F's in the following text without reading further:

FINISHED FILES ARE THE
RESULT OF YEARS OF SCIENTIFIC
STUDY COMBINED WITH THE
EXPERIENCE OF YEARS.

Most people come up with three, which is wrong. If you came up with fewer than six, count again, and this time, pay attention to the function word *of*.

This little test illustrates that the brain treats content and function words (like *of*) differently. A great deal of psychological and neurological evidence supports this claim. As discussed in chapter 2, some brain-damaged patients and people with specific language impairments have greater difficulty in using, understanding, or reading function words than they do with content words. Some aphasics are unable to read function words like *in* or *which*, but can read the lexical content words *inn* and *witch*.

The two classes of words also seem to function differently in **slips of the tongue** produced by normal individuals. For example, a speaker may inadvertently switch words producing "the journal of the editor" instead of "the editor of the journal," but the switching or exchanging of function words has not been observed. There is also evidence for this distinction from language acquisition (discussed in chapter 8). In the early stages of development, children often omit function words from their speech, as in for example, "doggie barking."

The linguistic evidence suggests that content words and function words play different roles in language. Content words bear the brunt of the meaning, whereas function words connect the content words to the larger grammatical context.

Morphemes: The Minimal Units of Meaning

"They gave it me," Humpty Dumpty continued, "for an un-birthday present."
"I beg your pardon?" Alice said with a puzzled air.
"I'm not offended," said Humpty Dumpty.
"I mean, what is an un-birthday present?"
"A present given when it isn't your birthday, of course."

LEWIS CARROLL, *Through the Looking-Glass*, 1871

In the foregoing dialogue, Humpty Dumpty is well aware that the prefix *un-* means "not," as further shown in the following pairs of words:

A	B
desirable	undesirable
likely	unlikely
inspired	uninspired
happy	unhappy
developed	undeveloped
sophisticated	unsophisticated

Thousands of English adjectives begin with *un-*. If we assume that the most basic unit of meaning is the word, what do we say about parts of words like *un-*, which has a fixed meaning? In all the words in the B column, *un-* means the same thing—"not." *Undesirable* means "not desirable," *unlikely* means "not likely," and so on. All the words in column B consist of at least two meaningful units: *un* + *desirable*, *un* + *likely*, *un* + *inspired*, and so on.

Just as *un-* occurs with the same meaning in the previous list of words, so does *phon-* in the following words. (You may not know the meaning of some of them, but you will when you finish this book.)

phone	phonology	phoneme
phonetic	phonologist	phonemic
phonetics	phonological	allophone
phonetician	telephone	euphonious
phonic	telephonic	symphony

Phon- is a minimal form in that it can't be decomposed. *Ph* doesn't mean anything; *pho*, though it may be pronounced like *foe*, has no relation in meaning to it; and *on* is not the preposition spelled *o-n*. In all the words on the list, *phon* has the identical meaning of "pertaining to sound."

Words have internal structure, which is rule-governed. *Uneaten*, *unadmired*, and *ungrammatical* are words in English, but **eatenun*, **admiredun*, and **grammaticalun* (to mean "not eaten," "not admired," "not grammatical") are not, because we form a negative meaning of a word not by suffixing *un-* but by prefixing it.

When Samuel Goldwyn, the pioneer moviemaker, announced, "In two words: im-possible," he was reflecting the common view that words are the basic meaningful elements of a language. We have seen that this cannot be so, because some words contain several distinct units of meaning. The linguistic term for the most elemental unit of grammatical form is **morpheme**. The word is derived from the Greek word *morphe*, meaning "form." If Goldwyn had taken a linguistics course, he would have said, more correctly, "In two morphemes: im-possible."

The study of the internal structure of words, and of the rules by which words are formed, is **morphology**. This word itself consists of two morphemes, *morph* + *ology*. The suffix *-ology* means "science of" or "branch of knowledge concerning." Thus, the meaning of *morphology* is "the science of (word) forms."

Morphology is part of our grammatical knowledge of a language. Like most linguistic knowledge, this is generally unconscious knowledge.

A single word may be composed of one or more morphemes:

one morpheme	boy
	desire
	morph ("to change form")
two morphemes	boy + ish
	desire + able
	morph + ology
three morphemes	boy + ish + ness
	desire + able + ity

four morphemes	gentle + man + li + ness
	un + desire + able + ity
more than four	un + gentle + man + li + ness
	anti + dis + establish + ment + ari + an + ism

A morpheme may be represented by a single sound, such as the morpheme *a* meaning "without" as in *amoral* and *asexual*, or by a single syllable, such as *child* and *ish* in *child + ish*. A morpheme may also consist of more than one syllable: by two syllables, as in *camel*, *lady*, and *water*; by three syllables, as in *Hackensack* and *crocodile*; or by four or more syllables, as in *hallucinate*, *apothecary*, and *onomatopoeia*.

A morpheme—the minimal linguistic unit—is thus an arbitrary union of a sound and a meaning (or grammatical function) that cannot be further analyzed. It is often called a **linguistic sign**, not to be confused with the *sign* of sign languages. This may be too simple a definition, but it will serve our purposes for now. Every word in every language is composed of one or more morphemes.

Internet bloggers love to point out "inconsistencies" in the English language. They observe that while singers sing and flingers fling, it is not the case that fingers "fing." However, English speakers know that *finger* is a single morpheme, or a **monomorphemic word**. The final *-er* syllable in *finger* is not a separate morpheme because a finger is not "something that fings."

The meaning of a morpheme must be constant. The agentive morpheme *-er* means "one who does" in words like *singer*, *painter*, *lover*, and *worker*, but the same sounds represent the comparative morpheme, meaning "more," in *nicer*, *prettier*, and *taller*. Thus, two different morphemes may be pronounced identically. The identical form represents two morphemes because of the different meanings. The same sounds may occur in another word and not represent a separate morpheme at all, as in *finger*. Conversely, the two morphemes *-er* and *-ster* have the same meaning, but different forms. Both *singer* and *songster* mean "one who sings." And like *-er*, *-ster* is not a morpheme in *monster* because a monster is not something that "mons" or someone that "is mon" the way *youngster* is someone who is young. All of this follows from the concept of the morpheme as a *sound* plus a *meaning* unit.

The decomposition of words into morphemes illustrates one of the fundamental properties of human language—**discreteness**. In all languages, sound units combine to form morphemes, morphemes combine to form words, and words combine to form larger units—phrases and sentences.

Discreteness is an important part of linguistic creativity. We can combine morphemes in novel ways to create new words whose meaning will be apparent to other speakers of the language. If you know that "to write" to a disk or a DVD means to put information on it, you automatically understand that a *writable* DVD is one that can take information; a *rewritable* DVD is one where the original information can be written over; and an *unrewritable* DVD is one that does not allow the user to write over the original information. You know the meanings of all these words by virtue of your knowledge of the discrete morphemes *write*, *re-*, *-able*, and *un-*, and the rules for their combination.

Bound and Free Morphemes

Prefixes and Suffixes

"Dennis the Menace" © Hank Ketcham. Reprinted with permission of North America Syndicate.

Our morphological knowledge has two components: knowledge of the individual morphemes and knowledge of the rules that combine them. One of the things we know about particular morphemes is whether they can stand alone or whether they must be attached to a base morpheme.

Some morphemes like *boy*, *desire*, *gentle*, and *man* may constitute words by themselves. These are **free morphemes**. Other morphemes like *-ish*, *-ness*, *-ly*, *pre-*, *trans-*, and *un-* are never words by themselves but are always parts of words. These **affixes** are **bound morphemes**. We know whether each affix precedes or follows other morphemes. Thus, *un-*, *pre-* (*premeditate*, *prejudge*), and *bi-* (*bipolar*, *bisexual*) are **prefixes**. They occur before other morphemes. Some morphemes occur only as **suffixes**, following other morphemes. English examples of suffix morphemes are *-ing* (*sleeping*, *eating*, *running*, *climbing*),

-er (*singer*, *performer*, *reader*), *-ist* (*typist*, *pianist*, *novelist*, *linguist*), and *-ly* (*manly*, *sickly*, *friendly*), to mention only a few.

Many languages have prefixes and suffixes, but languages may differ in how they deploy these morphemes. A morpheme that is a prefix in one language may be a suffix in another and vice versa. In English the plural morphemes *-s* and *-es* are suffixes (*boy*s, *lass*es). In Isthmus Zapotec, spoken in Mexico, the plural morpheme *ka-* is a prefix:

zigi	"chin"	kazigi	"chins"
zike	"shoulder"	kazike	"shoulders"
diaga	"ear"	kadiaga	"ears"

Languages may also differ in what meanings they express through affixation. In English we do not add an affix to derive a noun from a verb. We have the verb *dance* as in "I like to dance," and we have the noun *dance* as in "There's a dance or two in the old dame yet." The form is the same in both cases. In Turkish, you derive a noun from a verb with the suffix *-ak*, as in the following examples:

dur	"to stop"	durak	"stopping place"
bat	"to sink"	batak	"sinking place" or "marsh/swamp"

To express reciprocal action in English we use the phrase *each other*, as in *understand each other*, *love each other*. In Turkish a morpheme is added to the verb:

anla	"understand"	anlash	"understand each other"
sev	"love"	sevish	"love each other"

The reciprocal suffix in these examples is pronounced *sh* after a vowel and *ish* after a consonant. This is similar to the process in English, in which we use *a* as the indefinite article morpheme before a noun beginning with a consonant, as in *a dog*, and *an* before a noun beginning with a vowel, as in *an apple*. The same morpheme may have more than one slightly different form (see exercise 6, for example). We will discuss the various pronunciations of morphemes in more detail in chapter 7.

In Piro, an Arawakan language spoken in Peru, a single morpheme, *-kaka*, can be added to a verb to express the meaning "cause to":

cokoruha	"to harpoon"	cokoruhakaka	"cause to harpoon"
salwa	"to visit"	salwakaka	"cause to visit"

In Karuk, a Native American language spoken in the Pacific Northwest, adding *-ak* to a noun forms the locative adverbial meaning "in."

ikrivaam	"house"	ikrivaamak	"in a house"

It is accidental that both Turkish and Karuk have a suffix *-ak*. Despite the similarity in *form*, the two meanings are different. Similarly, the reciprocal suffix *-ish* in Turkish is similar in form to the English suffix *-ish* as in *greenish*.

Similarity in meaning may give rise to different forms. In Karuk the suffix *-ara* has the same meaning as the English *-y*, that is, "characterized by" (*hairy* means "characterized by hair").

aptiik	"branch"	aptikara	"branchy"

These examples illustrate again the arbitrary nature of the linguistic sign, that is, of the sound-meaning relationship, as well as the distinction between bound and free morphemes.

Infixes

Some languages also have **infixes**, morphemes that are inserted into other morphemes. Bontoc, spoken in the Philippines, is such a language, as illustrated by the following:

Nouns/Adjectives		**Verbs**	
fikas	"strong"	fumikas	"to be strong"
kilad	"red"	kumilad	"to be red"
fusul	"enemy"	fumusul	"to be an enemy"

In this language, the infix *-um-* is inserted after the first consonant of the noun or adjective. Thus, a speaker of Bontoc who knows that *pusi* means "poor" would understand the meaning of *pumusi*, "to be poor," on hearing the word for the first time, just as an English speaker who learns the verb *sneet* would know that *sneeter* is "one who sneets." A Bontoc speaker who knows that *ngumitad* means "to be dark" would know that the adjective "dark" must be *ngitad*.

Oddly enough, the only infixes in English are full-word obscenities, usually inserted into adjectives or adverbs. The most common infix in America is the word *fuckin'* and all the euphemisms for it, such as *friggin*, *freakin*, *flippin*, and *fuggin*, as in *in-fuggin-credible*, *un-fuckin-believable*, or *Kalama-flippin-zoo*, based on the city in Michigan. In Britain, a common infix is *bloody*, an obscene term in British English, and its euphemisms, such as *bloomin'*. In the movie and stage musical *My Fair Lady*, the word *abso + bloomin + lutely* occurs in one of the songs sung by Eliza Doolittle.

Circumfixes

Some languages have **circumfixes**, morphemes that are attached to a base morpheme both initially and finally. These are sometimes called **discontinuous morphemes**. In Chickasaw, a Muskogean language spoken in Oklahoma, the negative is formed with both a prefix *ik-* and the suffix *-o*. The final vowel of the affirmative is dropped before the negative suffix is added. Examples of this circumfixing are:

Affirmative		**Negative**	
chokma	"he is good"	ik + chokm + o	"he isn't good"
lakna	"it is yellow"	ik + lakn + o	"it isn't yellow"
palli	"it is hot"	ik + pall + o	"it isn't hot"
tiwwi	"he opens (it)"	ik + tiww + o	"he doesn't open (it)"

An example of a more familiar circumfixing language is German. The past participle of regular verbs is formed by adding the prefix *ge*- and the suffix *-t* to the verb root. This circumfix added to the verb root *lieb* "love" produces *geliebt*, "loved" (or "beloved," when used as an adjective).

Roots and Stems

Morphologically complex words consist of a morpheme **root** and one or more affixes. Some examples of English roots are *paint* in *painter*, *read* in *reread*, *ceive* in *conceive*, and *ling* in *linguist*. A root may or may not stand alone as a word (*paint* and *read* do; *ceive* and *ling* don't). In languages that have circumfixes, the root is the form around which the circumfix attaches, for example, the Chickasaw root *chokm* in *ikchokmo* ("he isn't good"). In infixing languages the root is the form into which the infix is inserted; for example, *fikas* in the Bontoc word *fumikas* ("to be strong").

Semitic languages like Hebrew and Arabic have a unique morphological system. Nouns and verbs are built on a foundation of three consonants, and one derives related words by varying the pattern of vowels and syllables. For example, the root for "write" in Egyptian Arabic is *ktb*, from which the following words (among others) are formed by infixing vowels:

katab	"he wrote"
kaatib	"writer"
kitáab	"book"
kútub	"books"

When a root morpheme is combined with an affix, it forms a **stem**. Other affixes can be added to a stem to form a more complex stem, as shown in the following:

root	Chomsky	(proper) noun
stem	Chomsky + ite	noun + suffix
word	Chomsky + ite + s	noun + suffix + suffix
root	believe	verb
stem	believe + able	verb + suffix
word	un + believe + able	prefix + verb + suffix
root	system	noun
stem	system + atic	noun + suffix
stem	un + system + atic	prefix + noun + suffix
stem	un + system + atic + al	prefix + noun + suffix + suffix
word	un + system + atic + al + ly	prefix + noun + suffix + suffix + suffix

With the addition of each new affix, a new stem and a new word are formed. Linguists sometimes use the word **base** to mean any root or stem to which an affix is attached. In the preceding example, *system*, *systematic*, *unsystematic*, and *unsystematical* are bases.

Bound Roots

> It had been a rough day, so when I walked into the party I was very chalant, despite my efforts to appear gruntled and consolate. I was furling my wieldy umbrella . . . when I saw her. . . . She was a descript person. . . . Her hair was kempt, her clothing shevelled, and she moved in a gainly way.
>
> **JACK WINTER,** "How I Met My Wife," *New Yorker*, July 25, 1994
>
>

Bound roots do not occur in isolation and they acquire meaning only in combination with other morphemes. For example, words of Latin origin such as *receive*, *conceive*, *perceive*, and *deceive* share a common root, *ceive*; and the words *remit*, *permit*, *commit*, *submit*, *transmit*, and *admit* share the root *mit*. For the original Latin speakers, the morphemes corresponding to *ceive* and *mit* had clear meanings, but for modern English speakers, Latinate morphemes such as *ceive* and *mit* have no independent meaning. Their meaning depends on the entire word in which they occur.

A similar class of words is composed of a prefix affixed to a bound root morpheme. Examples are *ungainly*, but no **gainly*; *discern*, but no **cern*; *nonplussed*, but no **plussed*; *downhearted* but no **hearted*, and others to be seen in this section's epigraph.

The morpheme *huckle*, when joined with *berry*, has the meaning of a berry that is small, round, and purplish blue; *luke* when combined with *warm* has the meaning "somewhat." Both these morphemes and others like them (*cran*, *boysen*) are bound morphemes that convey meaning only in combination.

Rules of Word Formation

> "I never heard of 'Uglification,'" Alice ventured to say. "What is it?" The Gryphon lifted up both its paws in surprise. "Never heard of uglifying!" it exclaimed. "You know what to beautify is, I suppose?" "Yes," said Alice doubtfully: "it means—to make—prettier." "Well, then," the Gryphon went on, "if you don't know what to uglify is, you are a simpleton."
>
> **LEWIS CARROLL,** *Alice's Adventures in Wonderland*, 1865

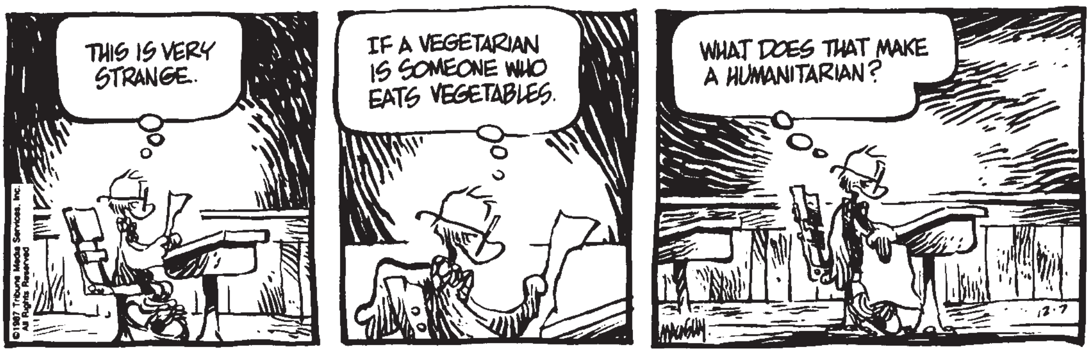
When the Mock Turtle listed the branches of Arithmetic for Alice as "Ambition, Distraction, Uglification, and Derision," Alice was very confused. She wasn't really a simpleton, since *uglification* was not a common word in English until Lewis Carroll used it. Still, most English speakers would immediately know the meaning of *uglification* even if they had never heard or used the word before because they would know the meaning of its individual parts—the root *ugly* and the affixes *-ify* and *-cation*.

We said earlier that knowledge of morphology includes knowledge of individual morphemes, their pronunciation, and their meaning, and knowledge of the rules for combining morphemes into complex words. The Mock Turtle added

-ify to the adjective *ugly* and formed a verb. Many verbs in English have been formed in this way: *purify*, *amplify*, *simplify*, *falsify*. The suffix *-ify* conjoined with nouns also forms verbs: *objectify*, *glorify*, *personify*. Notice that the Mock Turtle went even further; he added the suffix *-cation* to *uglify* and formed a noun, *uglification*, as in *glorification*, *simplification*, *falsification*, and *purification*. By using the **morphological rules** of English, he created a new word. The rules that he used are as follows:

Adjective + ify	→	Verb	"to make Adjective"
Verb + cation	→	Noun	"the process of making Adjective"

Derivational Morphology



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Bound morphemes like *-ify* and *-cation* are called **derivational morphemes**. When they are added to a base, a new word with a new meaning is derived. The addition of *-ify* to *pure*—*purify*—means "to make pure," and the addition of *-cation*—*purification*—means "the process of making pure." If we invent an adjective, *pouzy*, to describe the effect of static electricity on hair, you will immediately understand the sentences "Walking on that carpet really pouzified my hair" and "The best method of pouzification is to rub a balloon on your head." This means that we must have a list of the derivational morphemes in our mental dictionaries as well as the rules that determine how they are added to a root or stem. The form that results from the addition of a derivational morpheme is called a **derived word**.

Derivational morphemes have clear semantic content. In this sense they are like content words, except that they are not words. As we have seen, when a derivational morpheme is added to a base, it adds meaning. The derived word may also be of a different grammatical class than the original word, as shown by suffixes such as *-able* and *-ly*. When a verb is suffixed with *-able*, the result is an adjective, as in *desire* + *able*. When the suffix *-en* is added to an adjective, a verb is derived, as in *dark* + *en*. One may form a noun from an adjective, as in *sweet* + *ie*. Other examples are:

Noun to Adjective	Verb to Noun	Adjective to Adverb
boy + -ish	acquitt + -al	exact + -ly
virtu + -ous	clear + -ance	
Elizabeth + -an	accus + -ation	
pictur + -esque	sing + -er	
affection + -ate	conform + -ist	
health + -ful	predict + -ion	
alcohol + -ic		

Noun to Verb	Adjective to Noun	Verb to Adjective
moral + -ize	tall + -ness	read + -able
vaccin + -ate	specific + -ity	creat + -ive
hast + -en	feudal + -ism	migrat + -ory
	free + -dom	run(n) + -y

Some derivational suffixes do not cause a change in grammatical class. Prefixes never do.

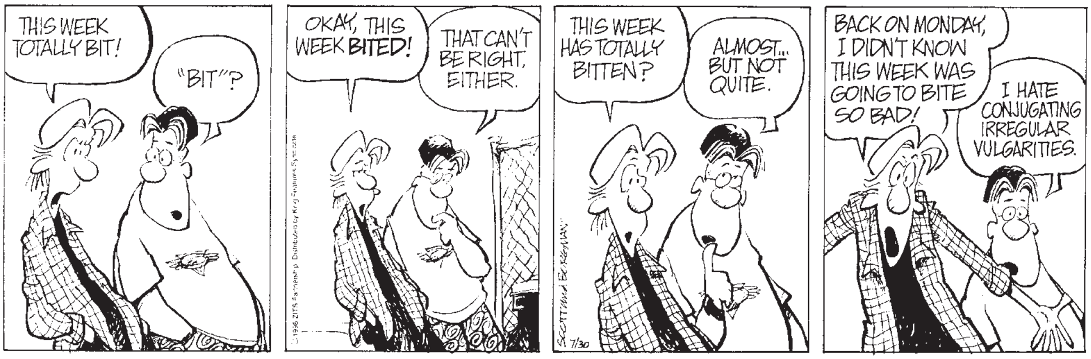
Noun to Noun	Verb to Verb	Adjective to Adjective
friend + -ship	un- + do	pink + -ish
human + -ity	re- + cover	red + -like
king + -dom	dis- + believe	a- + moral
New Jersey + -ite	auto- + destruct	il- + legal
vicar + -age		in- + accurate
Paul + -ine		un- + happy
America + -n		semi- + annual
humanit + -arian		dis- + agreeable
mono- + theism		sub- + minimal
dis- + advantage		
ex- + wife		
auto- + biography		

When a new word enters the lexicon by the application of morphological rules, other complex derivations may be **blocked**. For example, when *Commun + ist* entered the language, words such as *Commun + ite* (as in *Trotsky + ite*) or *Commun + ian* (as in *grammar + ian*) were not needed; their formation was blocked. Sometimes, however, alternative forms do coexist: for example, *Chomskyan* and *Chomskyist* and perhaps even *Chomskyite* (all meaning "follower of Chomsky's views of linguistics"). *Semanticist* and *semantician* are both used, but the possible word *semantite* is not.

Finally, derivational affixes appear to come in two classes. In one class, the addition of a suffix triggers subtle changes in pronunciation. For example, when we affix *-ity* to *specific* (pronounced "specifik" with a *k* sound), we get specificity (pronounced "specifisity" with an *s* sound). When deriving *Elizabeth + an* from *Elizabeth*, the fourth vowel sound changes from the vowel in *Beth* to the vowel in *Pete*. Other suffixes such as *-y*, *-ive*, and *-ize* may induce similar changes: *sane/sanity*, *deduce/deductive*, *critic/criticize*.

On the other hand, suffixes such as *-er*, *-ful*, *-ish*, *-less*, *-ly*, and *-ness* may be tacked onto a base word without affecting the pronunciation, as in *baker*, *wishful*, *boyish*, *needless*, *sanely*, and *fullness*. Moreover, affixes from the first class cannot be attached to a base containing an affix from the second class: **need + less + ity*, **moral + ize + ive*; but affixes from the second class may attach to bases with either kind of affix: *moral + iz(e) + er*, *need + less + ness*.

Inflectional Morphology



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Function words like *to*, *it*, and *be* are free morphemes. Many languages, including English, also have bound morphemes that have a strictly grammatical function. They mark properties such as tense, number, person and so forth. Such bound morphemes are called **inflectional morphemes**. Unlike derivational morphemes, they never change the grammatical category of the stems to which they are attached. Consider the forms of the verb in the following sentences:

1. I sail the ocean blue.
2. He sails the ocean blue.
3. John sailed the ocean blue.
4. John has sailed the ocean blue.
5. John is sailing the ocean blue.

In sentence (2) the *-s* at the end of the verb is an agreement marker; it signifies that the subject of the verb is third person and is singular, and that the verb is in the present tense. It doesn't add lexical meaning. The suffix *-ed* indicates past tense, and is also required by the syntactic rules of the language when verbs are used with *have*, just as *-ing* is required when verbs are used with forms of *be*.

Inflectional morphemes represent relationships between different parts of a sentence. For example, *-s* expresses the relationship between the verb and the third person singular subject; *-ing* expresses the relationship between the time the utterance is spoken (e.g., now) and the time of the event. If you say "John is dancing," it means John is engaged in this activity while you speak. If you say "John danced," the *-ed* affix places the activity before you spoke. As we will discuss in chapter 4, inflectional morphology is closely connected to the syntax of the sentence.

English also has other inflectional endings such as the plural suffix, which is attached to certain singular nouns, as in *boy/boys* and *cat/cats*. In contrast to Old and Middle English, which were more richly inflected languages, as we discuss in chapter 11, modern English has only eight bound inflectional affixes:

English Inflectional Morphemes		Examples
-s	third-person singular present	She wait-**s** at home.
-ed	past tense	She wait-**ed** at home.
-ing	progressive	She is eat-**ing** the donut.
-en	past participle	Mary has eat-**en** the donuts.
-s	plural	She ate the donut-**s**.
-'s	possessive	Disa**'s** hair is short.
-er	comparative	Disa has short-**er** hair than Karin.
-est	superlative	Disa has the short-**est** hair.

Inflectional morphemes in English follow the derivational morphemes in a word. Thus, to the derivationally complex word *commit* + *ment* one can add a plural ending to form *commit* + *ment* + *s*, but the order of affixes may not be reversed to derive the impossible *commit* + *s* + *ment* = **commitsment*.

Yet another distinction between inflectional and derivational morphemes is that inflectional morphemes are **productive**: they apply freely to nearly every appropriate base (excepting "irregular" forms such as *feet*, not **foots*). Most nouns takes an *-s* inflectional suffix to form a plural, but only some nouns take the derivational suffix *-ize* to form a verb: *idolize*, but not **picturize*.

Compared to many languages of the world, English has relatively little inflectional morphology. Some languages are highly inflected. In Swahili, which is widely spoken in eastern Africa, verbs can be inflected with multiple morphemes, as in *nimepiga* (ni + me + pig + a), meaning "he has hit something." Here the verb root *pig* meaning "hit" has two inflectional prefixes: *ni* meaning "I," and *me* meaning "completed action," and an inflectional suffix *a*, which is an object agreement morpheme.

Even the more familiar European languages have many more inflectional endings than English. In the Romance languages (languages descended from Latin), the verb has different inflectional endings depending on the subject of the sentence. The verb is inflected to agree in person and number with the subject, as illustrated by the Italian verb *parlare* meaning "to speak":

Io parl**o**	"I speak"	Noi parl**iamo**	"We speak"
Tu parl**i**	"You (singular) speak"	Voi parl**ate**	"You (plural) speak"
Lui/Lei parl**a**	"He/she speaks"	Loro parl**ano**	"They speak"

Russian has a system of inflectional suffixes for nouns that indicates the noun's grammatical relation—whether a subject, object, possessor, and so on—something English does with word order. For example, in English, the sentence *Maxim defends Victor* means something different from *Victor defends Maxim*. The order of the words is critical. But in Russian, all of the following sentences mean "Maxim defends Victor" (the *č* is pronounced like the *ch* in cheese; the *š* like the *sh* in shoe; the *j* like the *y* in yet):

Maksim zašiščajet Viktora.
Maksim Viktora zašiščajet.
Viktora Maksim zašiščajet.
Viktora zašiščajet Maksim.[2]

The inflectional suffix *-a* added to the name *Viktor* to derive *Viktora* shows that Victor, not Maxim, is defended. The suffix designates the object of the verb, irrespective of word order.

The grammatical relation of a noun in a sentence is called the **case** of the noun. When case is marked by inflectional morphemes, the process is referred to as **case morphology**. Russian has a rich case morphology, whereas English case morphology is limited to the one possessive *-s* and to its system of pronouns. Many of the grammatical relations that Russian expresses with its case morphology are expressed in English with prepositions.

Among the world's languages is a richness and variety of inflectional processes. Earlier we saw how German uses circumfixes to inflect a verb stem to produce a past particle: *lieb* to ***ge**lieb**t***, similar to the *-ed* ending of English. Arabic infixes vowels for inflectional purposes: *kitáab* "book" but *kútub* "books." Samoan (see exercise 10) uses a process of **reduplication**—inflecting a word through the repetition of part or all of the word: *savali* "he travels," but *sava**va**li* "they travel." Malay does the same with whole words: *orang* "person," but *orang orang* "people." Languages such as Finnish have an extraordinarily complex case morphology, whereas Mandarin Chinese lacks case morphology entirely.

Inflection achieves a variety of purposes. In English verbs are inflected with *-s* to show third person singular agreement. Languages like Finnish and Japanese have a dazzling array of inflectional processes for conveying everything from "temporary state of being" (Finnish nouns) to "strong negative intention" (Japanese verbs). English spoken 1,000 years ago had considerably more inflectional morphology than modern English, as we shall discuss in chapter 11.

In distinguishing inflectional from derivation morphemes we may summarize as follows:

Inflectional	**Derivational**
Grammatical function	Lexical function
No word class change	May cause word class change
Small or no meaning change	Some meaning change
Often required by rules of grammar	Never required by rules of grammar
Follow derivational morphemes in a word	Precede inflectional morphemes in a word
Productive	Some productive, many nonproductive

Figure 3.1 sums up our knowledge of how morphemes in English are classified.

[2]These Russian examples were provided by Stella de Bode.

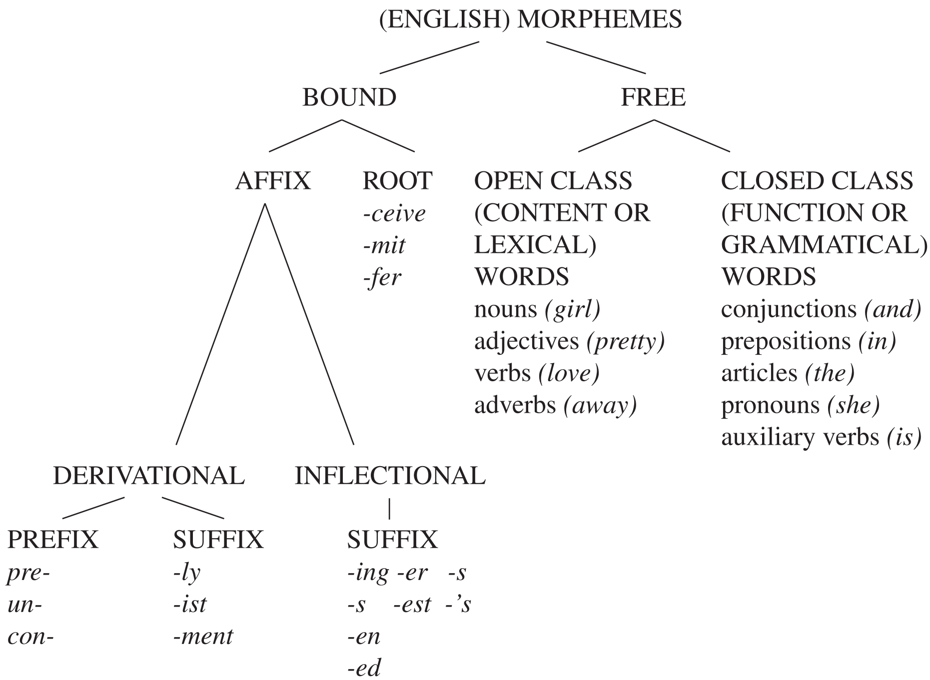
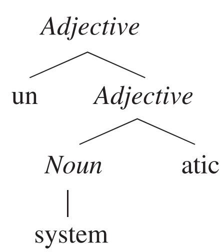


FIGURE 3.1 | Classification of English morphemes.

The Hierarchical Structure of Words

We saw earlier that morphemes are added in a fixed order. This order reflects the **hierarchical structure** of the word. A word is not a simple sequence of morphemes. It has an internal structure. For example, the word *unsystematic* is composed of three morphemes: *un-*, *system*, and *-atic*. The root is *system*, a noun, to which we add the suffix *-atic*, resulting in an adjective, *systematic*. To this adjective, we add the prefix *un-* forming a new adjective, *unsystematic*.

In order to represent the hierarchical organization of words (and sentences), linguists use **tree diagrams**. The tree diagram for *unsystematic* is as follows:



This tree represents the application of two morphological rules:

1. Noun + atic → Adjective
2. un + Adjective → Adjective

Rule 1 attaches the derivational suffix *-atic* to the root noun, forming an adjective. Rule 2 takes the adjective formed by rule 1 and attaches the derivational prefix *un-*. The diagram shows that the entire word—*unsystematic*—is an adjective that is composed of an adjective—*systematic*—plus *un*. The adjective is itself composed of a noun—*system*—plus the suffix *-atic*.

Hierarchical structure is an essential property of human language. Words (and sentences) have component parts, which relate to each other in specific, rule-governed ways. Although at first glance it may seem that, aside from order, the morphemes *un-* and *-atic* each relate to the root *system* in the same way, this is not the case. The root *system* is "closer" to *-atic* than it is to *un-*, and *un-* is actually connected to the adjective *systematic*, and not directly to *system*. Indeed, **unsystem* is not a word.

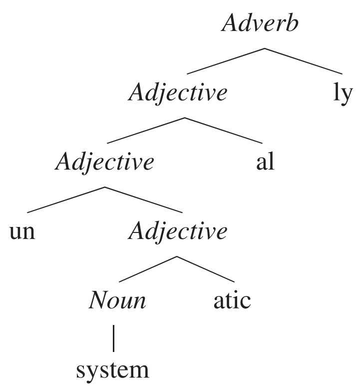
Further morphological rules can be applied to the given structure. For example, English has a derivational suffix *-al*, as in *egotistical*, *fantastical*, and *astronomical*. In these cases, *-al* is added to an adjective—*egotistic*, *fantastic*, *astronomic*—to form a new adjective. The rule for *-al* is as follows:

3. Adjective + al → Adjective

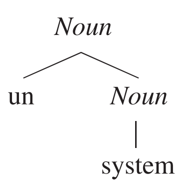
Another affix is *-ly*, which is added to adjectives—*happy*, *lazy*, *hopeful*—to form adverbs *happily*, *lazily*, *hopefully*. Following is the rule for *-ly*:

4. Adjective + ly → Adverb

Applying these two rules to the derived form *unsystematic*, we get the following tree for *unsystematically*:



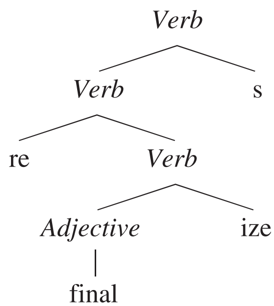
This is a rather complex word. Despite its complexity, it is well-formed because it follows the morphological rules of the language. On the other hand, a very simple word can be ungrammatical. Suppose in the above example we first added *un-* to the root *system*. That would have resulted in the nonword **unsystem*.



Unsystem is not a possible word because there is no rule of English that allows *un-* to be added to nouns. The large soft-drink company whose ad campaign promoted the *Uncola* successfully flouted this linguistic rule to capture people's attention. Part of our linguistic competence includes the ability to recognize possible versus impossible words, like **unsystem* and **Uncola*. Possible words are those that conform to the rules; impossible words are those that do not.

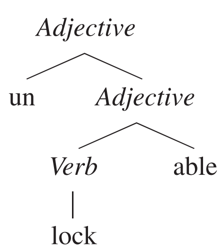
Tree diagrams make explicit the way speakers represent the internal structure of the morphologically complex words in their language. In speaking and writing, we appear to string morphemes together sequentially as in *un + system + atic*. However, our mental representation of words is hierarchical as well as linear, and this is shown by tree diagrams.

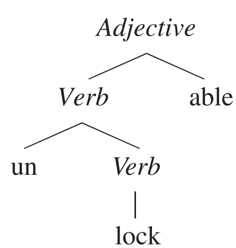
Inflectional morphemes are equally well represented. The following tree shows that the inflectional agreement morpheme *-s* follows the derivational morphemes *-ize* and *re-* in *refinalizes*:



The tree also shows that *re* applies to *finalize*, which is correct as **refinal* is not a word, and that the inflectional morpheme follows the derivational morpheme.

The hierarchical organization of words is even more clearly shown by structurally ambiguous words, words that have more than one meaning by virtue of having more than one structure. Consider the word *unlockable*. Imagine you are inside a room and you want some privacy. You would be unhappy to find the door is *unlockable*—"not able to be locked." Now imagine you are inside a locked room trying to get out. You would be very relieved to find that the door is *unlockable*—"able to be unlocked." These two meanings correspond to two different structures, as follows:





In the first structure the verb *lock* combines with the suffix *-able* to form an adjective *lockable* ("able to be locked"). Then the prefix *un-*, meaning "not," combines with the derived adjective to form a new adjective *unlockable* ("not able to be locked"). In the second case, the prefix *un-* combines with the verb *lock* to form a derived verb *unlock*. Then the derived verb combines with the suffix *-able* to form *unlockable*, "able to be unlocked."

An entire class of words in English follows this pattern: *unbuttonable*, *unzippable*, and *unlatchable*, among others. The ambiguity arises because the prefix *un-* can combine with an adjective, as illustrated in rule 2, or it can combine with a verb, as in *undo*, *unstaple*, *unearth*, and *unloosen*.

If words were only strings of morphemes without any internal organization, we could not explain the ambiguity of words like *unlockable*. These words also illustrate another important point, which is that structure is important to determining meaning. The same three morphemes occur in both versions of *unlockable*, yet there are two distinct meanings. The different meanings arise because of the different structures.

Rule Productivity

We have noted that some morphological processes, inflection in particular, are productive, meaning that they can be used freely to form new words from the list of free and bound morphemes. Among derivational morphemes, the suffix *-able* can be conjoined with any verb to derive an adjective with the meaning of the verb and the meaning of *-able*, which is something like "able to be" as in *accept* + *able*, *laugh* + *able*, *pass* + *able*, *change* + *able*, *breathe* + *able*, *adapt* + *able*, and so on. The productivity of this rule is illustrated by the fact that we find *-able* affixed to new verbs such as *downloadable* and *faxable*.

The prefix *un-* derives same-class words with an opposite meaning: *unafraid*, *unfit*, *un-American*, and so on. Additionally, *un-* can be added to derived adjectives that have been formed by morphological rules, resulting in perfectly acceptable words such as *un + believe + able* or *un + pick + up + able*.

Yet *un-* is not fully productive. We find *happy* and *unhappy*, *cowardly* and *uncowardly*, but not *sad* and **unsad*, *brave* and **unbrave*, or *obvious* and **unobvious*. It appears that the "un-Rule" is most productive for adjectives that are derived from verbs, such as *unenlightened*, *unsimplified*, *uncharacterized*, *unauthorized*, *undistinguished*, and so on. It also appears that most acceptable *un-* words have polysyllabic bases, and while we have *unfit*, *uncool*, *unread*, and *unclean*, many of the unacceptable *-un* forms have monosyllabic stems such as **unbig*, **ungreat*, **unred*, **unsad*, **unsmall*, **untall*.

The rule that adds an *-er* to verbs in English to produce a noun meaning "one who does" is a nearly productive morphological rule, giving us *examiner*, *exam-taker*, *analyzer*, *lover*, *hunter*, and so forth, but fails full productivity owing to "unwords" like **chairer*, which is not "one who chairs." Other derivational morphemes fall farther short of productivity. Consider:

sincerity	from	*sincere*
warmth	from	*warm*
moisten	from	*moist*

The suffix *-ity* is found in many other words in English, like *chastity*, *scarcity*, and *curiosity*; and *-th* occurs in *health*, *wealth*, *depth*, *width*, and *growth*. We find *-en* in *sadden*, *ripen*, *redden*, *weaken*, and *deepen*. Still, the phrase "*The tragicity of Hamlet" sounds somewhat strange, as does "*I'm going to *heaten* the sauce." Someone may say *coolth*, but when "words" like *tragicity*, *heaten*, and *coolth* are used, it is usually either a slip of the tongue or an attempt at humor. Most adjectives will not accept any of these derivational suffixes. Even less productive to the point of rareness are such derivational morphemes as the diminutive suffixes in the words *pig + let* and *sap + ling*.

In the morphologically complex words that we have seen so far, we can generally predict the meaning based on the meaning of the morphemes that make up the word. *Unhappy* means "not happy" and *acceptable* means "fit to be accepted." However, one cannot always know the meaning of the words derived from free and derivational morphemes by knowing the morphemes themselves. The following *un-* forms have unpredictable meanings:

unloosen	"loosen, let loose"
unrip	"rip, undo by ripping"
undo	"reverse doing"
untread	"go back through in the same steps"
unearth	"dig up"
unfrock	"deprive (a cleric) of ecclesiastic rank"
unnerve	"fluster"

Morphologically complex words whose meanings are not predictable must be listed individually in our mental lexicons. However, the morphological rules must also be in the grammar, revealing the relation between words and providing the means for forming new words.

Exceptions and Suppletions

The morphological process that forms plural from singular nouns does not apply to words like *child*, *man*, *foot*, and *mouse*. These words are exceptions to the English inflectional rule of plural formation. Similarly, verbs like *go*, *sing*, *bring*, *run*, and *know* are exceptions to the inflectional rule for producing past tense verbs in English.

When children are learning English, they first learn the regular rules, which they apply to all forms. Thus, we often hear them say *mans* and *goed*. Later in the acquisition process, they specifically learn irregular plurals like *men* and *mice*, and irregular past tense forms like *came* and *went*. These children's errors are actually evidence that the regular rules exist. This is discussed more fully in chapter 8.

Irregular, or **suppletive**, forms are treated separately in the grammar. That is, one cannot use the regular rules of inflectional morphology to add affixes to words that are exceptions like *child/children*, but must replace the uninflected form with another word. It is possible that for regular words, only the singular form need be specifically stored in the lexicon because we can use the inflectional rules to form plurals. But this can't be so with suppletive exceptions, and *children*, *mice*, and *feet* must be learned separately. The same is true for suppletive past tense forms and comparative forms. There are regular rules—suffixes *-ed* and *-er*—to handle most cases such as *walked* and *taller*, but words like *went* and *worse* need to be learned individually as meaning "goed" and "badder."

When a new word enters the language, the regular inflectional rules generally apply. The plural of *geek*, when it was a new word in English, was *geeks*, not **geeken*, although we are advised that some geeks wanted the plural of *fax* to be **faxen*, like *oxen*, when *fax* entered the language as a shortened form of *facsimile*. Never fear: its plural is *faxes*. The exception to this may be a word "borrowed" from a foreign language. For example, the plural of Latin *datum* has always been *data*, never *datums*, though nowadays *data*, the one-time plural, is treated by many as a singular word like *information*.

The past tense of the verb *hit*, as in the sentence "Yesterday you hit the ball," and the plural of the noun *sheep*, as in "The sheep are in the meadow," show that some morphemes seem to have no phonological shape at all. We know that *hit* in the above sentence is *hit + past* because of the time adverb *yesterday*, and we know that *sheep* is the phonetic form of *sheep + plural* because of the plural verb form *are*.

When a verb is derived from a noun, even if it is pronounced the same as an irregular verb, the regular rules apply to it. Thus *ring*, when used in the sense of encircle, is derived from the noun *ring*, and as a verb it is regular. We say *the police ringed the bank with armed men*, not **rang the bank with armed men*. In the jargon of baseball one says that the hitter *flied out* (hit a lofty ball that was caught), rather than **flew out*, because the verb came from the compound noun *fly ball*.

Indeed, when a noun is used in a compound in which its meaning is lost, such as *flatfoot*, meaning "cop," its plural follows the regular rule, so one says *two flatfoots* to refer to a pair of cops slangily, not **two flatfeet*. It's as if the noun is saying: "If you don't get your meaning from me, you don't get my special plural form."

Making compounds plural, however, is not always simply adding *-s* as in *girlfriends*. Thus for many speakers the plural of *mother-in-law* is *mothers-in-law*, whereas the possessive form is *mother-in-law's*; the plural of *court-martial* is *courts-martial* and the plural *of attorney general* is *attorneys general* in a legal setting, but for most of the rest of us it is *attorney generals*. If the rightmost word of a compound takes an irregular form, however, the entire compound generally follows suit, so the plural of *footman* is *footmen*, not **footmans* or **feetman* or **feetmen*.

Lexical Gaps

> "Curiouser and curiouser!" cried Alice (she was so much surprised, that for the moment she quite forgot how to speak good English).
>
> **LEWIS CARROLL,** *Alice's Adventures in Wonderland*, 1865

The redundancy of alternative forms such as *Chomskyan/Chomskyite*, all of which conform to the regular rules of word formation, may explain some of the **accidental gaps** (also called **lexical gaps**) in the lexicon. Accidental gaps are well-formed but nonexisting words. The actual words in a language constitute only a subset of the possible words. Speakers of a language may know tens of thousands of words. Dictionaries, as we noted, include hundreds of thousands of words, all of which are known by some speakers of the language. But no dictionary can list all **possible words**, because it is possible to add to the vocabulary of a language in many ways. (Some of these will be discussed here and some in chapter 11 on language change.) There are always gaps in the lexicon—words not present but that could be added. Some of the gaps are due to the fact that a permissible sound sequence has no meaning attached to it (like *blick*, or *slarm*, or *krobe*). Note that the sequence of sounds must be in keeping with the constraints of the language. **bnick* is not a "gap" because no word in English can begin with a *bn*. We will discuss such constraints in chapter 7.

Other gaps result when possible combinations of morphemes never come into use. Speakers can distinguish between impossible words such as **unsystem* and **needlessity*, and possible but nonexisting words such as *curiouser*, *linguisticism*, and *antiquify*. The ability to make this distinction is further evidence that the morphological component of our mental grammar consists of not just a lexicon—a list of existing words—but also of rules that enable us to create and understand new words, and to recognize possible and impossible words.

Other Morphological Processes

The various kinds of affixation that we have discussed are by far the most common morphological processes among the world's languages. But, as we continue to emphasize in this book, the human language capacity is enormously creative, and that creativity extends to ways other than affixation that words may be altered and created.

Back-Formations

> [A girl] was delighted by her discovery that *eats* and *cats* were really *eat* + *-s* and *cat* + *-s*. She used her new suffix snipper to derive *mik* (mix), *upstair*, *downstair*, *clo* (clothes), *len* (lens), *brefek* (from *brefeks*, her word for breakfast), *trappy* (trapeze), even *Santa Claw*.
>
> **STEVEN PINKER,** *Words and Rules: The Ingredients of Language*, 1999

Misconception can sometimes be creative, and nothing in this world both misconceives and creates like a child, as we shall see in chapter 8. A new word may enter the language because of an incorrect morphological analysis. For example, *peddle* was derived from *peddler* on the mistaken assumption that the *-er* was the agentive suffix. Such words are called **back-formations**. The verbs *hawk*, *stoke*, *swindle*, and *edit* all came into the language as back-formations—of *hawker*, *stoker*, *swindler*, and *editor*. *Pea* was derived from a singular word, *pease*, by speakers who thought *pease* was a plural.

Some word creation comes from deliberately miscast back-formations. The word *bikini* comes from the Bikini atoll of the Marshall Islands. Because the first syllable *bi-* is a morpheme meaning "two" in words like *bicycle*, some clever person called a topless bathing suit a *monokini*. Historically, a number of new words have entered the English lexicon in this way. Based on analogy with such pairs as *act/action*, *exempt/exemption*, and *revise/revision*, new words *resurrect*, *preempt*, and *televise* were formed from the existing words *resurrection*, *preemption*, and *television*.

Language purists sometimes rail against back-formations and cite *enthuse* and *liaise* (from *enthusiasm* and *liaison*) as examples of language corruption. However, language is not corrupt; it is adaptable and changeable. Don't be surprised to discover in your lifetime that *shevelled* and *chalant* have infiltrated the English language to mean "tidy" and "concerned," and if it happens do not cry "havoc"; all will be well.

Compounds

> [T]he Houynhnms have no Word in their Language to express any thing that is evil, except what they borrow from the Deformities or ill Qualities of the Yahoos. Thus they denote the Folly of a Servant, an Omission of a Child, a Stone that cuts their feet, a Continuance of foul or unseasonable Weather, and the like, by adding to each the Epithet of Yahoo. For instance, Hnhm Yahoo, Whnaholm Yahoo, Ynlhmnawihlma Yahoo, and an ill contrived House, Ynholmhnmrohlnw Yahoo.
>
> **JONATHAN SWIFT,** *Gulliver's Travels*, 1726

Two or more words may be joined to form new, **compound** words. English is very flexible in the kinds of combinations permitted, as the following table of compounds shows. Each entry in the table represents dozens of similar combinations.

	Adjective	Noun	Verb
Adjective	bittersweet	poorhouse	whitewash
Noun	headstrong	homework	spoonfeed
Verb	—	pickpocket	sleepwalk

Some compounds that have been introduced fairly recently into English are *Facebook*, *YouTube*, *power nap*, and *carjack*.

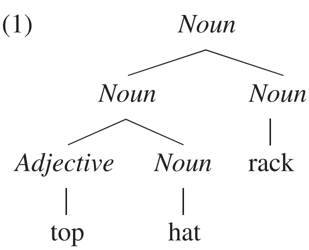
When the two words are in the same grammatical category, the compound will also be in this category: noun + noun = noun, as in *girlfriend*, *fighter-bomber*, *paper clip*, *elevator-operator*, *landlord*, *mailman*; adjective + adjective = adjective, as in *icy-cold*, *red-hot*, *worldly wise*. In English, the rightmost word in a compound is the **head** of the compound. The head is the part of a word or phrase that determines its broad meaning and grammatical category. Thus, when the two words fall into different categories, the class of the second or final word determines the grammatical category of the compound: noun + adjective = adjective, as in *headstrong*; verb + noun = noun, as in *pickpocket*. On the other hand, compounds formed with a preposition are in the category of the nonprepositional part of the compound, such as (to) *overtake* or (the) *sundown*. This is further evidence that prepositions form a closed-class category that does not readily admit new members.

Although two-word compounds are the most common in English, it would be difficult to state an upper limit: Consider *three-time loser*, *four-dimensional space-time*, *sergeant-at-arms*, *mother-of-pearl*, *man about town*, *master of ceremonies*, and *daughter-in-law*. Dr. Seuss uses the rules of compounding when he explains "when tweetle beetles battle with paddles in a puddle, they call it a tweetle beetle puddle paddle battle."[3]

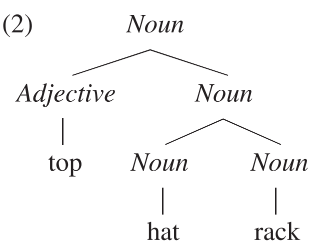
Spelling does not tell us what sequence of words constitutes a compound; whether a compound is spelled with a space between the two words, with a hyphen, or with no separation at all depends on the idiosyncrasies of the particular compound, as shown, for example, in *blackbird*, *gold-tail*, and *smoke screen*.

Like derived words, compounds have internal structure. This is clear from the ambiguity of a compound like *top* + *hat* + *rack*, which can mean "a rack for top hats" corresponding to the structure in tree diagram (1), or "the highest hat rack," corresponding to the structure in (2).

(1)



(2)



[3]From FOX IN SOCKS by Dr. Seuss, Trademark™ & copyright © by Dr. Seuss Enterprises, L.P., 1965, renewed 1993. Used by permission of Random House Children's Books, a division of Random House, Inc., and International Creative Management.

Meaning of Compounds

The meaning of a compound is not always the sum of the meanings of its parts; a *blackboard* may be green or white. Everyone who wears a red coat is not a *Redcoat* (slang for British soldier during the American Revolutionary War). The difference between the sentences “She has a red coat in her closet” and “She has a Redcoat in her closet” would have been highly significant in America in 1776.

Other compounds reveal other meaning relations between the parts, which are not entirely consistent because many compounds are idiomatic (idioms are discussed in chapter 5). A *boathouse* is a house for boats, but a *cathouse* is not a house for cats. (It is slang for a house of prostitution or whorehouse.) A *jumping bean* is a bean that jumps, a *falling star* is a star that falls, and a *magnifying glass* is a glass that magnifies; but a *looking glass* is not a glass that looks, nor is an *eating apple* an apple that eats, and *laughing gas* does not laugh. *Peanut oil* and *olive oil* are oils made from something, but what about *baby oil*? And is this a contradiction: “horse meat is dog meat”? Not at all, since the first is meat *from* horses and the other is meat *for* dogs.

In the examples so far, the meaning of each compound includes at least to some extent the meanings of the individual parts. However, many compounds nowadays do not seem to relate to the meanings of the individual parts at all. A *jack-in-a-box* is a tropical tree, and a *turncoat* is a traitor. A *highbrow* does not necessarily have a high brow, nor does a *bigwig* have a big wig, nor does an *egghead* have an egg-shaped head.

Like certain words with the prefix *un-*, the meaning of many compounds must be learned as if they were individual whole words. Some of the meanings may be figured out, but not all. If you had never heard the word *hunchback*, it might be possible to infer the meaning; but if you had never heard the word *flatfoot*, it is doubtful you would know it means “detective” or “policeman,” even though the origin of the word, once you know the meaning, can be figured out.

The pronunciation of English compounds differs from the way we pronounce the sequence of two words that are not compounded. In an actual compound, the first word is usually stressed (pronounced somewhat louder and higher in pitch), and in a noncompound phrase the second word is stressed. Thus we stress *Red* in *Redcoat* but *coat* in *red coat*. (Stress, pitch, and other similar features are discussed in chapters 6 and 7.)

Universality of Compounding

Other languages have rules for conjoining words to form compounds, as seen by French *cure-dent*, “toothpick”; German *Panzerkraftwagen*, “armored car”; Russian *cetyrexetaznyi*, “four-storied”; and Spanish *tocadiscos*, “record player.” In the Native American language Tohono O’odham, the word meaning “thing” is *haʔichu*, and it combines with *doakam*, “living creatures,” to form the compound *haʔichu doakam*, “animal life.”

In Twi, by combining the word meaning “son” or “child,” *ɔba*, with the word meaning “chief,” *ɔhene*, one derives the compound *ɔheneba*, meaning “prince.” By adding the word “house,” *ofi*, to *ɔhene*, the word meaning “palace,” *ahemfi*, is derived. The other changes that occur in the Twi compounds are due to phonological and morphological rules in the language.

In Thai, the word "cat" is *mɛɛw*, the word for "watch" (in the sense of "to watch over") is *fâw*, and the word for "house" is *bâan*. The word for "watch cat" (like a watchdog) is the compound *mɛɛwfâwbâan*—literally, "catwatchhouse."

Compounding is a common and frequent process for enlarging the vocabulary of all languages.

"Pullet Surprises"

Our knowledge of the morphemes and morphological rules of our language is often revealed by the "errors" we make. We may guess the meaning of a word we do not know. Sometimes we guess wrong, but our wrong guesses are nevertheless "intelligent."

Amsel Greene collected errors made by her students in vocabulary-building classes and published them in a book called *Pullet Surprises*.[4] The title is taken from a sentence written by one of her high school students: "In 1957 Eugene O'Neill won a Pullet Surprise." What is most interesting about these errors is how much they reveal about the students' knowledge of English morphology. The creativity of these students is illustrated in the following examples:

Word	Student's Definition
deciduous	"able to make up one's mind"
longevity	"being very tall"
fortuitous	"well protected"
gubernatorial	"to do with peanuts"
bibliography	"holy geography"
adamant	"pertaining to original sin"
diatribe	"food for the whole clan"
polyglot	"more than one glot"
gullible	"to do with sea birds"
homogeneous	"devoted to home life"

The student who used the word *indefatigable* in the sentence

She tried many reducing diets, but remained indefatigable.

clearly shows morphological knowledge: *in* meaning "not" as in *ineffective*; *de* meaning "off" as in *decapitate*; *fat* as in "fat"; *able* as in *able*; and combined meaning, "not able to take the fat off." Our contribution to Greene's collection is *metronome*: "a city-dwelling diminutive troll."

Sign Language Morphology

Sign languages are rich in morphology. Like spoken languages, signs belong to grammatical categories. They have root and affix morphemes, free and bound morphemes, lexical content and grammatical morphemes, derivational and inflectional morphemes, and morphological rules for their combination to form

[4]Greene, A. 1969. *Pullet surprises*. Glenview, IL: Scott, Foresman.

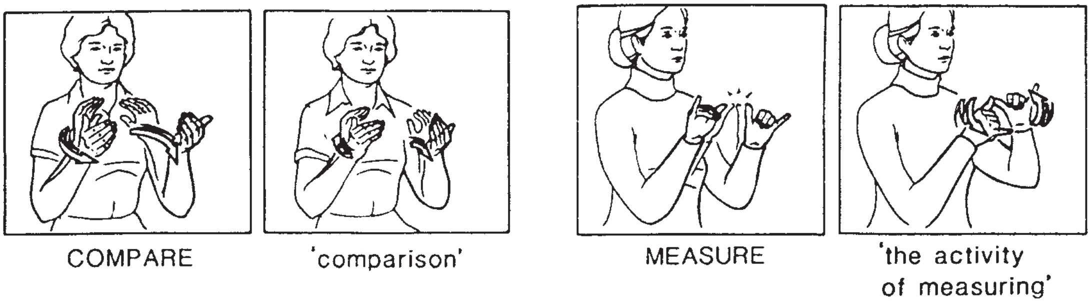


FIGURE 3.2 | Derivationally related sign in ASL.

morphologically complex signs. The affixation is accomplished by preceding or following a particular gesture with another "affixing" gesture.

The suffix meaning "negation," roughly analogous to *-un* or *-non* or *-dis*, is accomplished as a rapid turning over of the hand(s) following the end of the root sign that is being negated. For example, "want" is signed with open palms facing upward; "don't want" follows that gesture with a turning of the palms to face downward. This "reversal of orientation" suffix may be applied, with necessary adjustments, to many root signs.

In sign language many morphological processes are not linear. Rather, the sign stem occurs nested within various movements and locations in signing space so that the gestures are simultaneous, an impossibility with spoken languages, as in the examples in Figure 3.2.

Figure 3.2 illustrates the derivational process in ASL that is equivalent to the formation of the nouns *comparison* and *measuring* from the verbs *compare* and *measure* in English. Everything about the root morpheme remains the same except for the movement of the hands.

Inflection of sign roots also occurs in ASL and all other sign languages, which characteristically modify the movement of the hands and the spatial contours of the area near the body in which the signs are articulated. For example, movement away from the signer's body toward the "listener" might inflect a verb as in "I see you," whereas movement away from the listener and toward the body would inflect the verb as in "you see me."

Morphological Analysis: Identifying Morphemes

Speakers of a language have knowledge of the internal structure of a word because their mental grammars include a mental lexicon of morphemes and the

[5]Poizner, Howard, Edward Klima, and Ursula Bellugi. "What the Hands Reveal about the Brain" figure: "Derivationally related signs in ASL." © 1987 Massachusetts Institute of Technology, by permission of The MIT Press.

morphological rules for their combination. Of course, mistakes are made while learning, but these are quickly remedied. (See chapter 8 for details of how children acquire language.)

Suppose you didn't know English and were a linguist from the planet Zorx wishing to analyze the language. How would you discover the morphemes of English? How would you determine whether a word in that language had one, two, or more morphemes?

The first thing to do would be to ask native speakers how they say various words. (It would help to have a Zorxese-English interpreter along; otherwise, copious gesturing is in order.) Assume you are talented in miming and manage to collect the following forms:

Adjective	**Meaning**
ugly	"very unattractive"
uglier	"more ugly"
ugliest	"most ugly"
pretty	"nice looking"
prettier	"more nice looking"
prettiest	"most nice looking"
tall	"large in height"
taller	"more tall"
tallest	"most tall"

To determine what the morphemes are in such a list, the first thing a field linguist would do is to see if some forms mean the same thing in different words, that is, to look for *recurring* forms. We find them: *ugly* occurs in *ugly*, *uglier*, and *ugliest*, all of which include the meaning "very unattractive." We also find that -*er* occurs in *prettier* and *taller*, adding the meaning "more" to the adjectives to which it is attached. Similarly, -*est* adds the meaning "most." Furthermore, by asking additional questions of our English speaker, we find that -*er* and -*est* do not occur in isolation with the meanings of "more" and "most." We can therefore conclude that the following morphemes occur in English:

ugly	root morpheme
pretty	root morpheme
tall	root morpheme
-er	bound morpheme "comparative"
-est	bound morpheme "superlative"

As we proceed we find other words that end with -*er* (e.g., *singer*, *lover*, *bomber*, *writer*, *teacher*) in which the -*er* ending does not mean "comparative" but, when attached to a verb, changes it to a noun who "verbs," (e.g., *sings*, *loves*, *bombs*, *writes*, *teaches*). So we conclude that this is a different morpheme, even though it is pronounced the same as the comparative. We go on and find words like *number*, *somber*, *butter*, *member*, and many others in which the -*er* has no separate meaning at all—a *somber* is not "one who sombs" and a *member* does not *memb*—and therefore these words must be monomorphemic.

Once you have practiced on the morphology of English, you might want to go on to describe another language. Paku was invented by the linguist Victoria Fromkin for a 1970s TV series called *Land of the Lost*, recently made into a major motion picture of the same name. This was the language used by the monkey people called Pakuni. Suppose you found yourself in this strange land and attempted to find out what the morphemes of Paku were. Again, you would collect your data from a native Paku speaker and proceed as the Zorxian did with English. Consider the following data from Paku:

me	"I"	meni	"we"
ye	"you (singular)"	yeni	"you (plural)"
we	"he"	weni	"they (masculine)"
wa	"she"	wani	"they (feminine)"
abuma	"girl"	abumani	"girls"
adusa	"boy"	adusani	"boys"
abu	"child"	abuni	"children"
Paku	"one Paku"	Pakuni	"more than one Paku"

By examining these words you find that the plural forms end in *-ni* and the singular forms do not. You therefore conclude that *-ni* is a separate morpheme meaning "plural" that is attached as a suffix to a noun.

Here is a more challenging example, but the principles are the same. Look for repetitions and near repetitions of the same word parts, taking your cues from the meanings given. These are words from Michoacan Aztec, an indigenous language of Mexico:

nokali	"my house"	mopelo	"your dog"
nokalimes	"my houses"	mopelomes	"your dogs"
mokali	"your house"	ikwahmili	"his cornfield"
ikali	"his house"	nokwahmili	"my cornfield"
nopelo	"my dog"	mokwahmili	"your cornfield"

We see there are three base meanings: *house*, *dog*, and *cornfield*. Starting with *house* we look for commonalities in all the forms that refer to "house." They all contain *kali* so that makes a good first guess. (We might, and you might, have reasonably guessed *kal*, but eventually we wouldn't know what to do with the *i* at the end of *nokali* and *mokali*.) With *kali* as "house" we may infer that *no* is a prefix meaning "my," and that is supported by *nopelo*, meaning "my dog." This being the case, we guess that *pelo* is "dog," and see where that leads us. If *pelo* is "dog" and *mopelo* is "your dog," then *mo* is probably the prefix for "your." Now that we think that the possessive pronouns are prefixes, we can look at *ikali* and deduce that *i* means "his." If we're right about the prefixes then we can separate out the word for "cornfield" as *kwahmili*, and at this point we're a-rockin' and a-rollin'. The only morpheme unaccounted for is "plural." We have two instances of plurality, *nokalimes* and *mopelomes*, but since we know *no*, *kali*, *mo*, and *pelo*, it is straightforward to identify the plural morpheme as the suffix *mes*.

In summary of our analysis, then:

kali	"house"
pelo	"dog"
kwahmili	"cornfield"
no-	"my"
mo-	"your"
i-	"his"
-mes	"plural"

By following the analytical principles just discussed, you should be able to solve some of the more complex morphological puzzles that appear in the exercises.

Summary

Knowing a language means knowing the **morphemes** of that language, which are the elemental units that constitute words. *Moralizers* is an English word composed of four morphemes: *moral* + *ize* + *er* + *s*. When you know a word or morpheme, you know both its **form** (sound or gesture) and its **meaning**; these are inseparable parts of the **linguistic sign**. The relationship between form and meaning is **arbitrary**. There is no inherent connection between them (i.e., the words and morphemes of any language must be learned).

Morphemes may be free or bound. **Free morphemes** stand alone like *girl* or *the*, and they come in two types: **open class**, containing the content words of the language, and **closed class**, containing function words such as *the* or *of*. **Bound morphemes** may be **affixes** or bound roots such as *-ceive*. Affixes may be **prefixes, suffixes, circumfixes**, and **infixes**. Affixes may be derivational or inflectional. **Derivational affixes** derive new words; **inflectional affixes**, such as the plural affix *-s*, make grammatical changes to words. Complex words contain a **root** around which **stems** are built by affixation. Rules of morphology determine what kind of affixation produces actual words such as *un* + *system* + *atic*, and what kind produces nonwords such as **un* + *system*.

Words have hierarchical structure evidenced by ambiguous words such as *unlockable*, which may be *un* + *lockable* "unable to be locked" or *unlock* + *able* "able to be unlocked."

Some morphological rules are **productive**, meaning they apply freely to the appropriate stem; for example, *re-* applies freely to verbal stems to give words like *redo*, *rewash*, and *repaint*. Other rules are more constrained, forming words like *young* + *ster* but not **smart* + *ster*. Inflectional morphology is extremely productive: the plural *-s* applies freely even to nonsense words. **Suppletive forms** escape inflectional morphology, so instead of **mans* we have *men*; instead of **bringed* we have *brought*.

There are many ways for new words to be created other than affixation. **Compounds** are formed by uniting two or more root words in a single word, such as *homework*. The **head** of the compound (the rightmost word) bears the basic meaning, so *homework* means a kind of work done at home, but often the meaning of compounds is not easily predictable and must be learned as individual lexical items, such as *laughing gas*. **Back-formations** are words created by misinterpreting an affix look-alike such as *er* as an actual affix, so the verb *burgle* was formed under the mistaken assumption that *burglar* was *burgle* + *er*.

The grammars of sign languages also include a morphological component consisting of a root, derivational and inflectional sign morphemes, and the rules for their combination.

Morphological analysis is the process of identifying form-meaning units in a language, taking into account small differences in pronunciation, so that *in-* and *im-* are seen to be the "same" prefix in English.

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Exercises

1. Here is how to estimate the number of words in your mental lexicon. Consult any standard dictionary.

   a. Count the number of entries on a typical page. They are usually boldfaced.
   b. Multiply the number of words per page by the number of pages in the dictionary.
   c. Pick four pages in the dictionary at random, say, pages 50, 75, 125, and 303. Count the number of words on these pages.
   d. How many of these words do you know?
   e. What percentage of the words on the four pages do you know?
   f. Multiply the words in the dictionary by the percentage you arrived at in (e). You know approximately that many English words.

2. Divide the following words by placing a + between their morphemes. (Some of the words may be monomorphemic and therefore indivisible.)

4

Syntax: The Sentence Patterns of Language

> To grammar even kings bow.
>
> **J. B. MOLIÈRE,** *Les Femmes Savantes, II*, 1672

It is an astonishing fact that any speaker of any human language can produce and understand an infinite number of sentences. We can show this quite easily through examples such as the following:

The kindhearted boy had many girlfriends.
The kindhearted, intelligent boy had many girlfriends.
The kindhearted, intelligent, handsome boy had many girlfriends.
.
.
.
John found a book in the library.
John found a book in the library in the stacks.
John found a book in the library in the stacks on the fourth floor.
.
.
.
The cat chased the mouse.
The cat chased the mouse that ate the cheese.
The cat chased the mouse that ate the cheese that came from the cow.
The cat chased the mouse that ate the cheese that came from the cow that grazed in the field.

In each case the speaker could continue creating sentences by adding another adjective, prepositional phrase, or relative clause. In principle, this could go on forever. All languages have mechanisms of this sort that make the number of sentences limitless. Given this fact, the sentences of a language cannot be stored in a dictionary format in our heads. Rather, sentences are composed of discrete units that are combined by rules. This system of rules explains how speakers can store infinite knowledge in a finite space—our brains.

The part of grammar that represents a speaker's knowledge of sentences and their structures is called **syntax**. The aim of this chapter is to show you what syntactic structures look like and to familiarize you with some of the rules that determine them. Most of the examples will be from the syntax of English, but the principles that account for syntactic structures are universal.

What the Syntax Rules Do

"Then you should say what you mean," the March Hare went on.
"I do," Alice hastily replied, "at least—I mean what I say—that's the same thing, you know."
"Not the same thing a bit!" said the Hatter. "You might just as well say that 'I see what I eat' is the same thing as 'I eat what I see'!"
"You might just as well say," added the March Hare, "that 'I like what I get' is the same thing as 'I get what I like'!"
"You might just as well say," added the Dormouse . . . "that 'I breathe when I sleep' is the same thing as 'I sleep when I breathe'!"
"It is the same thing with you," said the Hatter.

LEWIS CARROLL, *Alice's Adventures in Wonderland*, 1865

The **rules of syntax** combine words into phrases and phrases into sentences. Among other things, the rules specify the correct word order for a language. For example, English is a Subject–Verb–Object (SVO) language. The English sentence in (1) is grammatical because the words occur in the right order; the sentence in (2) is ungrammatical because the word order is incorrect for English. (Recall that the asterisk or star preceding a sentence is the linguistic convention for indicating that the sentence is ungrammatical or ill-formed according to the rules of the grammar.)

1. The President nominated a new Supreme Court justice.
2. *President the new Supreme justice Court a nominated.

A second important role of the syntax is to describe the relationship between the meaning of a particular group of words and the arrangement of those words. For example, Alice's companions show us that the word order of a sentence contributes crucially to its meaning. The sentences in (3) and (4) contain the same words, but the meanings are quite different, as the Mad Hatter points out.

3. I mean what I say.
4. I say what I mean.

The rules of the syntax also specify the **grammatical relations** of a sentence, such as **subject** and **direct object**. In other words, they provide the information about who is doing what to whom. This information is crucial to understanding the meaning of a sentence. For example, the grammatical relations in (5) and (6) are reversed, so the otherwise identical sentences have very different meanings.

5. Your dog chased my cat.
6. My cat chased your dog.

Syntactic rules also specify other constraints that sentences must adhere to. Consider, for example, the sentences in (7). As an exercise you can first read through them and place a star before those sentences that *you* consider to be ungrammatical.

7. (**a**) The boy found.
(**b**) The boy found quickly.
(**c**) The boy found in the house.
(**d**) The boy found the ball.

We predict that you will find the sentence in (7d) grammatical and the ones in (7a–c) ungrammatical. This is because the syntax rules specify that a verb like *found* must be followed by something, and that something cannot be an expression like *quickly* or *in the house* but must be like *the ball*.

Similarly, we expect you will find the sentence in (8b) grammatical while the sentence in (8a) is not.

8. (**a**) Disa slept the baby.
(**b**) Disa slept soundly.

The verb *sleep* patterns differently than *find* in that it may be followed solely by a word like *soundly* but not by other kinds of phrases such as *the baby*.

We also predict that you'll find that the sentences in (9a, d, e, f) are grammatical and that (9b, c) are not. The examples in (9) show that specific verbs, such as *believe*, *try*, and *want*, behave differently with respect to the patterns of words that may follow them.

9. (**a**) Zack believes Robert to be a gentleman.
(**b**) Zack believes to be a gentleman.
(**c**) Zack tries Robert to be a gentleman.
(**d**) Zack tries to be a gentleman.
(**e**) Zack wants to be a gentleman.
(**f**) Zack wants Robert to be a gentleman.

The fact that all native speakers have the same judgments about the sentences in (7) to (9) tells us that grammatical judgments are neither idiosyncratic nor capricious, but are determined by rules that are shared by all speakers of a language.

In (10) we see that the phrase *ran up the hill* behaves differently from the phrase *ran up the bill*, even though the two phrases are superficially quite similar. For the expression *ran up the hill*, the rules of the syntax allow the word orders in (10a) and (10c), but not (10b). In *ran up the bill*, in contrast, the rules allow the order in (10d) and (10e), but not (10f).

10. (**a**) Jack and Jill ran up the hill.
(**b**) Jack and Jill ran the hill up.
(**c**) Up the hill ran Jack and Jill.
(**d**) Jack and Jill ran up the bill.
(**e**) Jack and Jill ran the bill up.
(**f**) Up the bill ran Jack and Jill.

The pattern shown in (10) illustrates that sentences are not simply strings of words with no further organization. If they were, there would be no reason to expect *ran up the hill* to pattern differently from *ran up the bill*. These phrases act differently because they have different syntactic structures associated with them. In *ran up the hill*, the words *up the hill* form a unit, as follows:

He ran [up the hill]

The whole unit can be moved to the beginning of the sentence, as in (10c), but we cannot rearrange its subparts, as shown in (10b). On the other hand, in *ran up the bill*, the words *up the bill* do not form a natural unit, so they cannot be moved, and (10f) is ungrammatical.

Our syntactic knowledge crucially includes rules that tell us how words form groups in a sentence, or how they are *hierarchically* arranged with respect to one another. Consider the following sentence:

The captain ordered all old men and women off the sinking ship.

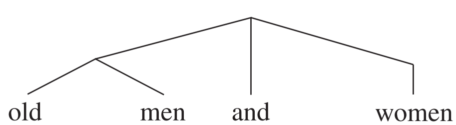
This phrase “old men and women” is ambiguous, referring either to old men and to women of any age or to old men and old women. The ambiguity arises because the words *old men and women* can be grouped in two ways. If the words are grouped as follows, *old* modifies only *men* and so the women can be any age.

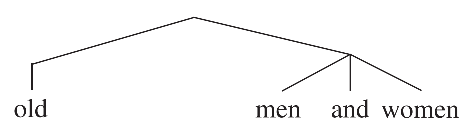
[old men] and [women]

When we group them like this, the adjective *old* modifies both *men* and *women*.

[old [men and women]]

The rules of syntax allow both of these groupings, which is why the expression is ambiguous. The following hierarchical diagrams illustrate the same point:





In the first structure *old* and *men* are under the same node and hence old modifies *men*. In the second structure *old* shares a node with the entire conjunction *men and women*, and so modifies both.

This is similar to what we find in morphology for ambiguous words such as *unlockable*, which have two structures, corresponding to two meanings, as discussed in chapter 3.

Many sentences exhibit such ambiguities, often leading to humorous results. Consider the following two sentences, which appeared in classified ads:

For sale: an antique desk suitable for lady with thick legs and large drawers.
We will oil your sewing machine and adjust tension in your home for $10.00.

In the first ad, the humorous reading comes from the grouping [a desk] [for lady with thick legs and large drawers] as opposed to the intended [a desk for lady] [with thick legs and large drawers], where the legs and drawers belong to the desk. The second case is similar.

Because these ambiguities are a result of different structures, they are instances of **structural ambiguity.**

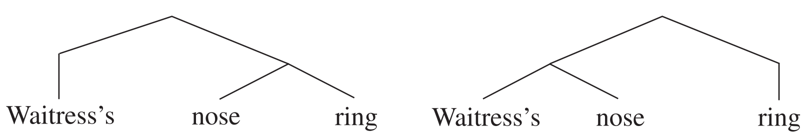
Contrast these sentences with:

This will make you smart.

The two interpretations of this sentence are due to the two meanings of smart—"clever" or "burning sensation." Such lexical or word-meaning ambiguities, as opposed to structural ambiguities, will be discussed in chapter 5.

Often a combination of differing structure and double word-meaning creates ambiguity (and humor) as in the cartoon:

Rhymes With Orange (105945) © Hilary B. Price. King Features Syndicate



Syntactic rules reveal the grammatical relations among the words of a sentence as well as their order and hierarchical organization. They also explain how the grouping of words relates to its meaning, such as when a sentence or phrase is ambiguous. In addition, the rules of the syntax permit speakers to produce and understand a limitless number of sentences never produced or heard before—*the creative aspect of linguistic knowledge*. A major goal of linguistics is to show clearly and explicitly how syntactic rules account for this knowledge. A theory of grammar must provide a complete characterization of what speakers implicitly know about their language.

What Grammaticality Is Not Based On

> *Colorless green ideas sleep furiously.* This is a very interesting sentence, because it shows that syntax can be separated from semantics—that form can be separated from meaning. The sentence doesn't seem to mean anything coherent, but it sounds like an English sentence.
>
> **HOWARD LASNIK,** *The Human Language: Part One*, 1995

Importantly, a person's ability to make grammaticality judgments does not depend on having heard the sentence before. You may never have heard or read the sentence

Enormous crickets in pink socks danced at the prom.

but your syntactic knowledge tells you that it is grammatical. As we showed at the beginning of this chapter, people are able to understand, produce, and make judgments about an infinite range of sentences, most of which they have never heard before. This ability illustrates that our knowledge of language is creative—not creative in the sense that we are all poets, which we are not, but creative in that none of us is limited to a fixed repertoire of expressions. Rather, we can exploit the resources of our language and grammar to produce and understand a limitless number of sentences embodying a limitless range of ideas and emotions.

We showed that the structure of a sentence contributes to its meaning. However, grammaticality and meaningfulness are not the same thing, as shown by the following sentences:

Colorless green ideas sleep furiously.
A verb crumpled the milk.

Although these sentences do not make much sense, they are syntactically well formed. They sound funny, but their funniness is different from what we find in the following strings of words:

*Furiously sleep ideas green colorless.
*Milk the crumpled verb a.

There are also sentences that we understand even though they are not well formed according to the rules of the syntax. For example, most English speakers could interpret

*The boy quickly in the house the ball found.

although they know that the word order is incorrect. Similarly, we could probably assign a meaning to sentence (8a) (Disa slept the baby) in the previous section. If asked to fix it up, we would probably come up with something like "Disa put the baby to sleep," but we also know that as it stands, (8a) is not a possible sentence of English. To be a sentence, words must conform to specific patterns determined by the syntactic rules of the language.

Some sentences are grammatical even though they are difficult to interpret because they include nonsense words, that is, words with no agreed-on meaning. This is illustrated by the following lines from the poem "Jabberwocky" by Lewis Carroll:

'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe

These lines are grammatical in the linguistic sense that they obey the word order and other constraints of English. Such nonsense poetry is amusing precisely because the sentences comply with syntactic rules and sound like good English. Ungrammatical strings of nonsense words are not entertaining:

*Toves slithy the and brillig 'twas
wabe the in gimble and gyre did

Grammaticality also does not depend on the truth of sentences. If it did, lying would be impossible. Nor does it depend on whether real objects are being discussed or whether something is possible in the real world. Untrue sentences can be grammatical, sentences discussing unicorns can be grammatical, and sentences referring to pregnant fathers can be grammatical.

The syntactic rules that permit us to produce, understand, and make grammaticality judgments are unconscious rules. The grammar is a mental grammar, different from the prescriptive grammar rules that we are taught in school. We develop the mental rules of grammar long before we attend school, as we shall see in chapter 8.

Sentence Structure

> I really do not know that anything has ever been more exciting than diagramming sentences.
>
> **GERTRUDE STEIN,** "Poetry and Grammar," 1935

Suppose we wanted to write a template that described the structure of an English sentence, and more specifically, a template that gave the correct word order for English. We might come up with something like the following:

Det—N—V—Det—N

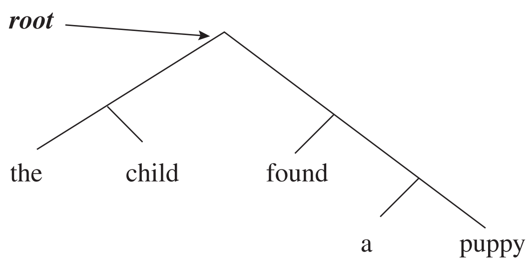
This template says that a determiner (an article) is followed by a noun, which is followed by a verb, and so on. It would describe English sentences such as the following:

The child found a puppy.
The professor wrote a book.
That runner won the race.

The implication of such a template would be that sentences are strings of words belonging to particular grammatical categories ("parts of speech") with no internal organization. We know, however, that such "flat" structures are incorrect. As noted earlier, sentences have a hierarchical organization; that is, the words are grouped into natural units. The words in the sentence

The child found a puppy.

may be grouped into [the child] and [found a puppy], corresponding to the subject and predicate of the sentence. A further division gives [the child] and then [[found] [a puppy]], and finally the individual words: [[the] [child]] [[found] [[a] [puppy]]]. It's sometimes easier to see the parts and subparts of the sentence in a **tree diagram**:



The "tree" is upside down with its "root" encompassing the entire sentence, "The child found a puppy," and its "leaves" being the individual words, *the*, *child*, *found*, *a*, *puppy*. The tree conveys the same information as the nested square brackets. The hierarchical organization of the tree reflects the groupings and subgroupings of the words of the sentence.

The tree diagram shows, among other things, that the phrase *found a puppy* divides naturally into two branches, one for the verb *found* and the other for the direct object *a puppy*. A different division, say, *found a* and *puppy*, is unnatural.

Constituents and Constituency Tests

Parts is parts.

WENDY'S COMMERCIAL, 2006

The natural groupings or parts of a sentence are called **constituents**. Various linguistic tests reveal the constituents of a sentence. The first test is the "stand alone" test. If a group of words can stand alone, they form a constituent. For example, the set of words that can be used to answer a question is a constituent. So in answer to the question "What did you find?" a speaker might answer *a puppy*, but not *found a*. *A puppy* can stand alone while *found a* cannot.

The second test is "replacement by a pronoun." Pronouns can substitute for natural groups. In answer to the question "Where did you find *a puppy*?" a speaker can say, "I found *him* in the park." Words such as *do* can also take the place of the entire predicate *found a puppy*, as in "John found a puppy and Bill *did* too." If a group of words can be replaced by a pronoun or a word like *do*, it forms a constituent.

A third test of constituency is the "move as a unit" test. If a group of words can be moved, they form a constituent. For example, if we compare the following sentences to the sentence "The child found a puppy," we see that certain elements have moved:

It was *a puppy* that *the child* found.
A puppy was found by *the child*.

In the first example, the constituent *a puppy* has moved from its position following *found*; in the second example, the positions of *a puppy* and *the child* have been changed. In all such rearrangements the constituents *a puppy* and *the child* remain intact. *Found a* does not remain intact, because it is not a constituent.

In the sentence "The child found a puppy," the natural groupings or constituents are the subject *the child*, the predicate *found a puppy*, and the direct object *a puppy*.

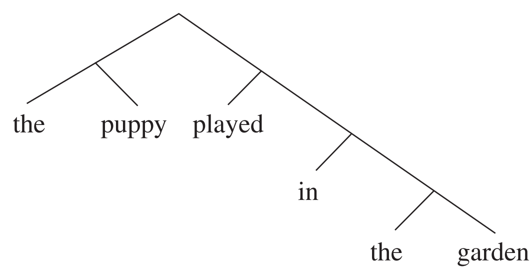
Some sentences have a prepositional phrase in the predicate. Consider

The puppy played in the garden.

We can use our tests to show that *in the garden* is also a constituent, as follows:

Where did the puppy play? *In the garden* (stand alone)
The puppy played *there*. (replacement by a pronoun-like word)
In the garden is where the puppy played. (move as a unit)
It was *in the garden* that the puppy played.

As before, our knowledge of the **constituent structure** of a sentence may be graphically represented by a tree diagram. The tree diagram for the sentence "The puppy played in the garden" is as follows:



In addition to the syntactic tests just described, experimental evidence has shown that speakers do not represent sentences as strings of words but rather in terms of constituents. In these experiments, subjects listen to sentences that have clicking noises inserted into them at random points. In some cases the click occurs at a constituent boundary, and in other sentences the click is inserted in the middle of a constituent. The subjects are then asked to report where the click occurred. There were two important results: (1) Subjects noticed the click and recalled its location best when it occurred at a major constituent boundary (e.g., between the subject and predicate); and (2) clicks that occurred inside the constituent were reported to have occurred between constituents. In other words, subjects displaced the clicks and put them at constituent boundaries. These results show that speakers perceive sentences in chunks corresponding to grammatical constituents.

Every sentence in a language is associated with one or more constituent structures. If a sentence has more than one constituent structure, it is ambiguous, and each tree will correspond to one of the possible meanings. For example, the sentence "I bought an antique desk suitable for a lady with thick legs and large drawers" has two phrase structure trees associated with it. In one structure the phrase [a lady with thick legs and large drawers] forms a constituent. For example, it could stand alone in answer to the question "Who did you buy an antique desk for?" In its second meaning, the phrase *with thick legs and large drawers* modifies the phrase *a desk for a lady*, and thus the structure is [[a desk for a lady][with thick legs and large drawers]].

Syntactic Categories

"I MISS THE GOOD OLD DAYS WHEN ALL WE HAD TO WORRY ABOUT WAS NOUNS AND VERBS."

Each grouping in the tree diagrams of "The child found a puppy" is a member of a large family of similar expressions. For example, *the child* belongs to a family that includes *the police officer*, *your neighbor*, *this yellow cat*, *he*, *John*, and countless others. We can substitute any member of this family for the child without affecting the grammaticality of the sentence, although the meaning of course would change.

A police officer found a puppy.
Your neighbor found a puppy.
This yellow cat found a puppy.

A family of expressions that can substitute for one another without loss of grammaticality is called a **syntactic category**.

The child, *a police officer*, *John*, and so on belong to the syntactic category **noun phrase (NP)**, one of several syntactic categories in English and every other language in the world. NPs may function as the subject or as an object in a sentence. NPs often contain a *determiner* (like *a* or *the*) and a noun, but they may also consist of a proper name, a pronoun, a noun without a determiner, or even a clause or a sentence. Even though a proper noun like *John* and pronouns such as *he* and *him* are single words, they are technically NPs, because they pattern like NPs in being able to fill a subject or object or other NP slots.

John found the puppy.
He found the puppy.
Boys love puppies.
The puppy loved him.
The puppy loved John.

NPs can be more complex as illustrated by the sentence:

The girl that Professor Snape loved married the man of her dreams.

The NP subject of this sentence is *the girl that Professor Snape loved*, and the NP object is *the man of her dreams*.

Syntactic categories are part of a speaker's knowledge of syntax. That is, speakers of English know that only items (a), (b), (e), (f), and (g) in the following list are NPs even if they have never heard the term *noun phrase* before.

1. (**a**) a bird
(**b**) the red banjo
(**c**) have a nice day
(**d**) with a balloon
(**e**) the woman who was laughing
(**f**) it
(**g**) John
(**h**) went

You can test this claim by inserting each expression into three contexts: *Who found* ________, ________ *was seen by everyone*, and *What/who I heard was* ________. For example, **Who found <u>with a balloon</u>* is ungrammatical, as is **<u>Have a nice day</u> was seen by everyone*, as opposed to *Who found it?* or *John was seen by everyone*. Only NPs fit into these contexts because only NPs can function as subjects and objects.

There are other syntactic categories. The expression *found a puppy* is a **verb phrase (VP)**. A verb phrase always contains a **verb (V)**, and it may contain other categories, such as a noun phrase or **prepositional phrase (PP)**, which is a preposition followed by an NP, such as *in the park*, *on the roof*, *with a balloon*. In (2) the VPs are those phrases that can complete the sentence "The child __________ ."

2. (**a**) saw a clown
(**b**) a bird
(**c**) slept
(**d**) smart
(**e**) ate the cake
(**f**) found the cake in the cupboard
(**g**) realized that the earth was round

Inserting (a), (c), (e), (f), and (g) will produce grammatical sentences, whereas the insertion of (b) or (d) would result in an ungrammatical sentence. Thus, (a), (c), (e), (f), and (g) are verb phrases.

Lexical and Functional Categories

> There are ten parts of speech, and they are all troublesome.
>
> **MARK TWAIN,** "The Awful German Language," in *A Tramp Abroad,* 1880

Syntactic categories include both phrasal categories such as NP, VP, AdjP (adjective phrase), PP (prepositional phrase), and AdvP (adverbial phrase), as well as lexical categories such as noun (N), verb (V), preposition (P), adjective (Adj), and adverb (Adv). Each lexical category has a corresponding phrasal category. Following is a list of lexical categories with some examples of each type:

Lexical categories

Noun (N)	*puppy*, *boy*, *soup*, *happiness*, *fork*, *kiss*, *pillow*, *cake*, *cupboard*
Verb (V)	*find*, *run*, *sleep*, *throw*, *realize*, *see*, *try*, *want*, *believe*
Preposition (P)	*up*, *down*, *across*, *into*, *from*, *by*, *with*
Adjective (Adj)	*red*, *big*, *candid*, *hopeless*, *fair*, *idiotic*, *lucky*
Adverb (Adv)	*again*, *carefully*, *luckily*, *never*, *very*, *fairly*

Many of these categories may already be familiar to you. As mentioned earlier, some of them are traditionally referred to as *parts of speech*. Other categories may be less familiar, for example, the category **determiner (Det)**, which includes the articles *a* and *the*, as well as **demonstratives** such as *this*, *that*, *these*, and *those*, and "counting words" such as *each* and *every*. Another less familiar category is **auxiliary (Aux)**, which includes the verbs *have*, *had*, *be*, *was*, and *were*, and the **modals** *may*, *might*, *can*, *could*, *must*, *shall*, *should*, *will*, and *would*. Aux and Det are **functional categories**, so called because their members have a grammatical function rather than a descriptive meaning. For example, determiners specify whether a noun is indefinite or definite (*a boy* versus *the* *boy*), or the proximity of the person or object to the context (*this boy* versus *that boy*). Auxiliaries provide the verb with a time frame, whether ongoing (*John* is *dancing*), completed in the past (*John* has *danced*), or occurring in the future (*John* will *dance*). Auxiliaries may also express notions such as possibility (*John* may *dance*), necessity (*John* must *dance*), ability (*John can dance*), and so on.

Lexical categories typically have particular kinds of meanings associated with them. For example, verbs usually refer to actions, events, and states (*kick*, *marry*, *love*); adjectives to qualities or properties (*lucky*, *old*); common nouns to general entities (*dog*, *elephant*, *house*); and proper nouns to particular individuals (*Noam Chomsky*) or places (*Dodger Stadium*) or other things that people give names to, such as commercial products (*Coca-Cola*, *Viagra*). But the relationship between grammatical categories and meaning is more complex than these few examples suggest. For example, some nouns refer to events (*marriage* and *destruction*) and others to states (*happiness*, *loneliness*). We can use abstract nouns such as *honor* and *beauty*, rather than adjectives, to refer to properties and qualities. In the sentence "Seeing is believing," *seeing* and *believing* are nouns but are not entities. Prepositions are usually used to express relationships between two entities involving a location (e.g., *the boy is in the room*, *the cat is under the bed*), but this is not always the case; the prepositions *of*, *by*, *about*, and *with* are not locational. Because of the difficulties involved in specifying the precise meaning of lexical categories, we do not usually define categories in terms of their meanings, but rather on the basis of their syntactic distribution (where they occur in a sentence) and morphological characteristics. For example, we define a noun as a word that can occur with a determiner (*the boy*) and that can take a plural marker (*boys*), among other properties.

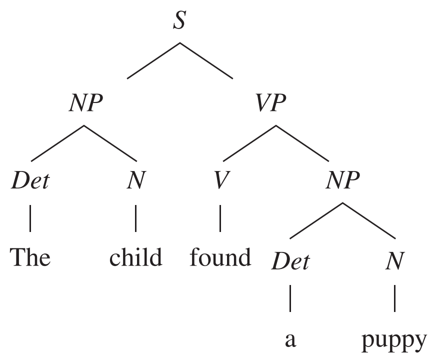
All languages have syntactic categories such as N, V, and NP. Speakers know the syntactic categories of their language, even if they do not know the technical terms. Our knowledge of the syntactic classes is revealed when we substitute equivalent phrases, as we just did in examples (1) and (2), and when we use the various syntactic tests that we have discussed.

Phrase Structure Trees and Rules

> Who climbs the Grammar-Tree distinctly knows
> Where Noun and Verb and Participle grows.
>
> **JOHN DRYDEN,** "The Sixth Satyr of Juvenal," 1693

Now that you know something about constituent structure and grammatical categories, you are ready to learn how the sentences of a language are constructed. We will begin by building trees for simple sentences and then proceed to more complex structures. The trees that we will build here are more detailed than those we saw in the previous sections, because the branches of the tree will have category labels identifying each constituent. In this section we will also introduce the syntactic rules that **generate** (a technical term for describe or specify) the different kinds of structures.

The following tree diagram provides labels for each of the constituents of the sentence "The child found a puppy." These labels show that the entire sentence belongs to the syntactic category of S (because the S-node encompasses all the words). It also reveals that *the child* and *a puppy* belong to the category NP, that is, they are noun phrases, and that *found a puppy* belongs to the category VP or is a verb phrase, consisting of a verb and an NP. It also reveals the syntactic category of each of the words in the sentence.



A tree diagram with syntactic category information is called a **phrase structure tree** or a **constituent structure tree**. This tree shows that a sentence is both a linear string of words and a hierarchical structure with phrases nested in phrases. Phrase structure trees (PS trees, for short) are explicit graphic representations of a speaker's knowledge of the structure of the sentences of his language.

PS trees represent three aspects of a speaker's syntactic knowledge:

1. The linear order of the words in the sentence
2. The identification of the syntactic categories of words and groups of words
3. The hierarchical structure of the syntactic categories (e.g., an S is composed of an NP followed by a VP, a VP is composed of a V that may be followed by an NP, and so on)

In chapter 3 we discussed the fact that the syntactic category of each word is listed in our mental dictionaries. We now see how this information is used by the syntax of the language. Words appear in trees under labels that correspond to their syntactic category. Nouns are under N, determiners under Det, verbs under V, and so on.

The larger syntactic categories, such as VP, consist of all the syntactic categories and words below that point, or **node**, in the tree. The VP in the PS tree above consists of syntactic category nodes V and NP and the words *found*, *a*, and *puppy*. Because *a puppy* can be traced up the tree to the node NP, this constituent is a noun phrase. Because *found* and *a puppy* can be traced up to the node VP, this constituent is a verb phrase. The PS tree reflects the speaker's intuitions about the natural groupings of words in a sentence. In discussing trees, every higher node is said to **dominate** all the categories beneath it. S dominates every node. A node is said to **immediately dominate** the categories one level below it. VP immediately dominates V and NP, the categories of which it is composed. Categories that are immediately dominated by the same node are **sisters**. V and NP are sisters in the phrase structure tree of "the child found a puppy."

A PS tree is a formal device for representing the speaker's knowledge of the structure of sentences in his language, as revealed by our linguistic intuitions. When we speak, we are not aware that we are producing sentences with such structures, but controlled experiments, such as the click experiments described earlier, show that we use them in speech production and comprehension. We will discuss these experiments further in chapter 9.

The information represented in a PS tree can also be represented by another formal device: phrase structure (PS) rules. PS rules capture the knowledge that speakers have about the possible structures of a language. Just as a speaker cannot have an infinite list of sentences in her head, so she cannot have an infinite set of PS trees in her head. Rather, a speaker's knowledge of the permissible and impermissible structures must exist as a finite set of rules that generate a tree for any sentence in the language. To express the structure given above, we need the following PS rules:

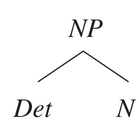
1. S → NP VP
2. NP → Det N
3. VP → V NP

Phrase structure rules specify the well-formed structures of a language precisely and concisely. They express the regularities of the language and make explicit a speaker's knowledge of the order of words and the grouping of words into syntactic categories. For example, in English an NP may contain a determiner followed by a noun. This is represented by rule 2. This rule conveys two facts:

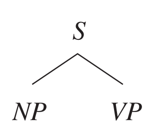
A noun phrase can contain a determiner followed by a noun in that order.

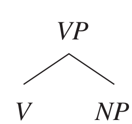
A determiner followed by a noun is a noun phrase.

You can think of PS rules as templates that a tree must match to be grammatical. To the left of the arrow is the dominating category, in this case NP, and the categories that it immediately dominates—that comprise it—appear on the right side, in this case Det and N. The right side of the arrow also shows the linear order of these components. Thus, one subtree for the English NP looks like this:



Rule 1 says that a sentence (S) contains (immediately dominates) an NP and a VP in that order. Rule 3 says that a verb phrase consists of a verb (V) followed by an NP. These rules are general statements and do not refer to any specific VP, V, or NP. The subtrees represented by rules 1 and 3 are as follows:

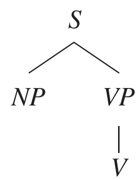




A VP need not contain an NP object, however. It may include a verb alone, as in the following sentences:

The woman laughed.
The man danced.
The horse galloped.

These sentences have the structure:



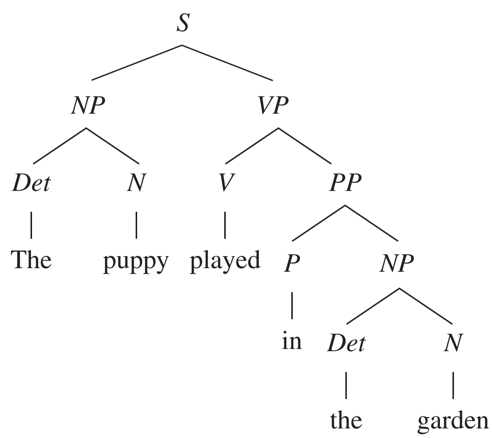
Thus a tree must have a VP that immediately dominates V, as specified by rule 4, which is therefore added to the grammar:

4. VP → V

The following sentences contain prepositional phrases following the verb:

The puppy played in the garden.
The boat sailed up the river.
A girl laughed at the monkey.
The sheepdog rolled in the mud.

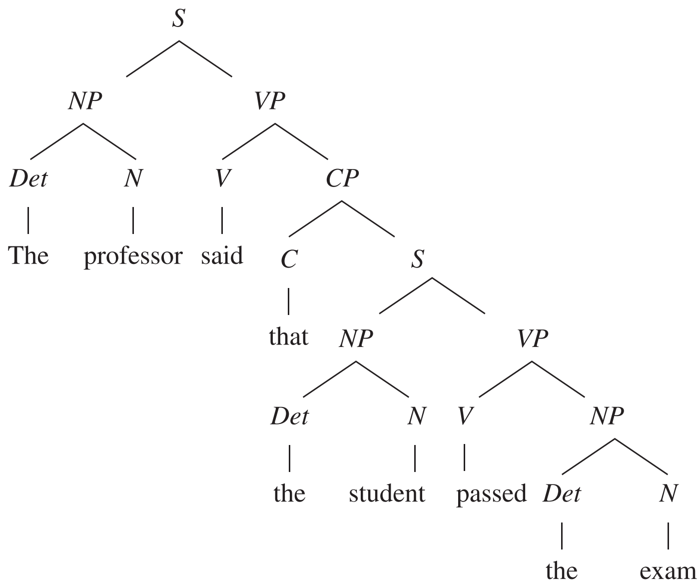
The PS tree for such sentences is



To permit structures of this type, we need two additional PS rules, as in 5 and 6.

5. VP → V PP
6. PP → P NP

Another option open to the VP is to contain or *embed* a sentence. For example, the sentence "The professor said that the student passed the exam" contains the sentence "the student passed the exam." Preceding the **embedded sentence** is the word *that*, which is a **complementizer (C)**. C is a functional category, like Aux and Det. Here is the structure of such sentence types:



To allow such embedded sentences, we need to add these two new rules to our set of phrase structure rules.

7. VP → V CP
8. CP → C S

CP stands for complementizer phrase. Rule 8 says that CP contains a complementizer such as *that* followed by the embedded sentence. Other complementizers are *if* and *whether* in sentences like

I don't know whether I should talk about this.
The teacher asked if the students understood the syntax lesson.

that have structures similar to the one above.

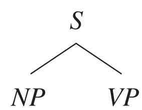
Here are the PS rules we have discussed so far. A few other rules will be considered later.

1. S → NP VP
2. NP → Det N
3. VP → V NP
4. VP → V
5. VP → V PP
6. PP → P NP
7. VP → V CP
8. CP → C S

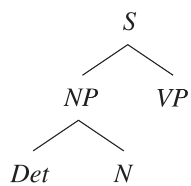
Some Conventions for Building Phrase Structure Trees

> Everyone who is master of the language he speaks . . . may form new . . . phrases, provided they coincide with the genius of the language.
>
> **JOHANN DAVID MICHAELIS,** *Dissertation,* 1769

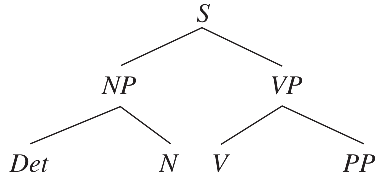
One can use the phrase structure rules as a guide for building trees that follow the structural constraints of the language. In so doing, certain conventions are followed. The S occurs at the top or "root" of the tree (it's upside down). Another convention specifies how the rules are applied: First, find the rule with S on the left side of the arrow, and put the categories on the right side below the S, as shown here:



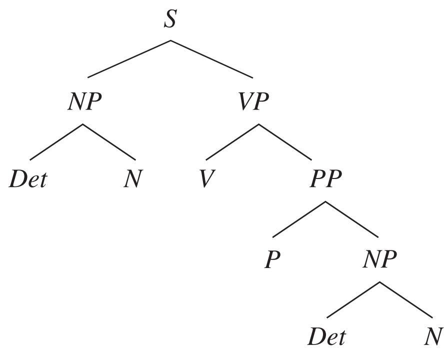
Continue by matching any syntactic category at the bottom of the partially constructed tree to a category on the left side of a rule, then expand the tree with the categories on the right side. For example, we may expand the tree by applying the NP rule to produce:



The categories at the bottom are Det, N, and VP, but only VP occurs to the left of an arrow in the set of rules and so needs to be expanded using one of the VP rules. Any one of the VP rules will work. The order in which the rules appear in the list of rules is irrelevant. (We could have begun by expanding the VP rather than the NP.) Suppose we use rule 5 next. Then the tree has grown to look like this:



Convention dictates that we continue in this way until none of the categories at the bottom of the tree appears on the left side of any rule (i.e., no phrasal categories may remain unexpanded). The PP must expand into a P and an NP (rule 6), and the NP into a Det and an N. We can use a rule as many times as it can apply. In this tree, we used the NP rule twice. After we have applied all the rules that can apply, the tree looks like this:



By following these conventions, we generate only trees specified by the PS rules, and hence only trees that conform to the syntax of the language. By implication, any tree not so specified will be ungrammatical, that is, not permitted by the syntax. At any point during the construction of a tree, any rule may be used as long as its left-side category occurs somewhere at the bottom of the tree. By choosing different VP rules, we could specify different structures corresponding to sentences such as:

The boys left. (VP → V)
The wind blew the kite. (VP → V NP)
The senator hopes that the bill passes. (VP → V CP)

Because the number of possible sentences in every language is infinite, there are also an infinite number of trees. However, all trees are built out of the finite set of substructures allowed by the grammar of the language, and these substructures are specified by the finite set of phrase structure rules.

The Infinity of Language: Recursive Rules

So, naturalists observe, a flea
Hath smaller fleas that on him prey;
And these have smaller still to bite 'em,
And so proceed ad infinitum.

JONATHAN SWIFT, "On Poetry, a Rhapsody," 1733

We noted at the beginning of the chapter that the number of sentences in a language is infinite and that languages have various means of creating longer and longer sentences, such as adding an adjective or a prepositional phrase. Even children know how to produce and understand very long sentences and know how to make them even longer, as illustrated by the children's rhyme about the house that Jack built.

This is the farmer sowing the corn,
that kept the cock that crowed in the morn,
that waked the priest all shaven and shorn,
that married the man all tattered and torn,
that kissed the maiden all forlorn,
that milked the cow with the crumpled horn,
that tossed the dog,

that worried the cat,
that killed the rat,
that ate the malt,
that lay in the house that Jack built.

The child begins the rhyme with *This is the house that Jack built*, continues by lengthening it to *This is the malt that lay in the house that Jack built*, and so on.

You can add any of the following to the beginning of the rhyme and still have a grammatical sentence:

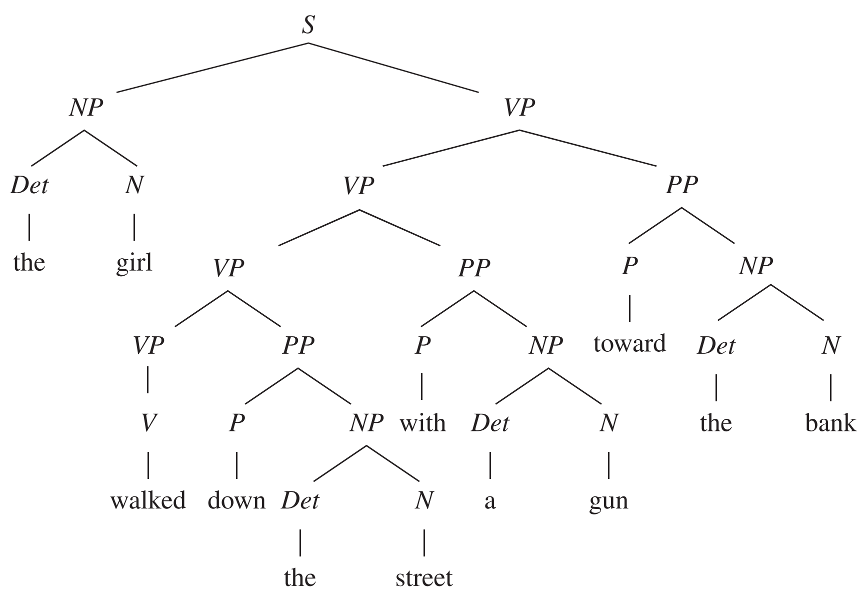
I think that . . .
What is the name of the unicorn that noticed that . . .
Ask someone if . . .
Do you know whether . . .

Once we acknowledge the unboundedness of sentences, we need a formal device to capture that crucial aspect of speakers' syntactic knowledge. It is no longer possible to specify each legal structure; there are infinitely many.

To see how this works, let us first look at the case of multiple prepositional phrases such as [The girl walked [down the street] [over the hill] [through the woods] . . .]. VP substructures currently allow only one PP per sentence (VP → V PP—rule 5). We can rectify this problem by revising rule 5:

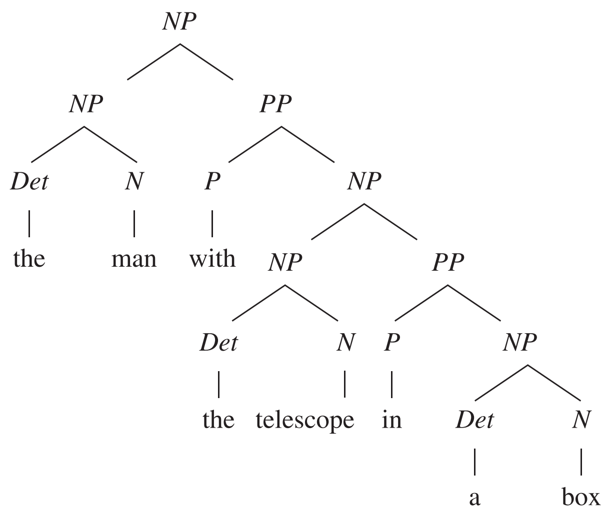
5. VP → VP PP

Rule 5 is different from the previous rules because it repeats its own category (VP) inside itself. This is an instance of a **recursive rule**. Recursive rules are of critical importance because they allow the grammar to generate an infinite set of sentences. Reapplying rule 5 shows how the syntax permits structures with multiple PPs, such as in the sentence "The girl walked down the street with a gun toward the bank."



In this structure the VP rule 5 has applied three times and so there are three PPs: [down the street] [with a gun] [toward the bank]. It is easy to see that the rule could have applied four or more times, for example by adding a PP like *for no good purpose*.

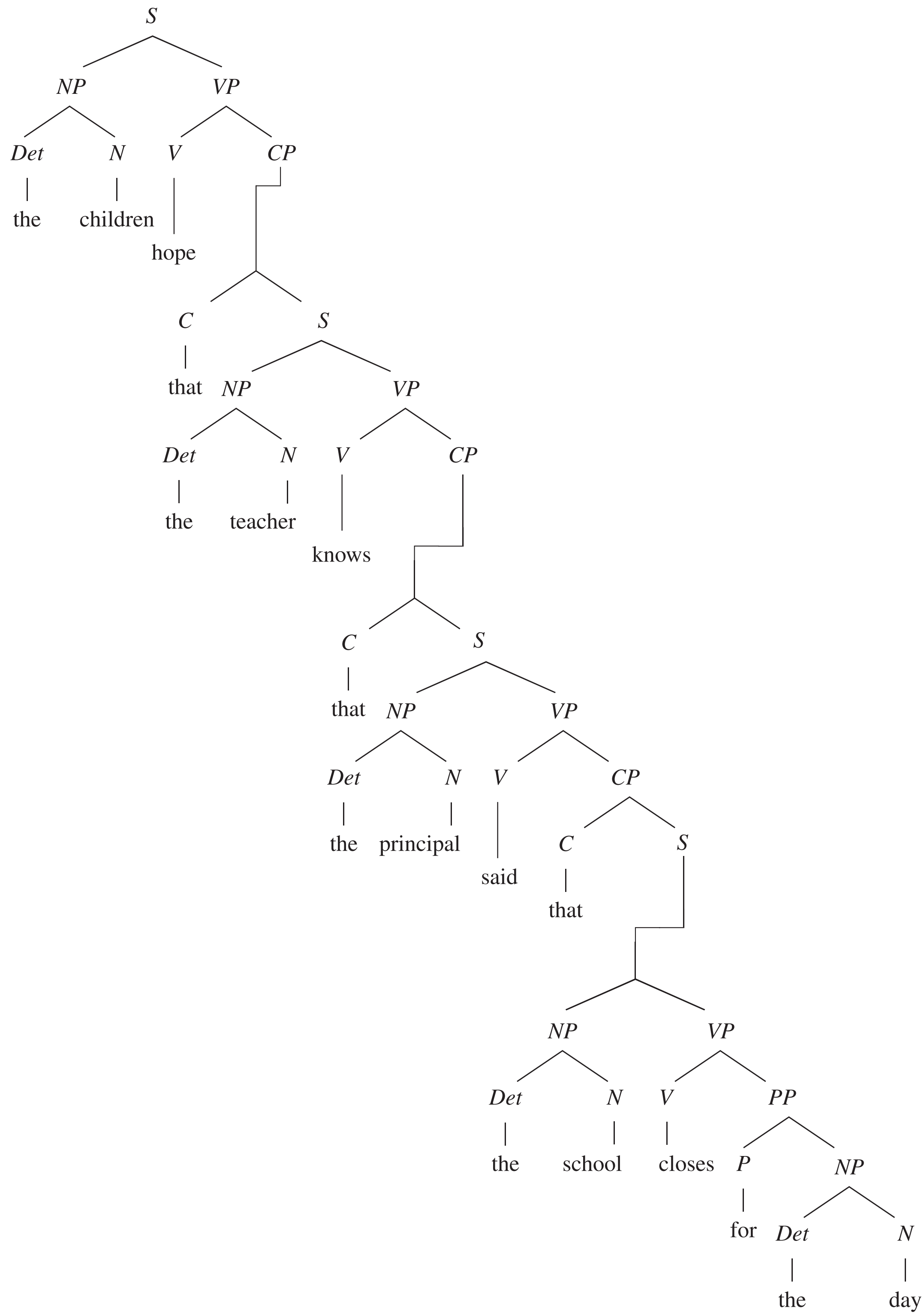
NPs can also contain PPs recursively. An example of this is shown by the phrase *the man with the telescope in a box*.



To show that speakers permit recursive NP structures of this sort, we need to include the following PS rule, which is like the recursive VP rule 5.

9. NP → NP PP

The PS rules define the allowable structures of the language, and in so doing make predictions about structures that we may not have considered when formulating each rule individually. These predictions can be tested, and if they are not validated, the rules must be reformulated because they must generate all and only the allowable structures. For example, rule 7 (VP → V CP) in combination with rules 8 (CP → C S) and 1 (S → NP VP) form a recursive set. (The recursiveness comes from the fact that S and VP occur on both the left and right side of the rules.) Those rules allow S to contain VP, which in turn contains CP, which in turn contains S, which in turn again contains VP, and so on, potentially without end. These rules, formulated for different purposes, correctly predict the limitlessness of language in which sentences are embedded inside larger sentences, such as *The children hope that the teacher knows that the principal said that the school closes for the day* as illustrated on the following page.


S
NP
VP
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V
CP
the
children
hope
C
S
that
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PP
the
school
closes
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for
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N
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day

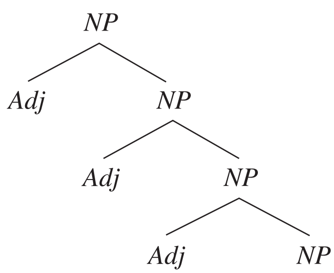
Recursive Adjectives and Possessives

"Very traditional. He's the noun. She's the adjective."

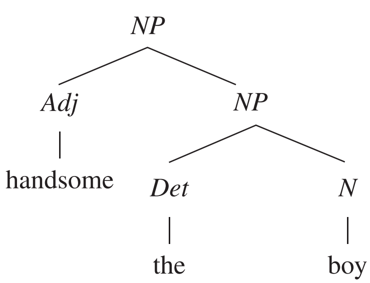
Now we consider the case of multiple adjectives, illustrated at the beginning of the chapter with sentences such as "The kindhearted, intelligent, handsome boy had many girlfriends." In English, adjectives occur before the noun. As a first approximation we might follow the system we have adopted thus far and introduce a recursive NP rule with a prenominal adjective:

NP → Adj NP

Repeated application of this rule would generate trees with multiple adjective positions, as desired.

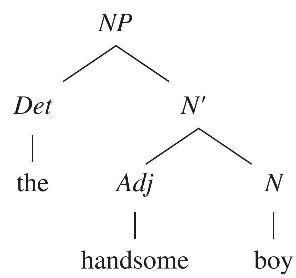


But there is something wrong in this tree, which is made apparent when we expand the lowest NP. The adjective can appear before the determiner, and this is not a possible word order in English NPs.



NOT POSSIBLE!

The problem is that although determiners and adjectives are both modifiers of the noun, they have a different status. First, an NP will never have more than one determiner in it, while it may contain many adjectives. Also, an adjective directly modifies the noun, while a determiner modifies the whole adjective(s) + noun complex. The expression "the big dog" refers to some specific dog that is big, and not just some dog of any size. In general, modification occurs between sisters. If the adjective modifies the noun, then it is sister to the noun. If the determiner modifies the adjective + noun complex, then the determiner is sister to this complex. We can represent these two sisterhood relations by introducing an additional level of structure between NP and N. We refer to this level as N-bar (written as N').



This structure provides the desired sisterhood relations. The adjective *handsome* is sister to the noun *boy*, which it therefore modifies, and the determiner is sister to the N' *handsome boy*. We must revise our NP rules to reflect this new structure, and add two rules for N'. Not all NPs have adjectives, of course. This is reflected in the second N' rule in which N' dominates only N.

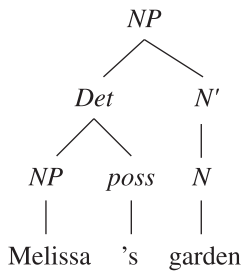
NP → Det N' (revised version of NP → Det N)
N' → Adj N'
N' → N

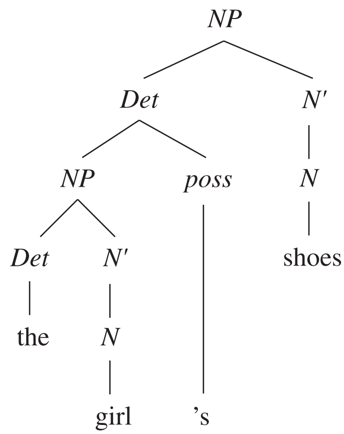
Let us now see how these revised rules generate NPs with multiple (potentially infinitely many) adjectives.

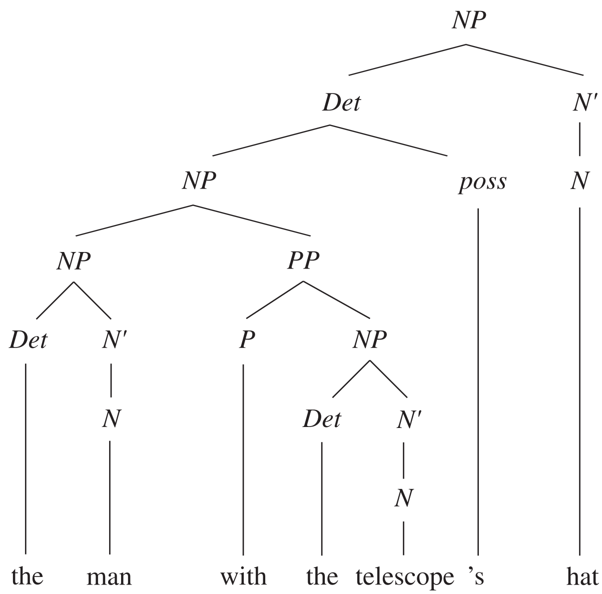
Thus far all the NPs we have looked at are common nouns with a simple definite or indefinite determiner (e.g., the cat, a boy), but NPs can consist of a simple pronoun (e.g., he, she, we, they) or a proper name (e.g., Robert, California, Prozac). To reflect determiner-less NP structures, we will need the rule

NP → N'

But that's not all. We have possessive noun phrases such as *Melissa's garden*, *the girl's shoes*, and *the man with the telescope's hat*. In these structures the possessor NP (e.g., *Melissa's*, *the girl's*, etc.) functions as a determiner in that it further specifies its sister noun. The *'s* is the phonological realization of the abstract element *poss*. The structures are illustrated in each of the following trees.







To accommodate the possessive structure we need an additional rule:

Det → NP poss

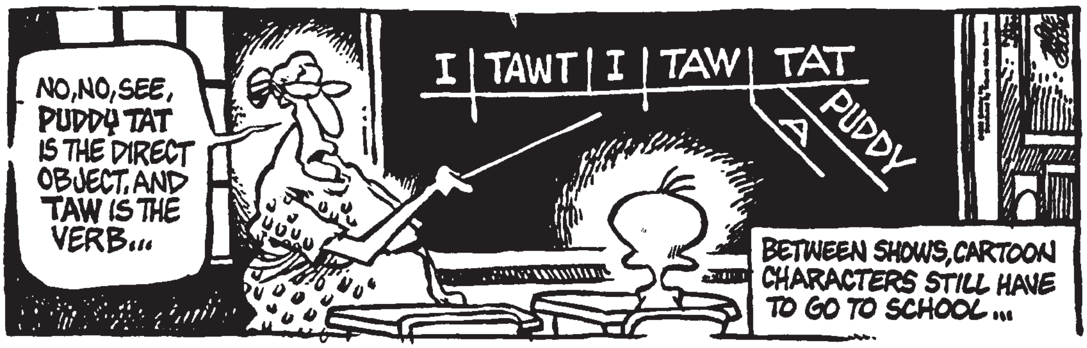
This rule forms a recursive set with the NP → Det N' rule. Together these rules allow an English speaker to have multiple possessives such as *The student's friend's cousin's book*.

The embedding of categories within categories is common to all languages. Our brain capacity is finite, able to store only a finite number of categories and rules for their combination. Yet this finite system places an infinite set of sentences at our disposal.

This linguistic property also illustrates the difference between competence and performance, discussed in chapter 1. All speakers of English (and other languages) have as part of their linguistic competence—their mental grammars—

the ability to embed phrases and sentences within each other ad infinitum. However, as the structures grow longer, they become increasingly more difficult to produce and understand. This could be due to short-term memory limitations, muscular fatigue, breathlessness, boredom, or any number of performance factors. (We will discuss performance factors more fully in chapter 9.) Nevertheless, these very long sentences would be well-formed according to the rules of the grammar.

Heads and Complements



Phrase structure trees also show relationships among elements in a sentence. For example, the *subject* and *direct object* of the sentence can be structurally defined. The subject is the NP that is closest to, or immediately dominated by, the root S. The direct object is the NP that is closest to, or immediately dominated by, VP.

Another kind of relationship is that between the **head** of a phrase and its sisters. The head of a phrase is the word whose lexical category defines the type of phrase: the noun in a noun phrase, the verb in a verb phrase, and so on. Reviewing the PS rules in the previous section, we see that every VP contains a verb, which is its head. The VP may also contain other categories, such as an NP or CP. Those sister categories are **complements**; they complete the meaning of the phrase. Loosely speaking, the entire phrase refers to whatever the head verb refers to. For example, the VP *find a puppy* refers to an event of "finding." The NP object in the VP that completes its meaning is a complement. The underscored CP (complementizer phrase) in the sentence "I thought <u>that the child found the puppy</u>" is also a complement. (Please do not confuse the terms *complementizer* and *complement*.)

Every phrasal category, then, has a head of its same syntactic type. NPs are headed by nouns, PPs are headed by prepositions, CPs by complementizers, and so on; and every phrasal head can have a complement, which provides further information about the head. In the sentence "The death of Lincoln shocked the nation," the PP *of Lincoln* is the complement to the head noun *death*. Other examples of complements are illustrated in the following examples, with the head in italics and the complement underlined:

an *argument* over jelly beans (PP complement to noun)
his *belief* that justice will prevail (CP complement to noun)
happy to be here (infinitive complement to adjective)
about the war in Iraq (NP complement to preposition)
wrote a long letter to his only sister (NP—PP complement to verb)
tell John that his mother is coming to dinner (NP CP complements to verb)

Each of these examples is a phrase (NP, AdjP, PP, VP) that contains a head (N, Adj, P, V), followed by a complement of varying composition such as CP in the case of *belief*, or NP PP in the case of *wrote*, and so on. The head-complement relation is universal. All languages have phrases that are headed and that contain complements.

However, the order of the head and complement may differ in different languages. In English, for example, we see that the head comes first, followed by the complement. In Japanese, complements precede the head, as shown in the following examples:

Taro-ga	inu-o	mitsuketa	
Taro-subject marker	dog-object marker	found	(Taro found a dog)

Inu-ga	niwa-de	asonde	iru	
dog-subject marker	garden-in	playing	is	(The dog is playing in the garden)

In the first sentence, the direct object complement *inu-o* "dog" precedes the head verb *mitsuketa* "found." In the second, the PP complement *niwa-de* "in the garden" also precedes the head verb phrase. English is a VO language, meaning that the verb ordinarily precedes its object. Japanese is an OV language, and this difference is also reflected in the head/complement word order.

Selection

Whether a verb takes a complement or not depends on the properties of the verb. For example, the verb *find* is a transitive verb. A transitive verb requires an NP complement (direct object), as in *The boy found the ball*, but not **The boy found*, or **The boy found in the house*. Some verbs like *eat* are optionally transitive. *John ate* and *John ate a sandwich* are both grammatical.

Verbs select different kinds of complements. For example, verbs like *put* and *give* take both an NP and a PP complement, but cannot occur with either alone:

Sam put the milk in the refrigerator.
*Sam put the milk.
Robert gave the film to his client.
*Robert gave to his client.

Sleep is an **intransitive verb**; it cannot take an NP complement.

Michael slept.
*Michael slept a fish.

Some verbs, such as *think*, select a sentence complement, as in "I think that Sam won the race." Other verbs, like *tell*, select an NP and a sentence, as in "I told Sam that Michael was on his bicycle"; yet other verbs like *feel* select either an AdjP or a sentence complement. (Complements are italicized.)

Paul felt *strong as an ox*.
He feels *that he can win*.

As we will discuss later, sentences that are complements must often be preceded by a complementizer *that*.

Other categories besides verbs also select their complements. For example, the noun *belief* selects either a PP or a CP, while the noun *sympathy* selects a PP, but not a CP, as shown by the following examples:

the belief *in freedom of speech*
the belief *that freedom of speech is a basic right*
their sympathy *for the victims*
*their sympathy that the victims are so poor

Adjectives can also have complements. For example, the adjectives *tired* and *proud* select PPs:

tired *of stale sandwiches*
proud *of her children*

With noun selection, the complement is often optional. Thus sentences like "He respected their belief," "We appreciated their sympathy," "Elimelech was tired," and "All the mothers were proud" are syntactically well-formed with a meaning that might be conveyed by an explicit complement understood from context. Verb selection is often not optional, however, so that **He put the milk* is ungrammatical even if it is clear from context where the milk was put.

The information about the complement types selected by particular verbs and other lexical items is called **C-selection** or **subcategorization**, and is included in the lexical entry of the item in our mental lexicon. (Here C stands for "categorial" and is not to be confused with the C that stands for "complementizer"—we apologize for the "clash" of symbols, but that's what it's like in the linguistic literature.)

Verbs also include in their lexical entry a specification of certain intrinsic semantic properties of their subjects and complements, just as they select for syntactic categories. This kind of selection is called **S-selection** (S for semantic). For example, the verb *murder* requires its subject and object to be human, while the verb *drink* requires its subject to be animate and its object liquid. Verbs such as *like*, *hate*, and so on select animate subjects. The following sentences violate S-selection and can only be used in a metaphorical sense. (We will use the symbol "!" to indicate a semantic anomaly.)

!The rock murdered the man.
!The beer drank the student.
!The tree liked the boy.

The famous sentence *Colorless green ideas sleep furiously*, discussed earlier in this chapter, is anomalous because (among other things) S-selection is violated (e.g., the verb *sleep* requires an animate subject). In chapter 5 we will discuss the semantic relationships between a verb and its subject and objects in far more detail.

The well-formedness of a phrase depends then on at least two factors: whether the phrase conforms to the structural constraints of the language as expressed in the PS rules, and whether it obeys the selectional requirements of the head, both syntactic (C-selection) and semantic (S-selection).

What Heads the Sentence

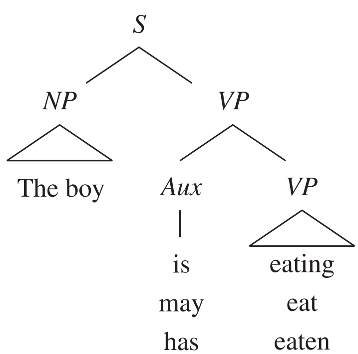
Might, could, would—they are contemptible auxiliaries.

GEORGE ELIOT (MARY ANN EVANS), *Middlemarch*, 1872

We said earlier that all phrases have heads. One category that we have not yet discussed in this regard is sentence (S). For uniformity's sake, we want all the categories to be headed, but what would the head of S be? To answer this question, let us consider sentences such as the following:

Sam will kick the soccer ball.
Sam has kicked the soccer ball.
Sam is kicking the soccer ball.
Sam may kick the soccer ball.

As noted earlier, words like *will*, *has*, *is*, and *may* are auxiliary verbs, belonging to the category Aux, which also includes modals such as *might*, *could*, *would*, *can*, and several others. They occur in structures such as the following one.



(From now on we will adopt the convention of using a triangle under a node when the content of a category is not crucial to the point under discussion.)

Auxiliary verbs specify a time frame for the event (or state) described by the verb, whether it will take place in the future, already took place in the past, or is taking place now. A modal such as *may* contains "possibility" as part of its meaning, and says it is possible that the event will occur at some future time. The category Aux is a natural category to head S. Just as the VP is about the situation described by the verb—*eat ice cream* is about "eating"—so a sentence is about a situation or state of affairs that occurs at some point in time.

The parallel with other categories extends further. In the previous PS tree, VP is the complement to Aux. The selectional relationship between Aux and VP is demonstrated by the fact that particular auxiliaries go with particular kinds of VPs. For example, the auxiliary *be* takes a progressive (-ing) form of the verb,

The boy **is** danc**ing.**

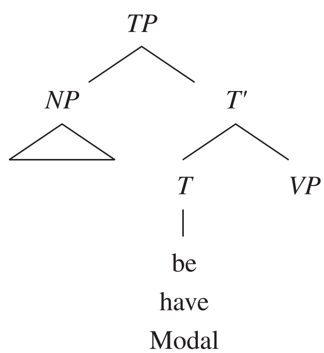
while the auxiliary *have* selects a past participle (-en) form of the verb,

The girl **has** eat**en.**

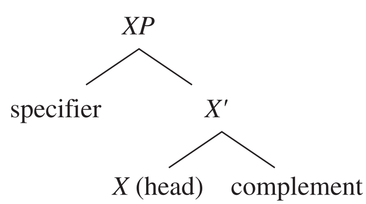
and the modals select the infinitival form of the verb (no affixes),

The child **must sleep**
The boy **may eat.**

To have a uniform notation, many linguists use the symbols **T (= tense)** and **TP (= tense phrase)** instead of Aux and S. Furthermore, just as the NP required the intermediate N-bar (N') category, the TP also has the intermediate T-bar (T') category, as in the phrase structure tree below.



Indeed, many linguists assume that all XPs, where XP stands for any of NP, PP, VP, TP, AdjP, or CP, have three levels of structure. This is referred to as **X-bar theory**. The basic three-level X-bar schema is as follows:



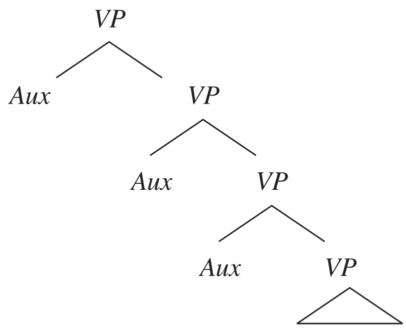
The first level is the XP itself. The second level consists of a **specifier**, which functions as a modifier (and which is generally an optional constituent), and an X' (i.e., "X-bar"). For example, an NP specifier is a determiner; a VP specifier is an adverb such as *never* or *often*; an AdjP specifier is a degree word such as *very* or *quite*. The third level is an expansion of X' and consists of a head X and a complement, which may itself be a phrasal category, thus giving rise to recursion. X-bar structure is thought to be universal, occurring in all the world's languages, though the order of the elements inside XP and X' may be reversed, as we saw in Japanese.

We will not use X-bar conventions in our description of syntax except on the few occasions where the notation provides an insight into the syntax of the language. For sentences we will generally use the more intuitive symbols S and Aux instead of TP and T, but you should think of Aux and S as having the same relationship to each other as V and VP, N and NP, and so on. To achieve this more straightforward approach, we will also ignore the T' category until it is needed later on in the description of the syntax of the main verb *be*.

Without the use of TP, T', and T, we need an additional PS rule to characterize structures containing Aux:

VP $\rightarrow$ Aux VP

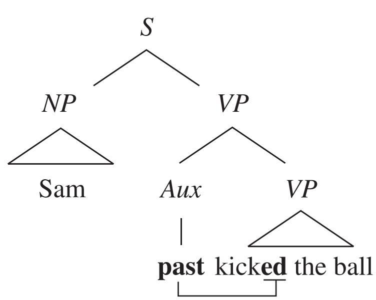
Like the other recursive VP rules, this rule will allow multiple Aux positions.



This is a desired consequence because English allows sentences with multiple auxiliaries such as:

The child may be sleeping.	(modal, be)
The dog has been barking all night.	(have, be)
The bird must have been flying home.	(modal, have, be)

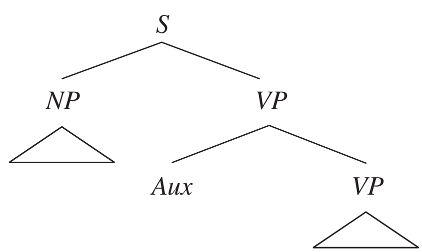
The introduction of Aux into the system raises a question. Not all sentences seem to have auxiliaries. For example, the sentence "Sam kicked the soccer ball" has no modal, *have* or *be*. There is, however, a time reference for this sentence, namely, the past tense on the verb *kicked*. In sentences without auxiliaries, the tense of the sentence is its head. Instead of having a word under the category Aux (or T), there is a tense specification, *present* or *past*, as in the following tree:



The inflection on the verb must match the tense in Aux. For example, if the tense of the sentence is *past*, then the verb must have an *-ed* affix (or must be an irregular past tense verb such as *ate*).

Thus, in English, and many other languages, the head of S may contain only an abstract tense specification and no actual word, as just illustrated. The actual morpheme, in this case *-ed* or an irregular past tense form such as *went*, is inserted into the tree after all the syntactic rules have applied. Most inflectional morphemes, which depend on elements of syntax, are represented in this way. Another example is the tense-bearing word *do* that is inserted into negative sentences such as *John did not go* and questions such as *Where did John go?* In these sentences *did* means "past tense." Later in this chapter we will see how *do*-insertion works.

In addition to specifying the time reference of the sentence, Aux specifies the agreement features of the subject. For example, if the subject is *we*, Aux contains the features first-person and plural; if the subject is *he* or *she*, Aux contains the features third-person and singular. So, another function of the syntactic rules is to use Aux as a "matchmaker" between the subject and the verb. When the subject and the verb bear the same features, Aux makes a match; when they have incompatible features, Aux cannot make a match and the sentence is ungrammatical. This matchmaker function of syntactic rules is more obvious in languages such as Italian, which have many different agreement morphemes, as discussed in chapter 3. Consider the Italian sentence for "I buy books."



Io	Present first person	compro i libri
*Io	Present second person	compri i libri

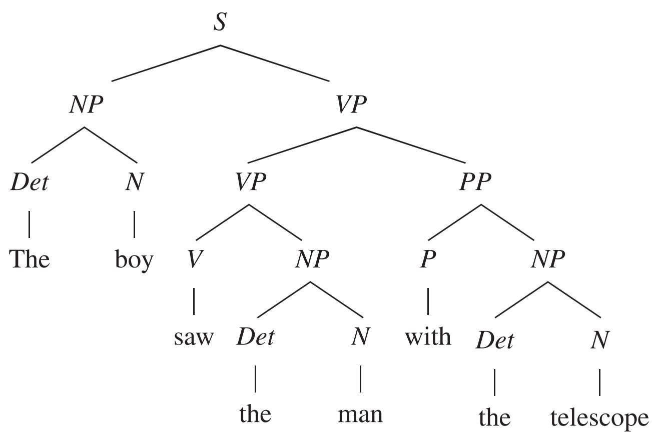
The verb *compro*, "buy," in the first sentence bears the first-person singular morpheme, *-o*, which matches the agreement feature in Aux, which in turn matches the subject *Io*, "I." The sentence is therefore grammatical. In the second sentence, there is a mismatch between the first-person subject and the second-person features in Aux (and on the verb), and so the sentence is ungrammatical.

Structural Ambiguities

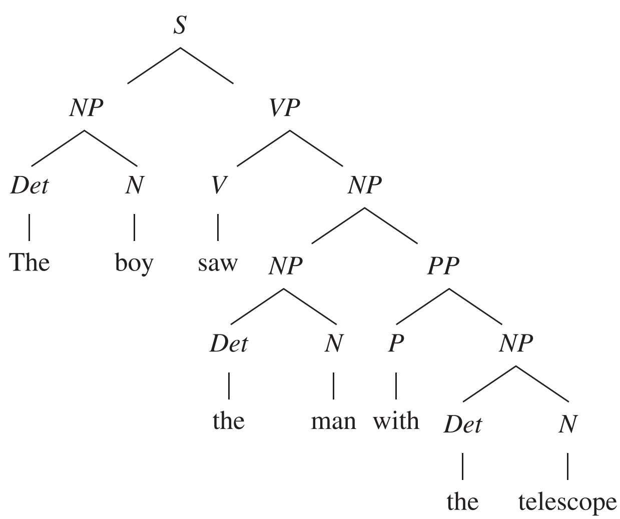
> The structure of every sentence is a lesson in logic.
>
> **JOHN STUART MILL,** Inaugural address at St. Andrews, 1867

As mentioned earlier, certain kinds of ambiguous sentences have more than one phrase structure tree, each corresponding to a different meaning. The sentence *The boy saw the man with the telescope* is structurally ambiguous. Its two meanings correspond to the following two phrase structure trees. (For simplicity we omit Aux in these structures and we return to the non-X-bar notation.)

1.



2.



One meaning of this sentence is "the boy used a telescope to see the man." The first phrase structure tree represents this meaning. The key element is the position of the PP directly under the VP. Notice that although the PP is under VP, it is not a complement because phrasal categories don't take complements (only heads do), and because it is not selected by the verb. The verb *see* selects an NP. In this sentence, the PP has an adverbial function and modifies the verb.

In its other meaning, "the boy saw a man who had a telescope," the PP *with the telescope* occurs under the direct object NP, where it modifies the noun *man*. In this second meaning, the complement of the verb *see* is the entire NP—*the man with the telescope*.

The PP in the first structure is generated by the rule

VP → VP PP

In the second structure the PP is generated by the rule

NP → NP PP

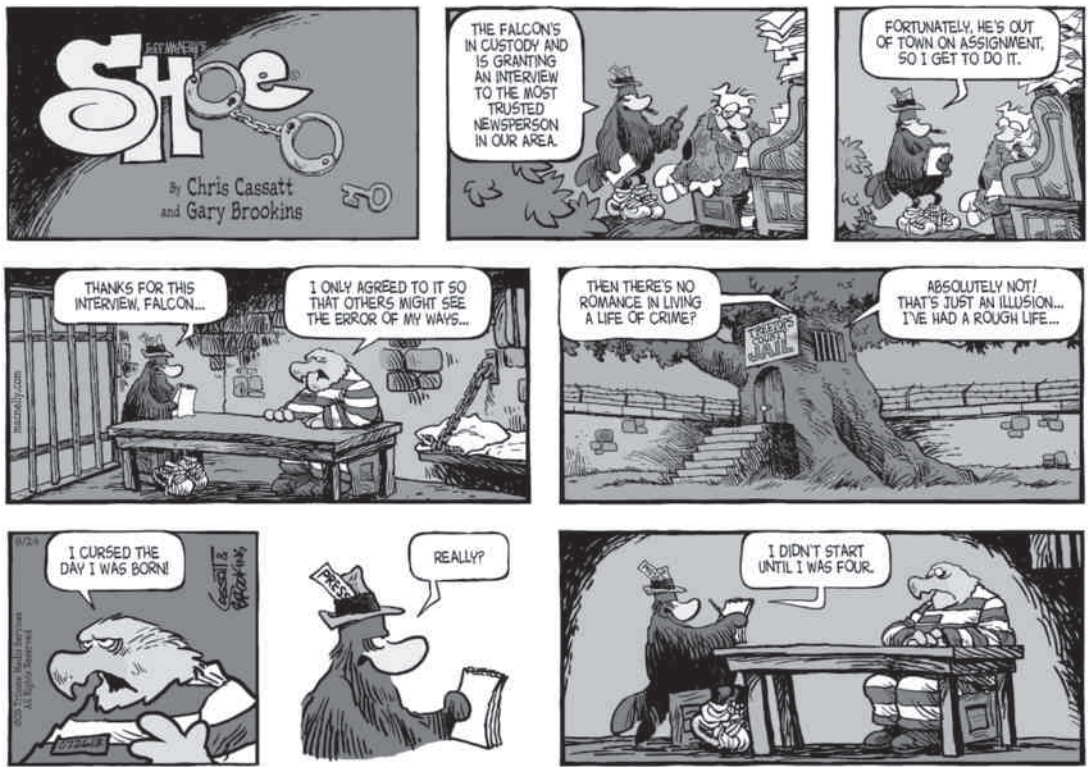
Two interpretations are possible because the rules of syntax permit different structures for the same linear order of words.

Following is the set of PS rules that we have presented so far in the chapter. The rules have been renumbered.

1. S → NP VP
2. NP → Det N'
3. Det → NP poss
4. NP → N'
5. NP → NP PP
6. N' → Adj N'
7. N' → N
8. VP → V
9. VP → V NP
10. VP → V CP
11. VP → Aux VP
12. VP → VP PP
13. PP → P NP
14. CP → C S

This is not the complete set of PS rules for the language. Various structures in English cannot be generated with these rules, some of which we will talk about later. But even this mini phrase structure grammar generates an infinite set of possible sentences because the rules are recursive. These PS rules specify the word order for English (and other SVO languages, but not for Japanese, say, in which the object comes before the verb). Linear order aside, the hierarchical organization illustrated by these rules is largely true for all languages, as expressed by X-bar schema.

More Structures

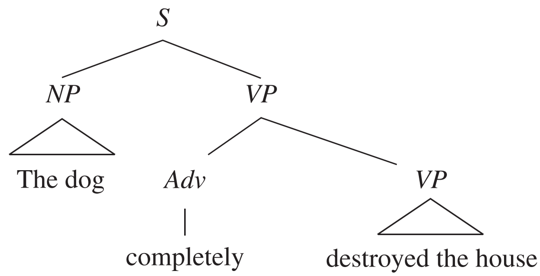


"Shoe" © MacNelly. King Features Syndicate

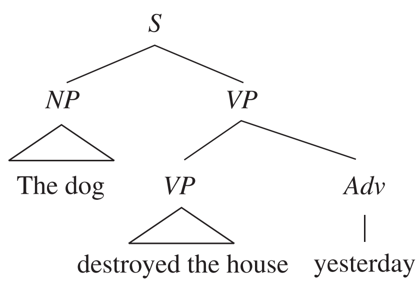
Many English sentence types are not accounted for by the phrase structure rules given so far, including:

1. The dog completely destroyed the house.
2. The cat and the dog were friends.
3. The cat is coy.

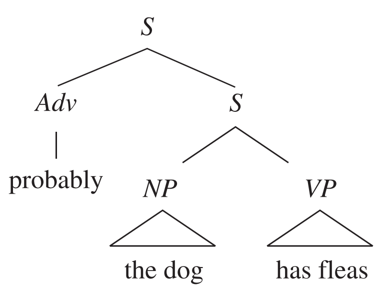
The sentence in (1) contains the adverb (Adv) *completely*. Adverbs are modifiers that can specify how an event happens (*quickly*, *slowly*, *completely*) or when it happens (*yesterday*, *tomorrow*, *often*). As modifiers, adverbs are sisters to phrasal (XP) categories. In sentence (1) the adverb is a sister to VP, as illustrated in the following structure (we ignore Aux in this structure):



Temporal adverbs such as *yesterday*, *today*, *last week*, and manner adverbs such as *quietly*, *violently*, *suddenly*, *carefully*, also occur to the right of VP as follows:

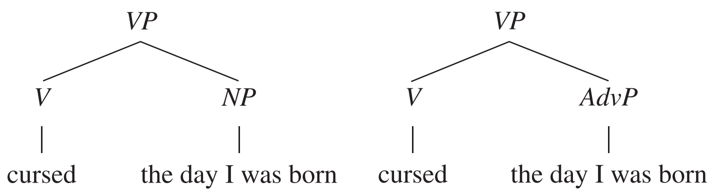


Adverbs also occur as sisters to S (which, recall, is also a phrasal category, TP).



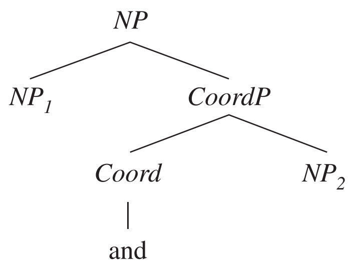
At this point you should be able to write the three PS rules that will account for the position of these adverbs.[1]

The "Shoe" cartoon's joke is based on the fact that *curse* may take an NP complement ("cursed *at* the day") and/or be modified by a temporal adverbial phrase (AdvP) ("cursed *on* the day"), leading to the structural ambiguity:



Interestingly, *I cursed the day I was born the day I was born*, with both the NP and AdvP modifying the verb, is grammatical and meaningful. (See exercise 23b.)

Sentence 2 contains a **coordinate structure** *The cat and the dog*. A coordinate structure results when two constituents of the same category (in this case, two NPs) are joined with a conjunction such as *and* or *or*. The coordinate NP has the following structure:



Though this may seem counterintuitive, in a coordinate structure the second member of the coordination (NP_2) forms a constituent with the conjunction *and*. We can show this by means of the "move as a unit" constituency test. In sentence (5) the words *and a CD* move together to the end of the sentence, whereas in (6) the constituent is broken, resulting in ungrammaticality.

4. Caley bought a book and a CD yesterday.
5. Caley bought a book yesterday and a CD.
6. *Caley bought a book and yesterday a CD.

Once again, we encourage you to write the two PS rules that generate this structure.[2]

---

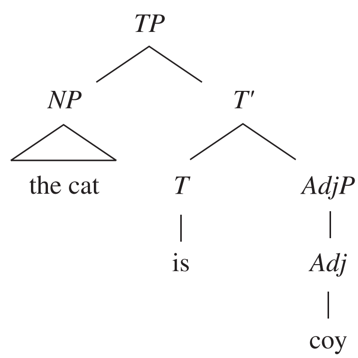
[1] Answer: S → Adv S VP → Adv VP VP → VP Adv

[2] Answer: NP → NP CoordP, CoordP → Coord NP

You can also construct trees for other kinds of coordinate structures, such as VP or PP coordination, which follow the same pattern.

Michael writes poetry and surfs. (VP *and* VP)
Sam rode his bicycle to school and to the pool. (PP *and* PP)

Sentence (3) contains the main verb *be* followed by an adjective. The structure of main verb *be* sentences is best illustrated using T' notation. The main verb *be* acts like the modals and the auxiliaries *be* and *have*. For example, it is moved to the beginning of the sentence in questions (*Is the cat coy?*). For this reason we assume that the main verb *be* occurs under T and takes an XP complement. The XP may be AdjP, as shown in the tree structure for (3):



or an NP or PP as would occur in *The cat is a feline* or *The cat is in the tree*.

As before we will leave it as an exercise for you to construct the PS rules for these sentence types and the tree structures they generate.[3] (You might try drawing the tree structures; they should look very much like the one above.)

There are also embedded sentence types other than those that we have discussed, for example:

Hilary is waiting *for you to sing*. (Cf. You sing.)
The host wants *the president to leave early*. (Cf. The president leaves early.)
The host believes *the president to be punctual*. (Cf. The president is punctual.)

Although the detailed structure of these different embedded sentences is beyond the scope of this introduction, you should note that an embedded sentence may be an infinitive. An infinitive sentence does not have a tense. The embedded sentences *for you to sing*, *the president to leave early*, *and the president to be punctual* are infinitives. Such verbs as *want* and *believe*, among many others, can take infinitival complements. This information, like other selectional properties, belongs to the lexical entry of the selecting verb (the higher verb in the tree).

[3] Answer: TP → NP T', T' → T XP (where XP = AdjP, PP, NP)

Sentence Relatedness

I put the words down and push them a bit.

EVELYN WAUGH, quoted in *The New York Times,* April 11, 1966

Another aspect of our syntactic competence is the knowledge that certain sentences are related to one another, such as the following pair:

The boy is sleeping. Is the boy sleeping?

These sentences describe the same situation. The sentence in the first column asserts that a particular situation exists, a boy-sleeping situation. Such sentences are called **declarative** sentences. The sentence in the second column asks whether such a boy-sleeping situation holds. Sentences of the second sort are called **yes-no questions**. The only actual difference in meaning between these sentences is that one asserts a situation and the other asks for confirmation of a situation. This element of meaning is indicated by the different word orders, which illustrates that two sentences may have a structural difference that corresponds *in a systematic way* to a meaning difference. The grammar of the language must account for this fact.

Transformational Rules

Method consists entirely in properly ordering and arranging the things to which we should pay attention.

RENÉ DESCARTES, *Oeuvres*, vol. X, c. 1637

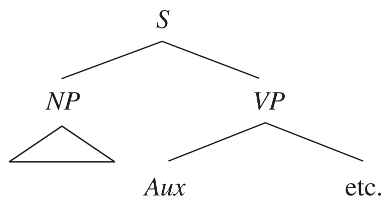
Phrase structure rules account for much of our syntactic knowledge, but they do not account for the fact that certain sentence types in the language relate systematically to other sentence types. The standard way of describing these relationships is to say that the related sentences come from a common underlying structure. Yes-no questions are a case in point, and they bring us back to a discussion of auxiliaries. Auxiliaries are central to the formation of yes-no questions as well as certain other types of sentences in English. In yes-no questions, the auxiliary appears in the position preceding the subject. Here are a few more examples:

The boy is sleeping.	Is the boy sleeping?
The boy has slept.	Has the boy slept?
The boy can sleep.	Can the boy sleep?
The boy will sleep.	Will the boy sleep?

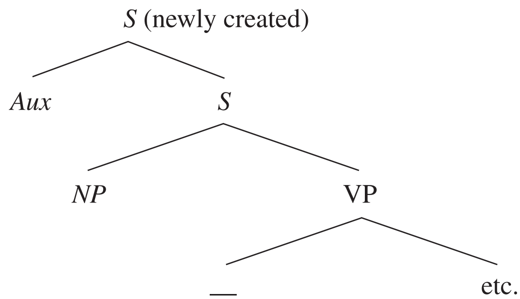
A way to capture the relationship between a declarative and a yes-no question is to allow the PS rules to generate a structure corresponding to the declarative sentence. Another formal device, called a **transformational rule**, then moves the auxiliary before the subject. The rule "Move Aux" is formulated as follows:

Move the highest Aux to adjoin to (the root) S.

That is, Move Aux applies to structures like:



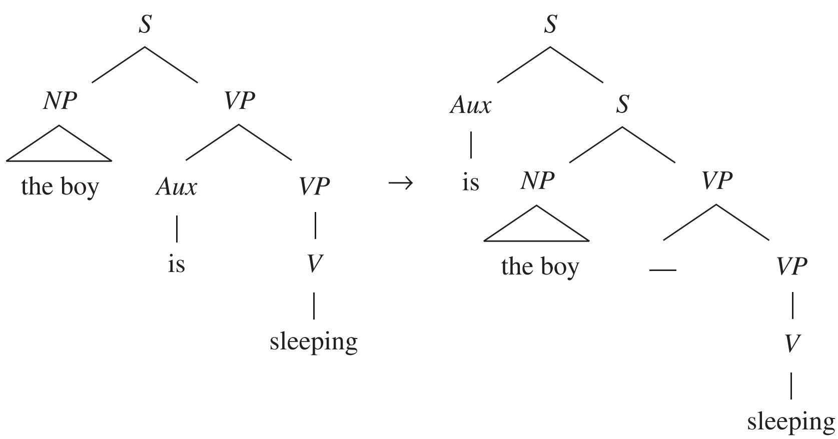
to give structures like:



The "__" shows the position from which the Aux is moved. For example:

The boy is sleeping. → Is the boy __ sleeping?

The rule takes the basic (NP-Aux) structure generated by the phrase structure rules and derives a second tree (the dash represents the position from which a constituent has been moved). The Aux is attached to the tree by **adjunction**. Adjunction is an operation that copies an existing node (in this case S) and creates a new level to which the moved category (in this case Aux) is appended.



Yes-no questions are thus generated in two steps.

1. The phrase structure rules generate a basic structure.
2. Aux movement applies to produce the derived structure.

The basic structures of sentences, also called **deep structures** or **d-structures**, conform to the phrase structure rules. Variants on the basic sentence structures are derived via transformations. By generating questions in two steps, we are claiming that for speakers a relationship exists between a question and its corresponding statement. Intuitively, we know that such sentences are related. The transformational rule is a formal way of representing this knowledge.

The derived structures—the ones that follow the application of transformational rules—are called **surface structures** or **s-structures**. The phonological rules of the language—the ones that determine pronunciation—apply to s-structures. If no transformations apply, then d-structure and s-structure are the same. If transformations apply, then s-structure is the result after all transformations have had their effect. Many sentence types are accounted for by transformations, which can alter phrase structure trees by moving, adding, or deleting elements.

Other sentence pairs that are transformationally related are:

active-passive

The cat chased the mouse. → The mouse was chased by the cat.

***there* sentences**

There was a man on the roof. → A man was on the roof.

PP preposing

The astronomer saw the quasar with the telescope. → With the telescope, the astronomer saw the quasar.

The Structural Dependency of Rules

“Peanuts” © United Feature Syndicate, Inc.

Transformations act on phrase structures without paying attention to the particular words that the structures contain. These rules are said to be **structure dependent**. The transformational rule of PP preposing moves any PP as long as it is immediately under the VP, as in *In the house, the puppy found the ball*; or *With the telescope, the boy saw the man*; and so on.

Evidence that transformations are structure dependent is provided by the fact that the sentence *With a telescope, the boy saw the man* is not ambiguous. It has only the meaning "the boy used a telescope to see the man," the meaning corresponding to the first phrase structure on page **149** in which the PP is immediately dominated by the VP. In the structure corresponding to the other meaning, "boy saw a man who had a telescope," the PP is in the NP as in the second tree on page **149.** The PP preposing transformation applies to the VP–PP structure and not to the NP–PP structure.

Another rule of English allows the complementizer *that* to be omitted when it precedes an embedded sentence but not a sentence that appears in subject position, as illustrated by these pairs:

I know that you know.	I know you know.
That you know bothers me.	*You know bothers me.

This is a further demonstration that rules are structure dependent.

Agreement rules are also structure dependent. In many languages, including English, the verb must agree with the subject. The verb is marked with an *-s* when the subject is third-person singular.

This guy seems kind of cute.
These guys seem kind of cute.

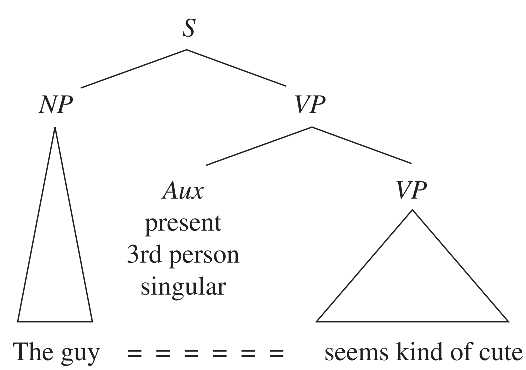
Now consider these sentences:

The *guy* we met at the party next door *seems* kind of cute.
The *guys* we met at the party next door *seem* kind of cute.

The verb *seem* must agree with the subject, *guy* or *guys*. Even though there are various words between the head noun and the verb, the verb always agrees with the head noun. Moreover, there is no limit to how many words may intervene, or whether they are singular or plural, as the following sentence illustrates:

The *guys* (*guy*) we met at the party next door that lasted until 3 A.M. and was finally broken up by the cops who were called by the neighbors *seem* (*seems*) kind of cute.

The phrase structure tree of such a sentence explains why this is so.



In the tree, "= = = = = =" represents the intervening structure, which may, in principle, be indefinitely long and complex. Speakers of English (and all other languages) know that agreement depends on sentence structure, not the linear order of words. Agreement is between the subject and the main verb, where the subject is structurally defined as the NP immediately dominated by S. The agreement relation is mediated by Aux, which contains the tense and agreement features that match up the subject and verb. As far as the rule of agreement is concerned, all other material can be ignored, although in actual performance, if the distance is too great, the speaker may forget what the head noun was.

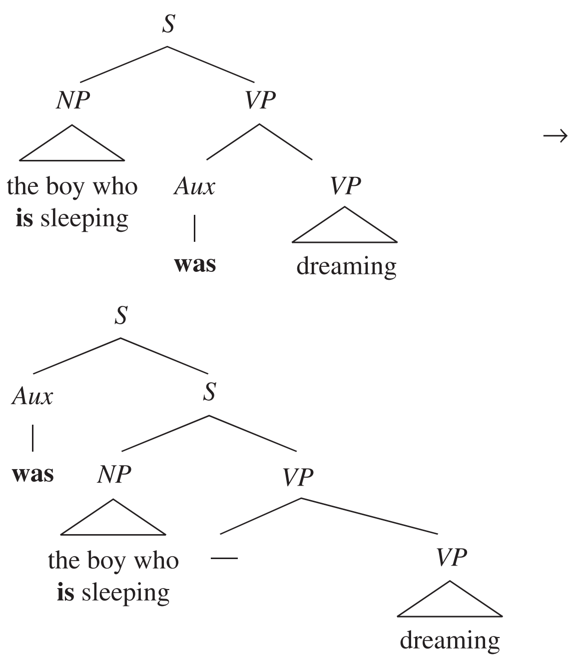
The "Peanuts" cartoon also illustrates that agreement takes place between the head noun—the first occurrence of "refusal"—and the structurally highest verb in the sentence, which is the final occurrence of "do," despite the 14 intervening words.

A final illustration of structure dependency is found in the declarative-question pairs discussed previously. Consider the following sets of sentences:

The boy who is sleeping was dreaming.
Was the boy who is sleeping dreaming?
*Is the boy who sleeping was dreaming?

The boy who can sleep will dream.
Will the boy who can sleep dream?
*Can the boy who sleep will dream?

The ungrammatical sentences show that to form a question, the rule that moves Aux singles out the auxiliary dominated by the root S, and not simply the *first* auxiliary in the sentence. We can see this in the following simplified phrase structure trees. There are two auxiliaries, one in the subject relative clause and the other in the root clause. The rule affects the auxiliary in the higher main clause.



If the rule picked out the *first* Aux, we would have the ungrammatical sentence *Is the boy who__ sleeping was dreaming*. To derive the correct s-structures, transformations such as Move Aux must refer to phrase structure and not to the linear order of elements.

Structure dependency is a principle of Universal Grammar, and is found in all languages. For example, in languages that have subject-verb agreement, the dependency is between the verb and the head noun, and never some other noun such as the closest one, as shown in the following examples from Italian, German, Swahili, and English, respectively (the third-person singular agreement affix in the verb is in boldface and is governed by the boldfaced head noun, not the underlined noun, even though the latter is nearest the main verb):

La **madre** con tanti figli lavor**a** molto.
Die **Mutter** mit den vielen Kindern arbeite**t** viel.
Mama anao watoto wengi **a**najitahidi.
The **mother** with many children work**s** a lot.

Further Syntactic Dependencies

Sentences are organized according to two basic principles: constituent structure and syntactic dependencies. As we have discussed, constituent structure refers to the hierarchical organization of the subparts of a sentence, and transformational rules are sensitive to it. The second important property is the dependencies among elements in the sentence. In other words, the presence of a particular word or morpheme can be contingent on the presence of some other word or morpheme in a sentence. We have already seen at least two examples of syntactic dependencies. Selection is one kind of dependency. Whether there is a direct object in a sentence depends on whether the verb is transitive or intransitive. More generally, complements depend on the properties of the head of their phrase. Agreement is another kind of dependency. The features in Aux (and on the verb) must match the features of the subject.

Wh Questions

Whom are you? said he, for he had been to night school.

GEORGE ADE, "The Steel Box," in *Bang! Bang!,* 1928

The following ***wh* questions** illustrate another kind of dependency:

1. (**a**) What will Max chase?
(**b**) Where has Pete put his bone?
(**c**) Which dog do you think loves balls?

There are several points of interest in these sentences. First, the verb *chase* in sentence (a) is transitive, yet there is no direct object following it. There is a gap where the direct object should be. The verb *put* in sentence (b) selects a direct object and a prepositional phrase, yet there is no PP following *his bone*. Finally, the embedded verb *loves* in sentence (c) bears the third-person *-s* morpheme, yet there is no obvious subject to trigger this agreement. If we remove the *wh* phrases, the remaining sentences would be ungrammatical.

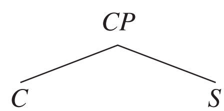
2. (a) *will Max chase ___?
   (b) *has Pete put his bone ___?
   (c) *do you think ___ loves balls?

The grammaticality of a sentence with a gap depends on there being a *wh* phrase at the beginning of the sentence. The sentences in (1) are grammatical because the *wh* phrase is acting like the object in (a), the prepositional phrase object in (b), and the embedded subject in (c).

We can explain the dependency between the *wh* phrase and the missing constituent if we assume that in each case the *wh* phrase originated in the position of the gap in a sentence with the corresponding declarative structure:

3. (a) Max will chase *what*?
   (b) Pete has put his bone *where*?
   (c) You think (that) *which dog* loves balls?

The *wh* phrase is then moved to the beginning of the sentence by a transformational rule: Move *wh*. Because embedded *wh* phrases (*I wonder who Mary likes*) are known to be complementizer phrases (CPs), we may deduce that main clause questions (*Who does Mary like?*) are also CPs, with the following structure (recall that C abbreviates "complementizer"):

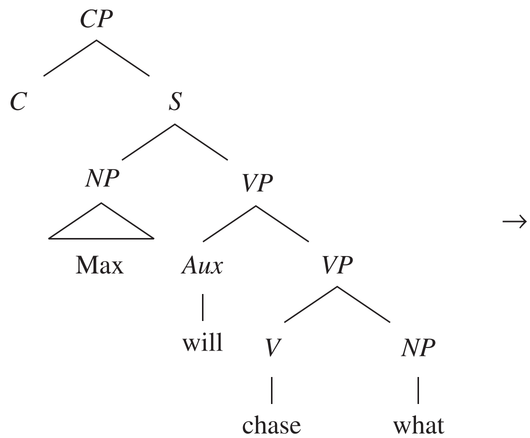


The *wh* phrase moves to the empty C position at the left periphery of the sentence.

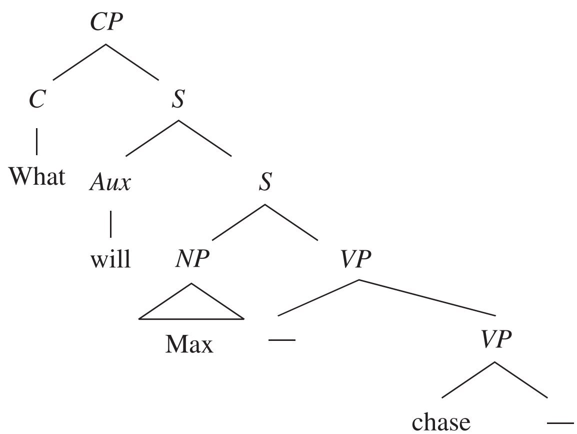
Thus, *wh* questions are generated in three steps:

1. The phrase structure rules generate the CP d-structure with the *wh* phrase occupying an NP position within the S: direct object in (3a); prepositional object in (3b); and subject in (3c).
2. Move Aux adjoins the auxiliary to S.
3. Move *wh* moves the *wh* phrase to C.

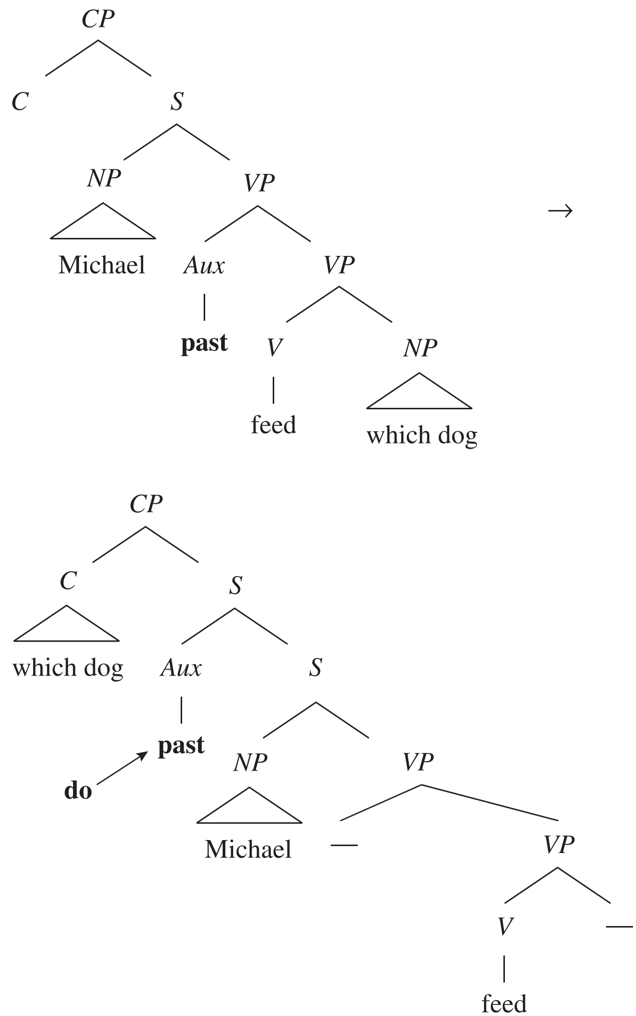
The following tree shows the d-structure of the sentence *What will Max chase?*



The s-structure representation of this sentence is:



In question (1c), there is an auxiliary "do." Unlike the other auxiliaries (e.g., *can*, *have*, *be*), *do* is not part of the d-structure of the question. The d-structure of the question *Which dog did Michael feed?* is "Michael fed which dog?" Because Move Aux is structure dependent (like all rules), it ignores the content of the category. It will therefore move Aux even when Aux contains only a tense feature such as *past*. In this case, another rule called "*do* support," inserts *do* into the structure to carry the tense:



The first tree represents the d-structure to which the Aux and *wh* movement rules apply. The second tree shows the output of those transformations and the insertion of “do.” “Do” combines with *past* to yield “did.” Rules that convert inflectional features such as *past tense*, *third-person present tense*, and the possessive *poss* into their proper phonological forms are called **spell-out rules**.

Unlike the other rules we have seen, which operate inside a phrase or clause, Move *wh* can move the *wh* phrase outside of its own clause. There is no limit to the distance that a *wh* phrase can move, as illustrated by the following sentences. The dashes indicate the position from which the *wh* phrase has been moved.

Who did Helen say the senator wanted to hire ___?
Who did Helen say the senator wanted the congressional representative to try to hire ___?
Who did Helen say the senator wanted the congressional representative to try to convince the Speaker of the House to get the Vice President to hire ___?

"Long-distance" dependencies created by *wh* movement are a fundamental part of human language. They provide still further evidence that sentences are not simply strings of words but are supported by a rich scaffolding of phrase structure trees. These trees express the underlying structure of a sentence as well as its relation to other sentences in the language, and as always are reflective of a person's knowledge of syntax.

UG Principles and Parameters

> Whenever the literary German dives into a sentence, that is the last you are going to see of him till he emerges on the other side of the Atlantic with his Verb in his mouth.
>
> **MARK TWAIN,** *A Connecticut Yankee in King Arthur's Court,* 1889

In this chapter we have largely focused on English syntax, but many of the grammatical structures we have described for English also hold in other languages. This is because Universal Grammar (UG) provides the basic design for all human languages, and individual languages are simply variations on this basic design. Imagine a new housing development. All of the houses have the same floor plan, but the occupants have some choices to make. They can have carpet or hardwood floors, curtains or blinds; they can choose their kitchen cabinets and the countertops, the bathroom tiles, and so on. This is more or less how the syntax operates. Languages conform to a basic design, and then there are choice points or points of variation.

All languages have phrase structure rules that specify the allowable d-structures. In all languages, phrases consist of heads and complements, and sentences are headed by Aux (or T), which is specified for information such as tense, agreement, and modality. However, languages may have different word orders within the phrases and sentences. The word order differences between English and Japanese, discussed earlier, illustrate the interaction of general and language-specific properties. UG specifies the structure of a phrase. It must have a head and may take one or more complement types (the X-bar schema discussed earlier). However, each language defines for itself the relative order of these constituents: English is head initial, Japanese is head final. We call the points of variation **parameters**.

All languages seem to have movement rules. Move Aux is a version of a more general rule that exists in languages such as Dutch, in which the auxiliary moves, if there is one, as in (1), and otherwise the main verb moves, as in (2):

1. Zal Femke fietsen?
will Femke bicycle ride (Will Femke ride her bicycle?)

2. Leest Meindert veel boeken?
reads Meindert many books (Does Meindert read many books?)

In English, main verbs other than *be* do not move. Instead, English "do" spells out the stranded tense and agreement features. All languages have expressions for requesting information about *who*, *when*, *where*, *what*, and *how*. Even if the question words in other languages do not necessarily begin with "wh," we will refer to such questions as *wh* questions. In some languages, such as Japanese and Swahili, the *wh* phrase does not move. It remains in its original d-structure position. In Japanese the sentence is marked with a question morpheme, *no:*

Taro-ga	nani-o	mitsuketa-no?
Taro	what	found

Recall that Japanese word order is SOV, so the *wh* phrase nani ("what") is an object and occurs before the verb.

In Swahili the *wh* phrase—*nani* by pure coincidence—also stays in its base position:

Ulipatia	nani	Kitabu?
you gave	who	a book

However, in all languages with *wh* movement (i.e., movement of the question phrase), the question element moves to C (complementizer). The "landing site" of the moved phrase is determined by UG. Among the *wh* movement languages, there is some variation. In the Romance languages, such as Italian, the *wh* phrase moves as in English, but when the *wh* phrase questions the object of a preposition, the preposition must move together with the *wh* phrase. In English, by contrast, the preposition can be "stranded" (i.e., left behind in its original position):

A chi hai dato il libro?
To whom (did) you give the book?
*Chi hai dato il libro a?
Who(m) did you give the book to?

In some dialects of German, long-distance *wh* movement leaves a trail of *wh* phrases in the C position of the embedded sentence:

Mit	wem	Glaubst	Du	Mit	wem	Hans	spricht?
With	whom	think	you	with	whom	Hans	talks

(Whom do you think Hans talks to?)

Wen	willst	Du	Wen	Hans	anruft?
Whom	want	you	whom	Hans	call

(Whom do you want Hans to call?)

In Czech the question phrase "how much" can be moved, leaving behind the NP it modifies:

Jak	velké	Václav	koupil	auto?
How	big	Václav	bought	car

(How big a car did Václav buy?)

Despite these variations, *wh* movement adheres to certain constraints. Although *wh* phrases such as *what*, *who*, and *which boy* can be inserted into any NP position, and are then free in principle to move to C, there are specific instances in which *wh* movement is blocked. For example, a *wh* phrase cannot move out of a relative clause like *the senator that wanted to hire who*, as in (1b). It also cannot move out of a clause beginning with *whether* or *if*, as in (2c) and (d). (Remember that the position from which the *wh* phrases have moved is indicated with ___.)

1. **(a)** Emily paid a visit to the senator that wants to hire who?
(b) *Who did Emily pay a visit to the senator that wants to hire ___?

2. **(a)** Miss Marple asked Sherlock whether Poirot had solved the crime.
(b) Who did Miss Marple ask ___ whether Poirot had solved the crime?
(c) *Who did Miss Marple ask Sherlock whether ___ had solved the crime?
(d) *What did Miss Marple ask Sherlock whether Poirot had solved ___?

The only difference between the grammatical (2b) and the ungrammatical (2c) and (d) is that in (2b) the *wh* phrase originates in the higher clause, whereas in (2c, d) the *wh* phrase comes from inside the *whether* clause. This illustrates that the constraint against movement depends on structure and not on the length of the sentence.

Some sentences can be very short and still not allow *wh* movement:

3. **(a)** Sam Spade insulted the fat man's henchman.
(b) Who did Sam Spade insult?
(c) Whose henchman did Sam Spade insult?
(d) *Whose did Sam Spade insult henchman?

4. **(a)** John ate bologna and cheese.
(b) John ate bologna with cheese.
(c) *What did John eat bologna and?
(d) What did John eat bologna with?

The sentences in (3) show that a *wh* phrase cannot be extracted from inside a possessive NP. In (3b) it is okay to question the whole direct object. In (3c) it is even okay to question a piece of the possessive NP, providing the entire *wh* phrase is moved, but (3d) shows that moving the *wh* word alone out of the possessive NP is illicit.

Sentence (4a) is a coordinate structure and has approximately the same meaning as (4b), which is not a coordinate structure. In (4c) moving a *wh* phrase out of the coordinate structure results in ungrammaticality, whereas in 4(d), moving the *wh* phrase out of the PP is fine. The ungrammaticality of 4(c), then, is related to its structure and not to its meaning.

The constraints on *wh* movement are not specific to English. Such constraints operate in all languages that have *wh* movement. Like the principle of structure dependency and the principles governing the organization of phrases, the constraints on *wh* movement are part of UG. These aspects of grammar need not be learned. They are part of the innate blueprint for language that the child brings to the task of acquiring a language. What children must learn are the language-specific aspects of grammar. Where there are parameters of variation, children must determine the correct choice for their language. The Japanese child must determine that the verb comes after the object in the VP, and the English-speaking child that the verb comes first. The Dutch-speaking child acquires a rule that moves the verb, while the English-speaking child must restrict his rule to auxiliaries. Italian, English, and Czech children learn that to form a question, the *wh* phrase moves, whereas Japanese and Swahili children determine that there is no movement. As far as we can tell, children fix these parameters very quickly. We will have more to say about how children set UG parameters in chapter 8.

Sign Language Syntax

All languages have rules of syntax similar in kind, if not in detail, to those of English, and sign languages are no exception. Signed languages have phrase structure rules that provide hierarchical structure and order constituents. A signer distinguishes *The dog chased the cat* from *The cat chased the dog* through the order of signing. The basic order of ASL is SVO. Unlike English, however, adjectives follow the head noun in ASL.

ASL has a category Aux, which expresses notions such as tense, agreement, modality, and so on. In Thai, to show that an action is continuous, the auxiliary verb *kamlang* is inserted before the verb. Thus *kin* means "eat" and *kamlang kin* means "is eating." In English a form of *be* is inserted and the main verb is changed to an *-ing* form. In ASL the sign for a verb such as *eat* may be articulated with a sweeping, repetitive movement to achieve the same effect. The sweeping, repetitive motion is a kind of auxiliary.

Many languages, including English, have a transformation that moves a direct object to the beginning of the sentence to draw particular attention to it, as in:

Many greyhounds, my wife has rescued.

The transformation is called **topicalization** because an object to which attention is drawn is generally the topic of the sentence or conversation. (The d-structure underlying this sentence is *My wife has rescued many greyhounds*.)

In ASL a similar reordering of signs accompanied by raising the eyebrows and tilting the head upward accomplishes the same effect. The head motion and facial expressions of a signer function as markers of the special word order, much as intonation does in English, or the attachment of prefixes or suffixes might in other languages.

There are constraints on topicalization similar to those on *wh* movement illustrated in a previous section. In English the following strings are ungrammatical:

*Henchman, Sam Spade insulted the fat man's.
*This film, John asked Mary whether she liked.
*Cheese, John ate bologna and for lunch.

Compare this with the grammatical:

The fat man's henchman, Sam Spade insulted.
This film, John asked Mary to see with her.
Bologna and cheese, John ate for lunch.

Sign languages exhibit similar constraints. The signed sequence **Henchman, Sam Spade insulted the fat man's* or the other starred examples are ungrammatical in ASL as in spoken languages.

ASL has *wh* phrases. The *wh* phrase in ASL may move or it may remain in its d-structure position as in Japanese and Swahili. The ASL equivalents of *Who did Bill see yesterday?* and *Bill saw who yesterday?* are both grammatical. As in topicalization, *wh* questions are accompanied by a nonmanual marker. For questions, this marker is a facial expression with furrowed brows and the head tilted back.

ASL and other sign languages show an interaction of universal and language-specific properties, just as spoken languages do. The rules of sign languages are structure dependent, and movement rules are constrained in various ways, as illustrated earlier. Other aspects are particular to sign languages, such as the facial gestures, which are an integral part of the grammar of sign languages but not of spoken languages. The fact that the principles and parameters of UG hold in both the spoken and manual modalities shows that the human brain is designed to acquire and use language, not simply speech.

Summary

Speakers of a language recognize the grammatical sentences of their language and know how the words in a sentence must be ordered and grouped to convey a certain meaning. All speakers are capable of producing and understanding an unlimited number of new sentences that have never before been spoken or heard. They also recognize ambiguities, know when different sentences mean the same thing, and correctly interpret the grammatical relations in a sentence, such as **subject** and **direct object**. This kind of knowledge comes from their knowledge of the **rules of syntax**.

Sentences have structure that can be represented by **phrase structure trees** containing **syntactic categories**. Phrase structure trees reflect the speaker's mental representation of sentences. Ambiguous sentences may have more than one phrase structure tree.

Phrase structure trees reveal the linear order of words and the constituency of each syntactic category. There are different kinds of syntactic categories: **Phrasal categories**, such as NP and VP, are composed of other syntactic categories; **lexical categories**, such as Noun and Verb, and **functional categories**, such as Det, Aux, and C, are not decomposable and often correspond to individual words. The internal structure of the phrasal categories is universal. It consists of a **head** and its **complements**. The particular order of elements within the phrase is accounted for by the **phrase structure rules** of each language. NPs, VPs, and so on are headed by nouns, verbs, and the like. The sentence (S or TP) is headed by Aux (or T), which carries such information as tense, agreement, and modality.

A grammar is a formally stated, explicit description of the mental grammar or speaker's linguistic competence. Phrase structure rules characterize the basic phrase structure trees of the language, the **d-structures**.

Some PS rules allow the same syntactic category to appear repeatedly in a phrase structure tree, such as a sentence embedded in another sentence. These rules are **recursive** and reflect a speaker's ability to produce countless sentences.

The **lexicon** represents the knowledge that speakers have about the vocabulary of their language. This knowledge includes the syntactic category of words and what elements may occur together, expressed as **c-selection** or **subcategorization**. The lexicon also contains semantic information including the kinds of NPs that can function as semantically coherent subjects and objects, **s-selection**.

Transformational rules account for relationships between sentences such as declarative and interrogative pairs, including *wh* questions. Transformations can move constituents. Much of the meaning of a sentence is interpreted from its d-structure. The output of the transformational rules is the **s-structure** of a sentence, the structure to which the phonological rules of the language apply. Inflectional information such as tense, agreement, and possessive, among others, is represented as features in the phrase structure tree. After the rules of the syntax have applied, these features are sometimes spelled out as affixes such as *-ed* and *-'s* or as function words such as *do*.

The basic design of language is universal. Universal Grammar specifies that syntactic rules are **structure dependent** and that movement rules may not move phrases out of certain structures such as coordinate structures. These constraints exist in all languages—spoken and signed—and need not be learned. UG also contains parameters of variation, such as the order of heads and complements, and the variations on movement rules. A child acquiring a language must fix the parameters of UG for that language.

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5

The Meaning of Language

Surely all this is not without meaning.

HERMAN MELVILLE, *Moby-Dick*, 1851

For thousands of years philosophers have pondered the **meaning** of *meaning*, yet speakers of a language can easily understand what is said to them and can produce strings of words that are meaningful to other speakers. We use language to convey information to others (*My new bike is pink*), ask questions (*Who left the party early?*), give commands (*Stop lying!*), and express wishes (*May there be peace on earth*).

What do you know about meaning when you know a language? To begin with, you know when a "word" is meaningful (*flick*) or meaningless (*blick*), and you know when a "sentence" is meaningful (*Jack swims*) or meaningless (*swims metaphorical every*). You know when a word has two meanings (*bear*) and when a sentence has two meanings (*Jack saw a man with a telescope*). You know when two words have the same meaning (*sofa* and *couch*), and when two sentences have the same meaning (*Jack put off the meeting*, *Jack put the meeting off*). And you know when words or sentences have opposite meanings (*alive/dead*; *Jack swims/Jack doesn't swim*).

You generally know the real-world object that words refer to like *the chair in the corner*; and even if the words do not refer to an actual object, such as *the unicorn behind the bush*, you still have a sense of what they mean, and if the particular object happened to exist, you would have the knowledge to identify it.

You know, or have the capacity to discover, when sentences are true or false. That is, if you know the meaning of a sentence, you know its **truth conditions**. In some cases it's obvious, or redundant (*all kings are male* [true], *all bachelors are* *married* [false]); in other cases you need some further, nonlinguistic knowledge (*Molybdenum conducts electricity*), but by knowing the meaning, you know the kind of world knowledge that is needed. Often, if you know that a sentence is true (*Nina bathed her dogs*), you can infer that another sentence must also be true (*Nina's dogs got wet*), that is, the first sentence **entails** the second sentence.

All of this knowledge about meaning extends to an unlimited set of sentences, just like our syntactic knowledge, and is part of the grammar of the language. Part of the job of the linguist is to reveal and make explicit this knowledge about meaning that every speaker has.

The study of the linguistic meaning of morphemes, words, phrases, and sentences is called **semantics**. Subfields of semantics are **lexical semantics**, which is concerned with the meanings of words, and the meaning relationships among words; and **phrasal** or **sentential semantics**, which is concerned with the meaning of syntactic units larger than the word. The study of how context affects meaning—for example, how the sentence *It's cold in here* comes to be interpreted as "close the windows" in certain situations—is called **pragmatics**.

What Speakers Know about Sentence Meaning

> Language without meaning is meaningless.
>
> **ROMAN JAKOBSON**

In this section we discuss the linguistic knowledge you have that permits you to determine whether a sentence is true or false, when one sentence implies the truth or falsehood of another, and whether a sentence has multiple meanings. One way to account for this knowledge is by formulating semantic rules that build the meaning of a sentence from the meaning of its words and the way the words combine syntactically. This is often called **truth-conditional semantics** because it takes speakers' knowledge of truth conditions as basic. It is also called **compositional semantics** because it calculates the truth value of a sentence by composing, or putting together, the meaning of smaller units. We will limit our discussion to declarative sentences like *Jack swims* or *Jack kissed Laura*, because we can judge these kinds of sentences as either true or false. At least part of their meaning, then, will be their **truth value**.

Truth

> . . . Having Occasion to talk of Lying and false Representation, it was with much Difficulty that he comprehended what I meant. . . . For he argued thus: That the Use of Speech was to make us understand one another and to receive Information of Facts; now if any one said the Thing which was not, these Ends were defeated; because I cannot properly be said to understand him. . . . And these were all the Notions he had concerning that Faculty of Lying, so perfectly well understood, and so universally practiced among human Creatures.
>
> **JONATHAN SWIFT,** *Gulliver's Travels,* 1726

Let's begin by returning to Jack, who is swimming in the pool. If you are poolside and you hear the sentence *Jack swims*, and you know the meaning of that sentence, then you will judge the sentence to be true. On the other hand, if you are indoors and you happen to believe that Jack never learned to swim, then when you hear the very same sentence *Jack swims*, you will judge the sentence to be false and you will think the speaker is misinformed or lying. More generally, if you know the meaning of a sentence, then you can determine under what conditions it is true or false.

You do not need to actually know whether a sentence is true or false to know its meaning. Knowing the meaning tells you how to determine the truth value. The sentence *copper conducts electricity* has meaning and is perfectly understood precisely because we know how to determine whether it's true or false.

Knowing the meaning of a sentence, then, means knowing under what circumstances it would be true or false according to your knowledge of the world, namely its truth conditions. Reducing the question of meaning to the question of truth conditions has proved to be very fruitful in understanding the semantic properties of language.

For most sentences it does not make sense to say that they are always true or always false. Rather, they are true or false in a given situation, as we previously saw with *Jack swims*. But a restricted number of sentences are indeed always true regardless of the circumstances. They are called **tautologies**. (The term **analytic** is also used for such sentences.) Examples of tautologies are sentences like *Circles are round* or *A person who is single is not married*. Their truth is guaranteed solely by the meaning of their parts and the way they are put together. Similarly, some sentences are always false. These are called **contradictions**. Examples of contradictions are sentences like *Circles are square* or *A bachelor is married*.

Entailment and Related Notions

> You mentioned your name as if I should recognize it, but beyond the obvious facts that you are a bachelor, a solicitor, a Freemason, and an asthmatic, I know nothing whatever about you.
>
> **SIR ARTHUR CONAN DOYLE,** "The Norwood Builder," in *The Memoirs of Sherlock Holmes,* 1894

Much of what we know is deduced from what people say alongside our observations of the world. As we can deduce from the quotation, Sherlock Holmes took deduction to the ultimate degree. Often, deductions can be made based on language alone.

If you know that the sentence *Jack swims beautifully* is true, then you also know that the sentence *Jack swims* must also be true. This meaning relation is called **entailment**. We say that *Jack swims beautifully* **entails** *Jack swims*. More generally, one sentence entails another if whenever the first sentence is true the second one is also true, in all conceivable circumstances.

Generally, entailment goes only in one direction. So while the sentence *Jack swims beautifully* entails *Jack swims*, the reverse is not true. Knowing merely that

Jack swims is true does not necessitate the truth of *Jack swims beautifully*. Jack could be a poor swimmer. On the other hand, negating both sentences reverses the entailment. *Jack doesn't swim* entails *Jack doesn't swim beautifully*.

The notion of entailment can be used to reveal knowledge that we have about other meaning relations. For example, omitting tautologies and contradictions, two sentences are **synonymous** (or **paraphrases**) if they are both true or both false with respect to the same situations. Sentences like *Jack put off the meeting* and *Jack postponed the meeting* are synonymous, because when one is true the other must be true; and when one is false the other must also be false. We can describe this pattern in a more concise way by using the notion of entailment:

Two sentences are synonymous if they entail each other.

Thus if sentence A entails sentence B and vice versa, then whenever A is true B is true, and vice versa. Although entailment says nothing specifically about false sentences, it's clear that if sentence A entails sentence B, then whenever B is false, A must be false. (If A were true, B would have to be true.) And if B also entails A, then whenever A is false, B would have to be false. Thus mutual entailment guarantees identical truth values in all situations; the sentences are synonymous.

Two sentences are **contradictory** if, whenever one is true, the other is false or, equivalently, there is no situation in which they are both true or both false. For example, the sentences *Jack is alive* and *Jack is dead* are contradictory because if the sentence *Jack is alive* is true, then the sentence *Jack is dead* is false, and vice versa. In other words, *Jack is alive* and *Jack is dead* have opposite truth values. Like synonymy, contradiction can be reduced to a special case of entailment.

Two sentences are *contradictory* if one entails the negation of the other.

For instance, *Jack is alive* entails the negation of *Jack is dead*, namely *Jack is not dead*. Similarly, *Jack is dead* entails the negation of *Jack is alive*, namely *Jack is not alive*.

The notions of *contradiction* (always false) and *contradictory* (opposite in truth value) are related in that if two sentences are contradictory, their conjunction with *and* is a contradiction. Thus *Jack is alive and Jack is dead* is a contradiction; it cannot be true under any circumstances.

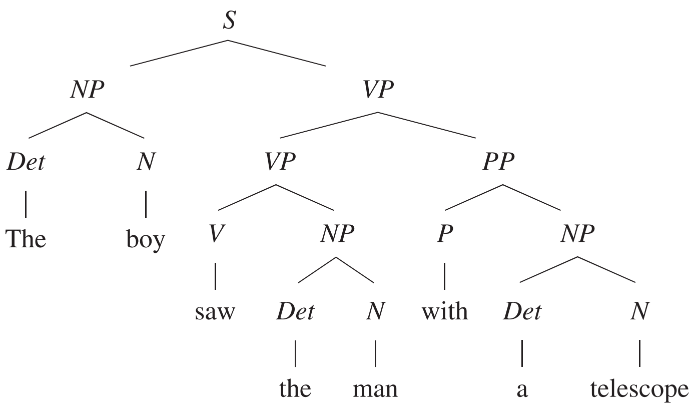
Ambiguity

Let's pass gas.

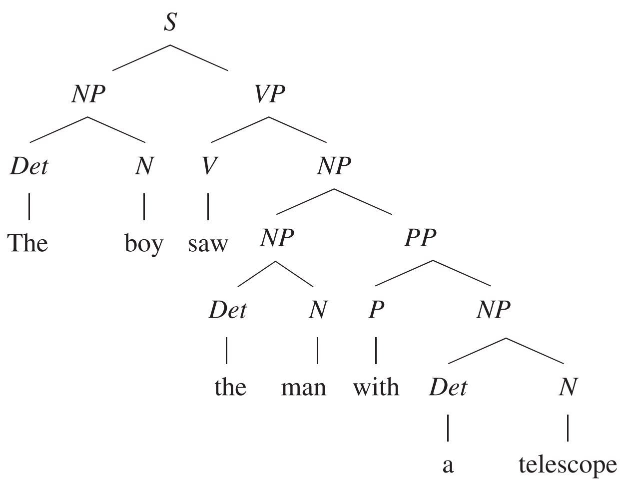
SEEN ON A SIGN IN THE LUNCHROOM OF AN ELECTRIC UTILITY COMPANY

Our semantic knowledge tells us when words or phrases (including sentences) have more than one meaning, that is, when they are ambiguous. In chapter 4 we saw that the sentence *The boy saw the man with a telescope* was an instance of structural ambiguity. It is ambiguous because it can mean that the boy saw the man by using a telescope or that the boy saw the man who was holding a telescope. The sentence is structurally ambiguous because it is associated with two different phrase structures, each corresponding to a different meaning. Here are the two structures:

(1)



(2)



In (1) the PP *with a telescope* modifies the VP, and the interpretation is that the action of seeing occurred by use of a telescope. In (2) the PP *with a telescope* modifies the NP *the man*, and the interpretation is that the man has the telescope.

Lexical ambiguity arises when at least one word in a phrase has more than one meaning. For instance the sentence *This will make you smart* is ambiguous because of the two meanings of the word *smart*: “clever” or “burning sensation.”

Our knowledge of lexical and structural ambiguities reveals that the meaning of a linguistic expression is built both on the words it contains and its syntactic structure. The notion that the meaning of an expression is composed of the meanings of its parts and how they are combined structurally is referred to as the **principle of compositionality.** In the next section we discuss the rules by which the meaning of a phrase or sentence is determined based on its composition.

Compositional Semantics

To account for speakers' knowledge of grammaticality, constituent structure, and relations between sentences, as well as for the limitless creativity of our linguistic competence, we concluded (chapter 4) that the grammar must contain syntactic rules.

To account for speaker's knowledge of the truth, reference, entailment, and ambiguity of sentences, as well as for our ability to determine the meaning of a limitless number of expressions, we must suppose that the grammar contains semantic rules that combine the meanings of words into meaningful phrases and sentences.

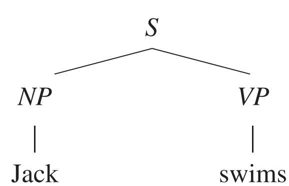
Semantic Rules

In the sentence *Jack swims*, we know that the word *Jack*, which is a **proper name**, refers to a precise object in the world, which is its **referent**. For instance, in the scenario given earlier, the referential meaning of *Jack* is the guy who is your friend and who is swimming happily in the pool right now. Based on this, we conclude that the meaning of the name *Jack* is the individual it refers to. What about the meaning of the verb *swim*? Part of its meaning is the group or set of individuals (human beings and animals) that swim. You will see in a moment how this aspect of the meaning of *swim* helps us understand sentences in a way that accords with our semantic knowledge.

Our semantic rules must be sensitive not only to the meaning of individual words but to the structure in which they occur. Taking as an example our simple sentence *Jack swims*, let us see how the semantic rules compute its meaning. The meanings of the individual words are summarized as follows:

Word	**Meanings**
Jack	refers to (or means) the individual Jack
swims	refers to (or means) the set of individuals that swim

The phrase structure tree for our sentence is as follows:



The tree tells us that syntactically the NP *Jack* and the VP *swims* combine to form a sentence. We want to mirror that combination at the semantic level: in other words, we want to combine the meaning of the NP *Jack* (an individual) and the meaning of the VP *swims* (a set of individuals) to obtain the meaning of the S *Jack swims*. This is done by means of Semantic Rule I.

Semantic Rule I

The meaning of [$_S$ NP VP] is the following truth condition:

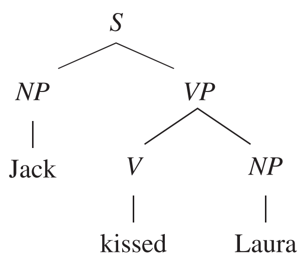
> If the meaning of NP (an individual) is a member of the meaning of VP (a set of individuals), then S is TRUE, otherwise it is FALSE.

Rule I states that a sentence composed of a subject NP and a predicate VP is true if the subject NP refers to an individual who is among the members of the set that constitute the meaning of the VP. This rule is entirely general; it does not refer to any particular sentence, individuals, or verbs. It works equally well for sentences like *Ellen sings* or *Max barks*. Thus the meaning of *Max barks* is the truth condition (i.e., the "if-sentence") that states that the sentence is true if the individual denoted by *Max* is among the set of *barking* individuals.

Let us now try a slightly more complex case: the sentence *Jack kissed Laura*. The main syntactic difference between this example and the previous one is that we now have a transitive verb that requires an extra NP in object position; otherwise our semantic rules will derive the meaning using the same mechanical procedure as in the first example. We again start with the word meaning and syntactic structure:

Word	**Meanings**
Jack	refers to (or means) the individual Jack
Laura	refers to (or means) the individual Laura
kissed	refers to (or means) the set of pairs of individuals X and Y such that X kissed Y.

Here is the phrase structure tree.



The meaning of the transitive verb *kiss* is still a set, but this time a set of pairs of individuals. The meaning of the VP, however, is still a set of individuals, namely those individuals who kissed Laura. This may be expressed formally in Semantic Rule II.

Semantic Rule II

> The meaning of [$_{VP}$ V NP] is the set of individuals X such that X is the first member of any pair in the meaning of V whose second member is the meaning of NP.

The meaning of the sentence is derived by first applying Semantic Rule II, which establishes the meaning of the VP as a certain set of individuals, namely those who kissed Laura. Now Semantic Rule I applies without further ado and gives the meaning of the sentence as the truth condition that determines S to be true whenever the meaning of *Jack* is a member of the set that is the meaning of the VP *kissed Laura*. In other words, S is true if Jack kissed Laura and false otherwise. These two semantic rules handle an essentially infinite number of intransitive and transitive sentences.

One last example will illustrate how the semantic knowledge of entailment may be represented in the grammar. Consider *Jack swims beautifully*, and consider further the meaning of the adverb *beautifully*. Its meaning is clearly not an individual or a set of individuals. Rather, the meaning of *beautifully* is an operation that reduces the size of the sets that are the meanings of verb phrases. When applied to the meaning of *swims*, it reduces the set of individuals who swim to the smaller set of those who swim beautifully. We won't express this rule formally, but it is now easy to see one source of entailment. The truth conditions that make *Jack swims beautifully* true are narrower than the truth conditions that make *Jack swims* true by virtue of the fact that among the individuals who swim, fewer of them swim beautifully. Therefore, any truth condition that causes *Jack swims beautifully* to be true necessarily causes *Jack swims* to be true, hence *Jack swims beautifully* entails *Jack swims*.

These rules, and many more like them, account for our knowledge about the truth value of sentences by taking the meanings of words and combining them according to the syntactic structure of the sentence. It is easy to see from these examples how ambiguous meanings arise. Because the meaning of a sentence is computed based on its hierarchical organization, different trees will have different meanings—structural ambiguity—even when the words are the same, as in the example *The boy saw the man with a telescope*. The occurrence of an ambiguous word—lexical ambiguity—when it combines with the other elements of a sentence, can make the entire sentence ambiguous, as in *She can't bear children*.

The semantic theory of sentence meaning that we just sketched is not the only possible one, and it is also incomplete, as shown by the paradoxical sentence *This sentence is false*. The sentence cannot be true, else it's false; it cannot be false, else it's true. Therefore it has no truth value, though it certainly has meaning. This notwithstanding, compositional truth-conditional semantics has proven to be an extremely powerful and useful tool for investigating the semantic properties of natural languages.

When Compositionality Goes Awry

> A loose sally of the mind; an irregular undigested piece; not a regular and orderly composition.
>
> **SAMUEL JOHNSON** (1709–1784)

The meaning of an expression is not always obvious, even to a native speaker of the language. Meanings may be obscured in many ways, or at least may require some imagination or special knowledge to be apprehended. Poets, pundits, and yes, even professors can be difficult to understand.

In the previous sections we saw that semantic rules compute sentence meaning compositionally based on the meanings of words and the syntactic structure that contains them. There are, however, interesting cases in which compositionality breaks down, either because there is a problem with words or with the semantic rules. If one or more words in a sentence do not have a meaning, then obviously we will not be able to compute a meaning for the entire sentence. Moreover, even if the individual words have meaning but cannot be combined together as required by the syntactic structure and related semantic rules, we will also not get to a meaning. We refer to these situations as semantic **anomaly**. Alternatively, it might require a lot of creativity and imagination to derive a meaning. This is what happens in **metaphors**. Finally, some expressions—called **idioms**—have a fixed meaning, that is, a meaning that is not compositional. Applying compositional rules to idioms gives rise to funny or inappropriate meanings.

Anomaly

> Don't tell me of a man's being able to talk sense; everyone can talk sense. Can he talk nonsense?
>
> **WILLIAM PITT**

> There is no greater mistake in the world than the looking upon every sort of nonsense as want of sense.
>
> **LEIGH HUNT,** "On the Talking of Nonsense," 1820

The semantic properties of words determine what other words they can be combined with. A sentence widely used by linguists that we encountered in chapter 4 illustrates this fact:

Colorless green ideas sleep furiously.

The sentence obeys all the syntactic rules of English. The subject is *colorless green ideas* and the predicate is *sleep furiously*. It has the same syntactic structure as the sentence

Dark green leaves rustle furiously.

but there is obviously something semantically wrong with the sentence. The meaning of *colorless* includes the semantic feature "without color," but it is combined with the adjective *green*, which has the feature "green in color." How can something be both "without color" and "green in color"? Other semantic violations occur in the sentence. Such sentences are semantically **anomalous**.

Other English "sentences" make no sense at all because they include "words" that have no meaning; they are **uninterpretable**. They can be interpreted only if some meaning for each nonsense word can be dreamt up. Lewis Carroll's "Jabberwocky" is probably the most famous poem in which most of the content words have no meaning—they do not exist in the lexicon of the grammar. Still, all the sentences sound as if they should be or could be English sentences:

'Twas brillig, and the slithy toves
Did gyre and gimble in the wabe;
All mimsy were the borogoves,
And the mome raths outgrabe.
. . .

He took his vorpal sword in hand:
Long time the manxome foe he sought—
So rested he by the Tumtum tree,
And stood awhile in thought.

Without knowing what *vorpal* means, you nevertheless know that

He took his vorpal sword in hand

means the same thing as

He took his sword, which was vorpal, in hand.
It was in his hand that he took his vorpal sword.

Knowing the language, and assuming that *vorpal* means the same thing in the three sentences (because the same sounds are used), you can decide that the sense—the truth conditions—of the three sentences are identical. In other words, you are able to decide that two things mean the same thing even though you do not know what either one means. You decide by assuming that the semantic properties of *vorpal* are the same whenever it is used.

We now see why Alice commented, when she had read "Jabberwocky":

"It seems very pretty, but it's *rather* hard to understand!" (You see she didn't like to confess, even to herself, that she couldn't make it out at all.) "Somehow it seems to fill my head with ideas—only I don't exactly know what they are! However, *somebody* killed *something*: that's clear, at any rate—"

Semantic violations in poetry may form strange but interesting aesthetic images, as in Dylan Thomas's phrase *a grief ago*. *Ago* is ordinarily used with words specified by some temporal semantic feature:

a week ago		*a table ago
an hour ago	but not	*a dream ago
a month ago		*a mother ago
a century ago		

When Thomas used the word *grief* with *ago*, he was adding a durational feature to grief for poetic effect, so while the noun phrase is anomalous, it evokes certain feelings.

In the poetry of E. E. Cummings, there are phrases like

the six subjunctive crumbs twitch.
a man . . . wearing a round jeer for a hat.
children building this rainman out of snow.

Though all of these phrases violate some semantic rules, we can understand them; breaking the rules creates the imagery desired. The fact that we are able to understand, or at least interpret, anomalous expressions, and at the same time recognize their anomalous nature, demonstrates our knowledge of the semantic system and semantic properties of the language.

Metaphor

> Our doubts are traitors.
>
> **WILLIAM SHAKESPEARE,** *Measure for Measure,* c. 1603
>
> Walls have ears.
>
> **MIGUEL DE CERVANTES,** *Don Quixote,* 1605
>
> The night has a thousand eyes and the day but one.
>
> **FRANCES WILLIAM BOURDILLON,** "Light," 1873

When what appears to be an anomaly is nevertheless understood in terms of a meaningful concept, the expression becomes a metaphor. There is no strict line between anomalous and metaphorical expressions. Technically, metaphors are anomalous, but the nature of the anomaly creates the salient meanings that metaphors usually have. The anomalous *A grief ago* might come to be interpreted by speakers of English as "the unhappy time following a sad event" and therefore become a metaphor.

Metaphors may have a literal meaning as well as their metaphorical meaning, so in some sense they are ambiguous. However, when the semantic rules are applied to *Walls have ears*, for example, the literal meaning is so unlikely that listeners use their imagination for another interpretation. The principle of compositionality is very "elastic" and when it fails to produce an acceptable literal meaning, listeners try to accommodate and stretch the meaning. This accommodation is based on semantic properties that are inferred or that provide some kind of resemblance or comparison that can end up as a meaningful concept.

This works only up to a certain point, however. It's not clear what the literal meaning of *Our doubts are traitors* might be, though the conceptual meaning that the act of doubting a precious belief is self-betrayal seems plausible. To interpret a metaphor we need to understand the individual words, the literal meaning of the whole expression, and facts about the world. To understand the metaphor

> Time is money

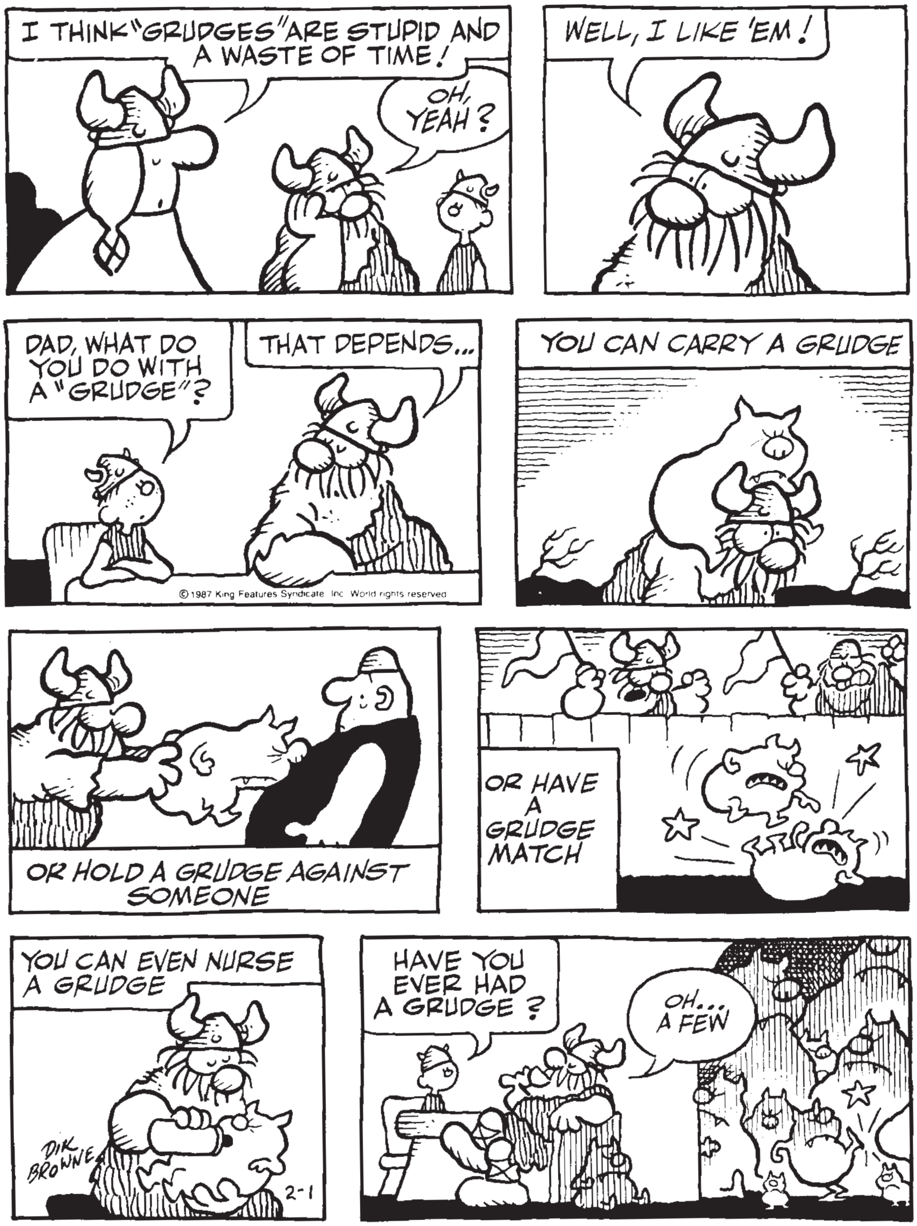
it is necessary to know that in our society we are often paid according to the number of hours or days worked. In fact, "time," which is an abstract concept, is the subject of multiple metaphors. We "save time," "waste time," "manage time," push things "back in time," live on "borrowed time," and suffer the "ravages of time" as the "sands of time" drift away. In effect, the metaphors take the abstract concept of time and treat it as a concrete object of value.

Metaphor has a strong cultural component. Shakespeare uses metaphors that are lost on many of today's playgoers. "I am a man whom Fortune hath cruelly scratched," is most effective as a metaphor in a society like Shakespeare's that commonly depicts "Fortune" as a woman. On the other hand *There's a bug in my program* would make little sense in a culture without computers, even if the idea of having bugs in something indicates a problem.

Many expressions now taken literally may have originated as metaphors, such as "the fall of the dollar," meaning its decline in value on the world market.

Many people wouldn't bat an eyelash (another metaphor) at the literal interpretation of saving or wasting time. Metaphor is one of the factors in language change (see chapter 11). Metaphorical use of language is language creativity at its highest. Nevertheless, the basis of metaphorical use is very much the ordinary linguistic knowledge that all speakers possess about words, their semantic properties, and their combinatorial possibilities.

Idioms



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Because the words (or morphemes) of a language are arbitrary (not predictable by rule), they must be listed in a mental lexicon. The lexicon is a repository of the words (or morphemes) of a language and their meanings. On the other hand, the meanings of morphologically complex words, phrases, and sentences are compositional and are derived by rules. We noted in chapter 3 that the meaning of some words (for example, compounds) is not predictable, so these must also be given in the lexicon. It turns out that languages also contain many phrases whose meanings are not predictable on the basis of the meanings of the individual words. These phrases typically start out as metaphors that "catch on" and are repeated so often that they become fixtures in the language. Such expressions are called *idioms*, or **idiomatic phrases**, as in these English examples:

sell down the river
rake over the coals
drop the ball
let their hair down
put his foot in his mouth
throw her weight around
snap out of it
cut it out
hit it off
get it off
bite your tongue
give a piece of your mind

Here is where the usual semantic rules for combining meanings do not apply. The principle of compositionality is superseded by expressions that act very much like individual morphemes in that they are not decomposable, but have a fixed meaning that must be learned. Idioms are similar in structure to ordinary phrases except that they tend to be frozen in form and do not readily undergo rules that change word order or substitution of their parts.

Thus, the sentence in (1) has the same structure as the sentence in (2).

1. She put her foot in her mouth.
2. She put her bracelet in her drawer.

But while the sentences in (3) and (4) are clearly related to (2),

3. The drawer in which she put her bracelet was hers.
4. Her bracelet was put in her drawer.

the sentences in (5) and (6) do not have the idiomatic sense of sentence (1), except, perhaps, humorously.

5. The mouth in which she put her foot was hers.
6. Her foot was put in her mouth.

Also, if we know the meaning of (2) and the meaning of the word "necklace" we will immediately understand (7).

7. She put her necklace in the drawer.

But if we try substituting "hand" for "foot" in sentence (1), we do not maintain the idiomatic meaning, but rather have the literal compositional meaning.

There are, however, some idioms whose parts can be moved without affecting the idiomatic sense:

The FBI kept tabs on radicals.
Tabs were kept on radicals by the FBI.
Radicals were kept tabs on by the FBI.

Like metaphors, idioms can break the rules on combining semantic properties. The object of *eat* must usually be something with the semantic feature "edible," but in

He ate his hat.
Eat your heart out.

this restriction is violated.

Idioms often lead to humor:

What did the doctor tell the vegetarian about his surgically implanted heart valve from a pig?
That it was okay as long as he didn't "eat his heart out."

They may also be used to create what appear to be paradoxes. In many places such as Times Square in New York, a ball is dropped at midnight on New Year's Eve. Now, if the person in charge doesn't drop the ball, then he has "dropped the ball." And if that person does indeed drop the ball, then he has not "dropped the ball." Right?

Idioms, grammatically as well as semantically, have special characteristics. They must be entered into the lexicon or mental dictionary as single items with their meanings specified, and speakers must learn the special restrictions on their use in sentences.

All languages have idioms, but idioms rarely if ever translate word for word from one language to another. Most speakers of American English understand the idiom *to kick the bucket* as meaning "to die." The same combination of words in Spanish (*patear el cubo*) has only the literal meaning of striking a specific bucket with a foot. On the other hand, *estirar la pata*, literally "to stretch the (animal) leg," has the idiomatic sense of "to die" in Spanish.

Most idioms originate as metaphorical expressions that establish themselves in the language and become frozen in their form and meaning.

Lexical Semantics (Word Meanings)

"There's glory for you!"
"I don't know what you mean by 'glory,' " Alice said.
Humpty Dumpty smiled contemptuously.

> "Of course you don't—till I tell you. I meant 'there's a nice knock-down argument for you!' "
> "But 'glory' doesn't mean 'a nice knock-down argument,' " Alice objected.
> "When I use a word," Humpty Dumpty said, in rather a scornful tone, "it means just what I choose it to mean—neither more nor less."
> "The question is," said Alice, "whether you can make words mean so many different things."
>
> **LEWIS CARROLL,** *Through the Looking-Glass,* 1871

As just discussed, the meaning of a phrase or sentence is partially a function of the meanings of the words it contains. Similarly, the meaning of morphologically complex words is a function of their component morphemes, as we saw in chapter 3. However, there is a fundamental difference between word meaning—or *lexical semantics*—and sentence meaning. The meaning of entries in the mental lexicon—be they morphemes, words, compound words, idioms, and so on—is conventional; that is, speakers of a language implicitly agree on their meaning, and children acquiring the language must simply learn those meanings outright. On the other hand, the meaning of most sentences must be constructed by the application of semantic rules. Earlier we discussed the rules of semantic composition. In this section we will talk about word meaning and the semantic relationships that exist between words and morphemes.

Although the agreed-upon meaning of a word may shift over time within a language community, we are not free as individuals to change the meanings of words at will; if we did, we would be unable to communicate with each other. Humpty Dumpty seems unwilling to accept this convention, though fortunately for us there are few Humpty Dumptys. All the speakers of a language share a basic vocabulary—the sounds and meanings of morphemes and words. Each of us knows the meanings of thousands of words. This knowledge permits us to use words to express our thoughts and to understand the thoughts of others. The meaning of words is part of linguistic knowledge. Your mental storehouse of information about words and morphemes is what we have been calling the *lexicon*.

Dictionaries such as the *Oxford English Dictionary (OED)* or *Webster's Collegiate Dictionary* are filled with words and their meanings. Dictionaries give the meaning of words using other words rather than in terms of some more basic units of meaning, whatever they might be. In this sense a dictionary really provides *paraphrases* rather than meanings. It relies on our knowledge of the language to understand the definitions. The meanings associated with words in our mental lexicon are probably not like what we find in the *OED* or *Webster's*, although it is admittedly very difficult to specify precisely how word meanings are represented in the mind.

Theories of Word Meaning

> It is natural . . . to think of there being connected with a sign . . . besides . . . the reference of the sign, also what I should like to call the sense of the sign. . . .
>
> **GOTTLOB FREGE,** "On Sense and Reference," 1892

If the meaning of a word is not like a dictionary entry, what is it? This question has been debated by philosophers and linguists for centuries. One proposal is that the meaning of a word or expression is its **reference**, its association with the object it refers to. This real world object is called the *referent*.

Reference

"There's nothing here under 'Superman'—is it possible you made the reservation under another name?"

We have already determined that the meaning of proper names like *Jack* is its reference, that link between the word *Jack* and the person named Jack, which is its referent. Proper names are noun phrases (NPs); you can substitute a proper name in any NP position in a sentence and preserve grammaticality. There are other NPs that refer to individuals as well. For instance, NPs like *the happy swimmer*, *my friend*, and *that guy* can all be used to refer to Jack in the situation where you've observed Jack swimming. The same is true for pronouns such as *I*, *you*, and *him*, which also function as NPs. In all these cases, the reference of the NP—which singles out the individual referred to under the circumstances—is part of the meaning of the NP.

On the other hand, not every NP refers to an individual. For instance, the sentence *No baby swims* contains the NP *no baby*, but your linguistic knowledge tells you that this NP does not refer to any specific individual. If *no baby* has no reference, but is not meaningless, then something about meaning beyond reference must be present.

Also in support of that "extra something" is our knowledge that, while under certain circumstances *the happy swimmer* and *Jack* may have the same reference in that both expressions are associated with the same referent, the former has some further meaning. To see this, we observe that *the happy swimmer is happy* is a tautology—true in every conceivable situation, but *Jack is happy* is not a tautology, for there are circumstances under which that sentence might be false.

Sense

If meaning were reference alone, then the meaning of words and expressions would be entirely dependent on the objects pointed out in the real world. For example, the meaning of *dog* would be tied to the set of canine objects. This theory of word meaning is attractive because it underscores the idea that meaning is a connection between language on the one hand, and objects and events in the world on the other.

An obvious problem for such a theory, however, is that speakers know many words that have no real-world referents (e.g., *hobbits*, *unicorns*, and *Harry Potter*). Yet speakers do know the meanings of these expressions. Similarly, what real-world entities would function words like *of* and *by*, or modal verbs such as *will* or *may* refer to?

A further problem is that two expressions may refer to the same individual but not have the same meaning, as we saw with *Jack* and *the happy swimmer*. For another example, *Barack Obama* and *the President* currently refer to the same individual, but the meaning of the NP *the President* is, in addition, something like "the head of state," which is an element of meaning separate from reference and more enduring. This element of meaning is often termed **sense**. It is the extra something referred to earlier. *Unicorns*, *hobbits*, and *Harry Potter* have sense but no reference (with regard to objects in the real world). Conversely, proper names typically have only reference. A name like Chris Jones may point out a certain person, its referent, but has little linguistic meaning beyond that. Sometimes two different proper names have the same referent, such as Mark Twain and Samuel Langhorne Clemens, or Unabomber and Theodore Kaczynski. Such pairs of noun phrases are **coreferential**. It is a hotly debated question in the philosophy of language as to whether coreferential expressions have the same or different senses.

Another proposal is that the meaning of a word is the mental image it conjures up in the mind of speakers. This solves the problem of unicorns, hobbits, and Harry Potter; we may have a clear image of these entities from books, movies, and so on, and that connection might serve as reference for those expressions. However, many meaningful expressions are not associated with any clear, unique image agreed on by most speakers of the language. For example, what image is evoked by the expressions *very*, *if*, and *every*? It's difficult to say, yet these expressions are certainly meaningful. What is the image of oxygen as distinct from nitrogen—both are clear gases, yet they mean very different things. What mental image would we have of *dog* that is general enough to include Yorkshire Terriers and Great Danes and yet excludes foxes and wolves? Astronauts will likely have a very different mental image of the expression *space capsule* than the average person, yet non-astronauts and astronauts do communicate with one another if they speak the same language.

Although the idea that the meaning of a word corresponds to a mental image is intuitive (because many words do provoke imagery), it is clearly inadequate as a general explanation of what people know about word meanings.

Perhaps the best we can do is to note that the reference part of a word's meaning, if it has reference at all, is the association with its referent; and the sense part of a word's meaning contains the information needed to complete the association, and to suggest properties that the referent may have, whether it exists in the real world or in the world of imagination.

Lexical Relations

Does he wear a turban, a fez or a hat?
Does he sleep on a mattress, a bed or a mat, or a Cot,
The Akond of Swat?
Can he write a letter concisely clear,
Without a speck or a smudge or smear or Blot,
The Akond of Swat?

EDWARD LEAR, "The Akond of Swat," in *Laughable Lyrics,* 1877

Although no theory of word meaning is complete, we know that speakers have considerable knowledge about the meaning relationships among different words in their mental lexicons, and any theory must take that knowledge into account.

Words are semantically related to one another in a variety of ways. The words that describe these relations often end in the bound morpheme *-nym*. The best-known lexical relations are synonyms, illustrated in the poem by Edward Lear, and antonyms or opposites. **Synonyms** are words or expressions that have the same meaning in some or all contexts. There are dictionaries of synonyms that contain many hundreds of entries, such as:

apathetic/phlegmatic/passive/sluggish/indifferent
pedigree/ancestry/genealogy/descent/lineage

A sign in the San Diego Zoo Wild Animal Park states:

Please do not annoy, torment, pester, plague, molest, worry, badger, harry, harass, heckle, persecute, irk, bullyrag, vex, disquiet, grate, beset, bother, tease, nettle, tantalize, or ruffle the animals.

It has been said that there are no perfect synonyms—that is, no two words ever have *exactly* the same meaning. Still, the following two sentences have very similar meanings:

He's sitting on the sofa. / He's sitting on the couch.

During the French Norman occupation of England that began in 1066 C.E., many French words of Latin origin were imported into English. As a result, English contains many synonymous pairs consisting of a word with an English (or Germanic) root, and another with a Latin root, such as:

English	**Latin**
manly	virile
heal	recuperate
send	transmit
go down	descend

Words that are opposite in meaning are **antonyms**. There are several kinds of antonymy. There are **complementary pairs**:

alive/dead   present/absent   awake/asleep

They are complementary in that *alive* = *not dead* and *dead* = *not alive*, and so on.

There are **gradable pairs** of antonyms:

big/small   hot/cold   fast/slow   happy/sad

The meaning of adjectives in gradable pairs is related to the object they modify. The words do not provide an absolute scale. For example, we know that "a small elephant" is much bigger than "a large mouse." *Fast* is faster when applied to an airplane than to a car.

Another characteristic of certain pairs of gradable antonyms is that one is **marked** and the other **unmarked**. The unmarked member is the one used in questions of degree. We ask, ordinarily, "How *high* is the mountain?" (not "How low is it?"). We answer "Ten thousand feet high" but never "Ten thousand feet low," except humorously or ironically. Thus *high* is the *unmarked* member of *high/low*. Similarly, *tall* is the unmarked member of *tall/short*, *fast* the unmarked member of *fast/slow*, and so on.

Another kind of opposite involves pairs like

give/receive   buy/sell   teacher/pupil

They are called **relational opposites**, and they display symmetry in their meaning. If X *gives* Y to Z, then Z *receives* Y from X. If X is Y's *teacher*, then Y is X's *pupil*. Pairs of words ending in *-er* and *-ee* are usually relational opposites. If Mary is Bill's *employer*, then Bill is Mary's *employee*.

Some words are their own antonyms. These "autoantonyms" or "contranyms" are words such as *cleave* "to split apart" or "to cling together" and *dust* "to remove something" or "to spread something," as in dusting furniture or dusting crops. Antonymic pairs that are pronounced the same but spelled differently are similar to autoantonyms: *raise* and *raze* are one such pair.

In English there are several ways to form antonyms. You can add the prefix *un-*:

likely/unlikely   able/unable   fortunate/unfortunate

or you can add *non-*:

entity/nonentity   conformist/nonconformist or you can add *in-*:

tolerant/intolerant   discreet/indiscreet   decent/indecent

These strategies occasionally backfire, however. Pairs such as *loosen* and *unloosen*; *flammable* and *inflammable*; *valuable* and *invaluable*, and a few other "antiautonyms" actually have the same or nearly the same meaning, despite looking like antonyms.

Other lexical relations include homonyms, polysemy, and hyponyms.

Rhymes With Orange (105945) © Hilary B. Price. King Features Syndicate

Words like *bear* and *bare* are **homonyms** (also called **homophones**). Homonyms are words that have different meanings but are pronounced the same, and may or may not be spelled the same. (They're **homographs** when spelled the same, but when homographs are pronounced differently like *pussy* meaning "infected" or *pussy* meaning "kitten," they are called **heteronyms** rather than homonyms.) Near nonsense sentences like *Entre <u>nous</u>, the <u>new</u> <u>gnu</u> <u>knew</u> <u>nu</u> is a Greek letter* tease us with homonyms. The humor in the cartoon above is based on the homonyms *walk* and *wok*.

Homonyms can create ambiguity. The sentence:

I'll meet you by the bank.

may mean "I'll meet you by the financial institution" or "I'll meet you by the riverside."

Homonyms are good candidates for confusion as well as humor, as illustrated in the following passage from *Alice's Adventures in Wonderland*:

"How is bread made?"
"I know *that*!" Alice cried eagerly.
"You take some flour—"
"Where do you pick the flower?" the White Queen asked. "In a garden, or in the hedges?"

"Well, it isn't *picked* at all," Alice explained; "it's ground—"
"How many acres of ground?" said the White Queen.

The confusion and humor is based on the different sets of homonyms: *flower* and *flour* and the two meanings of *ground*. Alice means *ground* as the past tense of *grind*, whereas the White Queen is interpreting *ground* to mean "earth."

When a word has multiple meanings that are related conceptually or historically, it is said to be **polysemous** (polly-seamus). For example, the word *diamond* referring to a geometric shape and also to a baseball field that has that shape is polysemous. Open a dictionary of English to any page and you will find words with more than one definition (e.g., *guard*, *finger*, *overture*). Each of these words is polysemous because each has several related meanings.

Speakers of English know that the words *red*, *white*, and *blue* are color words. Similarly, *lion*, *tiger*, *leopard*, and *lynx* are all felines. Such sets of words are called **hyponyms**. The relationship of *hyponymy* is between the more general term such as *color* and the more specific instances of it, such as *red*. Thus *red* is a hyponym of *color*, and *lion* is a hyponym of *feline*; or equivalently, *color* has the hyponym *red* and *feline* has the hyponym *lion*.

Semantic Features

In the previous sections we discussed word meaning in relation to objects in the world, and this permitted us to develop a truth-based semantics. We also explored the meaning of words in relation to other words. But it is also possible to look for a more basic set of **semantic features** or properties that are part of word meanings and that reflect our knowledge about what words mean.

Decomposing the meanings of words into semantic features can clarify how certain words relate to other words. For example, the basic property of antonyms is that they share all but one semantic feature. We know that *big* and *red* are not antonyms because they have too few semantic features in common. They are both adjectives, but *big* has a semantic feature "about size," whereas *red* has a semantic feature "about color." On the other hand, *buy/sell* are relational opposites because both contain a semantic feature like "change in possession," differing only in the direction of the change.

Semantic features are among the conceptual elements that are part of the meanings of words and sentence. Consider, for example, the sentence:

The assassin killed Thwacklehurst.

If the word *assassin* is in your mental dictionary, you know that it was some *person* who murdered some *important person* named Thwacklehurst. Your knowledge of the meaning of *assassin* tells you that an animal did not do the killing, and that Thwacklehurst was not an average citizen. Knowledge of *assassin* includes knowing that the individual to whom that word refers is human, is a murderer, and is a killer of important people. These bits of information are some of the semantic features of the word on which speakers of the language agree. The meaning of all nouns, verbs, adjectives, and adverbs—the content words—

and even some of the function words such as *with* and *over* can at least partially be specified by such properties.

Evidence for Semantic Features

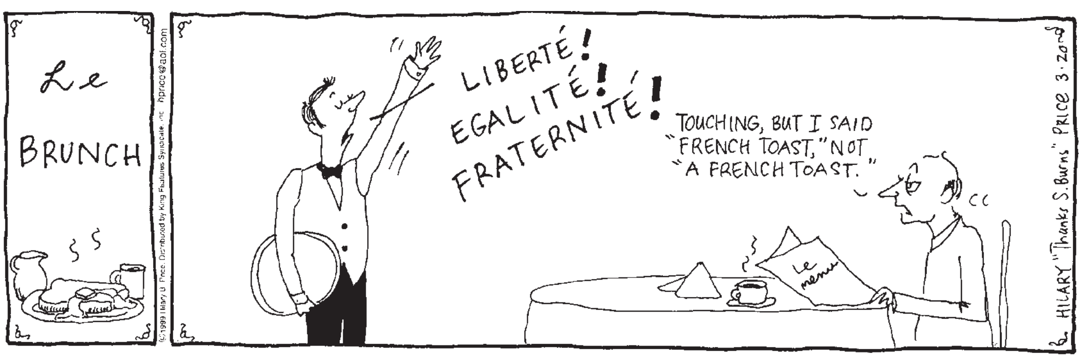
Semantic properties are not directly observable. Their existence must be inferred from linguistic evidence. One source of such evidence is the speech errors, or "slips of the tongue," that we all produce. Consider the following unintentional word substitutions that some speakers have actually spoken.

Intended Utterance	Actual Utterance (Error)
bridge of the nose	bridge of the neck
when my gums bled	when my tongues bled
he came too late	he came too early
Mary was young	Mary was early
the lady with the Dachshund	the lady with the Volkswagen
that's a horse of another color	that's a horse of another race
his ancestors were farmers	his descendants were farmers
he has to pay her alimony	he has to pay her rent

These errors, and thousands of others that have been collected and catalogued, reveal that the incorrectly substituted words are not random but share some semantic feature with the intended words. *Nose*, *neck*, *gums*, and *tongues* are all "body parts" or "parts of the head." *Young*, *early*, and *late* are related to "time." *Dachshund* and *Volkswagen* are both "German" and "small." The common semantic features of *color* and *race*, *ancestor* and *descendant*, and *alimony* and *rent* are apparent.

The semantic properties that describe the linguistic meaning of a word should not be confused with other nonlinguistic properties, such as physical properties. Scientists know that water is composed of hydrogen and oxygen, but such knowledge is not part of a word's meaning. We know that water is an essential ingredient of lemonade and baths. However, we don't need to know any of these things to know what the word *water* means, and to be able to use and understand it in a sentence.

Semantic Features and Grammar



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Further evidence that words are composed of smaller bits of meaning is that semantic features interact with different aspects of the grammar such as morphology or syntax. These effects show up in both nouns and verbs.

Semantic Features of Nouns

The same semantic feature may be shared by many words. “Female” is a semantic feature, sometimes indicated by the suffix *-ess*, that makes up part of the meaning of nouns, such as:

tigress	hen	aunt	maiden
doe	mare	debutante	widow
ewe	vixen	girl	woman

The words in the last two columns are also distinguished by the semantic feature “human,” which is also found in:

doctor	dean	professor	teenager
bachelor	parent	baby	child

Another part of the meaning of the words *baby* and *child* is that they are “young.” (We will continue to indicate words by using *italics* and semantic features by double quotes.) The word *father* has the properties “male” and “adult” as do *uncle* and *bachelor*.

In some languages, though not English, nouns occur with **classifiers**, grammatical morphemes that indicate the semantic class of the noun. In Swahili a noun that has the semantic feature “human” is prefixed with *m-* if singular and *wa-* if plural, as in *mtoto* (child) and *watoto* (children). A noun that has the feature “human artifact,” such as *bed*, *chair*, or *knife*, is prefixed with the classifiers *ki* if singular and *vi* if plural, for example, *kiti* (chair) and *viti* (chairs).

Semantic properties may have syntactic and semantic effects, too. For example, the kinds of determiners that a noun may occur with are controlled by whether it is a “count” noun or a “mass” noun.

Consider these data:

I have two dogs.	*I have two rice(s).
I have a dog.	*I have a rice.
*I have dog.	I have rice.
He has many dogs.	*He has many rice(s).
*He has much dogs.	He has much rice.

Count nouns can be enumerated and pluralized—*one potato*, *two potatoes*. They may be preceded by the indefinite determiner *a*, and by the quantifier *many* as in *many potatoes*, but not by *much*, **much potato*. They must also occur with a determiner of some kind. Nouns such as *rice*, *water*, and *milk*, which cannot be enumerated or pluralized, are **mass nouns**. They cannot be preceded by *a* or *many*, and they can occur with the quantifier *much* or without any determiner at all. The humor of the cartoon is based both on the ambiguity of *toast* and the fact that as a food *French toast* is a mass noun, but as an oration it is a count noun. The count/mass distinction captures the fact that speakers know the properties that govern which determiner types go with different nouns. Without it we could not describe these differences.

Generally, the count/mass distinction corresponds to the difference between discrete objects and homogeneous substances. But it would be incorrect to say that this distinction is grounded in human perception, because different languages may treat the same object differently. For example, in English the words *hair*, *furniture*, and *spaghetti* are mass nouns. We say *Some hair is curly*, *Much furniture is poorly made*, *John loves spaghetti*. In Italian, however, these words are count nouns, as illustrated in the following sentences:

Ivano ha mangiato molti spaghetti ieri sera.
Ivano ate many spaghettis last evening.
Piero ha comprato un mobile.
Piero bought a furniture.
Luisella ha pettinato i suoi capelli.
Luisella combed her hairs.

We would have to assume a radical form of linguistic determinism (remember the Sapir-Whorf hypothesis from chapter 1) to say that Italian and English speakers have different perceptions of hair, furniture, and spaghetti. It is more reasonable to assume that languages can differ to some extent in the semantic features they assign to words with the same referent, somewhat independently of the way they conceptualize that referent. Even within a particular language we can have different words—count and mass—to describe the same object or substance. For example, in English we have *shoes* (count) and *footwear* (mass), *coins* (count) and *change* (mass).

Semantic Features of Verbs

Verbs also have semantic features as part of their meaning. For example, "cause" is a feature of verbs such as *darken*, *kill*, *uglify*, and so on.

darken	cause to become dark
kill	cause to die
uglify	cause to become ugly

"Go" is a feature of verbs that mean a change in location or possession, such as *swim*, *crawl*, *throw*, *fly*, *give*, or *buy*:

Jack swims.
The baby crawled under the table.
The boy threw the ball over the fence.
John gave Mary a beautiful engagement ring.

Words like *swim* have an additional feature like "in liquid," while *crawl* is "close to a surface."

"Become" is a feature expressing the end state of the action of certain verbs. For example, the verb *break* can be broken down into the following components of meaning: "cause" to "become" broken.

Verbal features, like features on nouns, may have syntactic consequences. For example, verbs can either describe **events**, such as *John kissed Mary/John ate oysters*, or **states**, such as *John knows Mary/John likes oysters*. The eventive/stative difference is mirrored in the syntax. Eventive sentences still sound natural when passivized, when expressed progressively, when used imperatively, and with certain adverbs:

Eventives

Mary was kissed by John.	Oysters were eaten by John.
John is kissing Mary.	John is eating oysters.
Kiss Mary!	Eat oysters!
John deliberately kissed Mary.	John deliberately ate oysters.

The stative sentences seem peculiar, if not ungrammatical or anomalous, when cast in the same form. (The preceding "?" indicates the strangeness.)

Statives

?Mary is known by John.	?Oysters are liked by John.
?John is knowing Mary.	?John is liking oysters.
?Know Mary!	?Like oysters!
?John deliberately knows Mary.	?John deliberately likes oysters.

Negation is a particularly interesting component of the meaning of some verbs. Expressions such as *ever*, *anymore*, *have a red cent*, and many more are ungrammatical in certain simple affirmative sentences, but grammatical in corresponding negative ones.

*Mary will ever smile. (Cf. Mary will not ever smile.)
*I can visit you anymore. (Cf. I cannot visit you anymore.)
*It's worth a red cent. (Cf. It's not worth a red cent.)

Such expressions are called **negative polarity items** because a negative element such as "not" elsewhere in the sentence allows them to appear. Consider these data:

*John thinks that he'll ever fly a plane again.
*John hopes that he'll ever fly a plane again.
John doubts that he'll ever fly a plane again.
John despairs that he'll ever fly a plane again.

This suggests that verbs such as *doubt* and *despair*, but not *think* and *hope*, have "negative" as a component of their meaning. *Doubt* may be analyzed as "think that not," and *despair* as "has no hope." The negative feature in the verb allows the negative polarity item *ever* to occur grammatically without the overt presence of *not*.

Argument Structure

Verbs differ in terms of the number and types of NPs they can take as complements. As we noted in chapter 4, transitive verbs such as *find*, *hit*, *chase*, and so on take, or c-select, a direct object complement, whereas intransitive verbs like *arrive* or *sleep* do not. Ditransitive verbs such as *give* or *throw* take two object complements as in *John threw Mary a ball*. In addition, most verbs take a subject. The various NPs that occur with a verb are its **arguments**. Thus intransitive verbs have one argument: the subject; transitive verbs have two arguments: the subject and direct object; ditransitive verbs have three arguments: the subject, direct object, and indirect object. The **argument structure** of a verb is part of its meaning and is included in its lexical entry.

The verb not only determines the number of arguments in a sentence, but it also limits the semantic properties of both its subject and its complements. For example, *find* and *sleep* require (s-select) animate subjects. The well-known *colorless green ideas sleep furiously* is semantically anomalous because ideas (colorless or not) are not animate. Components of a verb's meaning can also be relevant to the choice of complements it can take. For example, the verbs in (1) and (3) can take two objects—they're ditransitive—while those in (2) and (4) cannot.

1. John threw/tossed/kicked/flung the boy the ball.
2. *John pushed/pulled/lifted/hauled the boy the ball.
3. Mary faxed/radioed/e-mailed/phoned Helen the news.
4. *Mary murmured/mumbled/muttered/shrieked Helen the news.

Although all the verbs in (1) and (2) are verbs of motion, they differ in how the force of the motion is applied: the verbs in (1) involve a single quick motion whereas those in (2) involve a prolonged use of force. Similarly, the verbs in (3) and (4) are all verbs of communication, but their meanings differ in the way the message is communicated; those in (3) involve an external apparatus whereas those in (4) involve the type of voice used. Finally, the ditransitive verbs have "transfer direct object to indirect object" in their meaning. In (1) the ball is transferred to the boy. In (3) the news is transferred, or leastwise transmitted, to Helen. The ditransitive verbs *give*, *write*, *send*, and *throw* all have this property. Even when the transference is not overt, it may be inferred. In *John baked Mary a cake*, there is an implied transfer of the cake from John to Mary. Subtle aspects of meaning are mirrored in the argument structure of the verbs, and indeed, this connection between form and meaning may help children acquire the syntactic and semantic rules of their language, as will be discussed in chapter 8.

Thematic Roles

A feminine boy from Khartoum
Took a masculine girl to his room
They spent the whole night
In one hell of a fight
About who should do what—and to whom?

ANONYMOUS LIMERICK, quoted in *More Limericks*, G. Legman (ed.), 1977

The NP arguments in the VP, which include the subject and any objects, are semantically related in various ways to the verb. The relations depend on the meaning of the particular verb. For example, the NP *the boy* in the sentence:

1. The boy rolled a red ball.
   agent theme

is the "doer" of the rolling action, also called the **agent**. The NP *a red ball* is the **theme** or the "undergoer" of the rolling action. Relations such as agent and theme are called **thematic roles**. Thematic roles express the kind of relation that holds between the arguments of the verb and the type of situation that the verb describes.

A further example is the sentence:

2. The boy threw the red ball to the girl.
   agent theme goal

Here, *the girl* bears the thematic role of **goal**, that is, the endpoint of a change in location or possession. The verb phrase is interpreted to mean that the theme of *throw* ends up in the position of the goal.

Other thematic roles are **source**, where the action originates; **instrument**, the means used to accomplish the action; and **experiencer**, one receiving sensory input:

Professor Snape awakened Harry Potter with his wand.
source experiencer instrument

The particular thematic roles assigned by a verb can be traced back to components of the verb's meaning. Verbs such as *throw*, *buy*, and *fly* contain a feature "go" expressing a change in location or possession. The feature "go" is thus linked to the presence of the thematic roles of theme, source, and goal. Verbs like *awaken* or *frighten* have a feature "affects mental state" so that one of its arguments takes on the thematic role of experiencer.

Thematic role assignment, or **theta assignment**, is also connected to syntactic structure. In the sentence in (2) the role of theme is assigned to the direct object *the ball* and the role of goal to the indirect object *the girl*. Verb pairs such as *sell* and *buy* both involve the feature "go." They are therefore linked to a thematic role of theme, which is assigned to the direct object, as in the following sentences:

3. John sold the book to Mary.
   agent theme goal

4. Mary bought the book from John.
   agent theme source

In addition, *sell* is linked to the presence of a goal (the recipient or endpoint of the transfer), and *buy* to the presence of a source (the initiator of the transfer). Thus, *buy/sell* are relational opposites because both contain the semantic feature "go" (the transfer of goods or services) and they differ only in the direction of transfer, that is, whether the indirect object is a source or goal. Thematic roles are not assigned to arguments randomly. There is a connection between the meaning of a verb and the syntactic structure of sentences containing the verb.

Our knowledge of verbs includes their syntactic category, which arguments they select, and the thematic roles they assign to their arguments.

Thematic roles are the same in sentences that are paraphrases.

1. The dog bit the stick. / The stick was bitten by the dog.
2. The trainer gave the dog a treat. / The trainer gave a treat to the dog.

In (1) *the dog* is the agent and *the stick* is the theme. In (2) *the treat* is the theme and *the dog* is the goal. This is because certain thematic roles must be assigned to the same deep structure position, for example, theme is assigned to the object of *bit/bitten*. This **uniformity of theta assignment**, a principle of Universal Grammar, dictates that the various thematic roles are always in their proper structural place in deep structure. Thus *the stick* in the passive sentence *the stick was bitten by the dog* must have originated in object position and moved to subject position by transformational rule:

__ was bitten the stick by the dog	→	the stick was bitten __ by the dog
d-structure		s-structure

Thematic roles may remain the same in sentences that are *not* paraphrases, as in the following instances:

3. The boy opened the door with the key.
4. The key opened the door.
5. The door opened.

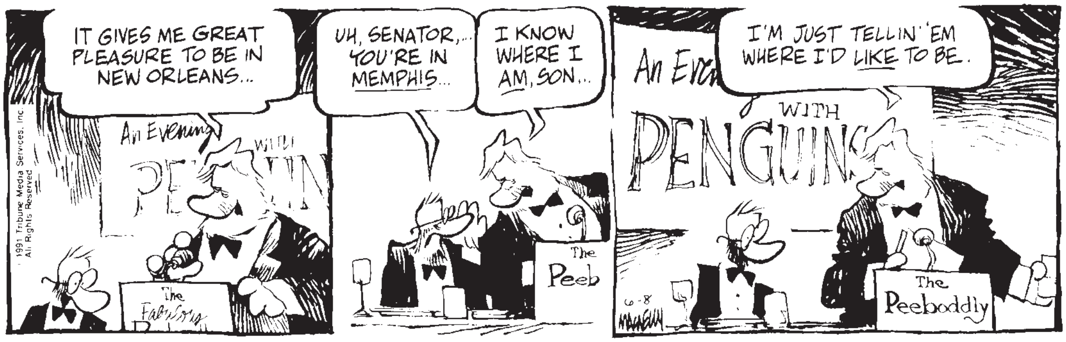
In all three of these sentences, *the door* is the theme, the object that is opened. Uniformity of theta assignment therefore entails that *the door* in the sentence in (5) originates as the object of *open* and undergoes a movement rule, much like in the passive example above.

___ opened the door → The door opened ___

Although the sentences in (3)–(5) are not strict paraphrases of one another, they are structurally and semantically related in that they have similar deep structure configurations.

In the sentences in (3) and (4), *the key*, despite its different positions, has the thematic role of instrument suggesting greater structural flexibility for some thematic roles. The semantics of the three sentences is determined by the meaning of the verb *open* and the rules that determine how thematic roles are assigned to the verb's arguments.

Pragmatics



SHOE © 1991 MACNELLY. KING FEATURES SYNDICATE. Reprinted with permission.

Pragmatics is concerned with our understanding of language in context. Two kinds of contexts are relevant. The first is *linguistic* context—the **discourse** that precedes the phrase or sentence to be interpreted; the second is *situational* context—virtually everything nonlinguistic in the environment of the speaker.

Speakers know how to combine words and phrases to form sentences, and they also know how to combine sentences into a larger discourse to express complex thoughts and ideas. **Discourse analysis** is concerned with the broad speech units comprising multiple sentences. It involves questions of style, appropriateness, cohesiveness, rhetorical force, topic/subtopic structure, differences between written and spoken discourse, as well as grammatical properties.

Within a discourse, preceding sentences affect the meaning of sentences that follow them in various ways. For example, the reference or meaning of pronouns often depends on prior discourse. Prior discourse can also disambiguate words like *bank* in that the discussion may be about rafting on a river or interest rates.

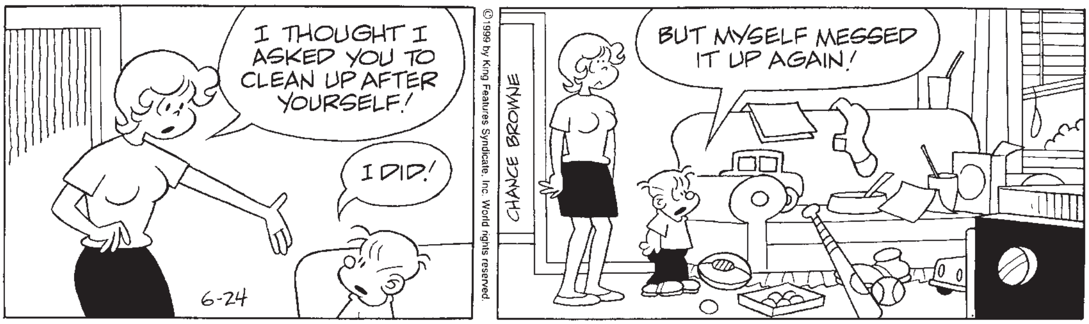
Situational context, on the other hand, is the nonlinguistic environment in which a sentence or discourse happens. It is the context that allows speakers to seamlessly, even unknowingly, interpret questions like *Can you pass the salt?* as requests to carry out a certain action and not a simple question. Situational context includes the speaker, hearer, and any third parties present, along with their beliefs and their beliefs about what the others believe. It includes the physical environment, the social milieu, the subject of conversation, the time of day, and so on, ad infinitum. Almost any imaginable extralinguistic factor may, under appropriate circumstances, influence the way language is interpreted.

Pronouns provide a good way to illustrate the two kinds of contexts—linguistic and situational—that affect meaning.

Pronouns

Pronouns are lexical items that can get their meaning from other NPs in the sentence or in the larger discourse. Any NP that a pronoun depends on for its meaning is called its *antecedent*. Pronouns are sensitive to *syntax*, *discourse*, and *situational context* for their interpretation. We'll take up syntactic matters first.

Pronouns and Syntax



"Hi and Lois" © King Features Syndicate. Reprinted with permission of King Features Syndicate.

There are different types of pronouns. **Reflexive pronouns** are pronouns such as *himself* and *themselves*. In English, reflexive pronouns always depend on an NP antecedent for their meaning and the antecedent must be in the same clause, as illustrated in the following examples:

1. Jane bit herself.
2. *Jane said that the boy bit herself.
3. *Herself left.

In (1) the NP *Jane* and the reflexive pronoun *herself* are in the same S; in (2) *herself* is in the embedded sentence and is structurally too far from the antecedent *Jane*, resulting in the ungrammaticality. In (3) *herself* has no antecedent at all, hence nothing to get its meaning from. The flouting of the rule that requires reflexives to have antecedents gives rise to the humor in the cartoon.

Languages also have pronouns that are not reflexive, such as *he*, *she*, *it*, *us*, *him*, *her*, *you*, and so on, which we will simply refer to as pronouns. Pronouns also depend on other elements for their meaning, but the syntactic conditions on pronouns are different from those on reflexives. Pronouns cannot refer to an antecedent in the same clause, but they are free to refer to an NP outside this clause, as illustrated in the following sentences (the underlining indicates the interpretation in which the pronoun takes the NP (in this case, John) as antecedent):

4. *<u>John</u> knows <u>him</u>.
5. <u>John</u> knows that <u>he</u> is a genius.

The sentence in (4) is ungrammatical relative to the interpretation because *him* cannot mean *John*. (Compare *John knows himself*.) In (5), however, the pronoun *he* can be interpreted as *John*. Notice that in both sentences it is possible for the pronouns to refer to some other person not mentioned in the sentence (e.g., Pete or Harry). In this case the pronoun gets its reference from the larger discourse or nonlinguistic context.

Pronouns and Discourse

> The 911 operator, trying to get a description of the gunman, asked, "What kind of clothes does he have on?"
> Mr. Morawski, thinking the question pertained to Mr. McClure [the victim, who lay dying of a gunshot wound], answered, "He has a bloody shirt with blue jeans, purple striped shirt."
> The 911 operator then gave police that description [the victim's] of a gunman.
>
> ***THE NEWS AND OBSERVER***, Raleigh, North Carolina, January 21, 1989

Pronouns may be used to refer to entities previously mentioned in discourse or to entities that are presumably known to the participants of a discourse. When that presumption fails, miscommunication such as the one at the head of this section may result.

In a discourse, prior linguistic context plays a primary role in pronoun interpretation. In the following discourse,

It seems that the man loves the woman.
Many people think he loves her.

the most natural interpretation of *her* is "the woman" referred to in the first sentence, whoever she happens to be. But it is also possible for *her* to refer to a different person, perhaps one indicated with a pointing gesture. In such a case *her* would be spoken with added emphasis:

Many people think he loves *her*!

Similar remarks apply to the reference of *he*, which most naturally refers to *the man*, but not necessarily so. Again, intonation and emphasis would provide clues.

Referring to the previous discourse, strictly speaking, it would not be ungrammatical if the discourse went this way:

It seems that the man loves the woman.
Many people think the man loves the woman.

However, most of us would find that the discourse sounds stilted. Often in discourse, the use of pronouns is a stylistic decision, which is part of pragmatics.

Pronouns and Situational Context

When a pronoun gets its reference from an NP antecedent in the same sentence, we say that the pronoun is **bound** to that noun phrase antecedent. If *her* in

1. Mary thinks he loves her

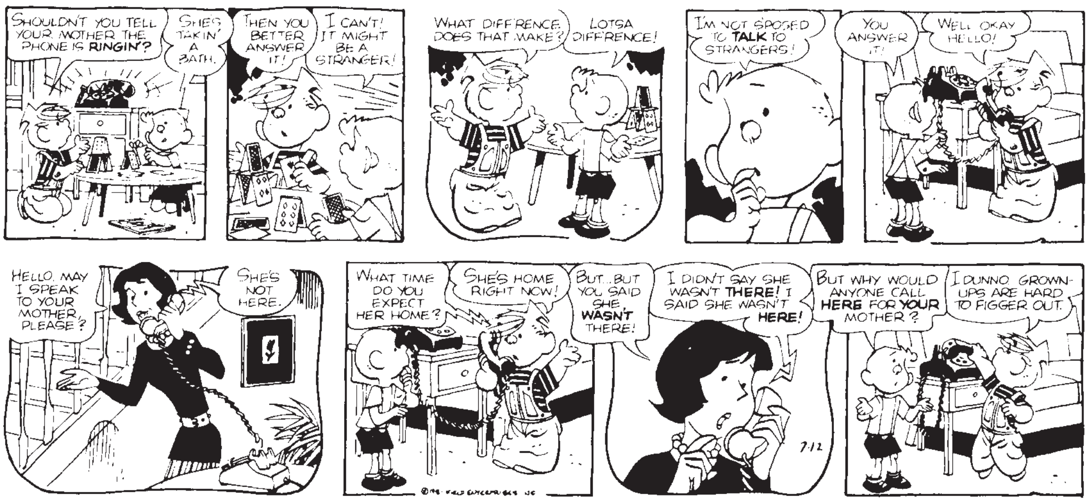
refers to "Mary," it would be a bound pronoun. Pronouns can also be bound to quantifier antecedents such as "every N'" as in the sentence:

2. Every girl in the class hopes John will ask her out on a date.

In this case *her* refers to each one of the girls in the class and is said to be bound to *every girl*. Reflexive pronouns are always bound. When a pronoun refers to some entity outside the sentence or not explicitly mentioned in the discourse, it is said to be **free** or **unbound**. So, *her* in the sentences in (1) and (2) need not be bound to *Mary* or to *every girl* and can also refer to some arbitrary girl. The reference of a free pronoun must ultimately be determined by the situational context.

First- and second-person nonreflexive (*I/we*, *you*) pronouns are bound to the speaker and hearer, respectively. They therefore depend on the situational context, namely, who is talking and who is listening. With third-person pronouns, semantic rules permit them either to be bound or free, as noted above. The ultimate interpretation in any event is context-dependent.

Deixis



"Dennis the Menace" © Hank Ketcham. Reprinted with permission of North America Syndicate.

In all languages, the reference of certain words and expressions relies entirely on the situational context of the utterance, and can only be understood in light of these circumstances. This aspect of pragmatics is called **deixis** (pronounced "dike-sis"). Pronouns are deictic. Their reference (or lack of same) is ultimately context dependent.

Expressions such as

this person
that man

these women
those children

are also deictic, because they require situational information for the listener to make a referential connection and understand what is meant. These examples illustrate **person deixis**. They also show that the **demonstrative articles** like *this* and *that* are deictic.

We also have **time deixis** and **place deixis**. The following examples are all deictic expressions of time:

now	then	tomorrow
this time	that time	seven days ago
two weeks from now	last week	next April

To understand what specific times such expressions refer to, we need to know when the utterance was said. Clearly, *next week* has a different reference when uttered today than a month from today. If you found an undated notice announcing a "BIG SALE NEXT WEEK," you would not know whether the sale had already taken place.

Expressions of place deixis require contextual information about the place of the utterance, as shown by the following examples:

here	there	this place
that place	this ranch	those towers over there
this city	these parks	yonder mountains

The "Dennis the Menace" cartoon at the beginning of this section illustrates the hilarity that may ensue if deictic expressions are misinterpreted.

Directional terms such as

before/behind   left/right   front/back

are deictic insofar as you need to know the orientation in space of the conversational participants to know their reference. In Japanese the verb *kuru* "come" can only be used for motion toward the place of utterance. A Japanese speaker cannot call up a friend and ask

May I *kuru* to your house?

as you might, in English, ask "May I come to your house?" The correct verb is *iku*, "go," which indicates motion away from the place of utterance. In Japanese these verbs have a deictic aspect to their meaning.

Deixis, as we've seen, is a great source of humor. A cartoon shows a chicken calling across the road to another chicken, "Hey, how do I cross to the other side of the road?"

"You're ON the other side," the other chicken replies.

Deixis abounds in language use and marks one of the boundaries of semantics and pragmatics. Deictic expressions such as *I*, *an hour from now*, and *behind me* have meaning to the extent that their referents are determined in a regular way as a function of the situation of use. (*I*, for example, picks out the speaker.) To complete their meaning, to determine their *reference*, it is necessary to know the situational context.

More on Situational Context

> Depending on inflection, *ah bon* [in French] can express shock, disbelief, indifference, irritation, or joy.
>
> **PETER MAYLE,** *Toujours Provence,* 1991

Much discourse is telegraphic. Verb phrases are not specifically mentioned, entire clauses are left out, direct objects vanish, pronouns roam freely. Yet people still understand one another, and part of the reason is that rules of grammar and rules of discourse combine with contextual knowledge to fill in what's missing and make the discourse cohere. Much of the contextual knowledge is knowledge of who is speaking, who is listening, what objects are being discussed, and general facts about the world we live in—what we have been calling **situational context**.

Often what we say is not literally what we mean. When we ask at the dinner table if someone "can pass the salt" we are not querying their ability to do so, we are requesting that they do so. If I say "You're standing on my foot," I am not making idle conversation; I am asking you to stand elsewhere. We say "It's cold in here" to convey "Shut the window," or "Turn up the heat," or "Let's leave," or a dozen other things that depend on the real-world situation at the time of speaking.

In the following sections, we will look at several ways that real-world context influences and interacts with meaning.

Maxims of Conversation

> POLONIUS: Though this be madness, yet there is method in't.
>
> **WILLIAM SHAKESPEARE,** *Hamlet,* c. 1600

Speakers recognize when a series of sentences "hangs together" or when it is disjointed. The following discourse (*Hamlet*, Act II, Scene II), which gave rise to Polonius's remark, does not seem quite right—it is not coherent.

POLONIUS: What do you read, my lord?
HAMLET: Words, words, words.
POLONIUS: What is the matter, my lord?
HAMLET: Between who?
POLONIUS: I mean, the matter that you read, my lord.
HAMLET: Slanders, sir: for the satirical rogue says here that old men have gray beards, that their faces are wrinkled, their eyes purging thick amber and plum-tree gum, and that they have a plentiful lack of wit, together with most weak hams: all which, sir, though I most powerfully and potently believe, yet I hold it not honesty to have it thus set down; for yourself, sir, should grow old as I am, if like a crab you could go backward.

Hamlet, who is feigning insanity, refuses to answer Polonius's questions "in good faith." He has violated certain conversational conventions, or **maxims**

of conversation. These maxims were first discussed by the British philosopher H. Paul Grice and are sometimes called Gricean Maxims. One such maxim, the **maxim of quantity**, states that a speaker's contribution to the discourse should be as informative as is required—neither more nor less. Hamlet has violated this maxim in both directions. In answering "Words, words, words" to the question of what he is reading, he is providing too little information. His final remark goes to the other extreme in providing too much information.

Hamlet also violates the **maxim of relevance** when he "misinterprets" the question about the reading matter as a matter between two individuals.

The run-on nature of Hamlet's final remark, a violation of the **maxim of manner**, is another source of incoherence. This effect is increased in the final sentence by the somewhat bizarre metaphor that compares growing younger with walking backward, a violation of the **maxim of quality**, which requires sincerity and truthfulness.

Here is a summary of the four conversational maxims, parts of the broad **cooperative principle**.

Name of Maxim	Description of Maxim
Quantity	Say neither more nor less than the discourse requires.
Relevance	Be relevant.
Manner	Be brief and orderly; avoid ambiguity and obscurity.
Quality	Do not lie; do not make unsupported claims.

Unless speakers (like Hamlet) are being deliberately uncooperative, they adhere to these maxims and to other conversational principles, and assume others do too.

Bereft of context, if one man says (truthfully) to another "I have never slept with your wife," that would be provocative because the very topic of conversation should be unnecessary, a violation of the maxim of quantity.

Asking an able-bodied person at the dinner table "Can you pass the salt?", if answered literally, would force the responder into stating the obvious, also a violation of the maxim of quantity. To avoid this, the person asked seeks a reason for the question, and deduces that the asker would like to have the salt shaker.

The maxim of relevance explains how saying "It's cold in here" to a person standing by an open window might be interpreted as a request to close it, or else why make the remark to that particular person in the first place?

For sentences like *I am sorry that the team lost* to be relevant, it must be true that "the team lost." Else why say it? Situations that must exist for utterances to be appropriate are called **presuppositions**. Questions like *Have you stopped hugging your border collie?* presuppose that you hugged your border collie, and statements like *The river Avon runs through Stratford* presuppose the existence of the river and the town. The presuppositions prevent violations of the maxim of relevance. When presuppositions are ignored, we get the confusion in this passage from Lewis Carroll's *Alice's Adventures in Wonderland*:

> "Take some more tea," the March Hare said to Alice, very earnestly.
> "I've had nothing yet," Alice replied in an offended tone, "so I can't take more."

"You mean you can't take less," said the Hatter: "It's very easy to take more than nothing."

Utterances like *Take some more tea* or *Have another beer* carry the presupposition that one has already had some. The March Hare is oblivious to this aspect of language, of which the annoyed Alice is keenly aware.

Presuppositions are different from entailments in that they are felicity conditions taken for granted by speakers adhering to the cooperative principle. Unlike entailments, they remain when the sentence is negated. *I am not sorry that the team lost* still presupposes that the team lost. On the other hand, while *John killed Bill* entails *Bill died*, no such entailment follows from *John did not kill Bill*.

Conversational conventions such as these allow the various sentence meanings to be sensibly combined into discourse meaning and integrated with context, much as rules of sentence grammar allow word meanings to be sensibly (and grammatically) combined into sentence meaning.

Implicatures

What does "yet" mean, after all? "I haven't seen *Reservoir Dogs* yet." What does that mean? It means you're going to go, doesn't it?

NICK HORNBY, *High Fidelity*, 1995

In conversation we sometimes infer or conclude based not only on what was said, but also on assumptions about what the speaker is trying to achieve. In the examples just discussed—*It's cold in here*, *Can you please pass the salt*, and *I have never slept with your wife*—the person spoken to derives a meaning that is not the literal meaning of the sentences. In the first case he assumes that he is being asked to close the window; in the second case he knows he's not being questioned but rather asked to pass the salt; and in the third case he will understand exactly the opposite of what is said, namely that the speaker has slept with his wife.

Such inferences are known as **implicatures**. Implicatures are deductions that are not made strictly on the basis of the content expressed in the discourse. Rather, they are made in accordance with the conversational maxims, taking into account both the linguistic meaning of the utterance as well as the particular circumstances in which the utterance is made.

Consider the following conversation:

SPEAKER A: Smith doesn't have any girlfriends these days.
SPEAKER B: He's been driving over to the West End a lot lately.

The implicature is that Smith has a girlfriend in the West End. The reasoning is that B's answer would be irrelevant unless it contributed information related to A's question. We assume speakers try to be cooperative. So it is fair to conclude that B uttered the second sentence because the reason that Smith drives to the West End is that he has a girlfriend there.

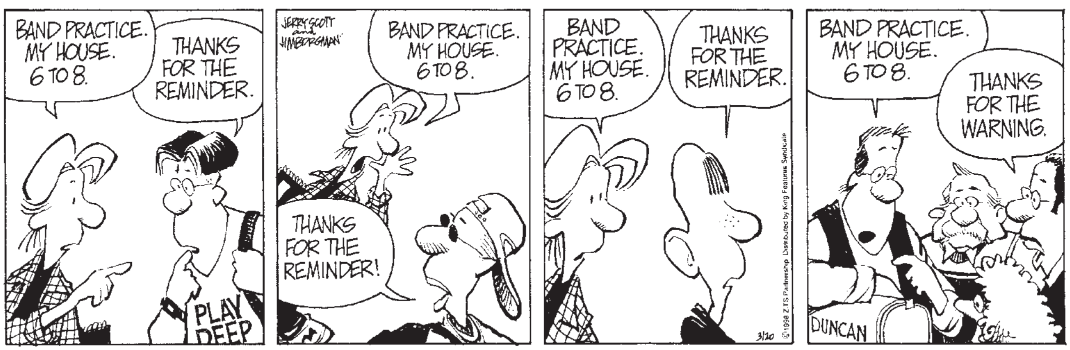
Because implicatures are derived on the basis of assumptions about the speaker that might turn out to be wrong, they can be easily cancelled. For this reason A could have responded as follows:

SPEAKER A: He goes to the West End to visit his mother who is ill.

Although B's utterance implies that the reason Smith goes to the West End is to visit his girlfriend, A's response cancels this implicature.

Implicatures are different than entailments. An entailment cannot be cancelled; it is logically necessary. Implicatures are also different than presuppositions. They are the possible consequences of utterances in their context, whereas presuppositions are situations that must exist for utterances to be appropriate in context, in other words, to obey Grice's Maxims. Further world knowledge may cancel an implicature, but the utterances that led to it remain sensible and well-formed, whereas further world knowledge that negates a presupposition—oh, the team didn't lose after all—renders the entire utterance inappropriate and in violation of Grice's Maxims.

Speech Acts



"Zits" © Zits Partnership. Reprinted with permission of King Features Syndicate.

You can use language to do things. You can use language to make promises, lay bets, issue warnings, christen boats, place names in nomination, offer congratulations, or swear testimony. The theory of **speech acts** describes how this is done.

By saying *I warn you that there is a sheepdog in the closet*, you not only say something, you *warn* someone. Verbs like *bet*, *promise*, *warn*, and so on are **performative verbs**. Using them in a sentence (in the first person, present tense) adds something extra over and above the statement.

There are hundreds of performative verbs in every language. The following sentences illustrate their usage:

I *bet* you five dollars the Yankees win.
I *challenge* you to a match.
I *dare* you to step over this line.

I *fine* you $100 for possession of oregano.
I *move* that we adjourn.
I *nominate* Batman for mayor of Gotham City.
I *promise* to improve.
I *resign*!
I *pronounce* you husband and wife.

In all of these sentences, the speaker is the subject (i.e., the sentences are in first person), who by uttering the sentence is accomplishing some additional action, such as daring, nominating, or resigning. In addition, all of these sentences are affirmative, declarative, and in the present tense. They are typical **performative sentences**.

An informal test to see whether a sentence contains a performative verb is to begin it with the words *I hereby*. . . . Only performative sentences sound right when begun this way. Compare *I hereby apologize to you* with the somewhat strange *I hereby know you*. The first is generally taken as an act of apologizing. In all of the examples given, insertion of *hereby* would be acceptable.

In studying speech acts, the importance of context is evident. In some situations *Band practice, my house, 6 to 8* is a reminder, but the same sentence may be a warning in a different context. We call this underlying purpose of the utterance—be it a reminder, a warning, a promise, a threat, or whatever—the **illocutionary force** of a speech act. Because the illocutionary force of a speech act depends on the context of the utterance, speech act theory is a part of pragmatics.

Summary

Knowing a language means knowing how to produce and understand the meaning of infinitely many sentences. The study of linguistic meaning is called **semantics**. **Lexical semantics** is concerned with the meanings of morphemes and words; **compositional semantics** with phrases and sentences. The study of how context affects meaning is called **pragmatics**.

Speakers' knowledge of sentence meaning includes knowing the **truth conditions** of declarative sentences; knowing when one sentence **entails** another sentence; knowing when two sentences are **paraphrases** or **contradictory**; knowing when a sentence is a **tautology**, **contradiction**, or **paradox**; and knowing when sentences are ambiguous, among other things. **Compositional semantics** is the building up of phrasal or sentence meaning from the meaning of smaller units by means of **semantic rules**.

There are cases when the meaning of larger units does not follow from the meaning of its parts. **Anomaly** is when the pieces do not fit sensibly together, as in *colorless green ideas sleep furiously*; **metaphors** are sentences that appear to be anomalous, but to which a meaningful concept can be attached, such as *time is money*; **idioms** are fixed expressions whose meaning is not compositional but rather must be learned as a whole unit, such as *kick the bucket* meaning "to die."

Part of the meaning of words may be the association with the objects the words refer to (if any), called **reference**, but often there is additional meaning beyond reference, which is called **sense**. The reference of *the President* is Barack Obama, and the sense of the expression is "highest executive office." Some expressions have reference but little sense such as proper names, and some have sense but no reference such as *the present king of France*.

Words are related in various ways. They may be **synonyms**, various kinds of **antonyms** such as **gradable pairs** and **relational opposites**, or **homonyms**, words pronounced the same but with different meanings such as *bare* and *bear*.

Part of the meaning of words may be described by **semantic features** such as "female," "young," "cause," or "go." Nouns may have the feature "count," wherein they may be enumerated (one potato, two potatoes), or "mass," in which enumeration may require contextual interpretation (*one milk, *two milks, perhaps meaning "one glass or quart or portion of milk"). Some verbs have the feature of being "eventive" while others are "stative." The semantic feature of negation is found in many words and is evidenced by the occurrence of **negative polarity** items (e.g., *John doubts that Mary gives a hoot*, but **John thinks that Mary gives a hoot*).

Verbs have various **argument structures**, which describe the NPs that may occur with particular verbs. For example, intransitive verbs take only an NP subject, whereas **ditransitive** verbs take an NP subject, an NP direct object, and an NP indirect object. **Thematic roles** describe the semantic relations between a verb and its NP arguments. Some thematic roles are **agent**: the doer of an action; **theme**: the recipient of an action; and **goal**, **source**, **instrument**, and **experiencer**. The principle of **uniformity of theta assignment** dictates that thematic roles must be assigned to particular structural position (e.g., theme to object position) illustrating that there is a close connection between syntax and semantics. The general study of how context affects linguistic interpretation is *pragmatics*. Context may be *linguistic*—what was previously spoken or written—or *knowledge of the world*, including the speech situation, what we've called **situational context**.

Discourse consists of several sentences, including exchanges between speakers. Pragmatics is important when interpreting discourse, for example, in determining whether a pronoun in one sentence has the same referent as a noun phrase in another sentence.

Deictic terms such as *you*, *there*, *now*, and *the other side* require knowledge of the situation (person spoken to, place, time, spatial orientation) of the utterance to be interpreted referentially.

Speakers of all languages adhere to various **cooperative principles** for communicating sincerely called **maxims of conversation**. Such maxims as "be relevant" or "say neither more nor less than the discourse requires" permit a person to interpret *It's cold in here* as "Shut the windows" or "Turn up the thermostat." **Implicatures** are the inferences that may be drawn from an utterance in context. When Mary says *It's cold in here*, one of many possible implicatures may be "Mary wants the heat turned up." Implicatures are like entailments in that their truth follows from sentences of the discourse, but unlike entailments, which are necessarily true, implicatures may be cancelled by information added later. Mary might wave you away from the thermostat and ask you to hand her a sweater. **Presuppositions** are situations that must be true for utterances to be appropriate, so that *Take some more tea* has the presupposition "already had some tea."

The theory of **speech acts** tells us that people use language to do things such as lay bets, issue warnings, or nominate candidates. By using the words "I nominate Bill Smith," you may accomplish an act of nomination that allows Bill Smith to run for office. Verbs that "do things" are called **performative verbs**. The speaker's intent in making an utterance is known as **illocutionary force**. In the case of performative verbs, the illocutionary force is mentioned overtly. In other cases it must be determined from context.

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Exercises

1. (This exercise requires knowledge of elementary set theory.)

A. Suppose that the reference (meaning) of *swims* points out the set of individuals consisting of Anna, Lu, Paul, and Benjamin. For which of the following sentences are the truth conditions produced by Semantic Rule I met?

i. Anna swims.
ii. Jack swims.
iii. Benjamin swims.

B. Suppose the reference (meaning) of *loves* points out the set consisting of the following pairs of individuals: <Anna, Paul>, <Paul, Benjamin>,

6

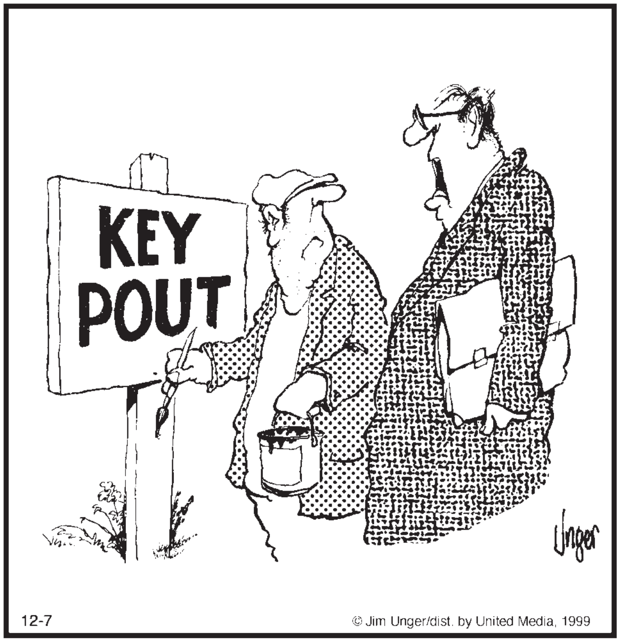
Phonetics: The Sounds of Language

> I gradually came to see that Phonetics had an important bearing on human relations—that when people of different nations pronounce each other's languages really well (even if vocabulary & grammar not perfect), it has an astonishing effect of bringing them together, it puts people on terms of equality, a good understanding between them immediately springs up.
>
> **FROM THE JOURNAL OF DANIEL JONES**

When you know a language you know the *sounds* of that language, and you know how to combine those sounds into words. When you know English you know the sounds represented by the letters *b*, *s*, and *u*, and you are able to combine them to form the words *bus* or *sub*.

Although languages may contain different sounds, the sounds of all the languages of the world together constitute a class of sounds that the human vocal tract is designed to make. This chapter will discuss these speech sounds, how they are produced, and how they may be classified.

Sound Segments



"Keep out! Keep out! K-E-E-P O-U-T."

The study of speech sounds is called **phonetics**. To describe speech sounds, it is necessary to know what an individual sound is, and how each sound differs from all others. This is not as easy as it may seem, for when we speak, the sounds seem to run together and it isn't at all obvious where one sound ends and the next begins. However, when we know the language we hear the individual sounds in our "mind's ear" and are able to make sense of them, unlike the sign painter in the cartoon.

A speaker of English knows that there are three sounds in the word *bus*. Yet, physically the word is just one continuous sound. You can **segment** that one sound into parts because you know English. And you recognize those parts when they occur elsewhere as *b* does in *b*et or ro*b*, as *u* does in *u*p, and as *s* does in *s*ister.

It is not possible to segment the sound of someone clearing her throat into a sequence of discrete units. This is not because throat-clearing is one continuous sound. It is because such sounds are not speech and are therefore not able to be segmented into the sounds of speech.

Speakers of English can separate *keepout* into the two words *keep* and *out* because they know the language. We do not generally pause between words (except to take a breath), even though we may think we do. Children learning a language reveal this fact. A two-year-old child going down stairs heard his mother say, “hold on.” He replied, “I’m holing don, I’m holing don,” not knowing where the break between words occurred. In fact, word boundary misperceptions have changed the form of words historically. At an earlier stage of English, the word *apron* was *napron*. However, the phrase *a napron* was so often misperceived as *an apron* that the word lost its initial *n*.

Some phrases and sentences that are clearly distinct when printed may be ambiguous when spoken. Read the following pairs aloud and see why we might misinterpret what we hear:

grade A	gray day
I scream	ice cream
The sun’s rays meet	The sons raise meat

The lack of breaks between spoken words and individual sounds often makes us think that speakers of foreign languages run their words together, unaware that we do too. X-ray motion pictures of someone speaking make the absence of breaks very clear. One can see the tongue, jaw, and lips in continuous motion as the individual sounds are produced.

Yet, if you know a language you have no difficulty segmenting the continuous sounds of speech. It doesn’t matter if there is an alphabet for the language or whether the listener can read and write. Everyone who knows a language knows how to segment sentences into words, and words into sounds.

Identity of Speech Sounds

> By infinitesimal movements of the tongue countless different vowels can be produced, all of them in use among speakers of English who utter the same vowels no oftener than they make the same fingerprints.
>
> **GEORGE BERNARD SHAW,** 1950

It is truly amazing, given the continuity of the speech signal, that we are able to understand the individual words in an utterance. This ability is more surprising because no two speakers ever say the same word identically. The speech signal produced when one speaker says *cat* is not the same as that of another speaker’s *cat*. Even two utterances of *cat* by the same speaker will differ to some degree.

Our knowledge of a language determines when we judge physically different sounds to be the same. We know which aspects of pronunciation are linguistically important and which are not. For example, if someone coughs in the middle of saying “How (cough) are you?” a listener will ignore the cough and interpret this simply as “How are you?” People speak at different pitch levels, at different rates of speed, and even with their heads encased in a helmet, like Darth Vader. However, such personal differences are not linguistically significant.

Our linguistic knowledge makes it possible to ignore nonlinguistic differences in speech. Furthermore, we are capable of making sounds that we know are not speech sounds in our language. Many English speakers can make a clicking sound of disapproval that writers sometimes represent as *tsk*. This sound never occurs as part of an English word. It is even difficult for many English speakers to combine this clicking sound with other sounds. Yet clicks are speech sounds in Xhosa, Zulu, Sosotho, and Khoikhoi—languages spoken in southern Africa—just like the *k* or *t* in English. Speakers of those languages have no difficulty producing them as parts of words. Thus, *tsk* is a speech sound in Xhosa but not in English. The sound represented by the letters *th* in the word *think* is a speech sound in English but not in French. In general, languages differ to a greater or lesser degree in the inventory of speech sounds that words are built from.

The science of phonetics attempts to describe all of the sounds used in all languages of the world. **Acoustic phonetics** focuses on the physical properties of sounds; **auditory phonetics** is concerned with how listeners perceive these sounds; and **articulatory phonetics**—the primary concern of this chapter—is the study of how the vocal tract produces the sounds of language.

The Phonetic Alphabet

> The English have no respect for their language, and will not teach their children to speak it. They cannot spell it because they have nothing to spell it with but an old foreign alphabet of which only the consonants—and not all of them—have any agreed speech value.
>
> **GEORGE BERNARD SHAW,** Preface to *Pygmalion,* 1912

Orthography, or alphabetic spelling, does not represent the sounds of a language in a consistent way. To be scientific—and phonetics *is* a science—we must devise a way for the same sound to be spelled with the same letter every time, and for any letter to stand for the same sound every time.

To see that ordinary spelling with our Roman alphabet is woefully inadequate for the task, consider sentences such as:

Did h**e** bel**ie**ve that C**ae**sar could s**ee** the p**eo**ple s**ei**ze the s**ea**s?
The sill**y** am**oe**ba stole the k**ey** to the mach**i**ne.

The same sound is represented variously by **e**, **ie**, **ae**, **ee**, **eo**, **ei**, **ea**, **y**, **oe**, **ey**, and **i**.

On the other hand, consider:

My f**a**ther w**a**nted m**a**ny **a** vill**a**ge d**a**me b**a**dly.

Here the letter **a** represents the various sounds in *father*, *wanted*, *many*, and so on.

Making the spelling waters yet muddier, we find that a combination of letters may represent a single sound:

shoot	***ch***aracter	***Th***omas	***ph***ysics
ei***th***er	d***ea***l	rou***gh***	na***ti***on
c***oa***t	gla***ci***al	***th***eater	pl***ai***n

Or, conversely, the single letter **x**, when not pronounced as **z**, usually stands for the *two* sounds **ks** as in sex (you may have to speak aloud to hear that *sex* is pronounced seks).

Some letters have no sound in certain words (so-called *silent* letters):

mnemonic	autum***n***	resig***n***	g***h***ost
pterodactyl	***w***rite	hol***e***	cor***ps***
psychology	s***w***ord	de***b***t	***g***naw
bou***gh***	lam***b***	i***s***land	***k***not

Or, conversely, there may be no letter to represent sounds that occur. In many words, the letter *u* represents a *y* sound followed by a *u* sound:

c***u***te	(sounds like kyute; compare: c***oo***t)
f***u***me	(sounds like fyume; compare: f***oo***l)
use	(sounds like yuse; compare: ***U***zbekistan)

Throughout several centuries English scholars have advocated spelling reform. George Bernard Shaw complained that spelling was so inconsistent that *fish* could be spelled *ghoti—gh* as in *tough*, *o* as in *women*, and *ti* as in *nation*. Nonetheless, spelling reformers failed to change our spelling habits, and it took phoneticians to invent an alphabet that absolutely guaranteed a one sound–one symbol correspondence. There could be no other way to study the sounds of all human languages scientifically.

In 1888 members of the International Phonetic Association developed a **phonetic alphabet** to symbolize the sounds of all languages. They utilized both ordinary letters and invented symbols. Each character of the alphabet had exactly one value across all of the world's languages. Someone who knew this alphabet would know how to pronounce a word written in it, and upon hearing a word pronounced, would know how to write it using the alphabetic symbols. The inventors of this **International Phonetic Alphabet**, or **IPA**, knew that a phonetic alphabet should include just enough symbols to represent the fundamental sounds of all languages.

Table 6.1 is a list of the IPA symbols that we will use to represent English speech sounds. The symbols do not tell us everything about the sounds, which may vary from person to person and which may depend on their position in a word. They are not all of the phonetic symbols needed for English, but they will suffice for our purposes. When we discuss the sounds in more detail later in the chapter, we will add appropriate symbols. From now on we will enclose phonetic symbols in square brackets [ ] to distinguish them from ordinary letters.

TABLE 6.1 | A Phonetic Alphabet for English Pronunciation

Consonants						**Vowels**			
p	**p**ill	t	**t**ill	k	**k**ill	i	b**ee**t	ɪ	b**i**t
b	**b**ill	d	**d**ill	g	**g**ill	e	b**ai**t	ɛ	b**e**t
m	**m**ill	n	**n**il	ŋ	ri**ng**	u	b**oo**t	ʊ	f**oo**t
f	**f**eel	s	**s**eal	h	**h**eal	o	b**oa**t	ɔ	b**ore**
v	**v**eal	z	**z**eal	l	**l**eaf	æ	b**a**t	a	p**o**t/b**a**r
θ	**th**igh	tʃ	**ch**ill	r	**r**eef	ʌ	b**u**tt	ə	sof**a**
ð	**th**y	dʒ	**g**in	j	**y**ou	aɪ	b**i**te	aʊ	b**ou**t
ʃ	**sh**ill	ʍ	**wh**ich	w	**w**itch	ɔɪ	b**oy**		
ʒ	mea**s**ure								

The symbol [ə] in *sofa* toward the bottom right of the chart is called a *schwa*. We use it to represent vowels in syllables that are not emphasized in speaking and whose duration is very short, such as *general*, *about*, *reader*, etc. The schwa is pronounced with the mouth in a neutral position and is a brief, colorless vowel. The schwa is reserved for the vowel sound in all reduced syllables, even though its pronunciation may vary slightly according to its position in the word and who is speaking. All other vowel symbols in the chart occur in syllables that receive at least some emphasis.

Speakers from different parts of the country may pronounce some words differently. For example, some of you may pronounce the words *which* and *witch* identically. If you do, the initial sound of both words is symbolized by [w] in the chart. If you don't, the breathy *wh* of *which* is represented by [ʍ].

Some speakers of English pronounce *bought* and *pot* with the same vowel; others pronounce them with the vowel sounds in *bore* and *bar*, respectively. We have therefore listed both words in the chart of symbols. It is difficult to include all the phonetic symbols needed to represent all differences in English. There may be sounds in your speech that are not represented, and vice versa, but that's okay. There are many varieties of English. The versions spoken in England, in Australia, in Ireland, and in India, among others, differ in their pronunciations. And even within American English, phonetic differences exist among the many dialects, as we discuss in chapter 10.

The symbols in Table 6.1 are IPA symbols with one small exception. The IPA uses an upside-down "r" (ɹ) for the English sound *r*. We, and many writers, prefer the right side up symbol r for clarity when writing for an English-reading audience. Apart from "r," some writers use different symbols for other sounds that once were traditional for transcribing American English. You may encounter these in other books. Here are some equivalents:

IPA	**Alternative**
ʃ	š
ʒ	ž
tʃ	č
dʒ	ǰ
ʊ	U

Using the IPA symbols, we can now unambiguously represent the pronunciation of words. For example, in the six words below, *ou* represents six distinct vowel sounds; the *gh* is silent in all but *rough*, where it is pronounced [f]; the *th* represents a single sound, either [Ð] or [ð], and the *l* in *would* is also silent. However, the phonetic transcription gives us the actual pronunciation.

Spelling	**Pronunciation**
though	[ðo]
thought	[θɔt]
rough	[rʌf]
bough	[baʊ]
through	[θru]
would	[wʊd]

Articulatory Phonetics

> The voice is articulated by the lips and the tongue. . . . Man speaks by means of the air which he inhales into his entire body and particularly into the body cavities. When the air is expelled through the empty space it produces a sound, because of the resonances in the skull. The tongue articulates by its strokes; it gathers the air in the throat and pushes it against the palate and the teeth, thereby giving the sound a definite shape. If the tongue would not articulate each time, by means of its strokes, man would not speak clearly and would only be able to produce a few simple sounds.
>
> **HIPPOCRATES** (460–377 B.C.E.)

The production of any sound involves the movement of air. Most speech sounds are produced by pushing lung air through the *vocal cords*—a pair of thin membranes—up the throat, and into the mouth or nose, and finally out of the body. A brief anatomy lesson is in order. The *opening* between the vocal cords is the **glottis** and is located in the voice box or **larynx**, pronounced "lair rinks." The tubular part of the throat above the larynx is the **pharynx** (rhymes with *larynx*). What sensible people call "the mouth," linguists call the **oral cavity** to distinguish it from the **nasal cavity**, which is the nose and the plumbing that connects it to the throat, plus your sinuses. Finally there are the tongue and the lips, both of which are capable of rapid movement and shape changing. All of these together comprise the **vocal tract**. Differing vocal tract shapes result in the differing sounds of language. Figure 6.1 should make these descriptions clearer. (The vocal cords and larynx are not specifically labeled in the figure.)

Consonants

The sounds of all languages fall into two classes: consonants and vowels. Consonants are produced with some restriction or closure in the vocal tract that impedes the flow of air from the lungs. In phonetics, the terms *consonant* and *vowel* refer to types of *sounds*, not to the letters that represent them. In speaking of the alphabet, we may call "a" a vowel and "c" a consonant, but that means only that we use the letter "a" to represent vowel sounds and the letter "c" to represent consonant sounds.

Place of Articulation

> Lolita, light of my life, fire of my loins. My sin, my soul. Lo-lee-ta: the tip of the tongue taking a trip of three steps down the palate to tap, at three, on the teeth. Lo. Lee. Ta.
>
> **VLADIMIR NABOKOV,** *Lolita*, 1955

We classify consonants according to where in the vocal tract the airflow restriction occurs, called the **place of articulation**. Movement of the tongue and lips creates the constriction, reshaping the oral cavity in various ways to produce the

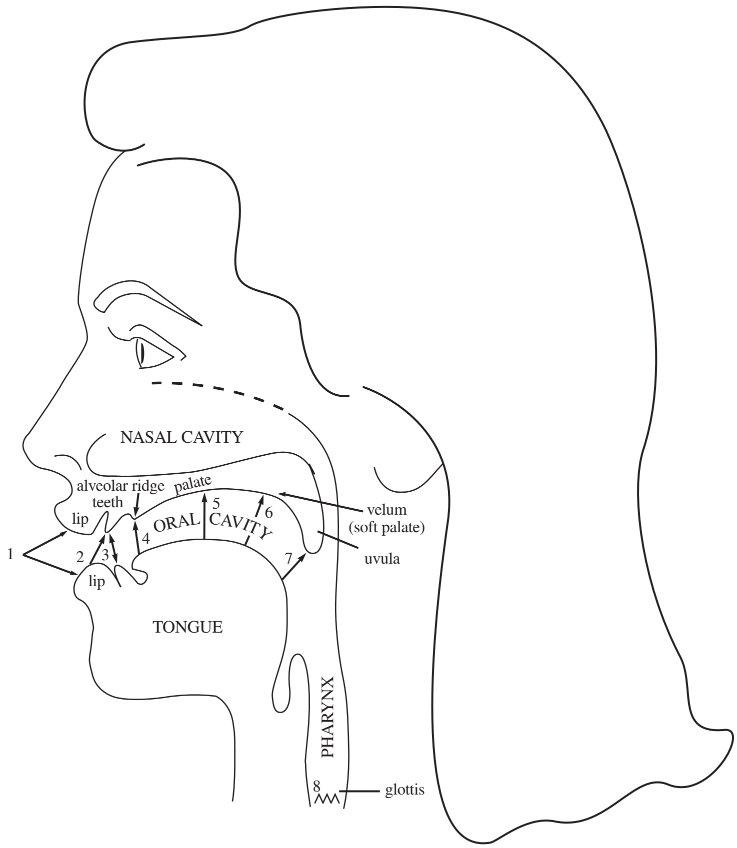


FIGURE 6.1 | The vocal tract. Places of articulation: 1. bilabial; 2. labiodental; 3. interdental; 4. alveolar; 5. (alveo)palatal; 6. velar; 7. uvular; 8. glottal.

various sounds. We are about to discuss the major places of articulation. As you read the description of each sound class, refer to Table 6.1, which provides key words containing the sounds. As you pronounce these words, try to feel which articulators are moving. (Watching yourself in a mirror helps, too.) Look at Figure 6.1 for help with the terminology.

Bilabials [p] [b] [m] When we produce a [p], [b], or [m] we articulate by bringing both lips together.

Labiodentals [f] [v] We also use our lips to form [f] and [v]. We articulate these sounds by touching the bottom lip to the upper teeth.

Interdentals [θ] [ð] These sounds, both spelled *th*, are pronounced by inserting the tip of the tongue between the teeth. However, for some speakers the tongue merely touches behind the teeth, making a sound more correctly called **dental**.

Watch yourself in a mirror and say *think* [θɪŋk] or *these* [ðiz] and see where *your* tongue tip goes.

Alveolars [t] [d] [n] [s] [z] [l] [r] All seven of these sounds are pronounced with the tongue raised in various ways to the **alveolar ridge**.

- For [t,d,n] the tongue tip is raised and touches the ridge, or slightly in front of it.
- For [s,z] the sides of the front of the tongue are raised, but the tip is lowered so that air escapes over it.
- For [l] the tongue tip is raised while the rest of the tongue remains down, permitting air to escape over its *sides*. Hence, [l] is called a **lateral** sound. You can feel this in the "l's" of *Lolita*.
- For [r] [IPA ɹ] most English speakers either curl the tip of the tongue back behind the alveolar ridge, or bunch up the top of the tongue behind the ridge. As opposed to [l], air escapes through the central part of the mouth when [r] is articulated. It is a **central** liquid.

Palatals [ʃ] [ʒ] [tʃ] [dʒ] [j] For these sounds, which occur in *mission* [mɪ**ʃ**ən], *measure* [mɛ**ʒ**ər], *cheap* [**tʃ**ip], *judge* [**dʒ**ʌ**dʒ**], and *yoyo* [**j**o**j**o], the constriction occurs by raising the front part of the tongue to the palate.

Velars [k] [g] [ŋ] Another class of sounds is produced by raising the back of the tongue to the soft palate or **velum**. The initial and final sounds of the words *kick* [**k**ɪ**k**] and *gig* [**g**ɪ**g**] and the final sounds of the words *back* [bæ**k**], *bag* [bæ**g**], and *bang* [bæ**ŋ**] are all velar sounds.

Uvulars [ʀ] [q] [ɢ] Uvular sounds are produced by raising the back of the tongue to the **uvula**, the fleshy protuberance that hangs down in the back of our throats. The *r* in French is often a uvular *trill* symbolized by [ʀ]. The uvular sounds [q] and [ɢ] occur in Arabic. These sounds do not ordinarily occur in English.

Glottals [h] [ʔ] The sound of [h] is from the flow of air through the open *glottis*, and past the tongue and lips as they prepare to pronounce a vowel sound, which always follows [h].

If the air is stopped completely at the glottis by tightly closed vocal cords, the sound upon release of the cords is a **glottal stop [ʔ]**. The interjection *uh-oh*, that you hope never to hear your dentist utter, has two glottal stops and is spelled phonetically [**ʔ**ʌ**ʔ**o].

Table 6.2 summarizes the classification of these English consonants by their place of articulation.

Manner of Articulation

We have described several classes of consonants according to their *place of articulation*, yet we are still unable to distinguish the sounds in each class from one another. What distinguishes [p] from [b] or [b] from [m]? All are bilabial sounds. What is the difference between [t], [d], and [n], which are all alveolar sounds?

TABLE 6.2 | Place of Articulation of English Consonants

Bilabial	p	b	m				
Labiodental	f	v					
Interdental	θ	ð					
Alveolar	t	d	n	s	z	l	r
Palatal	ʃ	ʒ	tʃ	dʒ			
Velar	k	g	ŋ				
Glottal	h	ʔ					

Speech sounds also vary in the way the airstream is affected as it flows from the lungs up and out of the mouth and nose. It may be blocked or partially blocked; the vocal cords may vibrate or not vibrate. We refer to this as the **manner of articulation**.

Voiced and Voiceless Sounds

Sounds are **voiceless** when the vocal cords are apart so that air flows freely through the glottis into the oral cavity. [p] and [s] in *super* [supər] are two of the several voiceless sounds of English.

If the vocal cords are together, the airstream forces its way through and causes them to vibrate. Such sounds are **voiced**. [b] and [z] in *buzz* [bʌz] are two of the many voiced sounds of English. To get a sense of voicing, try putting a finger in each ear and say the voiced "z-z-z-z-z." You can feel the vibrations of the vocal cords. If you now say the voiceless "s-s-s-s-s," you will not sense these vibrations (although you might hear a hissing sound). When you whisper, you are making all the speech sounds voiceless. Try it! Whisper "Sue" and "zoo." No difference, right?

The voiced/voiceless distinction is very important in English. This phonetic property distinguishes the words in word pairs like the following:

ro**p**e/ro**b**e	fa**t**e/fa**d**e	ra**ck**/ra**g**	wrea**th**/wrea**the**
[ro**p**]/[ro**b**]	[fe**t**]/[fe**d**]	[ræ**k**]/[ræ**g**]	[ri**θ**]/[ri**ð**]

The first word of each pair ends with a voiceless sound and the second word with a voiced sound. All other aspects of the sounds in each word pair are identical; the position of the lips and tongue is the same.

The voiced/voiceless distinction also occurs in the following pairs, where the first word begins with a voiceless sound and the second with a voiced sound:

fine/**v**ine	seal/**z**eal	**ch**oke/**j**oke
[**f**aɪn]/[**v**aɪn]	[sil/**z**il]	[**tʃ**ok]/[**dʒ**ok]
peat/**b**eat	**t**ote/**d**ote	**k**ale/**g**ale
[**p**it]/[**b**it]	[**t**ot]/[**d**ot]	[**k**el]/[**g**el]

In our discussion of [p], we did not distinguish the initial sound in the word *pit* from the second sound in the word *spit*. There is, however, a phonetic difference in these two voiceless stops. During the production of voiceless sounds, the glottis is open and the air flows freely between the vocal cords. When a voiceless sound is followed by a voiced sound such as a vowel, the vocal cords must close so they can vibrate.

Voiceless sounds fall into two classes depending on the timing of the vocal cord closure. When we say *pit*, the vocal cords remain open for a very short time after the lips come apart to release the *p*. We call this *p* **aspirated** because a brief puff of air escapes before the glottis closes.

When we pronounce the *p* in *spit*, however, the vocal cords start vibrating as soon as the lips open. That *p* is **unaspirated**. Hold your palm about two inches in front of your lips and say *pit*. You will feel a puff of air, which you will not feel when you say *spit*. The *t* in *tick* and the *k* in *kin* are also aspirated voiceless stops, while the *t* in *stick* and the *k* in *skin* are unaspirated.

Finally, in the production of the voiced [b] (and [d] and [g]), the vocal cords are vibrating throughout the closure of the lips, and continue to vibrate during the vowel sound that follows after the lips part.

We indicate aspirated sounds by writing the phonetic symbol with a raised *h*, as in the following examples:

pool	[p^{h}ul]	spool	[spul]
tale	[t^{h}el]	stale	[stel]
kale	[k^{h}el]	scale	[skel]

Figure 6.2 shows in diagrammatic form the timing of lip closure in relation to the state of the vocal cords.

Nasal and Oral Sounds

The voiced/voiceless distinction differentiates the bilabials [b] and [p]. The sound [m] is also a bilabial, and it is voiced. What distinguishes it from [b]?

Figure 6.1 shows the roof of the mouth divided into the (hard) palate and the soft palate (or velum). The palate is a hard bony structure at the front of the mouth. You can feel it with your thumb. First, wash your hands. Now, slide your thumb along the hard palate back toward the throat; you will feel the velum, which is where the flesh becomes soft and pliable. The velum terminates in the uvula, which you can see in a mirror if you open your mouth wide and say "aaah." The velum is movable, and when it is raised all the way to touch the back of the throat, the passage through the nose is cut off and air can escape only through the mouth.

Sounds produced with the velum up, blocking the air from escaping through the nose, are **oral sounds**, because the air can escape only through the oral cavity. Most sounds in all languages are oral sounds. When the velum is not in its raised position, air escapes through both the nose and the mouth. Sounds produced this way are **nasal sounds**. The sound [m] is a nasal consonant. Thus [m] is distinguished from [b] because it is a nasal sound, whereas [b] is an oral sound.

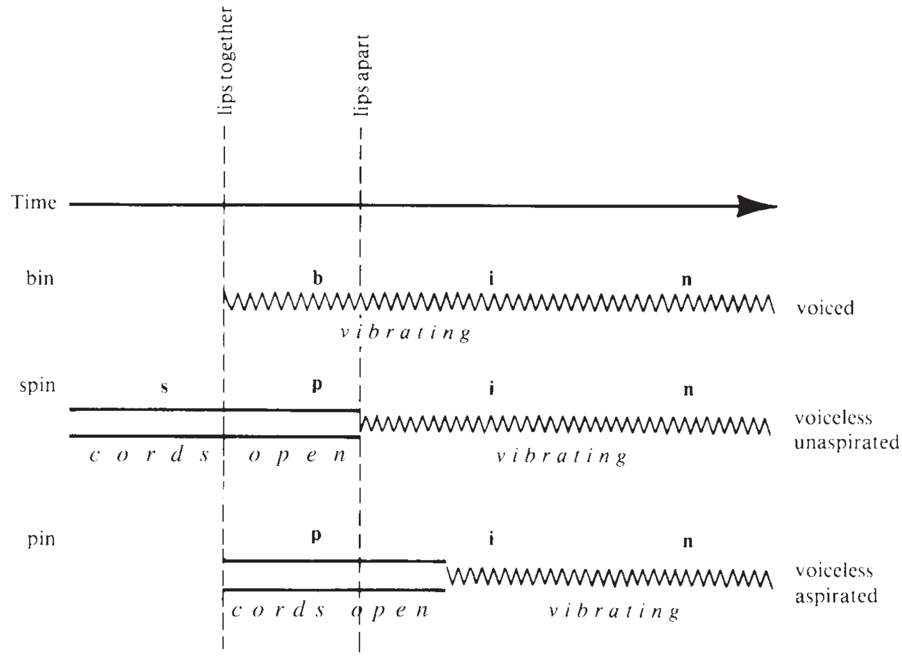


FIGURE 6.2 | Timing of lip closure and vocal-cord vibrations for voiced, voiceless unaspirated, and voiceless aspirated bilabial stops [b], [p], [p^h].

The diagrams in Figure 6.3 show the position of the lips and the velum when [m], [b], and [p] are articulated. The sounds [p], [b], and [m] are produced by stopping the airflow at the lips; [m] and [b] differ from [p] by being voiced; [m] differs from [b] by being nasal. (If you ever wondered why people sound

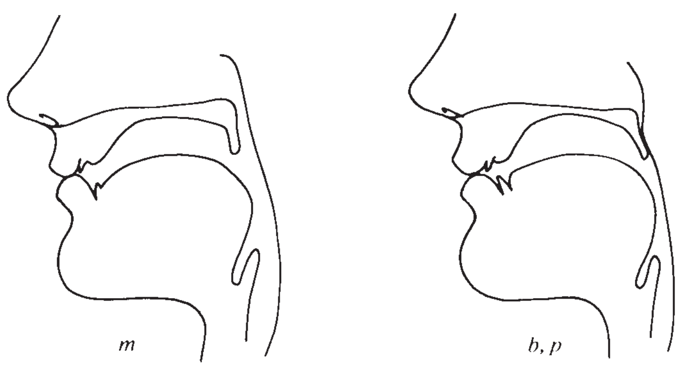


FIGURE 6.3 | Position of lips and velum for *m* (lips together, velum down) and *b*, *p* (lips together, velum up).

TABLE 6.3 | Four Classes of Speech Sounds

	Oral	Nasal
Voiced	b d g	m n ŋ
Voiceless	p t k	*

*Nasal consonants in English are usually voiced. Both voiced and voiceless nasal sounds occur in other languages.

"nasally" when they have a cold, it's because excessive mucous production prevents the velum from closing properly during speech.)

The same oral/nasal difference occurs in *raid* [re**d**] and *rain* [re**n**], *rug* [rʌ**g**] and *rung* [rʌ**ŋ**]. The velum is raised in the production of [d] and [g], preventing the air from flowing through the nose, whereas for [n] and [ŋ] the velum is down, allowing the air out through both the nose and the mouth when the closure is released. The sounds [m], [n], and [ŋ] are therefore nasal sounds, and [b], [d], and [g] are oral sounds.

The presence or absence of these **phonetic features**—nasal and voiced—permit the division of all speech sounds into four classes: voiced, voiceless, nasal, and oral, as shown in Table 6.3.

We now have three ways of classifying consonants: by voicing, by place of articulation, and by nasalization. For example, [p] is a voiceless, bilabial, oral sound; [n] is a voiced, alveolar, nasal sound, and so on.

Stops [p] [b] [m] [t] [d] [n] [k] [g] [ŋ] [tʃ] [dʒ] [ʔ] We are seeing finer and finer distinctions of speech sounds. However, both [t] and [s] are voiceless, alveolar, oral sounds. What distinguishes them? After all, *tack* and *sack* are different words.

Stops are consonants in which the airstream is completely blocked in the *oral* cavity for a short period (tens of milliseconds). All other sounds are **continuants**. The sound [t] is a stop, but the sound [s] is not, and that is what makes them different speech sounds.

- [p], [b], and [m] are *bilabial stops*, with the airstream stopped at the mouth by the complete closure of the lips.
- [t], [d], and [n] are *alveolar stops*; the airstream is stopped by the tongue, making a complete closure at the alveolar ridge.
- [k], [g], and [ŋ] are *velar stops*, with the complete closure at the velum.
- [tʃ] and [dʒ] are *palatal affricates* with complete stop closures. They will be further classified later.
- [ʔ] is a *glottal stop*; the air is completely stopped at the glottis.

We have been discussing the sounds that occur in English. A variety of stop consonants occur in other languages but not in English. For example, in Quechua, spoken in Bolivia and Peru, uvular stops occur, where the back of the tongue is raised and moved rearward to form a complete closure with the uvula. The phonetic symbol [q] denotes the voiceless version of this stop, which is the initial sound in the name of the language "Quechua." The voiced uvular stop [ɢ] also occurs in Quechua.

Fricatives [f] [v] [θ] [ð] [s] [z] [ʃ] [ʒ] [x] [ɣ] [h] In the production of some continuants, the airflow is so severely obstructed that it causes friction, and the sounds are therefore called **fricatives**. The first of the following pairs of fricatives are voiceless; the second voiced.

- [f] and [v] are *labiodental fricatives*; the friction is created at the lips and teeth, where a narrow passage permits the air to escape.
- [θ] and [ð] are *interdental fricatives*, represented by *th* in *thin* and *then*. The friction occurs at the opening between the tongue and teeth.
- [s] and [z] are *alveolar fricatives*, with the friction created at the alveolar ridge.
- [ʃ] and [ʒ] are *palatal fricatives*, and contrast in such pairs as *mission* [mɪʃən] and *measure* [mɛʒər]. They are produced with friction created as the air passes between the tongue and the part of the palate behind the alveolar ridge. In English, the voiced palatal fricative never begins words except for foreign words such as *genre*. The voiceless palatal fricative begins the words *shoe* [ʃu] and *sure* [ʃur] and ends the words *rush* [rʌʃ] and *push* [pʊʃ].
- [x] and [ɣ] denote *velar fricatives*. They are produced by raising the back of the tongue toward, but not quite touching, the velum. The friction is created as air passes through that narrow passage, and the sound is not unlike clearing your throat. These sounds do not commonly occur in English, though in some forms of Scottish English the final sound of *loch* meaning "lake" is [x]. In rapid speech the *g* in *wagon* may be pronounced [ɣ]. The final sound of the composer J. S. Bach's name is also pronounced [x], which is a common sound in German.
- [h] is a glottal fricative. Its relatively weak sound comes from air passing through the open glottis and pharynx.

All fricatives are continuants. Although the airstream is obstructed as it passes through the oral cavity, it is not completely stopped.

Affricates [tʃ] [dʒ] These sounds are produced by a stop closure followed immediately by a gradual release of the closure that produces an effect characteristic of a fricative. The palatal sounds that begin and end the words *church* and *judge* are voiceless and voiced affricates, respectively. Affricates are not continuants because of the initial stop closure.

Liquids [l] [r] In the production of the sounds [l] and [r], there is some obstruction of the airstream in the mouth, but not enough to cause any real constriction or friction. These sounds are **liquids**. They are articulated differently, as described in the earlier alveolar section, but are grouped as a class because they are acoustically similar. Due to that similarity, foreign speakers of English may confuse the two sounds and substitute one for the other. It also accounts for Dennis's confusion in the cartoon.

Glides [j] [w] The sounds [j] and [w], the initial sounds of *you* [ju] and *we* [wi], are produced with little obstruction of the airstream. They are always followed directly by a vowel and do not occur at the end of words (don't be fooled by spelling; words ending in *y* or *w* like *say* and *saw* end in a vowel sound). After articulating [j] or [w], the tongue glides quickly into place for pronouncing the next vowel, hence the term **glide**.

The glide [j] is a palatal sound; the blade of the tongue (the front part minus the tip) is raised toward the hard palate in a position almost identical to that in producing the vowel sound [i] in the word *beat* [bit]. The glide [w] is produced by both rounding the lips and simultaneously raising the back of the tongue toward the velum. It is thus a **labio-velar** glide. Where speakers of English have different pronunciations for the words *which* and *witch*, the labio-velar glide in the first word is voiceless, symbolized as [ʍ] (an upside-down *w*). The position of the tongue and the lips for [w] is similar to that for producing the vowel sound [u] in *suit* [sut].

Approximants In some books the sounds [w], [j], [r], and [l] are alternatively called approximants because the articulators approximate a frictional closeness, but no actual friction occurs. The first three are central approximants, whereas [l] is a lateral approximant.

Although in this chapter we focus on the sounds of English, the IPA has symbols and classifications for all the sounds of the world's languages. For example, many languages have sounds that are referred to as trills, and others have clicks. These are described in the following sections.

Trills and flaps The "*r*"-sound of many languages may be different from the English [r]. A trilled "*r*" is produced by rapid vibrations of an articulator. An alveolar **trill**, as in the Spanish word for dog, *perro*, is produced by vibrating the tongue tip against the alveolar ridge. Its IPA symbol is [r], strictly speaking, though we have co-opted [r] for the English "r." Many French speakers articulate the initial sound of *rouge* as a uvular trill, produced by vibrating the uvula. Its IPA symbol is [ʀ].

Another "*r*"-sound is called a **flap** and is produced by a flick of the tongue against the alveolar ridge. It sounds like a very fast *d*. It occurs in Spanish in words like *pero* meaning "but." It may also occur in British English in words such as *very*. Its IPA symbol is [ɾ]. Most American speakers produce a flap instead of a [t] or [d] in words like *writer* and *rider*, which then sound identical and are spelled phonetically as [raɪɾər].

Clicks These "exotic" sounds are made by moving air in the mouth between various articulators. The sound of disapproval often spelled *tsk* is an alveolar **click** that occurs in several languages of southern Africa such as Zulu. A lateral click, which is like the sound one makes to encourage a horse, occurs in Xhosa. In fact, the 'X' in Xhosa stands for that particular speech sound.

Phonetic Symbols for American English Consonants

We are now capable of distinguishing all of the consonant sounds of English via the properties of voicing, nasality, and place and manner of articulation. For example, [f] is a voiceless, (oral), labiodental fricative; [n] is a (voiced), nasal, alveolar stop. The parenthesized features are usually not mentioned because they are redundant; all sounds are oral unless nasal is specifically mentioned, and all nasals are voiced in English.

Table 6.4 lists the consonants by their phonetic features. The rows stand for manner of articulation and the columns for place of articulation. The entries are sufficient to distinguish all words in English from one another. For example, using [p] for both aspirated and unaspirated voiceless bilabial stops, and [b] for the voiced bilabial stop, suffices to differentiate the words *pit*, *spit*, and *bit*. If a narrower phonetic transcription of these words is desired, the symbol [p^h] can be used to indicate aspiration giving us [p^hɪt], [spɪt], [bɪt]. By "narrow transcription" we mean one that indicates all the phonetic details of a sound, even those that do not affect the word.

Examples of words in which these sounds occur are given in Table 6.5.

TABLE 6.4 | Some Phonetic Symbols for American English Consonants

	Bilabial	Labiodental	Interdental	Alveolar	Palatal	Velar	Glottal
Stop (oral)							
voiceless	p			t		k	ʔ
voiced	b			d		g	
Nasal (voiced)	m			n		ŋ	
Fricative							
voiceless		f	θ	s	ʃ		h
voiced		v	ð	z	ʒ		
Affricate							
voiceless					tʃ		
voiced					dʒ		
Glide							
voiceless	ʍ					ʍ	
voiced	w				j	w	
Liquid (voiced)							
(central)				r			
(lateral)				l			

TABLE 6.5 | Examples of Consonants in English Words

	Bilabial	Labiodental	Interdental	Alveolar	Palatal	Velar	Glottal
Stop (oral)							
voiceless	***p***ie			***t***ie		***k***ite	(ʔ)uh-(ʔ)oh
voiced	***b***uy			***d***ie		***g***uy	
Nasal (voiced)	***m***y			***n***ight		si***ng***	
Fricative							
voiceless		***f***ine	***th***igh	***s***ue	***sh***oe		***h***igh
voiced		***v***ine	***th***y	***z***oo	mea***s***ure		
Affricate							
voiceless					***ch***eese		
voiced					***j***ump		
Glide							
voiceless	***wh***ich					***wh***ich	
voiced	***w***ipe				***y***ou	***w***ipe	
Liquid (voiced)							
(central)				***r***ye			
(lateral)				***l***ye			

Vowels

HIGGINS:	Tired of listening to sounds?
PICKERING:	Yes. It's a fearful strain. I rather fancied myself because I can pronounce twenty-four distinct vowel sounds, but your hundred and thirty beat me. I can't hear a bit of difference between most of them.
HIGGINS:	Oh, that comes with practice. You hear no difference at first, but you keep on listening and presently you find they're all as different as A from B.

GEORGE BERNARD SHAW, *Pygmalion,* 1912

Vowels are produced with little restriction of the airflow from the lungs out the mouth and/or the nose. The quality of a vowel depends on the shape of the vocal tract as the air passes through. Different parts of the tongue may be high or low in the mouth; the lips may be spread or pursed; the velum may be raised or lowered.

Vowel sounds carry pitch and loudness; you can sing vowels or shout vowels. They may be longer or shorter in duration. Vowels can stand alone—they can be produced without consonants before or after them. You can say the vowels of *beat* [bit], *bit* [bɪt], or *boot* [but], for example, without the initial [b] or the final [t], but you cannot say a [b] or a [t] alone without at least a little bit of vowel sound.

Linguists can describe vowels acoustically or electronically. We will discuss that topic in chapter 9. In this chapter we describe vowels by their articulatory features as we did with consonants. Just as we say a [d] is pronounced by raising the tongue tip to the alveolar ridge, we say an [i] is pronounced by raising the body of the tongue toward the palate. With a [b], the lips come together; for an [æ] (the vowel in *cat*) the tongue is low in the mouth with the tongue tip forward, behind the front teeth.

If you watch a side view of an X-ray (that's *-ray*, not *-rated*!) video of someone's tongue moving during speech, you will see various parts of the tongue rise up high and fall down low; at the same time you will see it move forward and backward in the mouth. These are the dimensions over which vowels are produced. We classify vowels according to three questions:

1. How high or low in the mouth is the tongue?
2. How forward or backward in the mouth is the tongue?
3. Are the lips rounded (pursed) or spread?

Tongue Position

The upper two diagrams in Figure 6.4 show that the tongue is high in the mouth in the production of the vowels [i] and [u] in the words *he* [hi] and *who* [hu]. In *he* the front part (but not the tip) of the tongue is raised; in *who* it is the back of the tongue. (Prolong the vowels of these words and try to feel the raised part of your tongue.) These are both *high* vowels, and the [i] is a *high front* vowel while the [u] is a *high back* vowel.

To produce the vowel sound [a] of *hah* [ha], the back of the tongue is low in the mouth, as the lower diagram in Figure 6.4 shows. (The reason a doctor

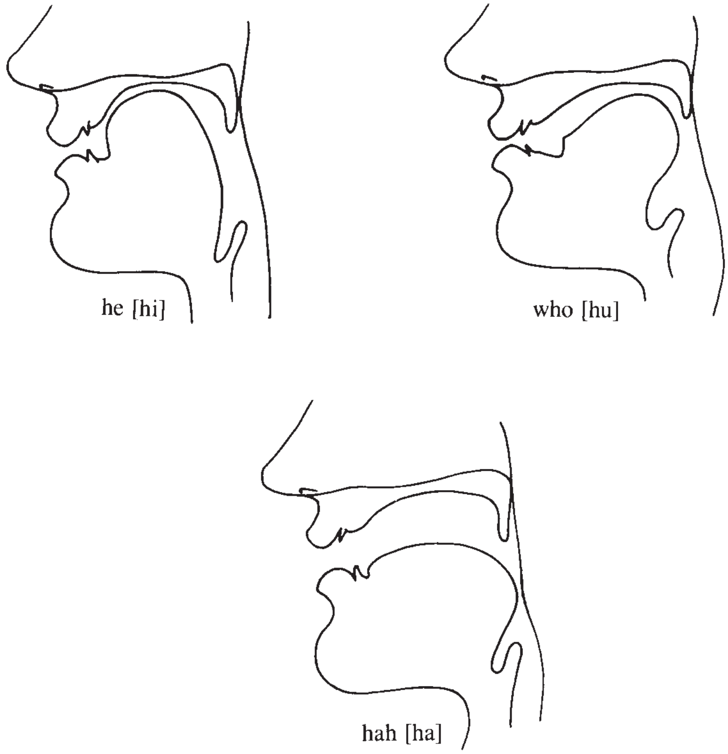


FIGURE 6.4 | Position of the tongue in producing the vowels in he, who, and hah.

examining your throat may ask you to say "ah" is that the tongue is low and easy to see over.) This vowel is therefore a *low back* vowel.

The vowels [ɪ] and [ʊ] in the words *hit* [hɪt] and *put* [pʰʊt] are similar to those in *heat* [hit] and *hoot* [hut] with slightly lowered tongue positions.

The vowel [æ] in *hack* [hæk] is produced with the front part of the tongue low in the mouth, similar to the low vowel [a], but with the front rather than the back part of the tongue lowered. Say "hack, hah, hack, hah, hack, hah . . ." and you should feel your tongue moving forward and back in the low part of your mouth. Thus [æ] is a *low front* vowel.

The vowels [e] and [o] in *bait* [bet] and *boat* [bot] are *mid vowels*, produced by raising the tongue to a position midway between the high and low vowels just discussed. [ɛ] and [ɔ] in the words *bet* [bɛt] and *bore* [bɔr] are also mid vowels, produced with a slightly lower tongue position than [e] and [o], respectively. Here, [e] and [ɛ] are *front*; [o] and [ɔ] are *back*.

To produce the vowel [ʌ] in the word *butt* [bʌt], the tongue is not strictly high nor low, front nor back. It is a lower midcentral vowel. The schwa vowel [ə], which occurs as the first sound in *about* [əbaʊt], or the final sound of *sofa* [sofə], is also articulated with the tongue in a more or less neutral position between the extremes of high/low, front/back. The schwa is used mostly to represent unstressed vowels. (We will discuss stress later.)

Lip Rounding

Vowels also differ as to whether the lips are rounded or spread. The back vowels [u], [ʊ], [o], and [ɔ] in *boot*, *put*, *boat*, and *bore* are the only **rounded vowels** in English. They are produced with pursed or rounded lips. You can get a feel for the rounding by prolonging the word *who*, as if you were an owl: *whoooooooooo*. Now pose for the camera and say *cheese*, only say it with a prolonged vowel: *cheeeeeeeeeeeese*. The high front [i] in *cheese* is unrounded, with the lips in the shape of a smile, and you can feel it or see it in a mirror. The low vowel [a] in the words *bar*, *bah*, and *aha* is the only (American) English back vowel that occurs without lip rounding.

Other languages may differ in whether or not they have rounded vowels. French and Swedish, for example, have *front* rounded vowels, which English lacks. English also lacks a high back *unrounded* vowel, but this sound occurs in Mandarin Chinese, Japanese, and the Cameroonian language FeʔFeʔ, among others. The IPA symbol for this vowel is [ɯ], and to show that roundedness is important, we note that in Mandarin Chinese the unrounded [sɯ] means "four," but the round [su] (like *sue*) means "speed."

Figure 6.5 shows the vowels based on tongue "geography." The position of the vowel relative to the horizontal axis is a measure of the vowel's front/back dimension. Its position relative to the vertical axis is a measure of tongue height. For example, we see that [i] is a high front vowel, [o] is a midback (rounded) vowel, and [ʌ] is a lower midcentral vowel, tending toward backness.

Diphthongs

A **diphthong** is a sequence of two vowel sounds. Diphthongs are present in the phonetic inventory of many languages, including English. The vowels we have studied so far are simple vowels, called **monophthongs**. The vowel sound in the word *bite* [baɪt], however, is the [a] vowel sound of *father* followed rapidly by the

Part of the Tongue Involved

Tongue Height	FRONT ⟵	CENTRAL	⟶ BACK		
HIGH	**i** beet		boot	**u**	
↑	**ɪ** bit		put	**ʊ**	↲ ROUNDED
MID	**e** bait		boat	**o**	
	ɛ bet	**ə** Rosa			
↓		**ʌ** butt	bore	**ɔ**	
LOW	**æ** bat		bomb	**a**	

FIGURE 6.5 | Classification of American English vowels.

[ɪ] sound of *fit*, resulting in the diphthong [aɪ]. Similarly, the vowel in *bout* [baʊt] is [a] followed by the [ʊ] sound of *put*, resulting in [aʊ]. Another diphthong that occurs in English is the vowel sound in *boy* [bɔɪ], which is the vowel [ɔ] of *bore* followed by [ɪ], resulting in [ɔɪ]. The pronunciation of any of these diphthongs may vary from our description because of the diversity of English speakers.

To some extent the midvowels [e] and [o] may be diphthongized, especially in American English, though not in other varieties such as Irish English. Many linguists therefore denote these sounds as [eɪ] and [oʊ] as a narrower transcription. In this book we will stay with [e] and [o] for these vowel sounds.

Nasalization of Vowels

Vowels, like consonants, can be produced with a raised velum that prevents the air from escaping through the nose, or with a lowered velum that permits air to pass through the nasal passage. When the nasal passage is blocked, *oral* vowels result; when the nasal passage is open, *nasal* (or *nasalized*) vowels result. In English, nasal vowels occur for the most part before nasal consonants in the same syllable, and oral vowels occur in all other places.

The words *bean*, *bone*, *bingo*, *boom*, *bam*, and *bang* are examples of words that contain nasalized vowels. To show the nasalization of a vowel in a narrow phonetic transcription, an extra mark called a **diacritic**—the symbol ~ (tilde) in this case—is placed over the vowel, as in *bean* [bĩn] and *bone* [bõn].

In languages like French, Polish, and Portuguese, nasalized vowels occur without nasal consonants. The French word meaning “sound” is *son* [sõ]. The *n* in the spelling is not pronounced but indicates that the vowel is nasal.

Tense and Lax Vowels

Figure 6.5 shows that the vowel [i] has a slightly higher tongue position than [ɪ]. This is also true for [e] and [ɛ], [u] and [ʊ], and [o] and [ɔ]. The first vowel in each pair is generally produced with greater tension of the tongue muscles than its counterpart, and they are often a little longer in duration. These vowels can be distinguished by the features **tense** and **lax**, as shown in the first four rows of the following:

Tense		**Lax**	
i	beat	ɪ	bit
e	bait	ɛ	bet
u	boot	ʊ	put
o	boat	ɔ	bore
a	hah	ɔɪ	boy
aɪ	high	æ	hat
aʊ	how	ʌ	hut
		ə	about

Additionally, [a] is a tense vowel as are the diphthongs [aɪ] and [aʊ], but the diphthong [ɔɪ] is lax as are [æ], [ʌ], and of course [ə]. Tense vowels may occur at the ends of words: [si], [se], [su], [so], [pa], [saɪ], and [haʊ] represent the English words *see*, *say*, *sue*, *sew*, *pa*, *sigh*, and *how*. Lax vowels mostly do not occur at the ends of words; [sɪ], [sɛ], [sʊ], [sæ], [sʌ], and [sə] are not possible words in English. (The one exception to this generalization is lax [ɔ] and its diphthong [ɔɪ], which occur in words such as [sɔ] (*saw*) and [sɔɪ] (*soy*).)

Different (Tongue) Strokes for Different Folks

The vowels in Figure 6.5 do not represent all the vowels of all English speakers. They may not represent your particular vowel set. If you speak British English, there's a good chance that you have a low, back, rounded vowel in the word *hot* that the vowel chart lacks. Canadian English speakers pronounce the vowel in words like *bite* as [ʌɪ] rather than [aɪ]. Consonants, too, vary from region to region, if not from person to person. One person's "alveolar" stops may technically be dental stops, with the tongue hard behind the upper front teeth. In Britain, the substitution of the glottal stop where an American might use a [t] or [d] is common. It's very much the case throughout the English-speaking world that, as the old song goes, "I say '*tomayto*' [təmeto], you say '*tomahto*' [təmato]," and we lovers of language say "vive la différence."

Major Phonetic Classes

Biologists divide life forms into larger and smaller classes. They may distinguish between animals and plants; or within animals, between vertebrates and invertebrates; and within vertebrates, between mammals and reptiles, and so on.

Linguists describe speech sounds similarly. All sounds are consonant sounds or vowel sounds. Within consonants, all are voiced or unvoiced, and so on. All the classes of sounds described so far in this chapter combine to form larger, more general classes that are important in the patterning of sounds in the world's languages.

Noncontinuants and Continuants

Stops and affricates belong to the class of **noncontinuants**. There is a total obstruction of the airstream in the *oral cavity*. Nasal stops are included although air does flow continuously out the nose. All other consonants, and all vowels, are continuants, in which the stream of air flows continuously out of the mouth.

Obstruents and Sonorants

The non-nasal stops, the fricatives, and the affricates form a major class of sounds called **obstruents**. The airstream may be fully obstructed, as in non-nasal stops and affricates, or nearly fully obstructed, as in the production of fricatives.

Sounds that are not obstruents are **sonorants**. Vowels, nasal stops [m,n,ŋ], liquids [l,r], and glides [j,w] are all sonorants. They are produced with much less obstruction to the flow of air than the obstruents, which permits the air to resonate. Nasal stops are sonorants because, although the air is blocked in the mouth, it continues to resonate in the nasal cavity.

Consonantal

Obstruents, nasal stops, liquids, and glides are all consonants. There is some degree of restriction to the airflow in articulating these sounds. With glides ([j,w]), however, the restriction is minimal, and they are the most vowel-like, and the least consonant-like, of the consonants. Glides are even referred to as "semivowels" or "semi-consonants" in some books. In recognition of this fact linguists place the obstruents, nasal stops, and liquids in a subclass of consonants called **consonantal**, from which the glides are excluded.

Here are some other terms used to form subclasses of consonantal sounds. These are not exhaustive, nor are they mutually exclusive (e.g., the interdentals belong to two subclasses). A full course in phonetics would note further classes that we omit.

Labials [p] [b] [m] [f] [v] [w] [ʍ] Labial sounds are those articulated with the involvement of the lips. They include the class of *bilabial* sounds [p] [b] and [m], the *labiodentals* [f] and [v], and the *labiovelars* [w] and [ʍ].

Coronals [θ] [ð] [t] [d] [n] [s] [z] [ʃ] [ʒ] [tʃ] [dʒ] [l] [r] Coronal sounds are articulated by raising the tongue blade. Coronals include the *interdentals* [θ] [ð], the *alveolars* [t] [d] [n] [s] [z], the *palatals* [ʃ] [ʒ], the *affricates* [tʃ] [dʒ], and the *liquids* [l] [r].

Anteriors [p] [b] [m] [f] [v] [θ] [ð] [t] [d] [n] [s] [z] Anterior sounds are consonants produced in the front part of the mouth, that is, from the alveolar area forward. They include the labials, the interdentals, and the alveolars.

Sibilants [s] [z] [ʃ] [ʒ] [tʃ] [dʒ] Another class of consonantal sounds is characterized by an acoustic rather than an articulatory property of its members. The friction created by sibilants produces a hissing sound, which is a mixture of high-frequency sounds.

Syllabic Sounds

Sounds that may function as the core of a syllable possess the feature **syllabic**. Clearly vowels are syllabic, but they are not the only sound class that anchors syllables.

Liquids and nasals can also be syllabic, as shown by the words *dazzle* [dæzl̩], *faker* [fekr̩], *rhythm* [rɪðm̩], and *button* [bʌtn̩]. (The diacritic mark under the [l̩], [r̩], [m̩], and [n̩] is the notation for syllabic.) Placing a schwa [ə] before the syllabic liquid or nasal also shows that these are separate syllables. The four words could be written as [dæzəl], [fekər], [rɪðəm], and [bʌtən]. We will use this transcription. Similarly, the vowel sound in words like *bird* and *verb* are sometimes written as a syllabic *r*, [br̩d] and [vr̩b]. For consistency we shall transcribe these words using the schwa—[bərd] and [vərb]—the only instances where a schwa represents a stressed vowel.

Obstruents and glides are never syllabic sounds because they are always accompanied by a vowel, and that vowel functions as the syllabic core.

Prosodic Features

Length, *pitch*, and *stress* (or "accent") are **prosodic**, or **suprasegmental**, features. They are features *over and above* the segmental values such as place or manner of articulation, thus the "supra" in *suprasegmental*. The term *prosodic* comes from poetry, where it refers to the metrical structure of verse. One of the essential characteristics of poetry is the placement of stress on particular syllables, which defines the versification of the poem.

Speech sounds that are identical in their place or manner features may differ in length (duration). Tense vowels are slightly longer than lax vowels, but only by a few milliseconds. However, in some languages when a vowel is prolonged to around twice its normal length, it can make a difference between words. In Japanese the word *biru* [biru] with a regular *i* means "building," but with the *i* doubled in length as in *biiru*, spelled phonetically as [biːru], the meaning is "beer." (The colon-like ː is the IPA symbol for segment length or doubling.) In Japanese vowel length can make the difference between two words.

Japanese, and many other languages such as Finnish and Italian, have long consonants that may contrast words. When a consonant is long, or doubled, either the closure or obstruction is prolonged. Pronounced with a short *k*, the word *saki* [saki] means "ahead" in Japanese; pronounced with a long *k*—prolonging the velar closure—the word *sakki* [sakːi] means "before." In effect, the extended silence of the prolonged closure is meaningful in these languages.

English is not a language in which vowel or consonant length can change a word. You might say "puleeeeeze" to emphasize your request, but the word is still *please*. You may also say in English "Whatttttt a dump!" to express your dismay at a hotel room, prolonging the *t*-closure, but the word *what* is not changed.

When we speak, we also change the **pitch** of our voice. The pitch depends on how fast the vocal cords vibrate; the faster they vibrate, the higher the pitch. If the larynx is small, as in women and children, the shorter vocal cords vibrate faster and the pitch is higher, all other things being equal. That is why women and children have higher-pitched voices than men, in general. When we discuss tone languages in the next section, we will see that pitch may affect the meaning of a word.

In many languages, certain syllables in a word are louder, slightly higher in pitch, and somewhat longer in duration than other syllables in the word. They are **stressed** syllables. For example, the first syllable of *digest*, the noun meaning "summation of articles," is stressed, whereas in *digest*, the verb meaning "to absorb food," the second syllable receives greater stress. Stress can be marked in several ways: for example, by putting an accent mark over the stressed vowel in the syllable, as in *dígest* versus *digést*.

English is a "stress-timed" language. In general, at least one syllable is stressed in an English word. French is not a stress-timed language. The syllables have approximately the same loudness, length, and pitch. It is a "syllable-timed" language. When native English speakers attempt to speak French, they often stress syllables, so that native French speakers hear French with "an English accent." When French speakers speak English, they fail to put stress where a native English speaker would, and that contributes to what English speakers call a "French accent."

Tone and Intonation

We have already seen how length and stress can make sounds with the same segmental properties different. In some languages, these differences make different words, such as the two *digests*. Pitch, too, can make a difference in certain languages.

Speakers of all languages vary the pitch of their voices when they talk. The effect of pitch on a syllable differs from language to language. In English, it doesn't matter whether you say *cat* with a high pitch or a low pitch. It will still mean "cat." But if you say [ba] with a high pitch in Nupe (a language spoken in Nigeria), it will mean "to be sour," whereas if you say [ba] with a low pitch, it will mean "to count." Languages that use the pitch of individual vowels or syllables to contrast meanings of words are called **tone languages**.

More than half the world's languages are tone languages. There are more than one thousand tone languages spoken in Africa alone. Many languages of Asia, such as Mandarin Chinese, Burmese, and Thai, are tone languages. In Thai, for example, the same string of segmental sounds represented by [naː] will mean different things if one says the sounds with a low pitch, a midpitch, a high pitch, a falling pitch from high to low, or a rising pitch from low to high. Thai therefore has five linguistic tones, as illustrated as follows:

(Diacritics are used to represent distinctive tones in the phonetic transcriptions.)

[ˋ]	L	low tone	[nàː]	"a nickname"
[ˉ]	M	mid tone	[nāː]	"rice paddy"
[ˊ]	H	high tone	[náː]	"young maternal uncle or aunt"
[ˆ]	HL	falling tone	[nâː]	"face"
[ˇ]	LH	rising tone	[nǎː]	"thick"

There are two kinds of tones. If the pitch is level across the syllable, we have a **register tone**. If the pitch changes across the syllable, whether from high to low or vice versa, we have a **contour tone**. Thai has three level and two contour tones. Commonly, tone languages will have two or three register tones and possibly one or two contour tones.

In a tone language it is not the absolute pitch of the syllables that is important but the relations among the pitches of different syllables. Thus men, women, and children with differently pitched voices can still communicate in a tone language.

Tones generally have a *lexical* function, that is, they make a difference between words. But in some languages tones may also have a *grammatical* function, as in Edo spoken in midwestern Nigeria. The tone on monosyllabic verbs followed by a direct object indicates the tense and transitivity of the verb. Low tone means present tense, transitive; high tone means past tense, transitive, as illustrated here:

òtà gbɛ̏	èbé
Ota write+PRES+TRANS	book
Ota writes a book.	
òtà gbɛ̋	èbé
Ota write+PAST+TRANS	book
Ota wrote a book.	

In many tone languages we find a continual lowering of the absolute pitch on the tones throughout an utterance. The *relative* pitches remain the same, however. In the following sentence in Twi, spoken in Ghana, the relative pitch rather than the absolute pitch is important.

"Kofi searches for a little food for his friend's child."

Kòfí	hwɛ̀hwɛ́	áduàŋ	kàkrá	mà	ǹ'	ádàmfò	bá
L H	L H	H L	L H	L	L	H L L	H

The actual pitches of these syllables would be rather different from each other, as shown in the following musical staff-like figure (the higher the number, the higher the pitch):

7		fí											
6				hwɛ́	á								
5	Kò							krá					
4			hwɛ̀								á		
3						duàŋ	kà						bá
2									mà	ǹ'			
1												dàmfò	

The lowering of the pitch is called **downdrift**. In languages with downdrift, a high tone that occurs after a low tone, or a low tone after a high tone, is lower in pitch than the preceding similarly marked tone. Notice that the first high tone in the sentence is given the pitch value 7. The next high tone (which occurs after an intervening low tone) is 6; that is, it is lower in pitch than the first high tone.

This example shows that in analyzing tones, just as in analyzing segments, all the physical properties need not be considered. Only essential features are important in language—in this case, whether the tone is high or low *in relation to the other pitches*. The absolute pitch is inessential. Speakers of tone languages are able to ignore the linguistically irrelevant absolute pitch differences between individual speakers and attend to the linguistically relevant relative pitch differences, much like speakers of non-tone languages ignore pitch altogether.

Languages that are not tone languages, such as English, are called **intonation** languages. The **pitch contour** of the utterance varies, but in an intonation language as opposed to a tone language, pitch is not used to distinguish words from each other. Intonation may affect the meaning of whole sentences, so that *John is here* spoken with falling pitch at the end is interpreted as a statement, but with rising pitch at the end, a question. We'll have more to say about intonation in the next chapter.

Phonetic Symbols and Spelling Correspondences

"Why do I have to keep writin' in these K's when they don't make any noise anyway?"

Table 6.6 shows the sound/spelling correspondences for American English consonants and vowels. (We have not given all possible spellings for every sound; however, these examples should help you relate English orthography to the English sound system.) We have included the symbols for the voiceless aspirated stops to illustrate that what speakers usually consider one sound—for example *p*—may occur phonetically as two sounds, [p], [p^h].

Some of these pronunciations may differ from your own. For example, you may (or may not) pronounce the words *cot* and *caught* identically. In the form of English described here, *cot* and *caught* are pronounced differently, so *cot* is one of the examples of the vowel sound [a] as in *car*. *Caught* illustrates the vowel [ɔ] as in *core*.

There will be other differences, too, because English is a worldwide language and is spoken in many forms in many countries. The English examples used in this book are a compromise among several varieties of American English, but this should not deter you. Our purpose is to teach phonetics in general, and to show you how phonetics might describe the speech sounds of any of the world's languages with the proper symbols and diacritics. We merely use American English for illustration, and we provide the major phonetic symbols for American English to show you how such symbols may be used to describe the phonetics of any of the world's languages.

TABLE 6.6 | Phonetic Symbol/English Spelling Correspondences

Consonants	
Symbol	**Examples**
p	s**p**it ti**p** La**pp**
p^h	**p**it **p**rick **p**laque a**pp**ear
b	**b**it ta**b** **b**rat **b**u**bb**le
m	**m**itt ta**m** s**m**ack E**mm**y ca**m**p co**mb**
t	s**t**ick pi**t** kiss**ed** wri**t**e
t^h	**t**ick in**t**end **pt**erodactyl a**tt**ack
d	**D**ick ca**d** **d**rip love**d** ri**d**e
n	**n**ick ki**n** s**n**ow **mn**emonic **Gn**ostic **pn**eumatic **kn**ow
k	s**k**in sti**ck** s**c**at criti**que** el**k**
k^h	**c**url **k**in **ch**arisma **c**ritic me**ch**anic **c**lose
g	**g**irl bur**g** lon**g**er Pittsbur**gh**
ŋ	si**ng** thi**n**k fi**n**ger
f	**f**at **ph**iloso**ph**y **f**lat **ph**logiston co**ff**ee ree**f** cou**gh**
v	**v**at do**ve** gra**v**el
s	**s**ip **s**kip **ps**ychology pa**ss** pat**s** democra**c**y **sc**issors fa**s**ten de**c**eive de**sc**ent
z	**z**ip ja**zz** ra**z**or pad**s** kisse**s** **X**erox de**s**ign la**z**y sci**ss**ors mai**ze**
θ	**th**igh **th**rough wra**th** e**th**er Ma**tth**ew
ð	**th**y **th**eir wea**th**er la**the** ei**th**er
ʃ	**sh**oe mu**sh** mi**ss**ion na**ti**on fi**sh** gla**ci**al **s**ure
ʒ	mea**s**ure vi**s**ion a**z**ure ca**s**ual deci**s**ion rou**g**e
tʃ	ma**tch** ri**ch** righ**t**eous
$tʃ^h$	**ch**oke **Tch**aikovsky dis**ch**arge
dʒ	**j**u**dg**e mi**dg**et **G**eor**g**e ma**g**istrate resi**d**ual
l	**l**eaf fee**l** ca**ll** sing**l**e
r	**r**eef fea**r** Pa**r**is singe**r**
j	**y**ou **y**es f**eu**d **u**se
w	**w**itch s**w**im q**u**een
ʍ	**wh**ich **wh**ere **wh**ale (for speakers who pronounce *which* differently than *witch*)
h	**h**at **wh**o **wh**ole re**h**ash
ʔ	bo**tt**le bu**tt**on glo**tt**al (for some speakers), (**ʔ**)uh-(**ʔ**)oh
ɾ	wri**t**er, ri**d**er, la**tt**er, la**dd**er

TABLE 6.6 | (Continued)

	Vowels
i	b**ee**t b**ea**t b**e** rec**ei**ve k**e**y bel**ie**ve am**oe**ba p**eo**ple C**ae**sar Vasel**i**ne ser**e**ne
ɪ	b**i**t cons**i**st **i**njury b**i**n w**o**men
e	g**a**te b**ai**t r**ay** gr**ea**t **ei**ght g**au**ge gr**ey**hound
ɛ	b**e**t ser**e**nity s**ay**s gu**e**st d**ea**d s**ai**d
æ	p**a**n **a**ct l**au**gh comr**a**de
u	b**oo**t l**u**te wh**o** s**ew**er thr**ough** t**o** t**oo** t**wo** m**o**ve L**ou** tr**ue** s**ui**t
ʊ	p**u**t f**oo**t b**u**tcher c**ou**ld
ʌ	c**u**t t**ou**gh am**o**ng **o**ven d**oe**s c**o**ver fl**oo**d
o	c**oa**t g**o** b**eau** gr**ow** th**ough** t**oe** **ow**n s**ew**
ɔ	c**augh**t st**al**k c**o**re s**aw** b**a**ll **aw**e **au**to
a	c**o**t f**a**ther p**al**m s**e**rgeant **ho**nor h**o**spital mel**o**dic
ə	sof**a** **a**lone symph**o**ny s**u**ppose mel**o**dy b**i**rd v**e**rb th**e**
aɪ	b**i**te s**igh**t b**y** b**uy** d**ie** d**ye** **ai**sle ch**oi**r l**i**ar **is**land h**ei**ght s**ig**n
aʊ	ab**ou**t br**ow**n d**ou**bt c**ow**ard s**au**erkraut
ɔɪ	b**oy** **oi**l

The "Phonetics" of Signed Languages

Earlier we noted that signed languages, like all other human languages, are governed by a grammatical system that includes syntactic and morphological rules. Signed languages are like spoken languages in another respect; signs can be broken down into smaller units analogous to the phonetic features discussed in this chapter. Just as spoken languages distinguish sounds according to place and manner of articulation, so signed languages distinguish signs according to the place and manner in which the signs are articulated by the hands. The signs of ASL, for example, are formed by three major features:

1. *The* ***configuration*** *of the hand (handshape)*
2. *The* ***movement*** *of the hand and arms toward or away from the body*
3. *The* ***location*** *of the hands in signing space*

To illustrate how these features define a sign, the ASL sign meaning "arm" is a flat hand, moving to touch the upper arm. It has three features: *flat hand*, *motion upward*, *upper arm*.

ASL has over 30 handshapes. But not all signed languages share the same handshapes, just as not all spoken languages share the same places of articulation (French lacks interdental stops; English lacks the uvular trill of French). For example, the T handshape of ASL does not occur in the European signed languages. Similarly, Chinese Sign Language has a handshape formed with an open hand with all fingers extended except the ring finger. ASL does not have this handshape.

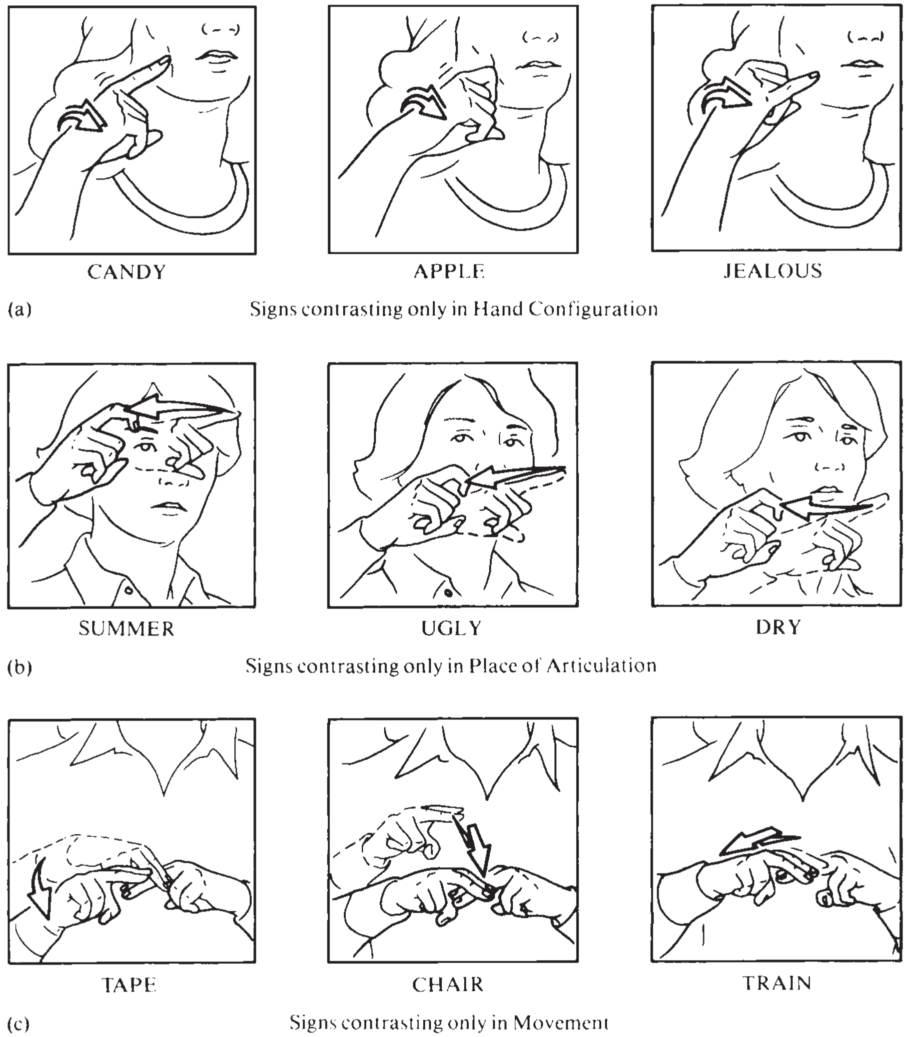


FIGURE 6.6 | Minimal contrasts illustrating major formational parameters.
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Movement can be either straight or in an arc. Secondary movements include wiggling or hooking fingers. Signs can also be unidirectional (moving in one direction) or bidirectional (moving in one direction and then back again). The location of signs is defined relative to the body or face and by whether the sign involves vertical movement, horizontal movement, or movement to or away from the body.

As in spoken language, a change along one of these parameters can result in different words. Just as a difference in voicing or tone can result in different words in a spoken language, a change in location, handshape, or movement can result in different signs with different meanings. For example, the sign meaning "father" differs from the sign meaning "fine" only in the place of articulation. Both signs are formed with a spread five-finger handshape, but the thumb touches the signer's forehead in "father" and it touches his chest in "fine."

Figure 6.6 illustrates several sets of words that differ from each other along one or another of the phonetic parameters of ASL.

There are two-handed and one-handed signs. One-handed signs are formed with the speaker's dominant hand, whether left or right. Just as spoken languages have features that do not distinguish different words (e.g., consonant length in English), in ASL (and probably all signed languages), a difference in handedness does not affect the meaning of the sign.

The parallels that exist in the organization of sounds and signs are not surprising when we consider that similar cognitive systems underlie both spoken and signed languages.

Summary

The science of speech sounds is called **phonetics**. It aims to provide the set of properties necessary to describe and distinguish all the sounds in human languages throughout the world.

When we speak, the physical sounds we produce are continuous stretches of sound, which are the physical representations of strings of discrete linguistic **segments**. Knowledge of a language permits one to separate continuous speech into individual sounds and words.

The discrepancy between spelling and sounds in English and other languages motivated the development of phonetic alphabets in which one letter corresponds to one sound. The major **phonetic alphabet** in use is the **International Phonetic Alphabet (IPA)**, which includes modified Roman letters and **diacritics**, by means of which the sounds of all human languages can be represented. To distinguish between **orthography** (spelling) and **phonetic transcriptions**, we write the latter between square brackets, as in [fə̃nɛɾɪk] for *phonetic*.

All English speech sounds come from the movement of lung air through the vocal tract. The air moves through the **glottis** (i.e., between the vocal cords), up the pharynx, through the oral (and possibly the nasal) cavity, and out the mouth or nose.

Human speech sounds fall into classes according to their phonetic properties. All speech sounds are either **consonants** or **vowels**, and all consonants are either **obstruents** or **sonorants**. Consonants have some obstruction of the airstream in the vocal tract, and the location of the obstruction defines their **place of articulation**, some of which are **bilabial**, **labiodental**, **alveolar**, **palatal**, **velar**, **uvular**, and **glottal**.

Consonants are further classified according to their **manner of articulation**. They may be **voiced** or **voiceless**, **oral** or **nasal**, long or short. They may be **stops**, **fricatives**, **affricates**, **liquids**, or **glides**. During the production of voiced sounds, the vocal cords are together and vibrating, whereas in voiceless sounds they are apart and not vibrating. Voiceless sounds may also be **aspirated** or **unaspirated**. In the production of aspirated sounds, the vocal cords remain apart for a brief time after the stop closure is released, resulting in a puff of air at the time of the release. Consonants may be grouped according to certain features to form larger classes such as **labials**, **coronals**, **anteriors**, and **sibilants**.

Vowels form the nucleus of syllables. They differ according to the position of the tongue and lips: high, mid, or low tongue; front, central, or back of the tongue; rounded or unrounded lips. The vowels in English may be **tense** or **lax**. Tense vowels are slightly longer in duration than lax vowels. Vowels may also be **stressed** (longer, higher in pitch, and louder) or **unstressed**. Vowels, like consonants, may be nasal or oral, although most vowels in all languages are oral.

Length, pitch, loudness, and stress are **prosodic**, or **suprasegmental**, features. They are imposed over and above the segmental values of the sounds in a syllable. In many languages, the pitch of the vowel in the syllable is linguistically significant. For example, two words with identical segments may contrast in meaning if one has a high pitch and another a low pitch. Such languages are **tone languages**. There are also **intonation** languages in which the rise and fall of pitch may contrast meanings of sentences. In English the statement *Mary is a teacher* will end with a fall in pitch, but in the question *Mary is a teacher?* the pitch will rise.

English and other languages use stress to distinguish different words, such as *cóntent* and *contént*. In some languages, long vowels and long consonants contrast with their shorter counterparts. Thus *biru* [biru] and *biiru* [biːru], *saki* [saki] and *sakki* [sakːi] are different words in Japanese.

Diacritics to specify such properties as nasalization, length, stress, and tone may be combined with the phonetic symbols for more detailed phonetic transcriptions. A phonetic transcription of *men* would use a tilde diacritic to indicate the nasalization of the vowel: [mɛ̃n].

In sign languages there are "phonetic" features analogous to those of spoken languages. In ASL these are handshape, movement, and location. As in spoken languages, changes along one of these parameters can result in a new word. In the following chapter, we discuss this meaning-changing property of features in much greater detail.

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7

Phonology: The Sound Patterns of Language

Speech is human, silence is divine, yet also brutish and dead; therefore we must learn both arts.

THOMAS CARLYLE (1795–1881)

Phonology is the study of telephone etiquette.

A HIGH SCHOOL STUDENT

What do you think is greater: the number of languages in the world, or the number of speech sounds in all those languages? Well, there are thousands of languages, but only hundreds of speech sounds, some of which we examined in the previous chapter. Even more remarkable, only a few dozen features, such as *voicing* or *bilabial* or *stop*, are needed to describe every speech sound that occurs in every human language.

That being the case, why, you may ask, do languages sound so different? One reason is that the sounds form different patterns in different languages. English has nasalized vowels, but only in syllables with nasal consonants. French puts nasal vowels anywhere it pleases, with or without nasal consonants. The speech sound that ends the word *song*—the velar nasal [ŋ]—cannot begin a word in English, but it can in Vietnamese. The common Vietnamese name spelled *Nguyen* begins with this sound, and the reason few of us can pronounce this name correctly is that it doesn't follow the English pattern.

The fact that a sound such as [ŋ] is difficult for an English speaker to pronounce at the beginning of a word, but easy for a Vietnamese speaker, means that there is no general notion of "difficulty of articulation" that can explain all of the sound patterns of particular languages. Rather, the ability to pronounce particular sounds depends on the speaker's unconscious knowledge of the sound patterns of her own language or languages.

The study of how speech sounds form patterns is **phonology**. These patterns may be as simple as the fact that the velar nasal cannot begin a syllable in English, or as complex as why *g* is silent in *sign* but is pronounced in the related word *signature*. To see that this is a pattern and not a one-time exception, just consider the slippery *n* in *autumn* and *autumn*nal, or the *b* in *bomb* and *bom*bard.

The word *phonology* refers both to the linguistic knowledge that speakers have about the sound patterns of their language and to the description of that knowledge that linguists try to produce. Thus it is like the way we defined *grammar*: your mental knowledge of your language, or a linguist's description of that knowledge.

Phonology tells you what sounds are in your language and which ones are foreign; it tells you what combinations of sounds could be an actual word, whether it is (*black*) or isn't (*blick*), and what combination of sounds could not be an actual word (*lbick). It also explains why certain phonetic features are important to identifying a word, for example voicing in English as in *pat* versus *bat*, while other features, such as aspiration in English, are not crucial to identifying a word, as we noted in the previous chapter. And it also allows us to adjust our pronunciation of a morpheme, for example the past or plural morpheme, to suit the different phonological contexts that it occurs in, as we will discuss shortly.

In this chapter we'll look at some of the phonological processes that you know, that you acquired as a child, and that yet may initially appear to you to be unreasonably complex. Keep in mind that we are only making explicit what you already know, and its complexity is in a way a wondrous feature of your own mind.

The Pronunciation of Morphemes

> The *t* is silent, as in Harlow.
>
> **MARGOT ASQUITH,** referring to her name being mispronounced by the actress Jean Harlow

Knowledge of phonology determines how we pronounce words and the parts of words we call morphemes. Often, certain morphemes are pronounced differently depending on their context, and we will introduce a way of describing this variation with phonological rules. We begin with some examples from English, and then move on to examples from other languages.

The Pronunciation of Plurals

Nearly all English nouns have a plural form: *cat/cats*, *dog/dogs*, *fox/foxes*. But have you ever paid attention to how plural forms are *pronounced*? Listen to a native speaker of English (or yourself if you are one) pronounce the plurals of the following nouns.

A	B	C	D
cab	cap	bus	child
cad	cat	bush	ox
bag	back	buzz	mouse
love	cuff	garage	criterion
lathe	faith	match	sheep
cam		badge	
can			
call			
bar			
spa			
boy			

The final sound of the plural nouns from Column A is a [z]—a *voiced* alveolar fricative. For column B the plural ending is an [s]—a *voiceless* alveolar fricative. And for Column C it's [əz]. Here is our first example of a morpheme with different pronunciations. Note also that there is a regularity in columns A, B, and C that does not exist in D. The plural forms in D—*children*, *oxen*, *mice*, *criteria*, and *sheep*—are a hodge-podge of special cases that are memorized individually when you acquire English, whether natively or as a second language. This is because there is no way to predict the plural forms of these words.

How do we know how to pronounce this plural morpheme? The spelling, which adds *s* or *es*, is misleading—not a *z* in sight—yet if you know English, you pronounce it as we indicated. When faced with this type of question, it's useful to make a chart that records the phonological environments in which each variant of the morpheme is known to occur. (The more technical term for a variant is **allomorph**.) Writing the words from the first three columns in broad phonetic transcription, we have our first chart for the plural morpheme.

Allomorph	Environment
[z]	After [kæb], [kæd], [bæg], [lʌv], [leð], [kæm], [kæn], [bæŋ], [kɔl], [bar], [spa], [bɔɪ], e.g., [kæbz], [kædz] . . . [bɔɪz]
[s]	After [kæp], [kæt], [bæk], [kʌf], [feθ], e.g., [kæps], [kæts] . . . [feθs]
[əz]	After [bʌs], [bʊʃ], [bʌz], [gəraʒ], [mætʃ], [bædʒ], e.g., [bʌsəz], [bʊʃəz] . . . [bædʒəz]

To discover the pattern behind the way plurals are pronounced, we look for some property of the environment associated with each group of allomorphs. For example, what is it about [kæb] or [lʌv] that determines that the plural morpheme will take the form [z] rather than [s] or [əz]?

To guide our search, we look for **minimal pairs** in our list of words. A minimal pair is two words with different meanings that are identical except for one sound segment that occurs in the same place in each word. For example, *cab* [kæb] and *cad* [kæd] are a minimal pair that differ only in their final segments, whereas *cat* [kæt] and *mat* [mæt] are a minimal pair that differ only in their initial segments. Other minimal pairs in our list include *cap/cab*, *bag/back*, and *bag/badge*.

Minimal pairs whose members take different allomorphs are particularly useful for our search. For example, consider *cab* [kæb] and *cap* [kæp], which respectively take the allomorphs [z] and [s] to form the plural. Clearly, the final segment is responsible, because that is where the two words differ. Similarly for *bag* [bæg] and *badge* [bædʒ]. Their final segments determine the different plural allomorphs [z] and [əz].

Apparently, the distribution of plural allomorphs in English is conditioned by the final segment of the singular form. We can make our chart more concise by considering just the final segment. (We treat diphthongs such as [ɔɪ] as single segments.)

Allomorph	**Environment**
[z]	After [b], [d], [g], [v], [ð], [m], [n], [ŋ], [l], [r], [a], [ɔɪ]
[s]	After [p], [t], [k], [f], [θ]
[əz]	After [s], [ʃ], [z], [ʒ] , [tʃ], [dʒ]

We now want to understand *why* the English plural follows this pattern. We *always* answer questions of this type by inspecting the *phonetic properties* of the conditioning segments. Such an inspection reveals that the segments that trigger the [əz] plural have in common the property of being *sibilants*. Of the nonsibilants, the *voiceless* segments take the [s] plural, and the *voiced* segments take the [z] plural. Now the rules can be stated in more general terms:

Allomorph	**Environment**
[z]	After voiced nonsibilant segments
[s]	After voiceless nonsibilant segments
[əz]	After sibilant segments

An even more concise way to express these rules is to assume that the basic or underlying form of the plural morpheme is /z/, with the meaning "plural." This is the "default" pronunciation. The rules tell us when the default does *not* apply:

1. Insert a [ə] before the plural morpheme /z/ when a regular noun ends in a sibilant, giving [əz].
2. Change the plural morpheme /z/ to a voiceless [s] when preceded by a voiceless sound.

These rules will derive the phonetic forms—that is, the pronunciations—of plurals for all regular nouns. Because the basic form of the plural is /z/, if no rule applies, then the plural morpheme will be realized as [z]. The following chart shows how the plurals of *bus*, *butt*, and *bug* are formed. At the top are the basic forms. The two rules apply or not as appropriate as one moves downward. The output of rule 1 becomes the input of rule 2. At the bottom are the phonetic realizations—the way the words are pronounced.

	bus + pl.	*butt* + pl.	*bug* + pl.
Basic representation	/bʌs + z/	/bʌt + z/	/bʌg + z/
Apply rule (1)	ə	NA*	NA
Apply rule (2)	NA	s	NA
Phonetic representation	[bʌsəz]	[bʌts]	[bʌgz]

*NA means "not applicable."

As we have formulated these rules, (1) must apply before (2). If we applied the rules in reverse order, we would derive an incorrect phonetic form for the plural of *bus*, as a diagram similar to the previous one illustrates:

Basic representation	/bʌs + z/
Apply rule (2)	s
Apply rule (1)	ə
Phonetic representation	*[bʌsəs]

The particular phonological rules that determine the phonetic form of the plural morpheme and other morphemes of the language are **morphophonemic rules**. Such rules concern the pronunciation of specific morphemes. Thus the plural morphophonemic rules apply to the plural morpheme specifically, not to all morphemes in English.

Additional Examples of Allomorphs

The formation of the regular past tense of English verbs parallels the formation of regular plurals. Like plurals, some irregular past tenses conform to no particular rule and must be learned individually, such as *go/went*, *sing/sang*, and *hit/hit*. And also like plurals, there are three *phonetic* past-tense morphemes for regular verbs: [d], [t], and [əd]. Here are several examples in broad phonetic transcription. Study sets A, B, and C and try to see the regularity before reading further.

Set A: *gloat* [glot], *gloated* [glotəd]; *raid* [red], *raided* [redəd]

Set B: *grab* [græb], *grabbed* [græbd]; *hug* [hʌg], *hugged* [hʌgd]; *faze* [fez], *fazed* [fezd]; *roam* [rom], *roamed* [romd].

Set C: *reap* [rip], *reaped* [ript]; *poke* [pok], *poked* [pokt]; *kiss* [kɪs], *kissed* [kɪst]; patch [pætʃ], *patched* [pætʃt]

Set A suggests that if the verb ends in a [t] or a [d] (i.e., non-nasal alveolar stops), [əd] is added to form the past tense, similar to the insertion of [əz] to form the plural of nouns that end in sibilants. Set B suggests that if the verb ends in a voiced segment other than [d], you add a voiced [d]. Set C shows us that if the verb ends in voiceless segment other than [t], you add a voiceless [t].

Just as /z/ was the basic form of the plural morpheme, /d/ is the basic form of the past-tense morpheme, and the rules for past-tense formation of regular verbs are much like the rules for the plural formation of regular nouns. These are also *morphophonemic* rules as they apply specifically to the past-tense morpheme /d/. As with the plural rules, the output of Rule 1, if any, provides the input to Rule 2, and the rules must be applied in order.

1. Insert a [ə] before the past-tense morpheme when a regular verb ends in a non-nasal alveolar stop, giving [əd].

2. Change the past-tense morpheme to a voiceless [t] when a voiceless sound precedes it.

Two further allomorphs in English are the possessive morpheme and the third-person singular morpheme, spelled *s* or *es*. These morphemes take on the same phonetic form as the plural morpheme *according to the same rules*! Add [s] to *ship* to get *ship's*; add [z] to *woman* to get *woman's*; and add [əz] to *judge* to get *judge's*. Similarly for the verbs *eat*, *need*, and *rush*, whose third-person singular forms are *eats* with a final [s], *needs* with a final [z], and *rushes* with a final [əz].

That the rules of phonology are based on properties of segments rather than on individual words is one of the factors that makes it possible for young children to learn their native language in a relatively short period. The young child doesn't need to learn each plural, each past tense, each possessive form, and each verb ending, on a noun-by-noun or verb-by-verb basis. Once the rule is learned, thousands of word forms are automatically known. And as we will see when we discuss language development in chapter 8, children give clear evidence of learning morphophonemic rules such as the plural rules by applying the rule too broadly and producing forms such as *mouses*, *mans*, and so on, which are ungrammatical in the adult language.

English is not the only language that has morphemes that are pronounced differently in different phonological environments. Most languages have morpheme variation that can be described by rules similar to the ones we have written for English. For example, the negative morpheme in the West African language Akan has three nasal allomorphs: [m] before *p*, [n] before *t*, and [ŋ] before *k*, as the following examples show ([mɪ] means "I"):

mɪ pɛ	"I like"	mɪ mpɛ	"I don't like"
mɪ tɪ	"I speak"	mɪ ntɪ	"I don't speak"
mɪ kɔ	"I go"	mɪ ŋkɔ	"I don't go"

The rule that describes the distribution of allomorphs is:

> Change the place of articulation of the nasal negative morpheme to agree with the place of articulation of a following consonant.

The rule that changes the pronunciation of nasal consonants as just illustrated is called the **homorganic nasal rule**—*homorganic* means "same place"—because the place of articulation of the nasal is the same as for the following consonant. The homorganic nasal rule is a common rule in the world's languages.

Phonemes: The Phonological Units of Language

> In the physical world the naive speaker and hearer actualize and are sensitive to sounds, but what they feel themselves to be pronouncing and hearing are "phonemes."
>
> **EDWARD SAPIR,** "The Psychological Reality of Phonemes," 1933

The phonological rules discussed in the preceding section apply only to particular morphemes. However, other phonological rules apply to sounds as they occur in any morpheme in the language. These rules express our knowledge about the sound patterns of the entire language.

This section introduces the notions of **phoneme** and **allophone**. Phonemes are what we have been calling the basic form of a sound and are sensed in your mind rather than spoken or heard. Each phoneme has associated with it one or more sounds, called allophones, which represent the actual sound corresponding to the phoneme in various environments. For example, the phoneme /p/ is pronounced with the aspiration allophone [pʰ] in *pit* but without aspiration [p] in *spit*. Phonological rules operate on phonemes to make explicit which allophones are pronounced in which environments.

Vowel Nasalization in English as an Illustration of Allophones

English contains a general phonological rule that determines the contexts in which vowels are nasalized. In chapter 6 we noted that both oral and nasal vowels occur *phonetically* in English. The following examples show this:

bean	[bĩn]	bead	[bid]
roam	[rõm]	robe	[rob]

Taking oral vowels as basic—that is, as the phonemes—we have a phonological rule that states:

Vowels are nasalized before a nasal consonant within the same syllable.

This rule expresses your knowledge of English pronunciation: nasalized vowels occur only before nasal consonants and never elsewhere. The effect of this rule is exemplified in Table 7.1.

As the examples in Table 7.1 illustrate, oral vowels in English occur in final position and before non-nasal consonants; nasalized vowels occur only before nasal consonants. The nonwords (starred) show us that nasalized vowels do not occur finally or before non-nasal consonants, nor do oral vowels occur before nasal consonants.

TABLE 7.1 | Nasal and Oral Vowels: Words and Nonwords

Words						Nonwords		
be	[bi]	bead	[bid]	bean	[bĩn]	*[bĩ]	*[bĩd]	*[bin]
lay	[le]	lace	[les]	lame	[lẽm]	*[lẽ]	*[lẽs]	*[lem]
baa	[bæ]	bad	[bæd]	bang	[bæ̃ŋ]	*[bæ̃]	*[bæ̃d]	*[bæŋ]

You may be unaware of this variation in your vowel production, but this is natural. Whether you speak or hear the vowel in *bean* with or without nasalization does not matter. Without nasalization, it might sound a bit strange, as if you had a foreign accent, but *bean* pronounced [bĩn] and *bean* pronounced [bin] would convey the same word. Likewise, if you pronounced *bead* as [bĩd], with a nasalized vowel, someone might suspect you had a cold, or that you spoke nasally, but the word would remain *bead*. Because nasalization is an inessential difference insofar as what the word actually is, we tend to be unaware of it.

Contrast this situation with a change in vowel height. If you intend to say *bead* but say *bad* instead, that makes a difference. The [i] in *bead* and the [æ] in *bad* are sounds from *different* phonemes. Substitute one for another and you get a different word (or no word). The [i] in *bead* and the [ĩ] in the nasalized *bead* do not make a difference in meaning. These two sounds, then, belong to the same phoneme, an abstract high front vowel that we denote between slashes as /i/.

Phonemes are not physical sounds. They are abstract mental representations of the phonological units of a language, the units used to represent words in our mental lexicon. The phonological rules of the language apply to phonemes to determine the pronunciation of words.

The process of substituting one sound for another in a word to see if it makes a difference is a good way to identify the phonemes of a language. Here are twelve words differing only in their vowel:

beat	[bit]	[i]	boot	[but]	[u]
bit	[bɪt]	[ɪ]	but	[bʌt]	[ʌ]
bait	[bet]	[e]	boat	[bot]	[o]
bet	[bɛt]	[ɛ]	bought	[bɔt]	[ɔ]
bat	[bæt]	[æ]	bout	[baʊt]	[aʊ]
bite	[baɪt]	[aɪ]	bot	[bat]	[a]

Any two of these words form a *minimal pair*: two *different* words that differ in one sound. The two sounds that cause the word difference belong to different phonemes. The pair [bid] and [bĩd] are not different words; they are variants of the same word. Therefore, [i] and [ĩ] do *not* belong to different phonemes. They are two actualizations of the same phoneme.

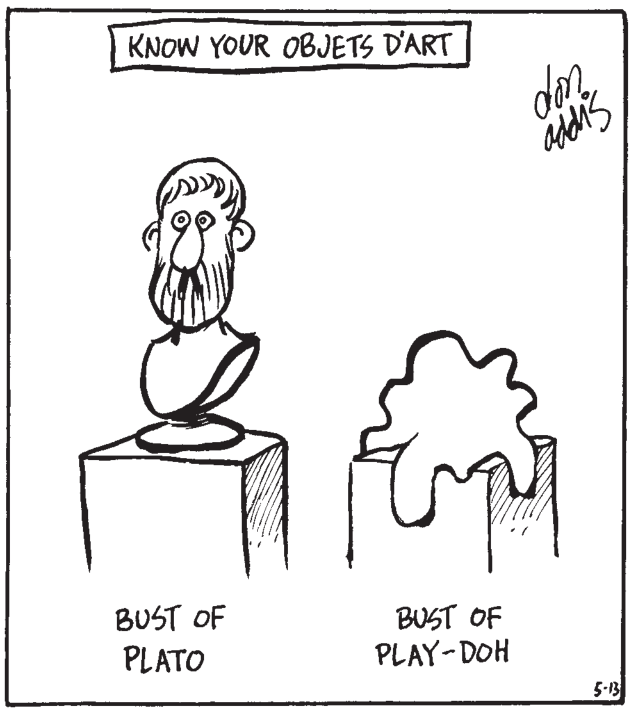
From the minimal set of [b–t] words we can infer that English has at least twelve vowel phonemes. (We consider diphthongs to function as single vowel sounds.) To that total we can add a phoneme corresponding to [ʊ] resulting from minimal pairs such as *book* [bʊk] and *beak* [bik]; and we can add one for [ɔɪ] resulting from minimal pairs such as *boy* [bɔɪ] and *buy* [baɪ].

Our minimal pair analysis has revealed eleven monophthongal and three diphthongal vowel phonemes, namely, /i ɪ e ɛ æ u ʊ o ɔ a ʌ/ and /aɪ/, /aʊ/, /ɔɪ/. (This set may differ slightly in other variants of English.) Importantly, each of these vowel phonemes has (at least) two allophones (i.e., two ways of being pronounced: orally as [i], [ɪ], [e], etc., and nasally as [ĩ], [ɪ̃], [ẽ], etc.), as determined by the phonological rule of nasalization.

A particular realization (pronunciation) of a phoneme is called a **phone**. The collection of phones that are the realizations of the same phoneme are called the *allophones* of that phoneme. In English, each vowel phoneme has both an oral and a nasalized allophone. The choice of the allophone is not random or haphazard; it is *rule-governed*.

To distinguish between a phoneme and its allophones, we use slashes / / to enclose phonemes and continue to use square brackets [ ] for allophones or phones. For example, [i] and [ĩ] are allophones of the phoneme /i/; [ɪ] and [ɪ̃] are allophones of the phoneme /ɪ/, and so on. Thus we will represent *bead* and *bean* phonemically as /bid/ and /bin/. We refer to these as *phonemic* transcriptions of the two words. The rule for the distribution of oral and nasal vowels in English shows that phonetically these words will be pronounced as [bid] and [bĩn]. The pronunciations are indicated by phonetic transcriptions, and written between square brackets.

Allophones of /t/



Consonants, too, have allophones whose distribution is rule-governed. For /t/ the following examples illustrate the point.

tick [tʰɪk] stick [stɪk] hits [hɪts] bitter [bɪɾər]

In *tick* we normally find an aspirated [tʰ], whereas in *stick* and *hits* we find an unaspirated [t], and in *bitter* we find the flap [ɾ]. As with vowel nasalization, swapping these sounds around will not change word meaning. If we pronounce *bitter* with a [tʰ], it will not change the word; it will simply sound unnatural (to most Americans).

We account for this knowledge of how *t* is pronounced by positing a phoneme /t/ with three allophones [tʰ], [t], and [ɾ]. We also posit phonological rules, which roughly state that the aspirated [tʰ] occurs before a stressed vowel, the unaspirated [t] occurs directly before or after /s/, and the flap [ɾ] occurs between a stressed vowel and an unstressed vowel.

Whether we pronounce *tick* as [tʰɪk], [tɪk], or [ɾɪk], we are speaking the same word, however strangely pronounced. The allophones of a phoneme do not *contrast*. If we change the voicing and say *Dick*, or the manner of articulation and say *sick*, or the nasalization and say *nick*, we get different words. Those sounds *do* contrast. *Tick*, *Dick*, *sick*, and *nick* thus form a minimal set that shows us that there are phonemes /t/, /d/, /s/, and /n/ in English. We may proceed in this manner to discover other phonemes by considering *pick*, *kick*, *Mick* (as in Jagger), *Vic*, *thick*, *chick*, *lick*, and *Rick* to infer the phonemes /p/, /k/, /m/, /v/, /θ/, /tʃ/, /l/, and /r/. By finding other minimal pairs and sets, we would discover yet more consonant phonemes such as /ð/, which, together with /θ/, contrasts the words *thy* and *thigh*, or *either* and *ether*.

Each of these phonemes has its own set of allophones, even if that set consists of a single phone, which would mean there is only one pronunciation in all environments. Most phonemes have more than one allophone, and the phonological rules dictate when the different allophones occur. It should be clear at this point that pronunciation is not a random process. It is systematic and rule-governed, and while the systems and the rules may appear complex, they are no more than a compendium of the knowledge that every speaker has.

Complementary Distribution

Minimal pairs illustrate that some speech sounds in a language are contrastive and can be used to make different words such as *big* and *dig*. These contrastive sounds group themselves into the phonemes of that language. Some sounds are non-contrastive and cannot be used to make different words. The sounds [t] and [ɾ] were cited as examples that do not contrast in English, so [raɪtər] and [raɪɾər] are not a minimal pair, but rather alternate ways in which *writer* may be pronounced.

Oral and nasal vowels in English are also non-contrastive sounds. What's more, the oral and nasal allophones of each vowel phoneme never occur in the same phonological context, as Table 7.2 illustrates.

Where oral vowels occur, nasal vowels do not occur, and vice versa. In this sense the phones are said to complement each other or to be in **complementary distribution**. By and large, the allophones of a phoneme are in complementary

TABLE 7.2 | Distribution of Oral and Nasal Vowels in English Syllables

	In Final Position	Before Nasal Consonants	Before Oral Consonants
Oral vowels	Yes	No	Yes
Nasal vowels	No	Yes	No

distribution—never occurring in identical environments. Complementary distribution is a fundamental concept of phonology, and interestingly enough, it shows up in everyday life. Here are a couple of examples that draw on the common experience of reading and writing English.

The first example focuses on *printed* letters such as those that appear on the pages of this book. Each printed letter of English has two main variants: lowercase and uppercase (or capital). If we restrict our attention to words that are not proper names or acronyms (such as Ron or UNICEF), we can formulate a simple rule that does a fair job of determining how letters will be printed:

> A letter is printed in uppercase if it is the first letter of a sentence; otherwise, it is printed in lowercase.

Even ignoring names and acronyms, this rule is only approximately right, but let's go with it anyway. It helps to explain why written sentences such as the following appear so strange:

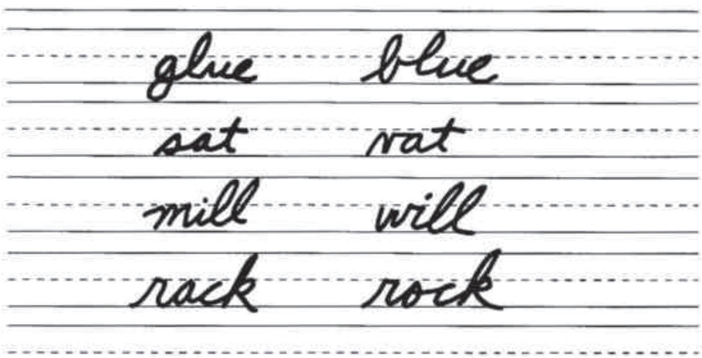
> phonology is the study of the sound patterns of human languageS.
> pHONOLOGY iS tHE sTUDY oF tHE sOUND pATTERNS oF hUMAN lANGUAGES.

These "sentences" violate the rule in funny ways, despite that they are comprehensible, just as the pronunciation of *bead* with a nasal [ĩ] as [bĩd] would sound funny but be understood.

To the extent that the rule is correct, the lowercase and uppercase variants of an English letter *are in complementary distribution*. The uppercase variant occurs in one particular context (namely, at the beginning of the sentence), and the lowercase variant occurs in every other context (or elsewhere). Therefore, just as every English vowel phoneme has an oral and a nasalized allophone that occurs in different spoken contexts, every letter of the English alphabet has two variants, or allographs, that occur in different written contexts. In both cases, the two variants of a single mental representation (phoneme or letter) are in *complementary distribution* because they never appear in the same environment. And, substituting one for the other—a nasal vowel in place of an oral one, or an uppercase letter in place of a lowercase one—may sound or look unusual, but it will not change the meaning of what is spoken or written.

Superman and Clark Kent, or Dr. Jekyll and Mr. Hyde—for those of you familiar with these fictional characters—are in complementary distribution *with respect to time*. At a given moment in time, the individual is either one or another of his alter egos.

Our next example turns to *cursive* handwriting, which you are likely to have learned in elementary school. Writing in cursive is in one sense more similar to the act of speaking than printing is, because in cursive writing each letter of a word (usually) connects to the following letter—just as adjacent sounds connect during speech. The following figure illustrates that the connections between the letters of a word in cursive writing create different variants of a letter in different environments:



Compare how the letter *l* appears after a *g* (as in *glue*) and after a *b* (as in *blue*). In the first case, the *l* begins near the bottom of the line, but in the second case, the *l* begins near the middle of the line (which is indicated by the dashes). In other words, the same letter *l* has two variants. It doesn't matter where the *l* begins, it's still an *l*. Likewise, it doesn't matter whether a vowel in English is nasalized or not, it's still that vowel. Which variant occurs in a particular word is determined by the immediately preceding letter. The variant that begins near the bottom of the line appears after letters like *g* that end near the bottom of the line. The variant that begins near the middle of the line appears after letters like *b* that end near the middle of the line. The two variants of *l* are therefore in complementary distribution.

This pattern of complementary distribution is not specific to *l* but occurs for other cursive letters in English. By examining the pairs *sat* and *vat*, *mill* and *will*, and *rack* and *rock*, you can see the complementary distribution of the variants of *a*, *i*, and *c*, respectively. In each case, the immediately preceding letter determines which variant occurs, with the consequence that the variants of a given letter are in complementary distribution.

We turn now to a general discussion of phonemes and allophones. When sounds are in complementary distribution, they do not contrast with each other. The replacement of one sound for the other will not change the meaning of the word, although it might not sound like typical English pronunciation. Given these facts about the patterning of sounds in a language, a phoneme can be defined as a set of phonetically similar sounds that are in complementary distribution. A set may consist of only one member. Some phonemes are represented by only one sound; they have one allophone. When there is more than one allophone in the set, the phones must be *phonetically similar*; that is, share most phonetic features. In English, the velar nasal [ŋ] and the glottal fricative [h] are in complementary distribution; [ŋ] does not occur word initially and [h] does not occur word finally. But they share very few phonetic features; [ŋ] is a voiced velar nasal stop; [h] is a voiceless glottal fricative. Therefore, they are not allophones of the same phoneme; [ŋ] and [h] are allophones of different phonemes.

Speakers of a language generally perceive the different allophones of a single phoneme as the same sound or phone. For example, most speakers of English are unaware that the vowels in *bead* and *bean* are different phones because mentally, speakers produce and hear phonemes, not phones.

Distinctive Features of Phonemes

We are generally not aware of the phonetic properties or features that distinguish the phonemes of our language. *Phonetics* provides the means to describe the phones (sounds) of language, showing how they are produced and how they vary. *Phonology* tells us how various sounds form patterns to create phonemes and their allophones.

For two phones to contrast meaning, there must be some phonetic difference between them. The minimal pairs *seal* [sil] and *zeal* [zil] show that [s] and [z] represent two contrasting phonemes in English. They cannot be allophones of one phoneme because one cannot replace the [s] with the [z] without changing the meaning of the word. Furthermore, they are not in complementary distribution; both occur word initially before the vowel [i]. They are therefore allophones of the two different phonemes /s/ and /z/. From the discussion of phonetics in chapter 6, we know that [s] and [z] differ in voicing: [s] is voiceless and [z] is voiced. The phonetic feature of voicing therefore distinguishes the two words. Voicing also distinguishes *feel* and *veal* [f]/[v] and *cap* and *cab* [p]/[b]. When a feature distinguishes one phoneme from another, hence one word from another, it is a **distinctive feature** or, equivalently, a **phonemic feature**.

Feature Values

One can think of voicing and voicelessness as the presence or absence of a single feature, *voiced*. This single feature may have two values: plus (+), which signifies its presence, and minus (–), which signifies its absence. For example, [b] is [+voiced] and [p] is [–voiced].

The presence or absence of nasality can similarly be designated as [+nasal] or [–nasal], with [m] being [+nasal] and [b] and [p] being [–nasal]. A [–nasal] sound is an oral sound.

We consider the phonetic and phonemic symbols to be *cover symbols* for sets of distinctive features. They are a shorthand method of specifying the phonetic properties of the segment. Phones and phonemes are not indissoluble units; they are composed of phonetic features, similar to the way that molecules are composed of atoms. A more explicit description of the phonemes /p/, /b/, and /m/ may thus be given in a feature matrix of the following sort.

	p	**b**	**m**
Stop	+	+	+
Labial	+	+	+
Voiced	–	+	+
Nasal	–	–	+

Aspiration is not listed as a phonemic feature in the specification of these units, because it is not necessary to include both [p] and [p^h] as phonemes. In a phonetic transcription, however, the aspiration feature would be specified where it occurs.

A phonetic feature is distinctive when the + value of that feature in certain words contrasts with the – value of that feature in other words. At least one feature value difference must distinguish each phoneme from all the other phonemes in a language.

Because the phonemes /b/, /d/, and /g/ contrast by virtue of their place of articulation features—*labial*, *alveolar*, and *velar*—these place features are also distinctive in English. Because uvular sounds do not occur in English, the place feature *uvular* is not distinctive. The distinctive features of the voiced stops in English are shown in the following:

	b	**m**	**d**	**n**	**g**	**ŋ**
Stop	+	+	+	+	+	+
Voiced	+	+	+	+	+	+
Labial	+	+	–	–	–	–
Alveolar	–	–	+	+	–	–
Velar	–	–	–	–	+	+
Nasal	–	+	–	+	–	+

Each phoneme in this chart differs from all the other phonemes by at least one distinctive feature.

Vowels, too, have distinctive features. For example, the feature [±back] distinguishes the vowel in *rock* [rak] ([+back]) from the vowel in *rack* [ræk] ([–back]), among others, and is therefore distinctive. Similarly, [±tense] distinguishes [i] from [ɪ] (*beat* versus *bit*), among others, and is also a distinctive feature of the vowel system.

Nondistinctive Features

We have seen that nasality is a distinctive feature of English consonants, but it is a **nondistinctive feature** for English vowels. Given the arbitrary relationship between form and meaning, there is no way to predict that the word *meat* begins with a nasal bilabial stop [m] and that the word *beat* begins with an oral bilabial stop [b]. You learn this when you learn the words. On the other hand, the nasality feature value of the vowels in *bean*, *mean*, *comb*, and *sing* is predictable because they occur before nasal consonants. When a feature value is predictable by rule for a certain class of sounds, the feature is a **nondistinctive** or **redundant** or **predictable feature** *for that class*. (The three terms are equivalent.) Thus nasality is a redundant feature in English vowels, but a **nonredundant** (distinctive or phonemic) feature for English consonants.

This is not the case in all languages. In French, nasality is a distinctive feature for both vowels and consonants: *gars* (pronounced [ga]) "lad" contrasts with *gant* [gã], which means "glove"; and *bal* [bal] "dance" contrasts with *mal* [mal] "bad." Thus, French has both oral and nasal consonant phonemes and vowel phonemes; English has oral and nasal consonant phonemes, but only oral vowel phonemes.

Like French, the African language Akan (spoken in Ghana) has nasal vowel phonemes. Nasalization is a distinctive feature for vowels in Akan, as the following examples illustrate:

[ka]	"bite"	[kã]	"speak"
[fi]	"come from"	[fĩ]	"dirty"
[tu]	"pull"	[tũ]	"den"
[nsa]	"hand"	[nsã]	"liquor"
[tʃi]	"hate"	[tʃĩ]	"squeeze"
[pam]	"sew"	[pãm]	"confederate"

Nasalization is not predictable in Akan as it is in English. There is no nasalization rule in Akan, as shown by the minimal pair [pam] and [pãm]. If you substitute an oral vowel for a nasal vowel, or vice versa, you will change the word.

Two languages may have the same phonetic segments (phones) but have two different phonemic systems. Phonetically, both oral and nasalized vowels exist in English and Akan. However, English does not have nasalized vowel phonemes, but Akan does. The same phonetic segments function differently in the two languages. Nasalization of vowels in English is redundant and nondistinctive; nasalization of vowels in Akan is nonredundant and distinctive.

Another nondistinctive feature in English is aspiration. In chapter 6 we pointed out that in English both aspirated and unaspirated voiceless stops occur. The voiceless aspirated stops [pʰ], [tʰ], and [kʰ] and the voiceless unaspirated stops [p], [t], and [k] are in complementary distribution in English, as shown in the following:

Syllable Initial before a Stressed Vowel			**After a Syllable Initial /s/**			**Nonword***		
[pʰ]	[tʰ]	[kʰ]	[p]	[t]	[k]			
pill	*till*	*kill*	*spill*	*still*	*skill*	[pɪl]*	[tɪl]*	[kɪl]*
[pʰɪl]	[tʰɪl]	[kʰɪl]	[spɪl]	[stɪl]	[skɪl]	[spʰɪl]*	[stʰɪl]*	[skʰɪl]*
par	*tar*	*car*	*spar*	*star*	*scar*	[par]*	[tar]*	[kar]*
[pʰar]	[tʰar]	[kʰar]	[spar]	[star]	[skar]	[spʰar]*	[stʰar]*	[skʰar]*

Where the unaspirated stops occur, the aspirated ones do not, and vice versa. If you wanted to, you could say *spit* with an aspirated [pʰ], as [spʰɪt], and it would be understood as *spit*, but listeners would probably think you were spitting out your words. Given this distribution, we see that aspiration is a redundant, nondistinctive feature in English; aspiration is predictable, occurring as a feature of voiceless stops when they occur initially in a stressed syllable.

This is the reason speakers of English usually perceive the [pʰ] in *pill* and the [p] in *spill* to be the same sound, just as they consider the [i] and [ĩ] that represent the phoneme /i/ in *bead* and *bean* to be the same. They do so because the difference between them is *predictable*, *redundant*, *nondistinctive*, and *nonphonemic* (all equivalent terms). This example illustrates why we refer to the phoneme as an abstract unit or as a mental unit. We do not utter phonemes; we produce phones, the allophones of the phonemes of the language. In English /p/ is a phoneme that is realized phonetically (pronounced) as both [p] and [pʰ], depending on context. The phones or sounds [p] and [pʰ] are allophones of the phoneme /p/.

Phonemic Patterns May Vary across Languages

> The tongue of man is a twisty thing, there are plenty of words there of every kind, the range of words is wide, and their variance.
>
> **HOMER,** *The Iliad,* c. 900 B.C.E.

We have seen that the same phones may occur in two languages but pattern differently because the phonologies are different. English, French, and Akan have oral and nasal vowel phones; in English, oral and nasal vowels are allophones of one phoneme, whereas in French and Akan they represent distinct phonemes.

Aspiration of voiceless stops further illustrates the asymmetry of the phonological systems of different languages. Both aspirated and unaspirated voiceless stops occur in English and Thai, but they function differently in the two languages. Aspiration in English is not a distinctive feature because its presence or absence is predictable. In Thai it is not predictable, as the following examples show:

Voiceless Unaspirated		**Voiceless Aspirated**	
[paa]	*forest*	[p^{h}aa]	*to split*
[tam]	*to pound*	[t^{h}am]	*to do*
[kat]	*to bite*	[k^{h}at]	*to interrupt*

The voiceless unaspirated and the voiceless aspirated stops in Thai occur in minimal pairs; they contrast and are therefore phonemes. In both English and Thai, the phones [p], [t], [k], [p^h], [t^h], and [k^h] occur. In English they represent the phonemes /p/, /t/, and /k/; in Thai they represent the phonemes /p/, /t/, /k/, /p^h/, /t^h/, and /k^h/. Aspiration is a distinctive feature in Thai; it is a nondistinctive redundant feature in English.

The phonetic facts alone do not reveal what is distinctive or phonemic:

> The *phonetic representation* of utterances shows what speakers know about the pronunciation of sounds.
>
> The *phonemic representation* of utterances shows what speakers know about the patterning of sounds.

That *pot/pat* and *spot/spat* are phonemically transcribed with an identical /p/ reveals the fact that English speakers consider the [p^h] in *pot* [p^{h}at] and the [p] in *spot* [spat] to be phonetic manifestations of the same phoneme /p/. This is also reflected in spelling, which is more attuned to phonemes than to individual phones.

In English, vowel length and consonant length are nonphonemic. Prolonging a sound in English will not produce a different word. In other languages, long and short vowels that are identical except for length are phonemic. In such languages, length is a nonpredictable distinctive feature. For example, vowel length is phonemic in Korean, as shown by the following minimal pairs (recall that the colon-like symbol : indicates length):

il	"day"	i:l	"work"
seda	"to count"	se:da	"strong"
kul	"oyster"	ku:l	"tunnel"

In Italian the word for "grandfather" is *nonno* /non:o/, which contrasts with the word for "ninth," which is *nono* /nono/, so consonant length is phonemic in Italian. In Luganda, an African language, consonant length is also phonemic: /kula/ with a short /k/ means "grow up," whereas /k:ula/ with a long /k:/ means "treasure." Thus consonant length is unpredictable in Luganda, just as whether a word begins with a /b/ or a /p/ is unpredictable in English.

ASL Phonology

As discussed in chapter 6, signs can be broken down into smaller units that are in many ways analogous to the phonemes and distinctive features in spoken languages. They can be decomposed into location, movement, and handshape and there are minimal pairs that are distinguished by a change in one or another of these features. Figure 6.6 in chapter 6 provides some examples. The signs meaning "candy," "apple," and "jealous" are articulated at the same location on the face and involve the same movement, but contrast minimally in hand configuration. "Summer," "ugly," and "dry" are a minimal set contrasting only in place of articulation, and "tape," "chair," and "train" contrast only in movement. Thus signs can be decomposed into smaller minimal units that contrast meaning. Some features are non-distinctive. Whether a sign is articulated on the right or left hand does not affect its meaning.

Natural Classes of Speech Sounds

> It's as large as life, and twice as natural!
>
> **LEWIS CARROLL,** *Through the Looking-Glass,* 1871

We show what speakers know about the predictable aspects of speech through phonological rules. In English, these rules determine the environments in which vowels are nasalized or voiceless stops aspirated. These rules apply to *all* the words in the language, and even apply to made-up words such as *sint*, *peeg*, or *sparg*, which would be /sɪnt/, /pig/, and /sparg/ phonemically and [sɪ̃nt], [p^{h}ig], and [sparg] phonetically.

The more linguists examine the phonologies of the world's languages, the more they find that similar phonological rules involve the same classes of sounds such as nasals or voiceless stops. For example, many languages besides English have a rule that nasalizes vowels before nasal consonants:

Nasalize a vowel when it precedes a nasal consonant in the same syllable.

The rule will apply to all vowel phonemes when they occur in a context preceding any segment marked [+nasal] in the same syllable, and will add the feature [+nasal] to the feature matrix of the vowel. Our description of vowel nasalization in English needs only this rule. It need not include a list of the individual vowels to which the rule applies or a list of the sounds that result from its application.

Many languages have rules that refer to [+voiced] and [–voiced] sounds. For example, the aspiration rule in English applies to the class of [–voiced] noncontinuant sounds in word-initial position. As in the vowel nasality rule, we do not need to consider individual segments. The rule automatically applies to initial /p/, /t/, /k/, and /tʃ/.

Phonological rules often apply to **natural classes** of sounds. A natural class is a group of sounds described by a small number of distinctive features such as [–voiced], [–continuant], which describe /p/, /t/, /k/, and /tʃ/. Any individual member of a natural class would require more features in its description than the class itself, so /p/ is not only [–voiced], [–continuant], but also [+labial].

The relationships among phonological rules and natural classes illustrate why segments are to be regarded as bundles of features. If segments were not specified as feature matrices, the similarities among /p/, /t/, /k/ or /m/, /n/, /ŋ/ would be lost. It would be just as likely for a language to have a rule such as

1. Nasalize vowels before *p*, *i*, or *z*.

as to have a rule such as

2. Nasalize vowels before *m*, *n*, or *ŋ*.

Rule 1 has no phonetic explanation, whereas Rule 2 does: the lowering of the velum in anticipation of a following nasal consonant causes the vowel to be nasalized. In Rule 1, the environment is a motley collection of unrelated sounds that cannot be described with a few features. Rule 2 applies to the natural class of nasal consonants, namely sounds that are [+nasal], [+consonantal].

The various classes of sounds discussed in chapter 6 also define natural classes to which the phonological rules of all languages may refer. They also can be specified by + and – feature values. Table 7.3 illustrates how these feature values combine to define some major classes of phonemes. The presence of +/– indicates that the sound may or may not possess a feature depending on its context. For example, word-initial nasals are [–syllabic] but some word-final nasals can be [+syllabic], as in *button* [bʌtn̩].

TABLE 7.3 | Feature Specification of Major Natural Classes of Sounds

Features	Obstruents	Nasals	Liquids	Glides	Vowels
Consonantal	+	+	+	–	–
Sonorant	–	+	+	+	+
Syllabic	–	+/–	+/–	–	+
Nasal	–	+	–	–	+/–

Feature Specifications for American English Consonants and Vowels

Here are feature matrices for vowels and consonants in English. By selecting all segments marked the same for one or more features, you can identify natural classes. For example, the natural class of high vowels /i, ɪ, u, ʊ/ is marked [+high] in the vowel feature chart of Table 7.4; the natural class of voiced stops /b, m, d, n, g, ŋ, dʒ/ are the ones marked [+voice] [–continuant] in the consonant chart of Table 7.5.

TABLE 7.4 | Features of Some American English Vowels

Features	i	ɪ	e	ɛ	æ	u	ʊ	o	ɔ	a	ʌ
High	+	+	−	−	−	+	+	−	−	−	−
Mid	−	−	+	+	−	−	−	+	+	−	+
Low	−	−	−	−	+	−	−	−	−	+	−
Back	−	−	−	−	−	+	+	+	+	+	−
Central	−	−	−	−	−	−	−	−	−	−	+
Round	−	−	−	−	−	+	+	+	+	−	−
Tense	+	−	+	−	−	+	−	+	−	+	−

The Rules of Phonology

But that to come
Shall all be done by the rule.

WILLIAM SHAKESPEARE, *Antony and Cleopatra*, 1623

Throughout this chapter we have emphasized that the relationship between the *phonemic* representation of a word and its *phonetic* representation, or how it is pronounced, is *rule-governed*. Phonological rules are part of a speaker's knowledge of the language.

The phonemic representations are *minimally specified* because some features or feature values are predictable. For example, in English all nasal consonants are voiced, so we don't need to specify voicing in the phonemic feature matrix for nasals. Similarly, we don't need to specify the feature *round* for non–low back vowels. If Table 7.5 was strictly phonemic, then instead of a + in the *voice*-row for *m*, *n*, and *ŋ*, the cells would be left blank, as would the cells in the *round*-row of Table 7.4 for *u*, *ʊ*, *o*, *ɔ*. Such underspecification reflects the redundancy in the phonology, which is also part of a speaker's knowledge of the sound system. The phonemic representation should include only the nonpredictable, distinctive features of the phonemes in a word. The phonetic representation, derived by applying the phonological rules, includes all of the linguistically relevant phonetic aspects of the sounds. It does not include all of the physical properties of the sounds of an utterance, however, because the physical signal may vary in many ways that have little to do with the phonological system. The absolute pitch of the sound, the rate of speech, or its loudness is not linguistically significant. The phonetic transcription is therefore also an abstraction from the physical signal; it includes the nonvariant phonetic aspects of the utterances, those features that remain relatively constant from speaker to speaker and from one time to another.

Although the specific rules of phonology differ from language to language, the kinds of rules, what they do, and the natural classes they refer to are universal.

Assimilation Rules

We have seen that nasalization of vowels in English is nonphonemic because it is predictable by rule. The vowel nasalization rule is an assimilation rule, or a rule

TABLE 7.5 | Features of Some American English Consonants

Features	**p**	**b**	**m**	**t**	**d**	**n**	**k**	**g**	**ŋ**	**f**	**v**	**θ**	**ð**	**s**	**z**	**ʃ**	**ʒ**	**tʃ**	**dʒ**	**l**	**r**	**j**	**w**	**h**
Consonantal	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−	−	−
Sonorant	−	−	+	−	−	+	−	−	+	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+
Syllabic	−	−	−/+	−	−	−/+	−	−	−/+	−	−	−	−	−	−	−	−	−	−	−/+	−/+	−	−	−
Nasal	−	−	+	−	−	+	−	−	+	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
Voiced	−	+	+	−	+	+	−	+	+	−	+	−	+	−	+	−	+	−	+	+	+	+	+	−
Continuant	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	−	−	+	+	+	+	+
Labial	+	+	+	−	−	−	−	−	−	+	+	−	−	−	−	−	−	−	−	−	−	−	+	−
Alveolar	−	−	−	+	+	+	−	−	−	−	−	−	−	+	+	−	−	−	−	+	+	−	−	−
Palatal	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	+	−	−	+	−	−
Anterior	+	+	+	+	+	+	−	−	−	+	+	+	+	+	+	−	−	−	−	+	+	−	−	−
Velar	−	−	−	−	−	−	+	+	+	−	−	−	−	−	−	−	−	−	−	−	−	−	+	−
Coronal	−	−	−	+	+	+	−	−	−	−	−	+	+	+	+	+	+	+	+	+	+	+	−	−
Sibilant	−	−	−	−	−	−	−	−	−	−	−	−	−	+	+	+	+	+	+	−	−	−	−	−

Note: The phonemes /r/ and /l/ are distinguished by the feature [lateral], not shown here. /l/ is the only phoneme that would be [+lateral].

that makes neighboring segments more similar by duplicating a phonetic property. For the most part, assimilation rules stem from articulatory processes. There is a tendency when we speak to increase the ease of articulation. It is easier to lower the velum while a vowel is being pronounced before a nasal stop than to wait for the completion of the vowel and then require the velum to move suddenly.

We now wish to look more closely at the phonological rules we have been discussing. Previously, we stated the vowel nasalization rule:

Vowels are nasalized before a nasal consonant within the same syllable.

This rule specifies the class of sounds affected by the rule:

Vowels

It states what phonetic change will occur by applying the rule:

Change phonemic oral vowels to phonetic nasal vowels.

And it specifies the context or phonological environment.

Before a nasal consonant within the same syllable.

A shorthand notation to write rules, similar to the way scientists and mathematicians use symbols, makes the rule statements more concise. Every physicist knows that $E = mc^2$ means "Energy equals mass times the square of the velocity of light." We can use similar notations to state the nasalization rule as:

V → [+nasal] / __ [+nasal] $

Let's look at the rule piece by piece.

V	→	[+nasal]	/	__	[+nasal]	$
Vowels	become	nasalized	in the environment	before	nasal segments	within a syllable

To the left of the arrow is the class of sounds that is affected. To the right of the arrow is the phonetic change that occurs. The phonological environment follows the slash. The underscore __ is the relative position of the sound to be changed within the environment, in this case *before* a nasal segment. The dollar sign denotes a syllable boundary and guarantees that the environment does not cross over to the next syllable.

This rule tells us that the vowels in such words as *den* /dɛn/ will become nasalized to [dɛ̃n], but *deck* /dɛk/ will not be affected and is pronounced [dɛk] because /k/ is not a nasal consonant. As well, a word such as *den$tal* /dɛn$təl/ will be pronounced [dɛ̃n$təl], where we have showed the syllable boundary explicitly. However, the first vowel in *de$note*, /di$not/, will not be nasalized, because the nasal segment does not precede the syllable boundary, so the "within a syllable" condition is not met.

Any rule written in formal notation can be stated in words. The use of formal notation is a shorthand way of presenting the information. Notation also reveals the *function* of the rule more explicitly than words. It is easy to see in the formal statement of the rule that this is an assimilation rule because the change to [+nasal] occurs before [+nasal] segments. Assimilation rules in languages reflect **coarticulation**—the spreading of phonetic features either in the anticipation or in the perseveration (the "hanging on") of articulatory processes. The auditory effect is that words sound smoother.

The following example illustrates how the English vowel nasalization rule applies. It also shows the assimilatory nature of the rule, that is, the change from no nasal feature to [+nasal]:

	"bob"			"boom"		
Phonemic representation	/b	a	b/	/b	u	m/
Nasality: phonemic feature value	–	0*	–	–	0	+
Apply nasal rule		NA			↓	
Nasality: phonetic feature value	–	–	–	–	+	+
Phonetic representation	[b	a	b]	[b	ũ	m]

*The 0 means not present on the phonemic level.

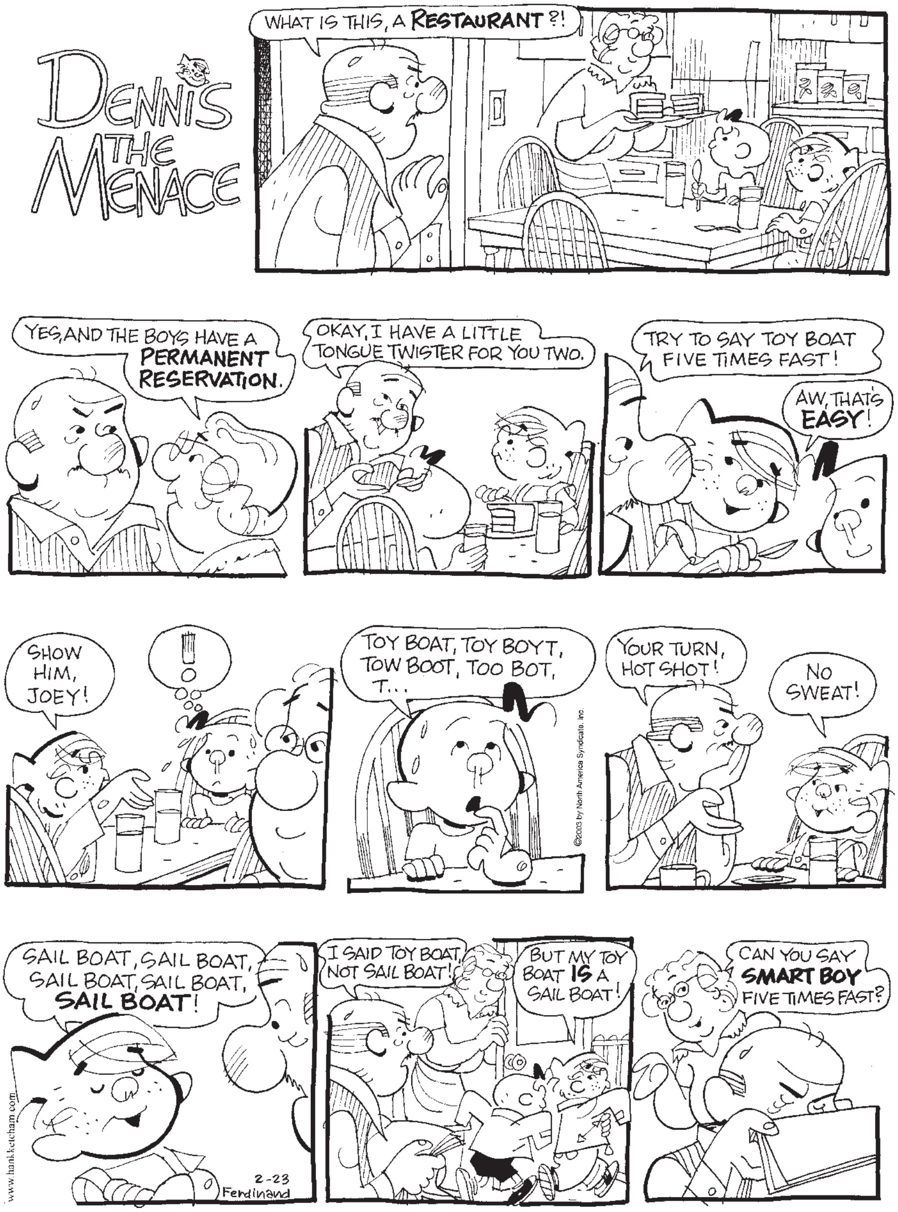
There are many assimilation rules in English and other languages. Recall that the voiced /z/ of the English regular plural suffix is changed to [s] after a voiceless sound, and that similarly the voiced /d/ of the English regular past-tense suffix is changed to [t] after a voiceless sound. These are instances of voicing assimilation. In these cases the value of the voicing feature goes from [+voice] to [–voice] because of assimilation to the [–voice] feature of the final consonant of the stem, as in the derivation of *cats*:

/kæt + z/ → [kæts]

We saw a different kind of assimilation rule in Akan, where we observed that the nasal negative morpheme was expressed as [m] before /p/, [n] before /t/, and [ŋ] before /k/. (This is the homorganic nasal rule.) In this case the place of articulation—bilabial, alveolar, velar—of the nasal assimilates to the place of articulation of the following consonant. The same process occurs in English, where the negative morpheme prefix spelled *in-* or *im-* agrees in place of articulation with the word to which it is prefixed, so we have *impossible* [ĩmp^{h}asəbəl], *intolerant* [ĩnt^{h}alərə̃nt], and *incongruous* [ĩŋk^{h}ãngruəs]. In effect, the rule makes two consonants that appear next to each other more similar.

ASL and other signed languages also have assimilation rules. One example is handshape assimilation, which takes place in compounds such as the sign for "blood." This ASL sign is a compound of the signs for "red" and "flow." The handshape for "red" alone is formed at the chin by a closed hand with the index finger pointed up. In the compound "blood" this handshape is replaced by that of the following word "flow," which is an open handshape (all fingers extended). In other words, the handshape for "red" has undergone assimilation. The location of the sign (at the chin) remains the same. Examples such as this tell us that while the features of signed languages are different from those of spoken languages, their phonologies are organized according to principles like those of spoken languages.

Dissimilation Rules



"Dennis the Menace" © Hank Ketcham. Reprinted with permission of North America Syndicate.

It is understandable that so many languages have assimilation rules; they permit greater ease of articulation. It might seem strange, then, to learn that languages also have **dissimilation rules**, in which a segment becomes less similar to another segment. Ironically, such rules have the same explanation: it is sometimes easier to articulate dissimilar sounds. The difficulty of tongue twisters like "the sixth sheik's sixth sheep is sick" is based on the repeated similarity of sounds. If one were to make some sounds less similar, as in "the second sheik's tenth sheep is sick," it would be easier to say. The cartoon makes the same point, with *toy boat* being more difficult to articulate repeatedly than *sail boat*, because the [ɔɪ] of *toy* is more similar to [o] than is the [e] of *sail*.

An example of easing pronunciation through dissimilation is found in some varieties of English, where there is a fricative dissimilation rule. This rule applies to sequences /fθ/ and /sθ/, changing them to [ft] and [st]. Here the fricative /θ/ becomes dissimilar to the preceding fricative by becoming a stop. For example, the words *fifth* and *sixth* come to be pronounced as if they were spelled *fift* and *sikst*.

A classic example of the same kind of dissimilation occurred in Latin, and the results of this process show up in the derivational morpheme /-ar/ in English. In Latin a derivational suffix *-alis* was added to nouns to form adjectives. When the suffix was added to a noun that contained the liquid /l/, the suffix was changed to *-aris*; that is, the liquid /l/ was changed to the dissimilar liquid /r/. These words came into English as adjectives ending in *-al* or in its dissimilated form *-ar*, as shown in the following examples:

-al	**-ar**
anecdot-al	angul-ar
annu-al	annul-ar
ment-al	column-ar
pen-al	perpendicul-ar
spiritu-al	simil-ar
ven-al	vel-ar

All of the *-ar* adjectives contain an /l/, and as *columnar* illustrates, the /l/ need not be the consonant directly preceding the dissimilated segment.

Though dissimilation rules are rarer than assimilation rules, they are nevertheless found throughout the world's languages.

Feature-Changing Rules

The assimilation and dissimilation rules we have seen may all be thought of as *feature-changing rules*. In some cases a feature already present is changed. The /z/ plural morpheme has its voicing value changed from plus to minus when it follows a voiceless sound. Similarly, the /n/ in the phonemic negative prefix morpheme /ɪn/ undergoes a change in its place of articulation feature when preceding bilabials or velars. In the case of the Latin dissimilation rule, the feature [+lateral] is changed to [–lateral], so that /l/ is pronounced [r].

The addition of a feature is the other way in which we have seen features change. The English vowel nasalization rule is a case in point. Phonemically, vowels are not marked for nasality; however, in the environment specified by the rule, the feature [+nasal] is added.

Some feature-changing rules are neither assimilation nor dissimilation rules. The rule in English that aspirates voiceless stops at the beginning of a syllable simply adds a nondistinctive feature. Generally, aspiration occurs only if the following vowel is stressed. The /p/ in *pit* and *repeat* is an aspirated [p^h], but the /p/ in *inspect* or *compass* is an unaspirated [p]. We also note that even with an intervening consonant, the aspiration takes place so that words such as *crib*, *clip*, and *quip* ([k^hrɪb], [k^hlɪp], and [k^hwɪp]) all begin with an aspirated [k^h]. And finally, the affricate /tʃ/ is subject to the rule, so *chip* is phonetically [$tʃ^h$ɪp]. We can now state the rule:

> A voiceless, noncontinuant has [+aspirated] added to its feature matrix at the beginning of a syllable containing a stressed vowel with an optional intervening consonant.

Aspiration is not specified in any phonemic feature matrices of English. The aspiration rule adds this feature for reasons having to do with the timing of the closure release rather than in an attempt to make segments more alike or not alike, as with assimilation and dissimilation rules.

Remember that /p/ and /b/ (and all such symbols) are simply cover symbols that do not reveal the phonemic distinctions. In phonemic and phonetic feature matrices, these differences are made explicit, as shown in the following phonemic matrices:

	p	b	
Consonantal	+	+	
Continuant	−	−	
Labial	+	+	
Voiced	−	+	← distinctive difference

The nondistinctive feature "aspiration" is not included in these phonemic representations because aspiration is predictable.

Segment Insertion and Deletion Rules

Phonological rules may add or delete entire segments. These are different from the feature-changing and feature-adding rules we have seen so far, which affect only parts of segments. The process of inserting a consonant or vowel is called **epenthesis**.

The rules for forming regular plurals, possessive forms, and third-person singular verb agreement in English all require an epenthesis rule. Here is the first part of that rule that we gave earlier for plural formation:

> Insert a [ə] before the plural morpheme /z/ when a regular noun ends in a sibilant, giving [əz].

Letting the symbol ∅ stand for "null," we can write this *morphophonemic* epenthesis rule more formally as "null becomes schwa between two sibilants," or like this:

∅ → ə / [+sibilant] ___ [+sibilant]

Similarly, we recall the first part of the rule for regular past-tense formation in English:

> Insert a [ə] before the past-tense morpheme when a regular verb ends in a non-nasal alveolar stop, giving [əd].

This epenthesis rule may also be expressed in our more formal notation:

∅ → ə / [– nasal, + alveolar, – continuant] ___ [– nasal, + alveolar, – continuant]

There is a plausible explanation for insertion of a [ə]. If we merely added a [z] to *squeeze* to form its plural, we would get [skwiz:], which would be hard for English speakers to distinguish from [skwiz]. Similarly, if we added just [d] to *load* to form its past tense, it would be [lod:], which would also be difficult to distinguish from [lod], because in English we do not contrast long and short consonants. These and other examples suggest that the morphological patterns in a language are closely related to other generalizations about the phonology of that language.

Just as vowel length can be used for emphasis without changing the meaning of a word, as in "Stooooop [sta:p] hitting me," an epenthetic schwa can have a similar effect, as in "P-uh-lease [p^{h}əliz] let me go."

Segment deletion rules are commonly found in many languages and are far more prevalent than segment insertion rules. One such rule occurs in casual or rapid speech. We often delete the unstressed vowels that are shown in bold type in words like the following:

myst**e**ry gen**e**ral mem**o**ry fun**e**ral vig**o**rous Barb**a**ra

These words in casual speech sound as if they were written:

mystry genral memry funral vigrous Barbra

The silent *g* that torments spellers in such words as *sign* and *design* is actually an indication of a deeper phonological process, in this case, one of segment deletion. Consider the following examples:

A		**B**	
sign	[sãɪn]	signature	[sɪgnətʃər]
design	[dəzãɪn]	designation	[dɛzɪgneʃə̃n]
paradigm	[p^{h}ærədãɪm]	paradigmatic	[p^{h}ærədɪgmærək]

In none of the words in column A is there a phonetic [g], but in each corresponding word in column B a [g] occurs. Our knowledge of English phonology accounts for these phonetic differences. The "[g]—no [g]" alternation is regular, and we apply it to words that we never have heard. Suppose someone says:

"He was a salignant [səlɪgnə̃nt] man."

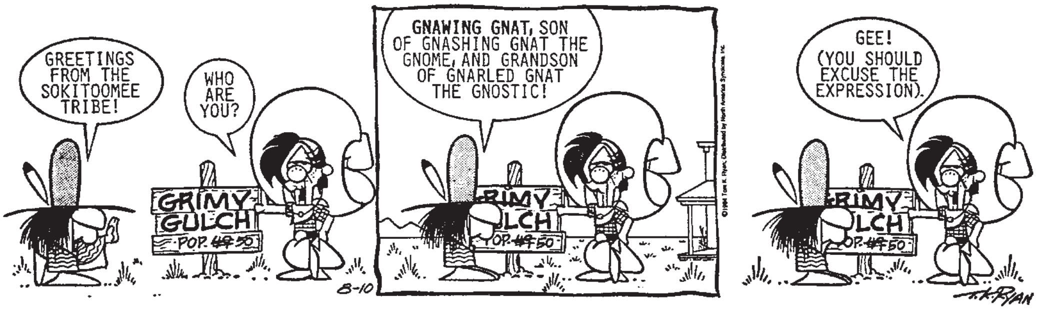
Not knowing what the word means (which you couldn't, since we made it up), you might ask:

"Why, did he salign [səlãɪn] somebody?"

It is highly doubtful that a speaker of English would pronounce the verb form without the *-ant* as [səlɪgn], because the phonological rules of English would delete the /g/ when it occurred in this context. This rule might be stated as:

Delete a /g/ when it occurs before a syllable-final nasal consonant.

The rule is even more general, as evidenced by the pair *gnostic* [nastɪk] and *agnostic* [ægnastɪk], and by the silent *g*'s in the cartoon:

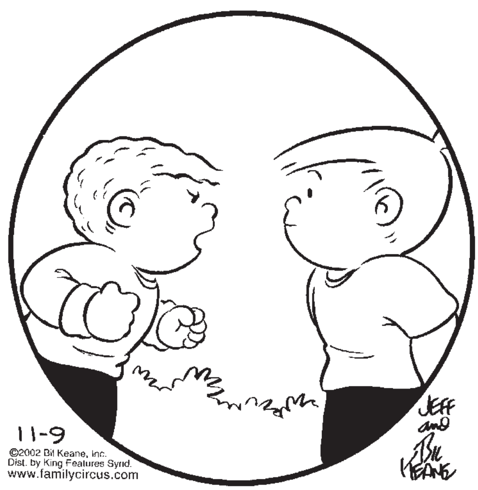


This more general rule may be stated as:

Delete a /g/ word initially before a nasal consonant or before a syllable-final nasal consonant.

Given this rule, the phonemic representation of the stems in *sign/signature*, *design/ designation*, *malign/malignant*, *phlegm/phlegmatic*, *paradigm/paradigmatic*, *gnostic/agnostic*, and so on will include a /g/ that will be deleted by the regular rule if a prefix or suffix is not added. By stating the class of sounds that follow the /g/ (nasal consonants) rather than any specific nasal consonant, the rule deletes the /g/ before both /m/ and /n/.

Movement (Metathesis) Rules



"The only reason I say 'aminal' is I can't say 'animal'!"

Phonological rules may also reorder sequences of phonemes, in which case they are called **metathesis** rules. For some speakers of English, the word *ask* is pronounced [æks], but the word *asking* is pronounced [æskĩŋ]. In this case a metathesis rule reorders the /s/ and /k/ in certain contexts. In Old English the verb was *aksian*, with the /k/ preceding the /s/. A historical metathesis rule switched these two consonants, producing *ask* in most dialects of English. Children's speech shows many cases of metathesis (which are corrected as the child approaches the adult grammar): *aminal* [æ̃mə̃nəl] for *animal* and *pusketti* [pʰəskɛti] for *spaghetti* are common children's pronunciations. Dog lovers have metathesized the She*tl*and sheepdog into a she*lt*ie, and at least two presidents of the United States have applied a metathesis rule to the word *nuclear*, which many Americans pronounce [n**j**u**k**liər], but is pronounced [nu**kj**ələr] by those leading statesmen.

From One to Many and from Many to One

As we've seen, phonological rules that relate phonemic to phonetic representations have several functions, among which are the following:

Function	**Example**
1. Change feature values	Nasal consonant assimilation rules in Akan and English
2. Add new features	Aspiration in English
3. Delete segments	*g*-deletion before nasals in English
4. Add segments	Schwa insertion in English plural and past tense
5. Reorder segments	Metathesis rule relating [æsk] and [æks]

The relationship between the phonemes and phones of a language is complex and varied. Rarely is a single phoneme realized as one and only one phone. We often find one phoneme realized as several phones, as in the case with English voiceless stops that may be realized as aspirated or unaspirated, among other possibilities. And we find the same phone may be the realization of several different phonemes. Here is a dramatic example of that many-to-one relationship.

Consider the vowels in the following pairs of words:

	A		**B**	
/i/	compet**e**	[i]	comp**e**tition	[ə]
/ɪ/	med**i**cinal	[ɪ]	med**i**cine	[ə]
/e/	maint**ai**n	[e]	maint**e**nance	[ə]
/ɛ/	t**e**legraph	[ɛ]	t**e**legraphy	[ə]
/æ/	an**a**lysis	[æ]	an**a**lytic	[ə]
/a/	s**o**lid	[a]	s**o**lidity	[ə]
/o/	ph**o**ne	[o]	ph**o**netic	[ə]
/ʊ/	Talm**u**dic	[ʊ]	Talm**u**d	[ə]

In column A all the boldfaced vowels are stressed vowels with a variety of vowel phones; in column B the boldfaced vowels are without stress or **reduced** and are pronounced as schwa [ə]. In these cases the stress pattern of the word varies because of the different suffixes. The vowel that is stressed in one form becomes reduced in a different form and is therefore pronounced as [ə]. The phonemic representations of all of the root morphemes contain an unreduced vowel such as /i/ or /e/ that is phonetically [ə] when it is reduced. We can conclude, then, that [ə] is an allophone of all English vowel phonemes. The rule to derive the schwa is simple to state:

Change a vowel to a [ə] when the vowel is reduced.

In the phonological description of a language, it is not always straightforward to determine phonemic representations from phonetic transcriptions. How would we deduce the /o/ in *phonetic* from its pronunciation as [fə̃nɛɾɪk] without a complete phonological analysis? However, given the phonemic representation and the phonological rules, we can always derive the correct phonetic representation. In our internal mental grammars this derivation is no problem, because the words occur in their phonemic forms in our mental lexicons and we know the rules of the language.

Similar rules exist in other languages that show that there is no one-to-one relationship between phonemes and phones. For example, in German both voiced and voiceless obstruents occur as phonemes, as is shown by the following minimal pair:

Tier [tiːr] "animal"   *dir* [diːr] "to you"

However, when voiced obstruents occur at the end of a word or syllable, they become voiceless. The words meaning "bundle" *Bund* /bʊnd/ and "colorful" *bunt* /bʊnt/ are phonetically identical and pronounced [bʊnt] with a final [t]. Obstruent voicing is neutralized in syllable-final position.

The German devoicing rule changes the specifications of features. In German, the phonemic representation of the final stop in *Bund* is /d/, specified as [+voiced]; it is changed by rule to [−voiced] to derive the phonetic [t] in word-final position. Again, this shows there is no simple relationship between phonemes and their allophones. German presents us with this picture:

$$\begin{tikzcd} \text{German Phonemes} & /d/ \arrow[d] \arrow[dr] & /t/ \arrow[d] \\ \text{German Phones} & [d] & [t] \end{tikzcd}$$

The devoicing rule in German provides a further illustration that we cannot discern the phonemic representation of a word given only the phonetic form; [bʊnt] can be derived from either /bʊnd/ or /bʊnt/. The phonemic representations and the phonological rules together determine the phonetic forms.

The Function of Phonological Rules

The function of the phonological rules in a grammar is to provide the phonetic information necessary for the pronunciation of utterances. We may illustrate this point in the following way:

input *Phonemic (Mental Lexicon) Representation of Words in a Sentence*

↓

Phonological rules (P-rules)

↓

output *Phonetic Representation of Words in a Sentence*

The input to the P-rules is the phonemic representation. The P-rules apply to the phonemic strings and produce as output the phonetic representation.

The application of rules in this way is called a **derivation**. We have given examples of derivations that show how plurals are derived, how phonemically oral vowels become nasalized, and how /t/ and /d/ become flaps in certain environments. A derivation is thus an explicit way of showing both the effects and the function of phonological rules in a grammar.

All the examples of derivations we have so far considered show the application of just one phonological rule, except the plural and past-tense rules, which are actually one rule with two parts. In any event, it is common for more than one rule to apply to a word. For example, the word *tempest* is phonemically /tɛmpɛst/ (as shown by the pronunciation of *tempestuous* [tʰɛ̃mpʰɛstʃuəs]) but phonetically [tʰɛ̃mpəst]. Three rules apply to it: the aspiration rule, the vowel nasalization rule, and the schwa rule. We can derive the phonetic form from the phonemic representation as follows:

Underlying phonemic representation	/	t	ɛ	m	p	ɛ	s	t	/
Aspiration rule		tʰ							
Nasalization rule			ɛ̃						
Schwa rule						ə			
Surface phonetic representation	[	tʰ	ɛ̃	m	p	ə	s	t	]

Slips of the Tongue: Evidence for Phonological Rules

Slips of the tongue, or **speech errors**, in which we deviate in some way from the intended utterance, show phonological rules in action. We all make speech errors, and they tell us interesting things about language and its use. Consider the following speech errors:

	Intended Utterance	**Actual Utterance**
1.	gone to seed	god to seen
	[gãn tə sid]	[gad tə sĩn]
2.	stick in the mud	smuck in the tid
	[stɪk ĩn ðə mʌd]	[smʌk ĩn ðə t^{h}ɪd]
3.	speech production	preach seduction
	[spitʃ p^{h}rədʌkʃə̃n]	[p^{h}ritʃ sədʌkʃə̃n]

In the first example, the final consonants of the first and third words were reversed. Notice that the reversal of the consonants also changed the nasality of the vowels. The vowel [ã] in the intended utterance is replaced by [a]. In the actual utterance, the nasalization was lost because it no longer occurred before a nasal consonant. The vowel in the third word, which was the non-nasal [i] in the intended utterance, became [ĩ] in the error, because it was followed by /n/. The nasalization rule applied.

In the other two errors, we see the application of the aspiration rule. In the intended *stick*, the /t/ would have been realized as an unaspirated [t] because it follows the syllable initial /s/. When it was switched with the /m/ in *mud*, it was pronounced as the aspirated [t^{h}], because it occurred initially. The third example also illustrates the aspiration rule in action. More than being simply amusing, speech errors are linguistically interesting because they provide further evidence for phonological rules and for the decomposition of speech sounds into features.

We will learn more about speech errors in chapter 9 on language processing.

Prosodic Phonology

Syllable Structure

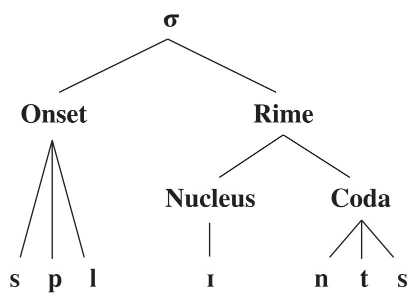
Baby Blues © Baby Blues Partnership. King Features Syndicate

Words are composed of one or more syllables. A **syllable** is a phonological unit composed of one or more phonemes. Every syllable has a **nucleus**, which is usually a vowel (but which may be a syllabic liquid or nasal). The nucleus may be preceded and/or followed by one or more phonemes called the syllable **onset** and **coda**. From a very early age, children learn that certain words rhyme. In rhyming words, the nucleus and the coda of the final syllable of both words are identical, as in the following jingle:

Jack and J**ill**
Went up the h**ill**
To fetch a pail of water.
Jack fell d**own**
And broke his cr**own**
And Jill came tumbling after.

For this reason, the nucleus + coda constitute the subsyllabic unit called a **rime** (note the spelling).

A syllable thus has a hierarchical structure. Using the IPA symbol σ for the phonological syllable, the hierarchical structure of the monosyllabic word *splints* can be shown:



Word Stress

In many languages, including English, one or more of the syllables in every content word (i.e., every word except for function words like *to*, *the*, *a*, *of*) are stressed. A stressed syllable, which can be marked by an acute accent (´), is perceived as more prominent than an unstressed syllable, as shown in the following examples:

pérvert	(noun)	as in	"My neighbor is a pervert."
pervért	(verb)	as in	"Don't pervert the idea."
súbject	(noun)	as in	"Let's change the subject."
subjéct	(verb)	as in	"He'll subject us to criticism."

These pairs show that stress can be contrastive in English. In these cases it distinguishes between nouns and verbs.

Some words may contain more than one stressed vowel, but exactly one of the stressed vowels is more prominent than the others. The vowel that receives primary stress is marked by an acute accent. The other stressed vowels are indicated by a grave accent (`) over the vowels (these vowels receive secondary stress).

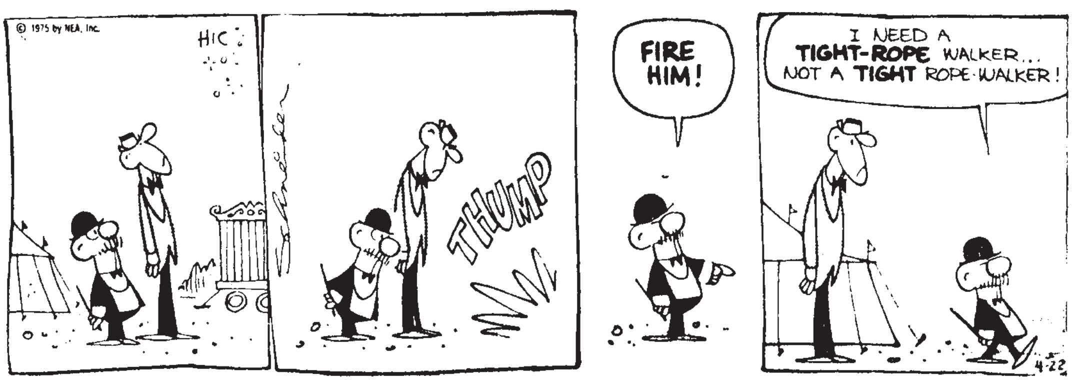
rèsignátion	lìnguístics	sỳstəmátic
fùndaméntal	ìntrodúctory	rèvolútion

Generally, speakers of a language know which syllable receives primary stress, which ones receive secondary stress, and which ones are reduced (are unstressed). It is part of their implicit knowledge of the language. It's usually easy to distinguish between stressed and reduced syllables, because the vowel in reduced syllables is pronounced as a schwa [ə], except at the ends of certain words such as *confetti* or *laboratory*. It may be harder to distinguish between primary and secondary stress. If you are unsure of where the primary stress is in a word (and you are a native or near-native speaker of English), try shouting the word as if talking to a person across a busy street. Often, the difference in stress becomes more apparent.

The stress pattern of a word may differ among English-speaking people. For example, in most varieties of American English the word *láboratòry* [lǽbərət^{h}òri] has two stressed syllables, but in most varieties of British English it receives only one stress [ləbɔ́rətri]. Because English vowels generally reduce to schwa or delete when they are not stressed, the British and American vowels differ in this word. In fact, in the British version the fourth vowel is deleted because it is not stressed.

Stress is a property of the syllable rather than a segment; it is a prosodic or suprasegmental feature. To produce a stressed syllable, one may change the pitch (usually by raising it), make the syllable louder, or make it longer. We often use all three of these phonetic means to stress a syllable.

Sentence and Phrase Stress



"Bimbo's Circus" © Howie Schneider/Dist. by Newspaper Enterprise Association, Inc.

When words are combined into phrases and sentences, one syllable receives greater stress than all others. That is, just as there is only one primary stress in a word spoken in isolation, only one of the vowels in a phrase (or sentence) receives primary stress or accent. All of the other stressed vowels are reduced to secondary stress. In English we place primary stress on the adjectival part of a compound noun (which may be written as one word, two words separated by a hyphen, or two separate words), but we place the stress on the noun when the words are a noun phrase consisting of an adjective followed by a noun. The differences between the following pairs are therefore predictable:

Compound Noun	**Adjective + Noun**
tíghtrope ("a rope for acrobatics")	tight rópe ("a rope drawn taut")
Rédcoat ("a British soldier")	red cóat ("a coat that is red")
hótdog ("a frankfurter")	hot dóg ("an overheated dog")
Whíte House ("the President's house")	white hóuse ("a house painted white")

Say these examples out loud, speaking naturally, and at the same time listen or feel the stress pattern. If English is not your native language, listen to a native speaker say them.

These pairs show that stress may be predictable from the morphology and syntax. The phonology interacts with the other components of the grammar. The stress differences between the noun and verb pairs discussed in the previous section (*subject* as noun or verb) are also predictable from the syntactic word category.

Intonation

"What can *I* do, Tertius?" said Rosamond, turning her eyes on him again. That little speech of four words, like so many others in all languages, is capable by varied vocal inflexions of expressing all states of mind from helpless dimness to exhaustive argumentative perception, from the completest self-devoting fellowship to the most neutral aloofness.

GEORGE ELIOT, *Middlemarch,* 1872

In chapter 6, we discussed pitch as a phonetic feature in reference to tone languages and intonation languages. In this chapter we have discussed the use of phonetic features to distinguish meaning. We can now see that pitch is a *phonemic* feature in tone languages such as Chinese, Thai, and Akan. We refer to these relative pitches as **contrasting tones**. In intonation languages such as English, pitch still plays an important role, but in the form of the **pitch contour** or **intonation** of the phrase or sentence.

In English, intonation may reflect syntactic or semantic differences. If we say *John is going* with a falling pitch at the end, it is a statement, but if the pitch rises at the end, it may be interpreted as a question. Similarly, *What's in the tea, honey?* may, depending on intonation, be a query to someone called "honey" regarding the contents of the tea (falling intonation on *honey*), or may be a query regarding whether the tea contains honey (rising intonation on *honey*).

A sentence that is ambiguous in writing may be unambiguous when spoken because of differences in the pitch contour, as we saw in the previous paragraph.

Here is a somewhat more subtle example. Written, sentence 1 is unclear as to whether Tristram intended for Isolde to read and follow directions, or merely to follow him:

1. Tristram left directions for Isolde to follow.

Spoken, if Tristram wanted Isolde to follow him, the sentence would be pronounced with a rise in pitch on the first syllable of *follow*, followed by a fall in pitch, as indicated (oversimplistically) in sentence 2.

Tristram left directions for Isolde to follow.

In this pronunciation of the sentence, the primary stress is on the word *follow*.

If the meaning is to read and follow a set of directions, the highest pitch comes on the second syllable of *directions*, as illustrated, again oversimplistically, in sentence 3.

Tristram left directions for Isolde to follow.

The primary stress in this pronunciation is on the word *directions*.

Pitch plays an important role in both tone languages and intonation languages, but in different ways, depending on the phonological system of the respective languages.

Sequential Constraints of Phonemes

> If you were to receive the following telegram, you would have no difficulty in correcting the "obvious" mistakes:
>
> BEST WISHES FOR VERY HAPPP BIRTFDAY
>
> because sequences such as BIRTFDAY do not occur in the language.
>
> **COLIN CHERRY,** *On Human Communication*, 1957

Suppose you were given the following four phonemes and asked to arrange them to form all *possible* English words:

/b/ /ɪ/ /k/ /l/

You would most likely produce the following:

/blɪk/
/klɪb/
/bɪlk/
/kɪlb/

These are the only permissible arrangements of these phonemes in English. */lbkɪ/, */ɪlbk/, */bkɪl/, and */ɪlkb/ are not possible English words. Although /blɪk/ and /klɪb/ are not now existing words, if you heard someone say:

"I just bought a beautiful new blick."

you might ask: “What’s a blick?”

If, on the other hand, you heard someone say:

“I just bought a beautiful new bkli.”

you might reply, “You just bought a new *what*?”

Your knowledge of English phonology includes information about what sequences of phonemes are permissible, and what sequences are not. After a consonant like /b/, /g/, /k/, or /p/, another stop consonant in the same syllable is not permitted by the phonology. If a word begins with an /l/ or an /r/, the next segment must be a vowel. That is why */lbɪk/ does not sound like an English word. It violates the restrictions on the sequencing of phonemes. People who like to work crossword puzzles are often more aware of these constraints than the ordinary speaker, whose knowledge, as we have emphasized, may not be conscious.

Other such constraints exist in English. If the initial sounds of *chill* or *Jill* begin a word, the next sound must be a vowel. The words /tʃʌt/ or /tʃon/ or /tʃæk/ are possible in English (*chut*, *chone*, *chack*), as are /dʒæl/ or /dʒil/ or /dʒalɪk/ (*jal*, *jeel*, *jolick*), but */tʃlɔt/ and */dʒpurz/ are not. No more than three sequential consonants can occur at the beginning of a word, and these three are restricted to /s/ + /p,t,k/ + /l,r,w,y/. There are even restrictions if this condition is met. For example, /stl/ is not a permitted sequence, so *stlick* is not a possible word in English, but *strick* is, along with *spew* /spju/, *sclaff* /sklæf/ (to strike the ground with a golf club), and *squat* /skwat/.

Other languages have different sequential restrictions. In Polish *zl* and *kt* are permissible syllable-initial combinations, as in /zlev/, “a sink,” and /kto/, “who.” Croatian permits words like the name *Mladen*. Japanese has severe constraints on what may begin a syllable; most combinations of consonants (e.g., /br/, /sp/) are impermissible.

The limitations on sequences of segments are called **phonotactic constraints**. Phonotactic constraints have as their basis the syllable, rather than the word. That is, only the clusters that can begin a syllable can begin a word, and only a cluster that can end a syllable can end a word.

In multisyllabic words, clusters that seem illegal may occur, for example the /kspl/ in *explicit* /ɛksplɪsɪt/. However, there is a syllable boundary between the /ks/ and /pl/, which we can make explicit using $: /ɛk $ splɪs $ ɪt/. Thus we have a permitted syllable coda /k/ that ends a syllable adjoined to a permitted onset /spl/ that begins a syllable. On the other hand, English speakers know that “condstluct” is not a possible word because the second syllable would have to start with an impermissible onset, either /stl/ or /tl/.

In Twi, a word may end only in a vowel or a nasal consonant. The sequence /pik/ is not a possible Twi word because it breaks the phonotactic rules of the language, whereas /mba/ is not a possible word in English, although it is a word in Twi.

All languages have constraints on the permitted sequences of phonemes, although different languages have different constraints. Just as spoken language has sequences of sounds that are not permitted in the language, so sign languages have forbidden combinations of features. For example, in the ASL compound for “blood” (red flow) discussed earlier, the total handshape must be assimilated, including the shape of the hand and the orientation of the fingers. Assimilation of just the handshape but not the finger orientation is impossible in ASL. The constraints may differ from one sign language to another, just as the constraints on sounds and sound sequences differ from one spoken language to another. A permissible sign in a Chinese sign language may not be a permissible sign in ASL, and vice versa. Children learn these constraints when they acquire the spoken or signed language, just as they learn what the phonemes are and how they are related to phonetic segments.

Lexical Gaps

The words *bot* [bat] and *crake* [k^hrek] are not known to all speakers of English, but they are words. On the other hand [bʊt] (rhymes with *put*), *creck* [k^hrɛk], *cruke* [k^hruk], *cruk* [k^hrʌk], and *crike* [k^hraɪk] are not now words in English, although they are possible words.

Advertising professionals often use possible but nonoccurring words for the names of new products. Although we would hardly expect a new product or company to come on the market with the name *Zhleet* [ʒlit]—an impossible word in English—we do not bat an eye at *Bic*, *Xerox* /ziraks/, *Kodak*, *Glaxo*, or *Spam* (a meat product, not junk mail), because those once nonoccurring words obey the phonotactic constraints of English.

A *possible word* contains phonemes in sequences that obey the phonotactic constraints of the language. An actual, occurring word is the union of a possible word with a meaning. Possible words without meaning are sometimes called nonsense words and are also referred to as **accidental gaps** in the lexicon, or **lexical gaps**. Thus "words" such as *creck* and *cruck* are nonsense words and represent accidental gaps in the lexicon of English.

Why Do Phonological Rules Exist?

No rule is so general, which admits not some exception.

ROBERT BURTON, *The Anatomy of Melancholy*, 1621

A very important question that we have not addressed thus far is: Why do grammars have phonological rules at all? In other words, why don't underlying or phonemic forms surface intact rather than undergoing various changes?

In the previous section we discussed *phonotactic constraints*, which are part of our knowledge of phonology. As we saw, phonotactic constraints specify which sound sequences are permissible in a particular language, so that in English *blick* is a possible word but **lbick* isn't. Many linguists believe that phonological rules exist to ensure that the surface or phonetic forms of words do not violate phonotactic constraints. If underlying forms remained unmodified, they would often violate the phonotactics of the language.

Consider, for example, the English past-tense rule and recall that it has two subrules. The first inserts a schwa when a regular verb ends in an alveolar stop (/t/ or /d/), as in *mated* [met**ə**d]. The second devoices the past-tense morpheme /d/ when it occurs after a voiceless sound, as in *reaped* [rip**t**] or *peaked* [p^hik**t**].

Notice that the part of the rule that devoices /d/ reflects the constraint that English words may not end in a sequence consisting of a voiceless stop + d. Words such as [lɪpd] and [mɪkd] do not exist, nor could they exist. They are impossible words of English, just as [bkɪl] is.

More generally, there are no words that end in a sequence of obstruents whose voicing features do not match. Thus words such as [kasb], where the final two obstruents are [–voice] [+voice] are not possible, nor are words such as [kabs] whose final two obstruents are [+voice] [–voice]. On the other hand, [kasp] and [kɛbz] are judged to be possible words because the final two segments agree in voicing. Thus, there appears to be a general constraint in English, stated as follows:

(A) Obstruent sequences may not differ with respect to their voice feature at the end of a word.

We can see then that the devoicing part of the past-tense rule changes the underlying form of the past-tense morpheme to create a surface form that conforms to this general constraint.

Similarly, the schwa insertion part of the past-tense rule creates possible sound sequences from impossible ones. English does not generally permit sequences of sounds within a single syllable that are very similar to each other, such as [kk], [kg], [gk], [gg], [pp], [sz], [zs], and so on. (The words spelled *egg* and *puppy* are phonetically [ɛg] and [pʌpɪ].) Thus the schwa insertion rule separates sequences of sounds that are otherwise not permitted in the language because they are too similar to each other, for example, the sequence of /d/ and /d/ in /mɛnd + d/, which becomes [mɛ̃ndəd] *mended*, or /t/ and /d/ in /part + d/, which becomes [pʰartəd] *parted*. The relevant constraint is stated as follows:

(B) Sequences of obstruents that differ at most with respect to voicing are not permitted within English words.

Constraints such as (A) and (B) are far more general than particular rules like the past-tense rule. For example, constraint B might also explain why an adjective such as *smooth* turns into the abstract noun *smoothness*, rather than taking the affix *-th* [θ], as in *wide-width*, *broad-breadth*, and *deep-depth*. Suffixing *smooth* with *-th* would result in a sequence of too similar obstruents, smoo[ðθ], which differ only in their voicing feature. This suggests that languages may satisfy constraints in various grammatical situations.

Thus, phonological rules exist because languages have general principles that constrain possible sequences of sounds. The rules specify minimal modifications of the underlying forms that bring them in line with the surface constraints. Therefore, we find different variants of a particular underlying form depending on the phonological context.

It has also been proposed that a universal set of phonological constraints exists, and that this set is ordered, with some constraints being more highly ranked than others. The higher the constraint is ranked, the more influence it exerts on the language. This proposal, known as **Optimality Theory**, also holds that the particular constraint rankings can differ from language to language, and that the different rankings generate the different sound patterns shown across languages. For example, constraint B is highly ranked in English; and so we have the English past-tense rule, as well as many other rules, including the plural rule (with some modification), that modify sequences of sounds that are too similar. Constraint B is also highly ranked in other languages, for example, Modern Hebrew, in which suffixes that begin with /t/ are always separated from stems ending in /t/ or /d/ by inserting [e], as in /kiʃat + ti/ → [kiʃatetɪ] meaning "I decorated." In Berber, similar consonants such as tt, dd, ss, and so on can surface at the end of words. In this language, constraint B is not highly ranked; other constraints outrank it and therefore exert a stronger effect on the language, notably constraints that require that surface forms not deviate from corresponding underlying forms. These constraints, known as *faithfulness constraints*, compete in the rankings with constraints that modify the underlying forms. Faithfulness constraints reflect the drive among languages to want a morpheme to have a single identifiable form, a drive that is in competition with constraints such as A and B. In the case of the English past-tense morpheme, the drive toward a single morpheme shows up in the spelling, which is always *-ed*.

In our discussion of syntactic rules in chapter 4, we noted that there are principles of Universal Grammar (UG) operating in the syntax. Two examples of this are the principle that transformational rules are structure dependent and the constraint that movement rules may not move phrases out of coordinate structures. If Optimality Theory is correct, and universal phonological constraints exist that differ among languages only in their rankings, then phonological rules, like syntactic rules, are constrained by universal principles. The differences in constraint rankings across languages are in some ways parallel to the different parameter settings that exist in the syntax of different languages, also discussed in chapter 4. We noted that in acquiring the syntax of her language, the young child must set the parameters of UG at the values that are correct for the language of the environment. Similarly, in acquiring the phonology of her language, the child must determine the correct constraint rankings as evidenced in the input language. We will have more to say about language acquisition in chapter 8.

Phonological Analysis

> Out of clutter, find simplicity.
> From discord, find harmony.
>
> **ALBERT EINSTEIN** (1879–1955)

Children recognize phonemes at an early age without being taught, as we shall see in chapter 8. Before reading this book, or learning anything about phonology, you knew a *p* sound was a phoneme in English because it contrasts words like *pat* and *cat*, *pat* and *sat*, *pat* and *mat*. But you probably did not know that the *p* in *pat* and the *p* in *spit* are different sounds. There is only one /p/ phoneme in English, but that phoneme has more than one allophone, including an aspirated one and an unaspirated one.

If a non-English-speaking linguist analyzed English, how could this fact about the sound *p* be discovered? More generally, how do linguists discover the phonological system of a language?

To do a phonological analysis, the words to be analyzed must be transcribed in great phonetic detail, because we do not know in advance which phonetic features are distinctive and which are not.

Consider the following Finnish words:

1.	[kudot]	"failures"	**5.**	[madon]	"of a worm"
2.	[kate]	"cover"	**6.**	[maton]	"of a rug"
3.	[katot]	"roofs"	**7.**	[ratas]	"wheel"
4.	[kade]	"envious"	**8.**	[radon]	"of a track"

Given these words, do the voiceless/voiced alveolar stops [t] and [d] represent different phonemes, or are they allophones of the same phone?

Here are a few hints as to how a phonologist might proceed:

1. Check to see if there are any minimal pairs.
2. Items (2) and (4) are minimal pairs: [kate] "cover" and [kade] "envious." Items (5) and (6) are minimal pairs: [madon] "of a worm" and [maton] "of a rug."
3. [t] and [d] in Finnish thus represent the distinct phonemes /t/ and /d/.

That was an easy problem. Now consider the following data from English, again focusing on [t] and [d] together with the alveolar flap [ɾ] and primary stress ´:

[ráɪt]	"write"	[ráɪɾər]	"writer"
[déɾə]	"data"	[dét]	"date"
[mǽd]	"mad"	[mǽt]	"mat"
[bətróð]	"betroth"	[lǽɾər]	"ladder"
[lǽɾər]	"latter"	[dístə̃ns]	"distance"
[ráɪɾər]	"rider"	[ráɪd]	"ride"
[déɾɪŋ]	"dating"	[bɛ́dsaɪd]	"bedside"
[mʌ́ɾər]	"mutter"	[túɾər]	"tutor"
[mǽɾər]	"madder"	[mǽdnɪs]	"madness"

A broad examination of the data reveals minimal pairs involving [t] and [d], so clearly /t/ and /d/ are phonemes. We also see some interesting homophones, such as *ladder* and *latter*, and *writer* and *rider*. And the flap [ɾ]? Is it a phoneme? Or is it predictable somehow? At this point the linguist undertakes the tedious task of identifying *all* of the immediate environments for [t], [d], and [ɾ], using # for a word boundary:

[t]: áɪ_#, é_#, ǽ_#, ə_r, s_ə, #_ú
[d]: #_é (3 times), ǽ_#, #_í, áɪ_#, ɛ́_s, ǽ_n
[ɾ]: áɪ_ə (2 times), é_ə, ǽ_ə (3 times), é_ɪ, ú_ə, ʌ́_ə

It does not appear at this point that anything systematic is going on with vowel or consonant quality, so we abstract the data a little, using *v* for an unstressed vowel, *v́* for a stressed vowel, C for a consonant, and # for a word boundary:

[t]: v́_#, #_v́, C_v, v_C
[d]: #_v́, v́_#, v́_C
[ɾ]: v́_v

Now we see clearly that [ɾ] is in complementary distribution with both [t] and [d]. It occurs only when preceded by a stressed vowel and followed by an unstressed vowel, and neither [t] nor [d] ever do. We may conclude, based on these data, that [ɾ] is an allophone of both /t/ and /d/. We tentatively propose the "alveolar flap rule":

> An alveolar stop becomes a flap in the environment between a stressed and unstressed vowel.

The phonemic forms lack a flap, so that *writer* is phonemically /raɪtər/ and *rider* is /raɪdər/, based on [raɪt] and [raɪd]. Similarly, we can propose /mædər/ for *madder* based on [mæd] and [mædnɪs], and /detɪŋ/ for *dating* based on [det]. But we don't have enough information to determine phonemic forms of *data*, *latter*, *ladder*, *tatter*, and *tutor*. This is typically the case in actual analyses. Rarely is there sufficient evidence to provide all the answers.

Finally, consider these data from Greek, focusing on the following sounds:

[x]	voiceless velar fricative
[k]	voiceless velar stop
[c]	voiceless palatal stop
[ç]	voiceless palatal fricative

1.	[kano]	"do"	**9.**	[çeri]	"hand"
2.	[xano]	"lose"	**10.**	[kori]	"daughter"
3.	[çino]	"pour"	**11.**	[xori]	"dances"
4.	[cino]	"move"	**12.**	[xrima]	"money"
5.	[kali]	"charms"	**13.**	[krima]	"shame"
6.	[xali]	"plight"	**14.**	[xufta]	"handful"
7.	[çeli]	"eel"	**15.**	[kufeta]	"bonbons"
8.	[ceri]	"candle"	**16.**	[oçi]	"no"

To determine the status of [x], [k], [c], and [ç], you should answer the following questions.

1. Are there are any minimal pairs in which these sounds contrast?
2. Are any noncontrastive sounds in complementary distribution?
3. If noncontrasting phones are found, what are the phonemes and their allophones?
4. What are the phonological rules by which the allophones can be derived?

1. By analyzing the data, we find that [k] and [x] contrast in a number of minimal pairs, for example, in [kano] and [xano]. [k] and [x] are therefore distinctive. [c] and [ç] also contrast in [çino] and [cino] and are therefore distinctive. But what about the velar fricative [x] and the palatal fricative [ç]? And the velar stop [k] and the palatal stop [c]? We can find no minimal pairs that would conclusively show that these represent separate phonemes.

2. We now proceed to answer the second question: Are these noncontrasting phones, namely [x]/[ç] and [k]/[c], in complementary distribution? One way to see if sounds are in complementary distribution is to list each phone with the environment in which it is found, as follows:

Phone	Environment
[k]	before [a], [o], [u], [r]
[x]	before [a], [o], [u], [r]
[c]	before [i], [e]
[ç]	before [i], [e]

We see that [k] and [x] are not in complementary distribution; they both occur before back vowels. Nor are [c] and [ç] in complementary distribution. They both occur before front vowels. But the stops [k] and [c] are in complementary distribution; [k] occurs before back vowels and [r], and never occurs before front vowels. Similarly, [c] occurs only before front vowels and never before back vowels or [r]. Finally, [x] and [ç] are in complementary distribution for the same reason. We therefore conclude that [k] and [c] are allophones of one phoneme, and the fricatives [x] and [ç] are also allophones of one phoneme. The pairs of allophones also fulfill the criterion of phonetic similarity. The first two are [–anterior] stops; the second are [–anterior] fricatives. (This similarity discourages us from pairing [k] with [ç], and [c] with [x], which are less similar to each other.)

3. Which of the phone pairs are more basic, and hence the ones whose features would define the phoneme? When two allophones can be derived from one phoneme, one selects as the underlying segment the allophone that makes the rules and the phonemic feature matrix as simple as possible, as we illustrated with the English unaspirated and aspirated voiceless stops.

In the case of the velar and palatal stops and fricatives in Greek, the rules appear to be equally simple. However, in addition to the simplicity criterion, we wish to state rules that have natural phonetic explanations. Often these turn out to be the simplest solution. In many languages, velar sounds become palatal before front vowels. This is an assimilation rule; palatal sounds are produced toward the front of the mouth, as are front vowels. Thus we select /k/ as a phoneme with the allophones [k] and [c], and /x/ as a phoneme with the allophones [x] and [ç].

4. We can now state the rule by which the palatals can be derived from the velars.

Palatalize velar consonants before front vowels.

Using feature notation we can state the rule as:

[+velar] → [+palatal] / ____ [–back]

Because only consonants are marked for the feature [velar], and only vowels for the feature [back], it is not necessary to include the features [consonantal] or [syllabic] in the rule. We also do not need to include any other features that are redundant in defining the segments to which the rule applies or the environment in which the rule applies. Thus [+palatal] in the change part of the rule is sufficient, and the feature [–back] also suffices to specify the front vowels. The simplicity criterion constrains us to state the rule as simply as we can.

Summary

Part of one's knowledge of a language is knowledge of the **phonology** or sound system of that language. It includes the inventory of **phones**—which are the phonetic sounds that occur in the language—and the ways in which they pattern. This patterning determines the inventory of **phonemes**—the abstract basic units that differentiate words.

When similar phones occur in **complementary distribution**, they are **allophones**—predictable phonetic variants—of one phoneme. Thus the aspirated [p^h] and the unaspirated [p] are allophones of the phoneme /p/ because they occur in different phonetic environments.

Some phones may be allophones of more than one phoneme. There is no one-to-one correspondence between the phonemes of a language and their allophones. In English, for example, stressed vowels become unstressed according to regular rules, and ultimately reduce to schwa [ə], which is an allophone of each English vowel.

Phonological segments—phonemes and phones—are composed of **phonetic features** such as *voiced*, *nasal*, *labial*, and *continuant*, whose presence or absence is indicated by + or – signs. *Voiced*, *continuant*, and many others are **distinctive features**—they can contrast words. Other features like *aspiration* are **nondistinctive** and are predictable from phonetic context. Some features like *nasal* may be distinctive for one class of sounds (e.g., consonants) but nondistinctive for a different class of sounds (e.g., vowels). Phonetic features that are nondistinctive in one language may be distinctive in another. Aspiration is distinctive in Thai and nondistinctive in English.

When two distinct words are distinguished by a single phone occurring in the same position, they constitute a **minimal pair**, e.g., *fine* [faɪn] and *vine* [vaɪn]. Minimal pairs also occur in sign languages. Signs may contrast by handshape, location, and movement.

Words in some languages may also be phonemically distinguished by **prosodic** or **suprasegmental** features, such as pitch, stress, and segment length. Languages in which syllables or words are contrasted by pitch are called **tone languages**. **Intonation** languages may use pitch variations to distinguish meanings of phrases and sentences.

The relationship between phonemic representation and phonetic representation (pronunciation) is determined by phonological rules. Phonological rules apply to phonemic strings and alter them in various ways to derive their phonetic pronunciation, or in the case of signed languages, their hand configuration. They may be **assimilation rules**, **dissimilation rules**, rules that *add* **nondistinctive features**, **epenthetic** rules that insert segments, **deletion** rules, and **metathesis** rules that reorder segments.

Phonological rules generally refer to entire classes of sound. These are **natural classes**, characterized by a small set of phonetic features shared by all the members of the class, e.g., [–continuant], [–voiced], to designate the natural class of voiceless stops.

Linguists may use a mathematical-like formulation to express phonological rules in a concise way. For example, the rule that nasalizes vowels when they occur before a nasal consonant may be written V → [+nasal] / __ [+nasal].

Morphophonemic rules apply to specific morphemes, e.g., the plural morpheme /z/ is phonetically [z], [s], or [əz], depending on the final phoneme of the noun to which it is attached.

The phonology of a language also includes sequential constraints (**phonotactics**) that determine which sounds may be adjacent within the syllable. These determine what words are possible in a language, and what phonetic strings are impermissible. Possible but nonoccurring words constitute **accidental gaps** and are **nonsense words**, e.g., *blick* [blɪk].

Phonological rules exist in part to enforce phonotactic constraints. **Optimality Theory** hypothesizes a set of ranked constraints that govern the phonological rules.

To discover the phonemes of a language, linguists (or students of linguistics) can use a methodology such as looking for minimal pairs of words, or for sounds that are in complementary distribution.

The phonological rules in a language show that the phonemic shape of words is not identical with their phonetic form. The phonemes are not the actual phonetic sounds, but are abstract mental constructs that are realized as sounds by the operation of rules such as those described in this chapter. No one is taught these rules, yet everyone knows them subconsciously.

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3

The Psychology of Language

The field of psycholinguistics, or the psychology of language, is concerned with discovering the psychological processes that make it possible for humans to acquire and use language.

JEAN BERKO GLEASON AND NAN BERNSTEIN RATNER,
Psycholinguistics, 1993

8

Language Acquisition

> [The acquisition of language] is doubtless the greatest intellectual feat any one of us is ever required to perform.
>
> **LEONARD BLOOMFIELD,** *Language*, 1933

> The capacity to learn language is deeply ingrained in us as a species, just as the capacity to walk, to grasp objects, to recognize faces. We don't find any serious differences in children growing up in congested urban slums, in isolated mountain villages, or in privileged suburban villas.
>
> **DAN SLOBIN,** *The Human Language Series program 2*, 1994

Language is extremely complex. Yet very young children—before the age of five—already know most of the intricate system that is the grammar of a language. Before they can add 2 + 2, children are conjoining sentences, asking questions, using appropriate pronouns, negating sentences, forming relative clauses, and inflecting verbs and nouns and in general have the creative capacity to produce and understand a limitless number of sentences.

It is obvious that children do not learn a language simply by memorizing the sentences of the language. Rather, they acquire a system of grammatical rules of the sort we have discussed in the preceding chapters. No one teaches children the rules of the grammar. Their parents are no more aware of the phonological, morphological, syntactic, and semantic rules than are the children. Even if you remember your early years, do you remember anyone telling you to form a sentence by adding a verb phrase to a noun phrase, or to add [s] or [z] to form plurals? No one told you "This is a grammatical utterance and that is not." Yet somehow you were able, as all children are, to quickly and effortlessly extract the intricate system of rules from the language you heard around you and thereby “reinvent” the grammar of your parents. How the child accomplishes this phenomenal task is the subject of this chapter.

Mechanisms of Language Acquisition

There have been various proposals concerning the psychological mechanisms involved in acquiring a language. Early theories of language acquisition were heavily influenced by behaviorism, a school of psychology prevalent in the 1950s. As the name implies, behaviorism focused on people’s behaviors, which are directly observable, rather than on the mental systems underlying these behaviors. Language was viewed as a kind of verbal behavior, and it was proposed that children learn language through imitation, reinforcement, analogy, and similar processes. B. F. Skinner, one of the founders of behaviorist psychology, proposed a model of language acquisition in his book *Verbal Behavior* (1957). Two years later, in a devastating reply to Skinner entitled *Review of Verbal Behavior* (1959), Noam Chomsky showed that language is a complex cognitive system that could not be acquired by behaviorist principles.

Do Children Learn through Imitation?

CHILD: My teacher holded the baby rabbits and we patted them.
ADULT: Did you say your teacher held the baby rabbits?
CHILD: Yes.
ADULT: What did you say she did?
CHILD: She holded the baby rabbits and we patted them.
ADULT: Did you say she held them tightly?
CHILD: No, she holded them loosely.

ANONYMOUS ADULT AND CHILD

At first glance the question of how children acquire language doesn’t seem difficult to answer. Don’t children just listen to what is said around them and imitate the speech they hear? Imitation is involved to some extent. An American child may hear *milk* and a Mexican child *leche* and each attempts to reproduce what is heard. But the early words and sentences that children produce show that they are not simply imitating adult speech. Many times the words are barely recognizable to an adult and the meanings are also not always like the adult’s, as we will discuss below.

Children do not hear words like *holded* or *tooths* or sentences such as *Cat stand up table* or many of the other utterances they produce between the ages of two and three, such as the following:[1]

[1]Many of the examples of child language in this chapter are taken from CHILDES (Child Language Data Exchange System), a computerized database of the spontaneous speech of children acquiring English and many other languages. MacWhinney, B., and C. Snow. 1985. The child language data exchange system. *Journal of Child Language* 12:271–96.

a my pencil
two foot
what the boy hit?
other one pants
Mommy get it my ladder
cowboy did fighting me

Even when children are trying to imitate what they hear, they are unable to produce sentences outside of the rules of their developing grammar. The following are a child's attempt to imitate what the adult has said:

ADULT:	He's going out.	CHILD:	He go out.
ADULT:	That's an old-time train.	CHILD:	Old-time train.
ADULT:	Adam, say what I say. Where can I put them?	CHILD:	Where I can put them?

Imitation also fails to account for the fact that children who are unable to speak for neurological or physiological reasons are able to learn the language spoken to them and understand it. When they overcome their speech impairment, they immediately use the language for speaking.

Do Children Learn through Correction and Reinforcement?

CHILD: Nobody don't like me.
MOTHER: No, say "Nobody likes me."
CHILD: Nobody don't like me.
(dialogue repeated eight times)
MOTHER: Now, listen carefully; say "Nobody likes me."
CHILD: Oh, nobody don't likes me.

ANONYMOUS MOTHER AND CHILD

Another proposal, in the behaviorist tradition, is that children learn to produce correct (grammatical) sentences because they are positively reinforced when they say something grammatical and negatively reinforced (corrected) when they say something ungrammatical. Roger Brown and his colleagues at Harvard University studied parent–child interactions. They report that correction seldom occurs, and when it does, it is usually for mispronunciations or incorrect reporting of facts and not for "bad grammar." They note, for example, that the ungrammatical sentence "Her curl my hair" was not corrected because the child's mother was in fact curling her hair. However, when the child uttered the grammatical sentence "Walt Disney comes on Tuesday," she was corrected because the television program was shown on Wednesday. Brown concludes that it is "truth value rather than syntactic well-formedness that chiefly governs explicit verbal reinforcement by parents—which renders mildly paradoxical the fact that the usual product of such a training schedule is an adult whose speech is highly grammatical but not notably truthful."

Adults will sometimes **recast** children's utterances into an adultlike form, as in the following examples:

Child	Mother
It fall.	It fell?
Where is them?	They're at home.
It doing dancing.	It's dancing, yes.

In these examples, the mother provides the correct model without actually correcting the child. Although recasts are potentially helpful to the child, they are not used in a consistent way. One study of forty mothers of children two to four years old showed that only about 25 percent of children's ungrammatical sentences are recast and that overall, grammatical sentences were recast as often as bad sentences. Parents tend to focus on the correctness of content more than on grammaticality. So parents allow many ungrammatical utterances to "slip by" and change many grammatical utterances. A child who relied on recasts to learn grammar would be mightily confused.

Even if adults did correct children's syntax more often than they do, it would still not explain how or what children learn from such adult responses, or how children discover and construct the correct rules. Children do not know what they are doing wrong and are unable to make corrections even when they are pointed out, as shown by the preceding example and the following one:

CHILD: Want other one spoon, Daddy.
FATHER: You mean, you want *the other spoon*.
CHILD: Yes, I want other one spoon, please, Daddy.
FATHER: Can you say "the other spoon"?
CHILD: Other . . . one . . . spoon.
FATHER: Say . . . "other."
CHILD: Other.
FATHER: Spoon.
CHILD: Spoon.
FATHER: Other . . . spoon.
CHILD: Other . . . spoon. Now give me other one spoon?

Such conversations between parents and children do not occur often; this conversation was between a linguist studying child language and his child. Mothers and fathers are usually delighted that their young children are talking and consider every utterance a gem. The "mistakes" children make are cute and repeated endlessly to anyone who will listen.

Do Children Learn Language through Analogy?

It has also been suggested that children put words together to form phrases and sentences by **analogy**, by hearing a sentence and using it as a model to form other sentences. But this is also problematic, as Lila Gleitman, an expert on developmental psycholinguistics, points out:

> [S]uppose the child has heard the sentence "I painted a red barn." So now, by analogy, the child can say "I painted a blue barn." That's exactly the

> kind of theory that we want. You hear a sample and you extend it to all of the new cases by similarity. . . . In addition to "I painted a red barn" you might also hear the sentence "I painted a barn red." So it looks as if you take those last two words and switch their order. . . . So now you want to extend this to the case of seeing, because you want to look at barns instead of paint them. So you have heard, "I saw a red barn." Now you try (by analogy) a . . . new sentence—"I saw a barn red." Something's gone wrong. This is an analogy, but the analogy didn't work. It's not a sentence of English.[2]

This kind of problem arises constantly. Consider another example. The child hears the following pair of sentences:

The boy was sleeping. Was the boy sleeping?

Based on pairs of sentences like this, he formulates a rule for forming questions: "Move the auxiliary to the position preceding the subject." He then acquires the more complex relative clause construction:

The boy who is sleeping is dreaming about a new car.

He now wants to form a question. What does he do? If he forms a question on analogy to the simple yes-no question, he will move the first auxiliary *is* as follows:

*Is the boy who sleeping is dreaming about a new car?

Studies of spontaneous speech, as well as experiments, show that children never make mistakes of this sort. As discussed in chapter 4, syntactic rules, such as the rule that moves the auxiliary, are sensitive to the structure of the sentence and not to the linear order of words. The available evidence shows that children know about the structure dependency of rules at a very early age.

In recent years, a computer model of language representation and acquisition called **connectionism** has been proposed that relies in part on behaviorist learning principles such as analogy and reinforcement. In the connectionist model, no grammatical rules are stored anywhere. Linguistic knowledge, such as knowledge of the past tense, is represented by a set of neuron-like connections between different phonological forms (e.g., between *play* and *played*, *dance* and *danced*, *drink* and *drank*). Repeated exposure to particular verb pairs in the input reinforces the connection between them, mimicking rule-like behavior. Based on similarities between words, the model can produce a past-tense form that it was not previously exposed to. On analogy to *dance-danced*, it will convert *prance* to *pranced*; on analogy to *drink-drank* it will convert *sink* to *sank*.

As a model of language acquisition, connectionism faces some serious challenges. The model assumes that the language of the child's environment has very specific properties. However, investigation of the input that children actually receive shows that it is not consistent with those assumptions. Another problem

[2]Gleitman, L. R., and E. Wanner. 1982. *Language acquisition: The state of the art*. Cambridge, UK: Cambridge University Press.

is that rules such as formation of past tense cannot be based on phonological form alone but must also be sensitive to information in the lexicon. For example, the past tense of a verb derived from a noun is always regular even if an irregular form exists. When a fly ball is caught in a baseball game, we say the batter *flied out*, not *flew out*. Similarly, when an irregular plural is part of a larger noun, it may be regularized. When we see several images of Walt Disney's famous rodent, we describe them as Mickey Mouses, not Mickey Mice.

Do Children Learn through Structured Input?

Yet another suggestion is that children are able to learn language because adults speak to them in a special "simplified" language sometimes called **motherese**, or **child-directed speech** (CDS) (or more informally, **baby talk**). This hypothesis places a lot of emphasis on the role of the environment in facilitating language acquisition.

In our culture adults do typically talk to young children in a special way. We tend to speak more slowly and more clearly, we may speak in a higher pitch and exaggerate our intonation, and sentences are generally grammatical. However, motherese is not syntactically simpler. It contains a range of sentence types, including syntactically complex sentences such as questions (*Do you want your juice now?*); embedded sentences (*Mommy thinks you should sleep now*); imperatives (*Pat the dog gently!*); and negatives with tag questions (*We don't want to hurt him, do we?*). And adults do not simplify their language by dropping inflections from verbs and nouns or by omitting function words such as determiners and auxiliaries, though children do this all the time. It is probably a good thing that motherese is not syntactically restricted. If it were, children might not have sufficient information to extract the rules of their language.

Although infants prefer to listen to motherese over normal adult speech, studies show that using motherese does not significantly affect the child's language development. In many cultures, adults do not use a special style of language with children, and there are even communities in which adults hardly talk to babies at all. Nevertheless, children around the world acquire language in much the same way, irrespective of these varying circumstances. Adults seem to be the followers rather than the leaders in this enterprise. The child does not develop linguistically because he is exposed to ever more adultlike language. Rather, the adult adjusts his language to the child's increasing linguistic sophistication. The exaggerated intonation and other properties of motherese may be useful for getting a child's attention and for reassuring the child, but it is not a driving force behind language development.

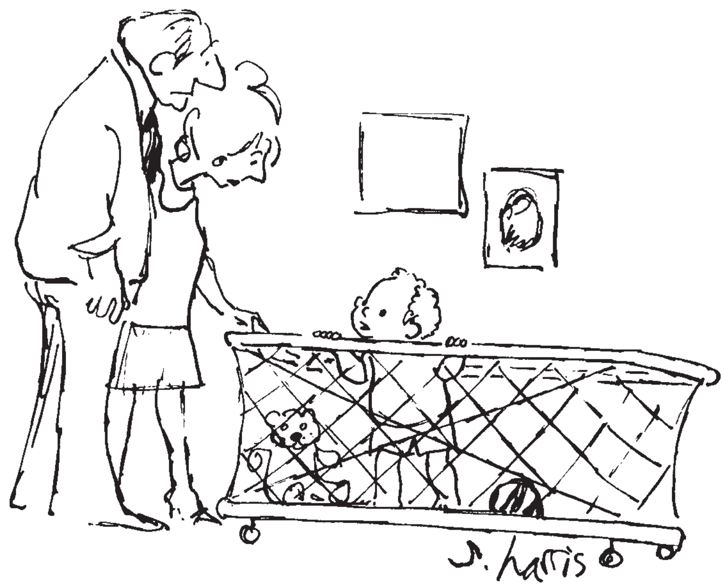
Analogy, imitation, and reinforcement cannot account for language development because they are based on the (implicit or explicit) assumption that what the child acquires is a set of sentences or forms rather than a set of grammatical rules. Theories that assume that acquisition depends on a specially structured input also place too much emphasis on the environment rather than on the grammar-making abilities of the child. These proposals do not explain the creativity that children show in acquiring language, why they go through stages, or why they make some kinds of "errors" but not others, for example, "Give me other one spoon" but not "Is the boy who sleeping is dreaming about a new car?"

Children Construct Grammars

> We are designed to walk. . . . That we are taught to walk is impossible. And pretty much the same is true of language. Nobody is taught language. In fact you can't prevent the child from learning it.
>
> **NOAM CHOMSKY,** *The Human Language Series* program 2, 1994

Language acquisition is a creative process. Children are not given explicit information about the rules, by either instruction or correction. They extract the rules of the grammar from the language they hear around them, and their linguistic environment does not need to be special in any way for them to do this. Observations of children acquiring different languages under different cultural and social circumstances reveal that the developmental stages are similar, possibly universal. Even deaf children of deaf signing parents go through stages in their signing development that parallel those of children acquiring spoken languages. These factors lead many linguists to believe that children are equipped with an innate template or blueprint for language—which we have referred to as Universal Grammar (UG)—and that this blueprint aids the child in the task of constructing a grammar for her language. This is referred to as the **innateness hypothesis**.

The Innateness Hypothesis



"WHAT'S THE BIG SURPRISE? ALL THE LATEST THEORIES OF LINGUISTICS SAY WE'RE BORN WITH THE INNATE CAPACITY FOR GENERATING SENTENCES."

The innateness hypothesis receives its strongest support from the observation that the grammar a person ends up with is vastly underdetermined by his linguistic experience. In other words, we end up knowing far more about language than is exemplified in the language we hear around us. This argument for the innateness of UG is called the **poverty of the stimulus**.

Although children hear many utterances, the language they hear is incomplete, noisy, and unstructured. We said earlier that child-directed speech is largely well formed, but children are also exposed to adult–adult interactions. These utterances include slips of the tongue, false starts, ungrammatical and incomplete sentences, and no consistent information as to which utterances are well formed and which are not. But most important is the fact that children come to know aspects of the grammar about which they receive *no* information. In this sense, the data they are exposed to is **impoverished**. It is less than what is necessary to account for the richness and complexity of the grammar they attain.

For example, we noted that the rules children construct are **structure dependent**. Children do not produce questions by moving the first auxiliary as in (1) below. Instead, they correctly invert the auxiliary of the main clause, as in (2). (We use ___ to mark the position from which a constituent moves.)

1. *Is the boy who ___ sleeping is dreaming of a new car?
2. Is the boy who is sleeping ___ dreaming of a new car?

To come up with a rule that moves the auxiliary of the main clause rather than the first auxiliary, the child must know something about the structure of the sentence. Children are not told about structure dependency. They are not told about constituent structure. Indeed, adults who have not studied linguistics do not explicitly know about structure dependency, constituent structure, and other abstract properties of grammar and so could not instruct their children even if they were so inclined. This knowledge is tacit or implicit. The input children get is a sequence of sounds, not a set of phrase structure trees. No amount of imitation, reinforcement, analogy, or structured input will lead the child to formulate a phrase structure tree, much less a principle of structure dependency. Yet, children do create phrase structures, and the rules they acquire are sensitive to this structure.

The child must also learn many aspects of grammar from her specific linguistic environment. English-speaking children learn that the subject comes first and that the verb precedes the object inside the VP, that is, that English is an SVO language. Japanese children acquire an SOV language. They learn that the object precedes the verb.

English-speaking children must learn that yes-no questions are formed by moving the auxiliary to the beginning of the sentence, as follows:

You will come home. → Will you ___ come home?

Japanese children learn that to form a yes-no question, the morpheme *-ka* is suffixed to a verb stem.

Tanaka ga sushi o tabete iru	"Tanaka is eating sushi."
Tanaka ga sushi o tabete iru**ka**	"Is Tanaka eating sushi?"

In Japanese questions, sentence constituents are not rearranged.

According to the innateness hypothesis, the child extracts from the linguistic environment those rules of grammar that are language specific, such as word order and movement rules. But he does not need to learn universal principles like structure dependency, or general principles of sentence formation such as the fact that heads of categories can take complements. All these principles are part of the innate blueprint for language that children use to construct the grammar of their language.

The innateness hypothesis provides an answer to *the logical problem of language acquisition* posed by Chomsky: What accounts for the ease, rapidity, and uniformity of language acquisition in the face of impoverished data? The answer is that children acquire a complex grammar quickly and easily without any particular help beyond exposure to the language because they do not start from scratch. UG provides them with a significant head start. It helps them to extract the rules of their language and to avoid many grammatical errors. Because the child constructs his grammar according to an innate blueprint, all children proceed through similar developmental stages, as we will discuss in the next section.

The innateness hypothesis also predicts that all languages will conform to the principles of UG. We are still far from understanding the full nature of the principles of UG. Research on more languages provides a way to test any principles that linguists propose. If we investigate a language in which a posited UG principle is absent, we will have to correct our theory and substitute other principles, as scientists must do in any field. But there is little doubt that human languages conform to abstract universal principles and that the human brain is specially equipped for acquisition of human language grammars.

Stages in Language Acquisition

> . . . for I was no longer a speechless infant; but a speaking boy. This I remember; and have since observed how I learned to speak. It was not that my elders taught me words . . . in any set method; but I . . . did myself . . . practice the sounds in my memory. . . . And thus by constantly hearing words, as they occurred in various sentences . . . I thereby gave utterance to my will.
>
> **ST. AUGUSTINE,** *Confessions*, 398 C.E.

Children do not wake up one fine morning with a fully formed grammar in their heads. Relative to the complexity of the adult grammar that they eventually attain, the process of language acquisition is fast, but it is not instantaneous. From first words to virtual adult competence takes three to five years, during which time children pass through linguistic stages. They begin by babbling, they then acquire their first words, and in just a few months they begin to put words together into sentences.

Observations of children acquiring different languages reveal that the stages are similar, possibly universal. The earliest studies of child language acquisition come from diaries kept by parents. More recent studies include the use of tape recordings, videotapes, and controlled experiments. Linguists record the spontaneous utterances of children and purposefully elicit other utterances to study the child's production and comprehension. Researchers have also invented ingenious techniques for investigating the linguistic abilities of infants, who are not yet speaking.

Children's early utterances may not look exactly like adult sentences, but child language is not just a degenerate form of adult language. The words and sentences that the child produces at each stage of development conform to the set of grammatical rules he has developed to that point. Although child grammars and adult grammars differ in certain respects, they also share many formal properties. Like adults, children have grammatical categories such as NP and VP, rules for building phrase structures and for moving constituents, as well as phonological, morphological, and semantic rules, and they adhere to universal principles such as structure dependency.

From the perspective of the adult grammar, sentences such as *Nobody don't like me* and *Want other one spoon, Daddy* contain grammatical errors, but such "errors" often reflect the child's current stage of grammatical competence and therefore provide researchers with a window into their grammar.

The Perception and Production of Speech Sounds

An infant crying in the night:
An infant crying for the light:
And with no language but a cry.

ALFRED LORD TENNYSON, *In Memoriam A.H.H.*, 1849

The notion that a person is born with a mind like a blank slate is belied by a wealth of evidence that newborns are reactive to some subtle distinctions in their environment and not to others. That is, the mind appears to be attuned at birth to receive certain kinds of information. Infants will respond to visual depth and distance distinctions, to differences between rigid and flexible physical properties of objects, and to human faces rather than to other visual stimuli.

Infants also show a very early response to different properties of language. Experiments demonstrate that infants will increase their sucking rate—measured by ingeniously designed pacifiers—when stimuli (visual or auditory) presented to them are varied, but will decrease the sucking rate when the same stimuli are presented repeatedly. Early in acquisition when tested with a preferential listening technique, they will also turn their heads toward and listen longer to sounds, stress patterns, and words that are familiar to them. These instinctive responses can be used to measure a baby's ability to discriminate and recognize different linguistic stimuli.

A newborn will respond to phonetic contrasts found in human languages even when these differences are not phonemic in the language spoken in the baby's home. A baby hearing a human voice over a loudspeaker saying [pa] [pa] [pa] will slowly decrease her rate of sucking. If the sound changes to [ba] or even [p^ha], the sucking rate increases dramatically. Controlled experiments show that adults find it difficult to differentiate between the allophones of one phoneme, but for infants it comes naturally. Japanese infants can distinguish between [r] and [l] whereas their parents cannot; babies can hear the difference between aspirated and unaspirated stops even if students in an introductory linguistics course cannot. Babies can discriminate between sounds that are phonemic in other languages and nonexistent in the language of their parents. For example, in Hindi, there is a phonemic contrast between a retroflex "t" [ʈ] (made with the tongue curled back) and the alveolar [t]. To English-speaking adults, these may sound the same; to their infants, they do not.

Infants can perceive voicing contrasts such as [pa] versus [ba], contrasts in place of articulation such as [da] versus [ga], and contrasts in manner of articulation such as [ra] versus [la], or [ra] versus [wa], among many others. Babies will not react, however, to distinctions that never correspond to phonemic contrasts in any human language, such as sounds spoken more or less loudly or sounds that lie between two phonemes. Furthermore, a vowel that we perceive as [i], for example, is a different physical sound when produced by a male, female, or child, but babies ignore the nonlinguistic aspects of the speech signal just as adults do.

Infants appear to be born with the ability to perceive just those sounds that are phonemic in some language. It is therefore possible for children to learn any human language they are exposed to. During the first year of life, the infant's job is to uncover the sounds of the ambient language. From around six months, he begins to lose the ability to discriminate between sounds that are not phonemic in his own language. His linguistic environment molds the infant's initial perceptions. Japanese infants can no longer hear the difference between [r] and [l], which do not contrast in Japanese, whereas babies in English-speaking homes retain this perception. They have begun to learn the sounds of the language of their parents. Before that, they appear to know the sounds of human language in general.

Babbling

"Hi & Lois" © King Features Syndicate

The shaping by the linguistic environment that we see in perception also occurs in the speech the infant is producing. At around six months, the infant begins to babble. The sounds produced in this period include many sounds that do not occur in the language of the household. However, **babbling** is not linguistic chaos. The twelve most frequent consonants in the world's languages make up

95 percent of the consonants infants use in their babbling. There are linguistic constraints even during this very early stage. The early babbles consist mainly of repeated consonant-vowel sequences, like *mama*, *gaga*, and *dada*. Later babbles are more varied.

By the end of the first year the child's babbles come to include only those sounds and sound combinations that occur in the target language. Babbles begin to sound like words, although they may not have any specific meaning attached to them. At this point adults can distinguish the babbles of an English-babbling infant from those of an infant babbling in Cantonese or Arabic. During the first year of life, the infant's perceptions and productions are being fine-tuned to the surrounding language(s).

Deaf infants produce babbling sounds that are different from those of hearing children. Babbling is related to auditory input and is linguistic in nature. Studies of vocal babbling of hearing children and manual babbling of deaf children support the view that babbling is a linguistic ability related to the kind of language input the child receives. These studies show that four- to seven-month-old hearing infants exposed to spoken language produce a restricted set of phonetic forms. At the same age, deaf children exposed to sign language produce a restricted set of signs. In each case the forms are drawn from the set of possible sounds or possible gestures found in spoken and signed languages.

Babbling illustrates the readiness of the human mind to respond to linguistic input from a very early stage. During the babbling stage, the intonation contours produced by hearing infants begin to resemble the intonation contours of sentences spoken by adults. The different intonation contours are among the first linguistic contrasts that children perceive and produce. During this same period, the vocalizations produced by deaf babies are random and nonrepetitive. Similarly, the manual gestures produced by hearing babies differ greatly from those produced by deaf infants exposed to sign language. The hearing babies move their fingers and clench their fists randomly with little or no repetition of gestures. The deaf infants, however, use more than a dozen different hand motions repetitively, all of which are elements of American Sign Language or the sign languages used in deaf communities of other countries.

The generally accepted view is that humans are born with a predisposition to discover the units that serve to express linguistic meanings, and that at a genetically specified stage in neural development, the infant will begin to produce these units—sounds or gestures—depending on the language input the baby receives. This suggests that babbling is the earliest stage in language acquisition, in opposition to an earlier view that babbling was prelinguistic and merely neuromuscular in origin. The "babbling as language acquisition" hypothesis is supported by recent neurological studies that link babbling to the language centers of the left hemisphere, also providing further evidence that the brain specializes for language functions at a very early age, as discussed in chapter 2.

First Words

> From this golden egg a man, Prajapati, was born. . . . A year having passed, he wanted to speak. He said "bhur" and the earth was created. He said "bhuvar" and the space of the air was created. He said "suvar" and the sky was created. That is why a child wants to speak

> after a year. . . . When Prajapati spoke for the first time, he uttered one or two syllables. That is why a child utters one or two syllables when he speaks for the first time.
>
> **HINDU MYTH**

Some time after the age of one, the child begins to repeatedly use the same string of sounds to mean the same thing. At this stage children realize that sounds are related to meanings. They have produced their first true words. The age of the child when this occurs varies and has nothing to do with the child's intelligence. (It is reported that Einstein did not start to speak until he was three or four years old.)

The child's first utterances differ from adult language. The following words of one child, J. P., at the age of sixteen months, illustrate the point:

[ʔaʊ]	"not," "no," "don't"	[sː]	"aerosol spray"
[bʌʔ]/[mʌʔ]	"up"	[sʲuː]	"shoe"
[da]	"dog"	[haɪ]	"hi"
[iʔo]/[siʔo]	"Cheerios"	[sr]	"shirt," "sweater"
[sa]	"sock"	[sæː]/[əsæː]	"what's that?"/"hey, look!"
[aɪ]/[ʌɪ]	"light"	[ma]	"mommy"
[baʊ]/[daʊ]	"down"	[dæ]	"daddy"

Most children go through a stage in which their utterances consist of only one word. This is called the **holophrastic** or "whole phrase" stage because these one-word utterances seem to convey a more complex message. For example, when J. P. says "down" he may be making a request to be put down, or he may be commenting on a toy that has fallen down from the shelf. When he says "cheerios" he may simply be naming the box of cereal in front of him, or he may be asking for some Cheerios. This suggests that children have a more complex mental representation than their language allows them to express. Comprehension experiments confirm the hypothesis that children's productive abilities do not fully reflect their underlying grammatical competence.

It has been claimed that deaf babies develop their first signs earlier than hearing children speak their first words. This has led to the development of Baby Sign, a technique in which hearing parents learn and model for their babies various "signs," such as a sign for "milk," "hurt," and "mother." The idea is that the baby can communicate his needs manually even before he is able to articulate spoken words. Promoters of Baby Sign (and many parents) say that this leads to less frustration and less crying. The claim that signs appear earlier than words is controversial. Some linguists argue that what occurs earlier in both deaf and hearing babies are pre-linguistic gestures that lack the systematic meaning of true signs. Baby Sign may perhaps be exploiting this earlier manual dexterity, and not a precocious linguistic development. More research is needed.

Segmenting the Speech Stream

> I scream, you scream, we all scream for ice cream.
>
> **TRANSCRIBED FROM VOCALS BY TOM STACKS,** performing with Harry Reser's Six Jumping Jacks, January 14, 1928

The acquisition of first words is an amazing feat. How do infants discover where one word begins and another leaves off? Speech is a continuous stream broken only by breath pauses. Children are in the same fix that you might be in if you tuned in a foreign-language radio station. You wouldn't have the foggiest idea of what was being said or what the words were. Intonation breaks that do exist do not necessarily correspond to word, phrase, or sentence boundaries. The adult speaker with knowledge of the lexicon and grammar of a language imposes structure on the speech he hears, but a person without such knowledge cannot. How then do babies, who have not yet learned the lexicon or rules of grammar, extract the words from the speech they hear around them? The ability to segment the continuous speech stream into discrete units—words—is one of the remarkable feats of language acquisition.

Studies show that infants are remarkably good at extracting information from continuous speech. They seem to know what kind of cues to look for in the input that will help them to isolate words. One of the cues that English-speaking children attend to that helps them figure out word boundaries is stress.

As noted in chapter 7, every content word in English has a stressed syllable. (Function words such as *the*, *a*, *am*, *can*, etc. are ordinarily unstressed.) If the content word is monosyllabic, then that syllable is stressed as in *dóg* or *hám*. Bisyllabic content words can be **trochaic**, which means that stress is on the first syllable, as in *páper* or *dóctor*, or **iambic**, which means stress is on the second syllable, as in *giráffe* or *devíce*. The vast majority of English words have trochaic stress. In controlled experiments adult speakers are quicker to recognize words with trochaic stress than words with iambic stress. This can be explained if English-speaking adults follow a strategy of taking a stressed syllable to mark the onset of a new word.

But what about children? Could they avail themselves of the same strategy? Stress is very salient to infants, and they are quick to acquire the rhythmic structure of their language. Using the preferential listening technique mentioned earlier, researchers have shown that at just a few months old infants are able to discriminate native and non-native stress patterns. Before the end of the first year their babbling takes on the rhythmic pattern of the ambient language. At about nine months old, English-speaking children prefer to listen to bisyllabic words with initial rather than final stress. And most notably, studies show that infants acquiring English can indeed use stress cues to segment words in fluent speech. In a series of experiments, infants who were seven and a half months old listened to passages with repeated instances of a trochaic word such as *púppy*, and passages with iambic words such as *guitár*. They were then played lists of words, some of which had occurred in the previous passage and others that had not. Experimenters measured the length of time that they listened to the familiar versus unfamiliar words. The results showed that children listened significantly longer (indicated by turning their head in the direction of the loudspeaker) to words that they had heard in the passage, but only when the words had the trochaic pattern (*púppy*). For words with the iambic pattern (*guitár*), the children responded only to the stressed syllable (tár), though the monosyllabic word *tar* had not appeared in the passage. These results suggest that the infants—like adults—are taking the stressed syllable to mark the onset of a new word. Following such a strategy will sometimes lead to errors (for iambic words and unstressed function words), but it provides the child with a way of getting started. This is sometimes referred to as **prosodic bootstrapping**. Infants can use the stress pattern of the language as a start to word learning.

Infants are also sensitive to phonotactic constraints and to the distribution of allophones in the target language. For example, we noted in chapter 7 that in English aspiration typically occurs at the beginning of a stressed syllable—[p^{h}ɪt] versus [spɪt]—and that certain combinations of sounds are more likely to occur at the end of a word rather than at the beginning, for example [rt]. Studies show that nine-month-olds can use this information to help segment speech into words in English.

Languages differ in their stress patterns as well as in their allophonic variation and phonotactics. Wouldn't the infant then need some way to first figure out what stress pattern he is dealing with, or what the allophones and possible sound combinations are, before he could use this information to extract the words of his language from fluent speech? This seems to be a classic chicken and egg problem—he has to know the language to learn the language. A way out of this conundrum is provided by the finding that infants may also rely on statistical properties of the input to segment words, such as the frequency with which particular sequences of sounds occur.

In one study, eight-month-old infants listened to two minutes of speech formed from four nonsense words, *pabiku*, *tutibu*, *golabu*, *babupu*. The words were produced by a speech synthesizer and strung together in three different orders, analogous to three different sentences, without any pauses or other phonetic cues to the word boundaries. Here is an example of what the children heard:

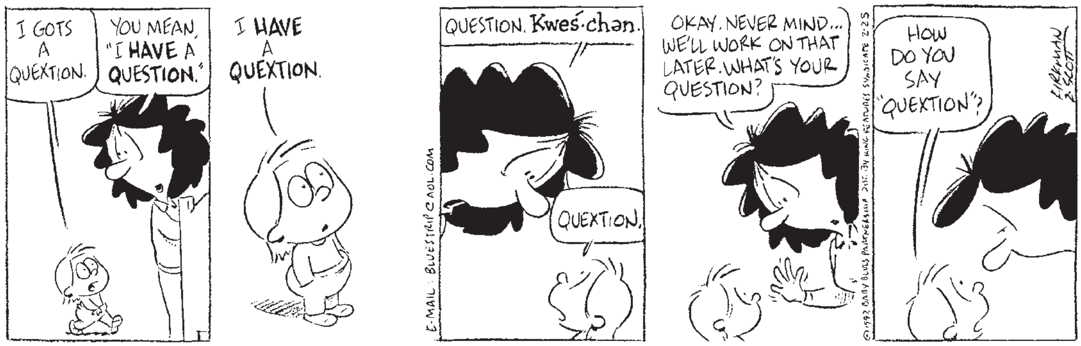
golabupabikututibubabupugolabubabupututibu. . . . .

After listening to the strings the infants were tested to see if they could distinguish the "words" of the language, for example *pabiku* (which, recall, they had never heard in isolation before), from sequences of syllables that spanned word boundaries, such as *bubabu* (also in the input). Despite the very brief exposure and the lack of boundary cues, the infants were able to distinguish the words from the nonwords. The authors of the study conclude that the children do this by tracking the frequency with which the different sequences of syllables occur: the sequences inside the words (e.g., pa-bi-ku) remain the same whatever order the words are presented in, but the sequences of syllables that cross word boundaries will change in the different presentations and hence these sequences will occur much less frequently. Though it is still unclear how much such statistical procedures can accomplish with real language input, which is vastly larger and more varied, this experiment and others like it suggest that babies are sensitive to statistical information as well as to linguistic structure to extract words from the input. It is possible that they first rely on statistical properties to isolate some words, and then, based on these words, they are able to detect the rhythmic, allophonic, and phonotactic properties of the language, and with this further knowledge they can do further segmentation. Studies that measure infants' reliance on statistics versus stress for segmenting words support this two stage model: younger infants (seven-and-a-half months old) respond to frequency while older infants (nine months old) attend to stress, allophonic, and phonotactic information.

The Development of Grammar

Children are biologically equipped to acquire all aspects of grammar. In this section we will look at development in each of the components of language, and we will illustrate the role that Universal Grammar and other factors play in this development.

The Acquisition of Phonology



"Baby Blues" © Baby Blues Partnership. Reprinted with permission of King Features Syndicate.

In terms of his phonology, J. P. is like most children at the one-word stage. The first words are generally monosyllabic with a CV (consonant-vowel) form. The vowel part may be a diphthong, depending on the language being acquired. The phonemic inventory is much smaller than is found in the adult language. It appears that children first acquire the small set of sounds common to all languages regardless of the ambient language(s), and in later stages acquire the less common sounds of their own language. For example, most languages have the sounds [p] and [s], but [θ] is a rare sound. J. P.'s sound system followed this pattern. His phonological inventory at an early stage included the consonants [b,m,d,k], which are frequently occurring sounds in the world's languages.

In general, the order of acquisition of classes of sounds begins with vowels and then goes by *manner* of articulation for consonants: nasals are acquired first, then glides, stops, liquids, fricatives, and affricates. Natural classes characterized by *place* of articulation features also appear in children's utterances according to a more or less ordered series: labials, velars, alveolars, and palatals. It is not surprising that *mama* is an early word for many children.

The distribution and frequency of sounds in a language can also influence the acquisition of certain segments. Sounds that are expected to be acquired late may appear earlier in children's language when they are frequently occurring. For example, the fricative [v] is a very late acquisition in English but it is an early phoneme in Estonian, Bulgarian, and Swedish, languages that have several [v]-initial words that are common in the vocabularies of young children.

If the first year is devoted to figuring out the sounds of the target language, the second year involves learning how these sounds are used in the phonology of the language, especially which contrasts are phonemic. When children first begin to contrast one pair of a set (e.g., when they learn that /p/ and /b/ are distinct phonemes due to a voicing difference), they also begin to distinguish between other similar pairs (e.g., /t/ and /d/, /s/ and /z/, and all the other voiceless–voiced phonemic pairs). As we would expect, the generalizations refer to natural classes of speech sounds.

Controlled experiments show that children at this stage can perceive or comprehend many more phonological contrasts than they can produce. The same child who says [wæbɪt] instead of "rabbit," and who does not seem to distinguish [w] and [r], will not make mistakes on a picture identification task in which she must point to either a ring or a wing. In addition, children sometimes produce two different sounds in a way that makes them indiscernible to adult observers. Acoustic analyses of children's utterances show that although a child's pronunciation of *wing* and *ring* may seem the same to the adult ear, they are physically different sounds. As a further example, a spectrographic analysis of *ephant*, "elephant," produced by a three-year-old child, clearly showed an [l] in the representation of the word, even though the adult experimenter could not hear it.

Many anecdotal reports also show the disparity between the child's production and perception at this stage. An example is the exchange between the linguist Neil Smith and his two-year-old son Amahl. At this age Amahl's pronunciation of "mouth" is [maʊs].

NS: What does [maʊs] mean?
A: Like a cat.
NS: Yes, what else?
A: Nothing else.
NS: It's part of your head.
A: (*fascinated*)
NS: (*touching A's mouth*) What's this?
A: [*maʊs*]

According to Smith, it took Amahl a few seconds to realize his word for "mouse" and his word for "mouth" were the same. It is not that Amahl and other children do not hear the correct adult pronunciation. They do, but they are unable in these early years to produce it themselves. Another linguist's child (yes, linguists love to experiment on their own children) pronounced the word *light* as *yight* [jaɪt] but would become very angry if someone said to him, "Oh, you want me to turn on the yight." "No no," he would reply, "not yight—yight!"

Therefore, even at this stage, it is not possible to determine the extent of the grammar of the child—in this case, the phonology—simply by observing speech production. It is sometimes necessary to use various experimental and instrumental techniques to tap the child's competence.

A child's first words show many substitutions of one feature for another or one phoneme for another. In the preceding examples, *mouth* [maʊθ] is pronounced *mouse* [maʊs], with the alveolar fricative [s] replacing the less common interdental fricative [θ]; *light* [laɪt] is pronounced *yight* [jaɪt], with the glide [j] replacing the liquid [l]; and *rabbit* is pronounced *wabbit*, with the glide [w] replacing the liquid [r]. Glides are acquired earlier than liquids, and hence substitute for them.

These substitutions are simplifications of the adult pronunciation. They make articulation easier until the child achieves greater articulatory control.

Children's early pronunciations are not haphazard, however. The phonological substitutions are rule governed. The following is an abridged lexicon for another child, Michael, between the ages of eighteen and twenty-one months:

[pun]	"spoon"	[maɪtl]	"Michael"
[peɪn]	"plane"	[daɪtər]	"diaper"
[tɪs]	"kiss"	[pati]	"Papi"
[taʊ]	"cow"	[mani]	"Mommy"
[tin]	"clean"	[bərt]	"Bert"
[polər]	"stroller"	[bərt]	"(Big) Bird"

Michael systematically substituted the alveolar stop [t] for the velar stop [k] as in his words for "cow," "clean," "kiss," and his own name. He also replaced labial [p] with [t] when it occurred in the middle of a word, as in his words for "Papi" and "diaper." He reduced consonant clusters in "spoon," "plane," and "stroller," and he devoiced final stops as in "Big Bird." In devoicing the final [d] in "bird," he created an ambiguous form [bərt] referring both to Bert and Big Bird. No wonder only parents understand their children's first words!

Michael's substitutions are typical of the phonological rules that operate in the very early stages of acquisition. Other common rules are reduplication—"bottle" becomes [baba], "water" becomes [wawa]; and the dropping of a final consonants—"bed" becomes [be], "cake" becomes [ke]. These two rules show that the child prefers a simple CV syllable.

Of the many phonological rules that children create, no child will necessarily use all rules. Early phonological rules generally reflect natural phonological processes that also occur in adult languages. For example, various adult languages have a rule of syllable-final consonant devoicing (German does—/bʊnd/ is pronounced [bʊnt]—English doesn't). Children do not create bizarre or whimsical rules. Their rules conform to the possibilities made available by Universal Grammar.

The Acquisition of Word Meaning

> Suddenly I felt a misty consciousness as of something forgotten—a thrill of returning thought; and somehow the mystery of language was revealed to me. . . . Everything had a name, and each name gave birth to a new thought.
>
> **HELEN KELLER,** *The Story of My Life*, 1903

In addition to what it tells us about phonological regularities, the child's early vocabulary also provides insight into how children use words and construct word meaning. For J. P. the word *up* was originally used only to mean "Get me up!" when he was either on the floor or in his high chair, but later he used it to mean "Get up!" to his mother as well. J. P. used his word for *sock* not only for socks but also for other undergarments that are put on over the feet, such as undershorts. This illustrates how a child may extend the meaning of a word from a particular referent to encompass a larger class.

When J. P. began to use words, the object had to be physically present, but that requirement did not last very long. He first used "dog" only when pointing to a real dog, but later he used the word for pictures of dogs in various books. A new word that entered J. P.'s vocabulary at seventeen months was "uh-oh," which he would say after he had an accident like spilling juice, or when he deliberately poured his yogurt over the side of his high chair. His use of this word shows his developing use of language for social purposes. At this time he added two new words meaning "no," [doː] and [no], which he used when anyone attempted to take something from him that he wanted, or tried to make him do something he did not want to do. He used them either with the imperative meaning of "Don't do that!" or with the assertive meaning of "I don't want to do that." Even at this early stage, J. P. was using words to convey a variety of ideas and feelings, as well as his social awareness.

But how do children learn the meanings of words? Most people do not see this aspect of acquisition as posing a great problem. The intuitive view is that children look at an object, the mother says a word, and the child connects the sounds with the object. However, this is not as easy as it seems:

> A child who observes a cat sitting on a mat also observes . . . a mat supporting a cat, a mat under a cat, a floor supporting a mat and a cat, and so on. If the adult now says "The cat is on the mat" even while pointing to the cat on the mat, how is the child to choose among these interpretations of the situation?

Even if the mother simply says "cat," and the child accidentally associates the word with the animal on the mat, the child may interpret cat as "Cat," the name of a particular animal, or of an entire species. In other words, to learn a word for a class of objects such as "cat" or "dog," children have to figure out exactly what the word refers to. Upon hearing the word *dog* in the presence of a dog, how does the child know that "dog" can refer to any four-legged, hairy, barking creature? Should it include poodles, tiny Yorkshire terriers, bulldogs, and Great Danes, all of which look rather different from one another? What about cows, lambs, and other four-legged mammals? Why are they not "dogs"? The important and very difficult question is: What relevant features define the class of objects we call *dog*, and how does a child acquire knowledge of them? Even if a child succeeds in associating a word with an object, nobody provides explicit information about how to extend the use of that word to all the other objects to which that word refers.

It is not surprising, therefore, that children often **overextend** a word's meaning, as J. P. did with the word *sock*. A child may learn a word such as *papa* or *daddy*, which she first uses only for her own father, and then extend its meaning to apply to all men, just as she may use the word *dog* to mean any four-legged creature. After the child has acquired her first seventy-five to one hundred words, the overextended meanings start to narrow until they correspond to those of the other speakers of the language. How this occurs is still not entirely understood.

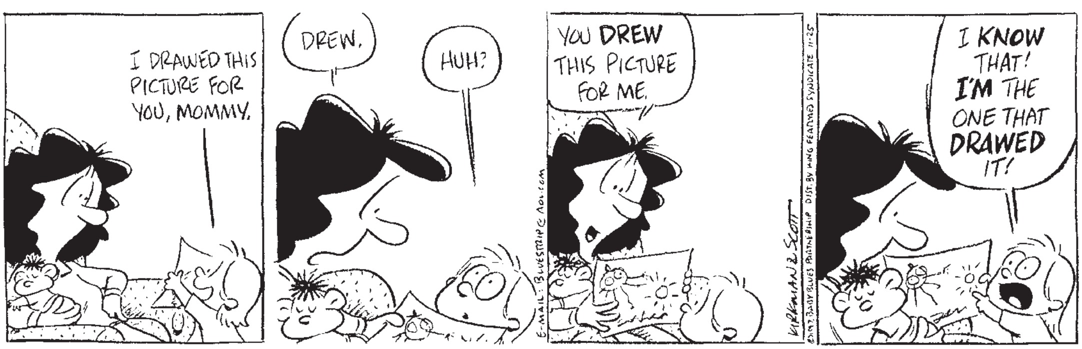
On the other hand, early language learning may involve **underextension**, in which a lexical item is used in an overly restrictive way. It is common for children to first apply a word like *bird* only to the family's pet canary without making a connection to birds in the tree outside, as if the word were a proper noun. And just as overextended meanings narrow in on the adult language, underextended meanings broaden their scope until they match the target language.

The mystery surrounding the acquisition of word meanings has intrigued philosophers and psychologists as well as linguists. We know that all children view the world in a similar fashion and apply the same general principles to help them determine a word's meaning. For example, overextensions are usually based on physical attributes such as size, shape, and texture. *Ball* may refer to all round things, *bunny* to all furry things, and so on. However, children will not make overextensions based on color. In experiments, children will group objects by shape and give them a name, but they will not assign a name to a group of red objects.

If an experimenter points to an object and uses a nonsense word like *blick*, saying *that's a blick*, the child will interpret the word to refer to the whole object, not one of its parts or attributes. Given the poverty of stimulus for word learning, principles like the "form over color principle" and the "whole object principle" help the child organize his experience in ways that facilitate word learning. Without such principles, it is doubtful that children could learn words as quickly as they do. Children learn approximately fourteen words a day for the first six years of their lives. That averages to about 5,000 words per year. How many students know 10,000 words of a foreign language after two years of study?

There is also experimental evidence that children can learn the meaning of one class of words—verbs—based on the syntactic environment in which they occur. If you were to hear a sentence such as *John blipped Mary the gloon*, you would not know exactly what John did, but you would likely understand that the sentence is describing a transfer of something from John to Mary. Similarly, if you heard *John gonked that Mary. . . .* , you would conclude that the verb *gonk* was a verb of communication like *say* or a mental verb like *think*. The complement types that a verb selects can provide clues to its meaning and thereby help the child. This learning of word meaning based on syntax is referred to as **syntactic bootstrapping**.

The Acquisition of Morphology



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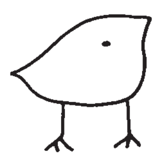
The child's acquisition of morphology provides the clearest evidence of rule learning. Children's errors in morphology reveal that the child acquires the regular rules of the grammar and then overgeneralizes them. This **overgeneralization** occurs when children treat irregular verbs and nouns as if they were regular. We have probably all heard children say *bringed*, *goed*, *drawed*, and *runned*, or *foots*, *mouses*, *and sheeps*.

These mistakes tell us much about how children learn language because such forms could not arise through imitation; children use them in families in which the parents never speak "bad English." In fact, children generally go through three phases in the acquisition of an irregular form:

Phase 1	Phase 2	Phase 3
broke	breaked	broke
brought	bringed	brought

In phase 1 the child uses the correct term such as *brought* or *broke*. At this point the child's grammar does not relate the form *brought* to *bring*, or *broke* to *break*. The words are treated as separate lexical entries. Phase 2 is crucial. This is when the child constructs a rule for forming the past tense and attaches the regular past-tense morpheme to all verbs—*play*, *hug*, *help*, as well as *break* and *bring*. Children look for general patterns. What they do not know at phase 2 is that there are exceptions to the rule. Now their language is more regular than the adult language. During phase 3 the child learns that there are exceptions to the rule, and then once again uses *brought* and *broke*, with the difference being that these irregular forms will be related to the root forms.

The child's morphological rules emerge quite early. In a classic study, preschool children and children in the first, second, and third grades were shown a drawing of a nonsense animal like the funny creature shown in the following picture. Each "animal" was given a nonsense name. The experimenter would then say to the child, pointing to the picture, "This is a wug."



Then the experimenter would show the child a picture of two of the animals and say, "Now here is another one. There are two of them. There are two ___."

The child's task was to give the plural form, "wugs" [wʌgz]. Another little make-believe animal was called a "bik," and when the child was shown two biks, he or she again was to say the plural form [bɪks]. The children applied regular plural formation to words they had never heard, showing that they had acquired the plural rule. Their ability to add [z] when the animal's name ended with a voiced sound, and [s] when there was a final voiceless consonant, showed that the children were also using rules based on an understanding of natural classes of phonological segments, and not simply imitating words they had previously heard.

More recently, studies of children acquiring languages with richer inflectional morphologies than English reveal that they learn agreement at a very early age. For example, Italian verbs must be inflected for number and person to agree with the subject. This is similar to the English agreement rule "add *s* to the verb" for third-person, singular subjects—*He giggles a lot* but *We giggle a lot*—except that in Italian more verb forms must be acquired. Italian-speaking children between the ages of 1;10 (one year, ten months) and 2;4 correctly inflect the verb, as the following utterances of Italian children show:

Tu legg**i** il libro.	"You (second person singular) read the book."
Io vad**o** fuori.	"I go (first person singular) outside."
Dorm**e** miao dorme.	"Sleeps (third person singular) cat sleeps."
Legg**iamo** il libro.	"(We) read (first person plural) the book."

Children acquiring other richly inflected languages such as Spanish, German, Catalan, and Swahili quickly acquire agreement morphology. It is rare for them to make agreement errors, just as it is rare for an English-speaking child to say "I goes."

In these languages there is also gender and number agreement between the head noun and the article and adjectives inside the noun phrase. Children as young as two years old respect these agreement requirements when producing NPs, as shown by the following Italian examples:

E mi**a** gonn**a**.	"(It) is my (feminine singular) skirt."
Quest**o** mio bimb**o**.	"This my (masculine singular) baby."
Guarda **la** mel**a** piccolin**a**.	"Look at the little (feminine singular) apple."
Guarda **il** top**o** piccolin**o**.	"Look at the little (masculine singular) mouse."

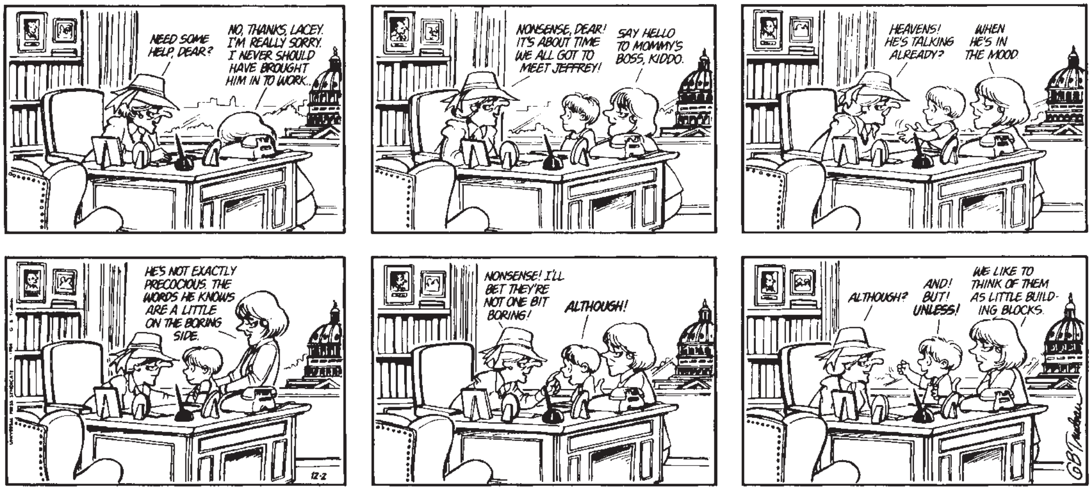
Experimental studies with twenty-five-month-old French-speaking children also show that they use gender information on determiners to help identify the subsequent noun, for example, *le ballon* (the-masc. balloon) versus *la banane* (the-fem. banana).

Children also show knowledge of the derivational rules of their language and use these rules to create novel words. In English, for example, we can derive verbs from nouns. From the noun *microwave* we now have a verb *to microwave*; from the noun *e(lectronic) mail* we derived the verb *to e-mail*. Children acquire this derivational rule early and use it often because there are lots of gaps in their verb vocabulary.

Child Utterance	**Adult Translation**
You have to scale it.	"You have to weigh it."
I broomed it up.	"I swept it up."
He's keying the door.	"He's opening the door (with a key)."

These novel forms provide further evidence that language acquisition is a creative process and that children's utterances reflect their internal grammars, which include both derivational and inflectional rules.

The Acquisition of Syntax



When children are still in the holophrastic stage, adults listening to the one-word utterances often feel that the child is trying to convey a more complex message. Experimental techniques show that at that stage (and even earlier), children have knowledge of some syntactic rules. In these experiments the infant sits on his mother's lap and hears a sentence over a speaker while seeing two video displays depicting different actions, one of which corresponds to the sentence. Infants tend to look longer at the video that matches the sentence they hear. This methodology allows researchers to tap the linguistic knowledge of children who are using only single words or who are not talking at all. Results show that children as young as seventeen months can understand the difference between sentences such as "Ernie is tickling Bert" and "Bert is tickling Ernie." Because these sentences have all the same words, the child cannot be relying on the words alone to understand the meanings. He must also understand the word-order rules and how they determine the grammatical relations of subject and object. This same preferential looking technique has shown that eighteen-month-olds can distinguish between subject and object *wh* questions, such as *What is the apple hitting?* and *What hit the apple?* These results and many others strongly suggest that children's syntactic competence is ahead of their productive abilities, which is also how their phonology develops.

Around the time of their second birthday, children begin to put words together. At first these utterances appear to be strings of two of the child's earlier holophrastic utterances, each word with its own single-pitch contour. Soon, they begin to form actual two-word sentences with clear syntactic and semantic relations. The intonation contour of the two words extends over the whole utterance rather than being separated by a pause between the two words. The following utterances illustrate the kinds of patterns that are found in children's utterances at this stage:

allgone sock	hi Mommy
bye bye boat	allgone sticky
more wet	it ball
Katherine sock	dirty sock

These early utterances can express a variety of semantic and syntactic relations. For example, noun + noun sentences such as *Mommy sock* can express a subject + object relation in the situation when the mother is putting the sock on the child, or a possessive relation when the child is pointing to Mommy's sock. Two nouns can also be used to show a subject-locative relation, as in *sweater chair* to mean "The sweater is on the chair," or to show attribution as in *dirty sock*. Children often have a variety of modifiers such as *allgone*, *more*, and *bye bye*.

Because children mature at different rates and the age at which children start to produce words and put words together varies, chronological age is not a good measure of a child's language development. Instead, researchers use the child's **mean length of utterances** (MLU) to measure progress. MLU is the average length of the utterances the child is producing at a particular point. MLU can be measured in terms of morphemes, so words like *boys*, *danced*, and *crying* each have a value of two (morphemes). MLU can also be measured in term of words, which is a more revealing measure when comparing children acquiring languages with different morphological systems. Children with the same MLU are likely to have similar grammars even though they are different ages.

In their earliest multiword utterances, children are inconsistent in their use of function words (grammatical morphemes) such as *a* and *the*, subject pronouns, auxiliary verbs such as *can* and *is*, and verbal inflection. Many (though not all) utterances consist only of open-class or content words, while some or all of the function words, auxiliaries, and verbal inflection may be missing. During this stage children often sound as if they are sending an e-message or reading an old-fashioned telegram (containing only the required words for basic understanding), which is why such utterances are sometimes called "telegraphic speech," and we call this the **telegraphic stage** of the child's language development.

Cat stand up table.
What that?
He play little tune.
Andrew want that.
Cathy build house.
No sit there.
Ride truck.
Show Mommy that.

J. P.'s early sentences were similar (the words in parentheses are missing from J. P.'s sentences):

Age in Months		
25	[danʔ ɪʔ tsɪʔ]	"Don't eat (the) chip."
	[bʷaʔ tat]	"Block (is on) top."
26	[mamis tu hæs]	"Mommy's two hands."
	[mo bʌs go]	"Where bus go?"
	[dædi go]	"(Where) Daddy go?"
27	[ʔaɪ gat tu dʲus]	"I got two (glasses of) juice."
	[do baɪʔ mi]	"Don't bite (kiss) me."
	[kʌder sʌni ber]	"Sonny color(ed a) bear."
28	[ʔaɪ gat pwe dɪs]	"I('m) play(ing with) this."
	[mamis tak mɛns]	"Mommy talk(ed to the) men."

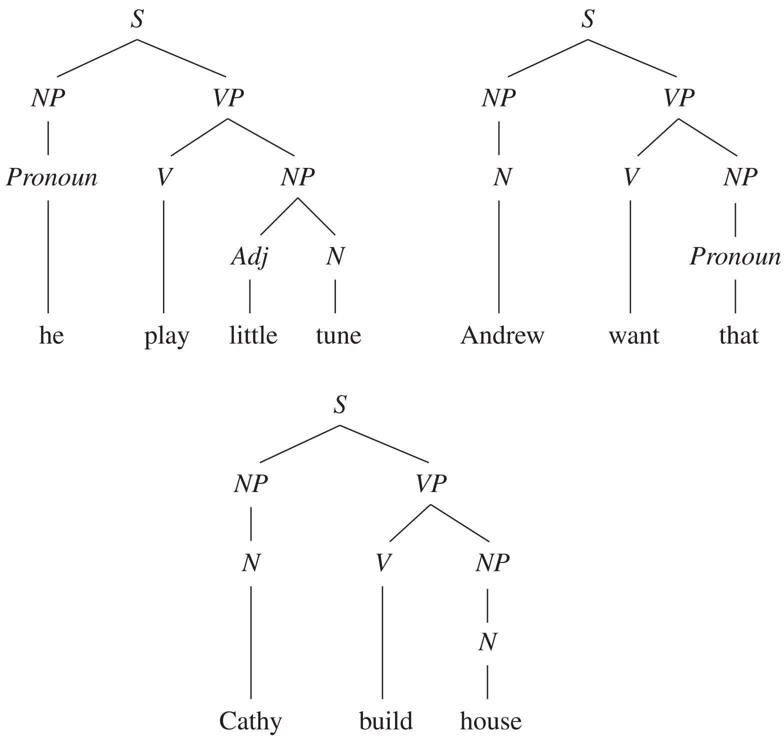
It can take many months before children use all the grammatical morphemes and auxiliary verbs consistently. However, the child does not deliberately leave out function words as would an adult sending a twitter. The sentences reflect the child's linguistic capacity at that particular stage of language development.

There is a great deal of debate among linguists about how to characterize telegraphic speech: Do children omit function morphemes because of limitations in their ability to produce longer, more complex sentences, or do they omit these morphemes because their grammar permits such elements to be unexpressed? On the first account, telegraphic speech is due to performance limitations: Since there is an upper limit on the length of utterance a child can produce, and function morphemes are prosodically and semantically weak, they are omitted. On the second view, telegraphic speech is an early grammatical stage similar to languages like Italian or Spanish that allow subject pronouns to be dropped, as in *Hablo ingles* "(I) speak English," or Chinese, which lacks many types of determiners.

Although these sentences may lack certain morphemes, they nevertheless appear to have hierarchical constituent structures and syntactic rules similar to those in the adult grammar. For example, children almost never violate the word-order rules of their language. In languages with relatively fixed word order such as English and Japanese, children use the required order (SVO in English, SOV in Japanese) from the earliest stage. In languages with freer word order, like Turkish and Russian, grammatical relations such as subject and object are generally marked by inflectional morphology, such as case markers. Children acquiring these languages quickly learn the morphological case markers. For example, Russian- and German-speaking children mark subjects with nominative case and objects with accusative case with very few errors.

Telegraphic speech is also very good evidence against the hypothesis that children learn sentences by imitation. Adults—even when speaking motherese—do not drop function words when they talk to children.

The correct use of word order, case marking, and agreement rules shows that even though children may often omit function morphemes, they are aware of constituent structure and syntactic rules. Their utterances are not simply words randomly strung together. From a very early stage onward, children have a grasp of the principles of phrase and sentence formation and of the kinds of structure dependencies mentioned in chapter 4, as revealed by these constituent structure trees:



In order to apply morphological and syntactic rules the child must know what syntactic categories the words in his language belong to. But how exactly does the child come to know that *play* and *want* are verbs and *tune* and *house* are nouns? One suggestion is that children first use the meaning of the word to figure out its category. This is called **semantic bootstrapping**. The child may have rules such as "if a word refers to a physical object, it's a noun" or "if a word refers to an action, it's a verb," and so on. However, the rules that link certain meanings to specific categories are not foolproof. For example, the word *action* denotes an action but it is not a verb, *know* is not an action but is a verb, and *justice* is a noun though it is not a physical object. But the rules that drive semantic bootstrapping might be helpful for the kind of words children learn early on which tend to refer to objects and actions.

Word frames may also help the child to determine when words belong to the same category. Studies of the language used to children show that there are certain frames that occur frequently enough to be reliable for categorization, for example, "you __ it" and "the __ one." Most typically, verbs such as *see*, *do*, *did*, *win*, *fix*, *turned*, and *get* occur in the first frame, while adjectives like *red*, *big*, *wrong*, and *light* occur in the second. If a child knows that *see* is a verb, then he could also deduce that all the other words appearing in the same frame are also verbs. Like semantic bootstrapping, the distributional evidence is not foolproof. For example, "it __ the" can frame a verb, *it **hit** the ball*, but also a preposition, *I hit it **across** the street*. And also like semantic bootstrapping, this evidence may well be reliable enough to give the child a head start into the complex task of learning the syntactic categories of words.

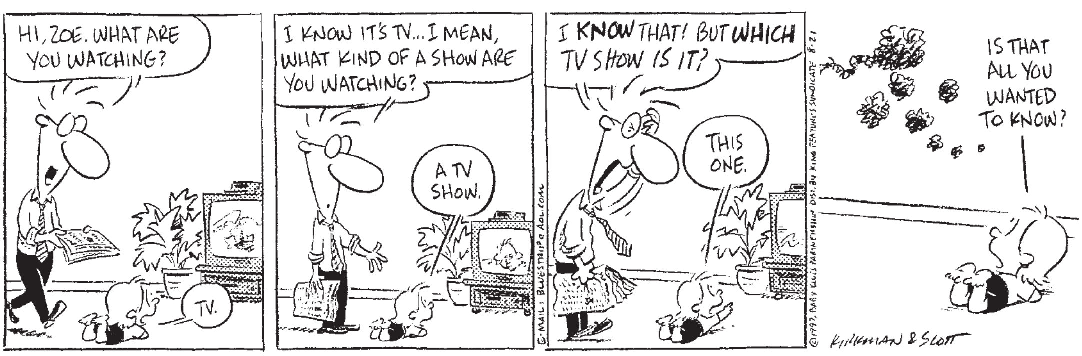
The most frequent frames typically consist of function words, determiners such as *the* or *a* or pronouns like *it* or *one*. This suggests that children can learn from function morphemes in the input even though they omit these elements in their own speech. Indeed, comprehension studies show that children pay attention to function words. Two-year-olds respond more appropriately to grammatical commands such as *Find the bird* than to commands with an ungrammatically positioned function word as in *Find was bird*. Other studies suggest that function morphemes such as determiners help children in word segmentation and categorization.

Sometime between the ages of 2;6 and 3;6, a virtual language explosion occurs. At this point it is difficult to identify distinct stages because the child is undergoing so much development so rapidly. By the age of 3;0, most children are consistent in their use of function morphemes. Moreover, they have begun to produce and understand complex structures, including coordinated sentences and embedded sentences of various kinds, such as the following:

He was stuck and I got him out.
I want this doll because she's big.
I know what to do.
I like to play with something else.
I think she's sick.
Look at the train Ursula bought.
I gon' make it like a rocket to blast off with.
It's too early for us to eat.

Past the age of 3;6 children can generally form grammatical *wh* questions with the proper Aux inversion such as *What can I do tomorrow?* They can produce and understand relative clauses such as *This is the lion that chased the giraffe*, as well as other embedded clauses such as *I know that Mommy is home*. They can use reflexive pronouns correctly such as *I saw myself in the camera*. Somewhat beyond 4;0, depending on the individual, much of the adult grammar has been acquired.

The Acquisition of Pragmatics



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In addition to acquiring the rules of grammar, children must learn the appropriate use of language in context, or pragmatics. The cartoon is funny because of the inappropriateness of the interaction, showing that Zoe hasn't completely acquired the pragmatic "maxims of conversation" discussed in chapter 5.

Context is needed to determine the reference of pronouns. A sentence such as "Amazingly, he loves her anyway" is uninterpretable unless both speaker and hearer understand who the pronouns *he* and *her* refer to. If the sentence were preceded by "I saw John and Mary kissing in the park," then the referents of the pronouns would be clear. Children are not always sensitive to the needs of their interlocutors, and they may fail to establish the referents for pronouns. It is not unusual for a three- or four-year-old (or even older children) to use pronouns out of the blue, like the child who cries to her mother "He hit me" when mom has no idea who did the deed.

The speaker and listener form part of the context of an utterance. The meaning of *I* and *you* depends on who is talking and who is listening, which changes from situation to situation. Younger children (around age two) have difficulty with the "shifting reference" of these pronouns. A typical error that children make at this age is to refer to themselves as "you," for example, saying "You want to take a walk" when they mean "I want to take a walk."

Children also show a lack of pragmatic awareness in the way they sometimes use articles. Like pronouns, the interpretation of articles depends on context. The definite article *the*, as in "the boy," can be used felicitously only when it is clear to speaker and hearer what boy is being discussed. In a discourse the indefinite article *a/an* must be used for the first mention of a new referent, but the definite article (or pronoun) may be used in subsequent mentions, as illustrated following:

A boy walked into the class.
He was in the wrong room.
The teacher directed the boy to the right classroom.

Children do not always respect the pragmatic rules for articles. In experimental studies, three-year-olds may use the definite article for introducing a new referent. In other words, the child tends to assume that his listener knows who he is talking about without having established this in a linguistically appropriate way.

It may take a child several months or years to master those aspects of pragmatics that involve establishing the reference for function morphemes such as determiners and pronouns. Other aspects of pragmatics are acquired very early. Children in the holophrastic stage use their one-word utterances with different illocutionary force (see page 216). The utterance "up" spoken by J. P. at sixteen months might be a simple statement such as "The teddy is up on the shelf," or a request: "Pick me up."

The Development of Auxiliaries: A Case Study

We have seen in this chapter that language acquisition involves development in various components—the lexicon, phonology, morphology, and syntax, as well as pragmatics. These different modules interact in complex ways to chart an overall course of language development.

As an example, let us take the case of the English auxiliaries. As noted earlier, children in the telegraphic stage do not typically use auxiliaries such as *can*, *will*, or *do*, and they often omit *be* and *have* from their utterances. Several syntactic constructions in English depend on the presence of an auxiliary, the most central of which are questions and negative sentences. To negate a main verb requires an auxiliary verb (or *do* if there isn't one) as in the following examples:

I don't like this book.
I won't read this book.

An adult does not say "I not like this book."

Similarly, as discussed in chapter 4, English yes-no and *wh* questions are formed by moving an auxiliary to precede the subject, as in the following examples:

Can I leave now?
Do you love me?
Where should John put the book?

Although the two-year-old does not have productive control of auxiliaries, she is able to form negative sentences and questions. During the telegraphic stage, the child produces questions of the following sort:

Yes-No Questions
I ride train?
Mommy eggnog?
Have some?

These utterances have a rising intonation pattern typical of yes-no questions in English, but because there are no auxiliaries, there can be no auxiliary movement. In *wh* questions there is also no auxiliary, but there is generally a *wh* phrase that has moved to the beginning of the sentence. English-speaking children do not produce sentences such as "Cowboy doing what?" in which the *wh* phrase remains in its deep structure position.

The two-year-old has an insufficient lexicon. The lack of auxiliaries means that she cannot use a particular syntactic device associated with question formation in English—auxiliary movement. However, she has the pragmatic knowledge to make a request or ask for information, and she has the appropriate prosody, which depends on knowledge of phonology and the syntactic structure of the question. She also knows the grammatical rule that requires *wh* phrases to be in a fronted position. Many components of language must be in place to form an adultlike question.

In languages that do not require auxiliaries to form a question, children appear more adultlike. For example, in Dutch and Italian, the main verb moves. Because many main verbs are acquired before auxiliaries, Dutch and Italian children in the telegraphic stage produce questions that follow the adult rule:

Dutch

En wat doen ze daar?	and what do they there	"And what are they doing there?"
Wordt mama boos?	becomes mama angry	"Is mommy angry?"
Weet je n kerk?	know you a church	"Do you know a church?"

Italian

Cosa fanno questi bambini?	what do these children	"What are these babies doing?"
Chando vene a mama?	when comes the mommy	"When is Mommy coming?"
Vola cici?	flies birdie	"Is the birdie flying?"

The Dutch and Italian children show us there is nothing intrinsically difficult about syntactic movement rules. The delay that English-speaking children show in producing adultlike questions may simply be because auxiliaries are acquired later than main verbs and because English is idiosyncratic in forming questions by moving only auxiliaries.

The lack of auxiliaries during the telegraphic stage also affects the formation of negative sentences. During this stage the English-speaking child's negative sentences look like the following:

He no bite you.
Wayne not eating it.
Kathryn not go over there.
You no bring choo-choo train.
That no fish school.

Because of the absence of auxiliaries, these utterances do not look very adultlike. However, children at this stage understand the pragmatic force of negation. The child who says "No!" when asked to take a nap knows exactly what he means.

As children acquire the auxiliaries, they generally use them correctly; that is, the auxiliary usually appears before the subject in yes-no questions, but not always.

Yes-No Questions
Does the kitty stand up?
Can I have a piece of paper?
Will you help me?
We can go now?
***Wh* Questions**
Which way they should go?
What can we ride in?
What will we eat?

The introduction of auxiliaries into the child's grammar also affects negative sentences. We now find correctly negated auxiliaries, though *be* is still missing in many cases.

Paul can't have one.
Donna won't let go.
I don't want cover on it.
I am not a doctor.
It's not cold.
Paul not tired.
I not crying.

The child always places the negation in the correct position in relation to the auxiliary or *be*. Main verbs follow negation and *be* precedes negation. Children never produce errors such as "Mommy dances not" or "I not am going."

In languages such as French and German, which are like Italian and Dutch in having a rule that moves inflected verbs, the verb shows up before the negative marker. French and German children respect this rule, as follows. (In the German examples *nich* is the baby form of *nicht*.)

French

Veux pas lolo.	want not water	"I don't want water."
Marche pas.	walks not	"She doesn't walk."
Ça tourne pas.	that turns not	"That doesn't turn."

German

Macht nich aua.	makes not ouch	"It doesn't hurt."
Brauche nich lala.	need not pacifier	"I don't need a pacifier."
Schmeckt auch nich.	tastes also not	"It doesn't taste good either."

Though the stages of language development are universal, they are shaped by the grammar of the particular adult language the child is acquiring. During the telegraphic stage, German, French, Italian, and English-speaking children omit auxiliaries, but they form negative sentences and questions in different ways because the rules of question and negative formation are different in the respective adult languages. This tells us something essential about language acquisition: Children are sensitive to the rules of the adult language at the earliest stages of development. Just as their phonology is quickly fine-tuned to the ambient language(s), so is their syntactic system.

The ability of children to form complex rules and construct grammars of the languages around them in a relatively short time is phenomenal. That all children go through similar stages regardless of language shows that they are equipped with special abilities to know what generalizations to look for and what to ignore, and how to discover the regularities of language.

Setting Parameters

Children acquire some aspects of syntax very early, even while they are still in the telegraphic stage. Most of these early developments correspond to what we referred to as the parameters of UG in chapter 4. One such parameter determines whether the head of a phrase comes before or after its complements, for example, whether the order of the VP is verb-object (VO) as in English or OV as in Japanese. Children produce the correct word order of their language in their earliest multiword utterances, and they understand word order even when they are in the one-word stage of production. According to the parameter model of UG, the child does not actually have to formulate a word-order rule. Rather, he must choose between two already specified values: head first or head last. He determines the correct value based on the language he hears around him. The English-speaking child can quickly figure out that the head comes before its complements; a Japanese-speaking child can equally well determine that his language is head final.

Other parameters of UG involve the verb movement rules. In some languages the verb can move out of the VP to higher positions in the phrase structure tree. We saw this in the Dutch and Italian questions discussed in the last section. In other languages, such as English, verbs do not move (only auxiliaries do). The verb movement parameters provide the child with an option: my language does/does not allow verb movement. As we saw, Dutch- and Italian-speaking children quickly set the verb movement parameters to the "does allow" value, and so they form questions by moving the verb. English-speaking children never make the mistake of moving the verb, even when they don't yet have auxiliaries. In both cases, the children have set the parameter at the correct value for their language. Even after English-speaking children acquire the auxiliaries and the Aux movement rule, they never overgeneralize this movement to include verbs. This supports the hypothesis that the parameter is set early in development and cannot be undone. In this case as well, the child does not have to formulate a rule of verb movement; he does not have to learn when the verb moves and where it moves to. This is all given by UG. He simply has to decide whether verb movement is possible in his language.

The parameters of UG limit the grammatical options to a small well-defined set—is my language head first or head last, does my language have verb movement, and so on. Parameters greatly reduce the acquisition burden on the child and contribute to explaining the ease and rapidity of language acquisition.

The Acquisition of Signed Languages

Deaf children who are born to deaf signing parents are naturally exposed to sign language just as hearing children are naturally exposed to spoken language. Given the universal aspects of sign and spoken languages, it is not surprising that language development in these deaf children parallels the stages of spoken language acquisition. Deaf children babble, they then progress to single signs similar to the single words in the holophrastic stage, and finally they begin to combine signs. There is also a telegraphic stage in which the function signs may be omitted. Use of function signs becomes consistent at around the same age for deaf children as function words in spoken languages. The ages at which signing children go through each of these stages are comparable to the ages of children acquiring a spoken language.

Both spoken and signed language acquisition adhere to a set of universal principles, overlaid by language-particular components. We saw earlier that English-speaking children easily acquire *wh* movement, which is governed by universal principles, but they show some delay in their use of Aux movement, which is specific to English. In *wh* questions in ASL, the *wh* word can move or it can be left in its original position. Both of the following sentences are grammatical:

___________________________whq
WHO BILL SEE YESTERDAY?

___________________________ whq
BILL SAW WHO YESTERDAY?

(*Note*: We follow the convention of writing the glosses for signs in uppercase letters.)

There is no Aux movement in ASL, but a question is accompanied by a facial expression with furrowed brows and the head tilted back. This is represented by the "whq" above the ASL glosses. This *non-manual marker* is part of the grammar of ASL. It is like the rising intonation we use when we ask questions in English and other spoken languages.

In the acquisition of *wh* questions in ASL, signing children easily learned the rules associated with the *wh* phrase. The children sometimes move the *wh* phrase and sometimes leave it in place, as adult signers do. But they often omit the non-manual marker, an omission that is not grammatical in the adult language.

Sometimes the parallels between the acquisition of signed and spoken languages are striking. For example, some of the grammatical morphemes in ASL are semantically transparent or **iconic**, that is, they look like what they mean; for example, the sign for the pronoun "I" involves the speaker pointing to his chest. The sign for the pronoun "you" is a point to the chest of the addressee. As noted earlier, at around age two, children acquiring spoken languages often reverse the pronouns "I" and "you." Interestingly, at this same age signing children make this same error. They will point to themselves when they mean "you" and point to the addressee when they mean "I." Children acquiring ASL make this error despite the transparency or iconicity of these particular signs, because signing children (like signing adults) treat these pronouns as linguistic symbols and not simply as pointing gestures. As part of the language, the shifting reference of these pronouns presents the same problem for signing children that it does for speaking children.

Hearing children of deaf parents acquire both sign language and spoken language when exposed to both. Studies show that Canadian bilingual children who acquire Langues des Signes Quebecoise (LSQ), or Quebec Sign Language, develop the two languages exactly as bilingual children acquiring two spoken languages. The LSQ–French bilinguals reached linguistic milestones in each of their languages in parallel with Canadian children acquiring French and English. They produced their first words, as well as their first word combinations, at the same time in each language. In reaching these milestones, neither group showed any delay compared to monolingual children.

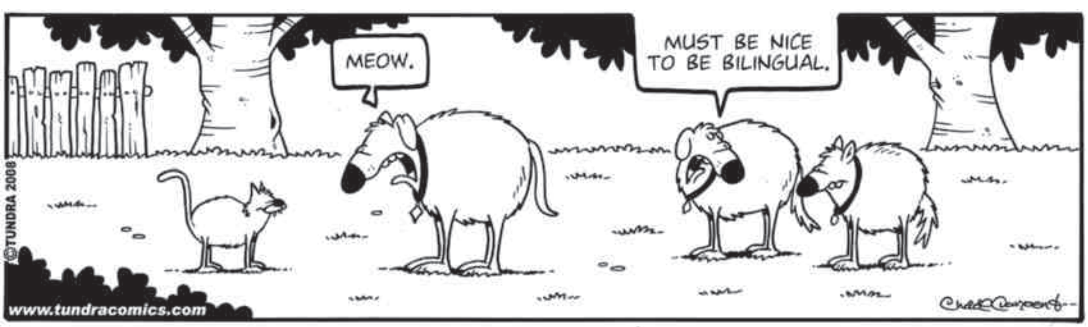
Deaf children of hearing parents who are not exposed to sign language from birth suffer a great handicap in acquiring language. It may be many years before these children are able to use a spoken language or before they encounter a conventional sign language. Yet the instinct to acquire language is so strong in humans that these deaf children begin to develop their own manual gestures to express their thoughts and desires. A study of six such children revealed that they not only developed individual signs but joined pairs and formed sentences with definite syntactic order and systematic constraints. Although these "home signs," as they are called, are not fully developed languages like ASL or LSQ, they have a linguistic complexity and systematicity that could not have come from the input, because there was no input. Cases such as these demonstrate not only the strong drive that humans have to communicate through language, but also the innate basis of language structure.

Knowing More Than One Language

> He that understands grammar in one language, understands it in another as far as the essential properties of Grammar are concerned. The fact that he can't speak, nor comprehend, another language is due to the diversity of words and their various forms, but these are the accidental properties of grammar.
>
> **ROGER BACON** (1214–1294)

People can acquire a second language under many different circumstances. You may have learned a second language when you began middle school, or high school, or college. Moving to a new country often means acquiring a new language. Other people live in communities or homes in which more than one language is spoken and may acquire two (or more) languages simultaneously. The term **second language acquisition**, or **L2 acquisition**, generally refers to the acquisition of a second language by someone (adult or child) who has already acquired a first language. This is also referred to as **sequential bilingualism**. **Bilingual language acquisition** refers to the (more or less) simultaneous acquisition of two languages beginning in infancy (or before the age of three years), also referred to as **simultaneous bilingualism**.

Childhood Bilingualism



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Approximately half of the people in the world are native speakers of more than one language. This means that as children they had regular and continued exposure to those languages. In many parts of the world, especially in Africa and Asia, bilingualism (even multilingualism) is the norm. In contrast, many Western countries (though by no means all of them) view themselves as monolingual, even though they may be home to speakers of many languages. In the United States and many European countries, bilingualism is often viewed as a transitory phenomenon associated with immigration.

Bilingualism is an intriguing topic. People wonder how it's possible for a child to acquire two (or more) languages at the same time. There are many questions, such as: Doesn't the child confuse the two languages? Does bilingual language development take longer than monolingual development? Are bilingual children brighter, or does acquiring two languages negatively affect the child's cognitive development in some way? How much exposure to each language is necessary for a child to become bilingual?

Much of the early research into bilingualism focused on the fact that bilingual children sometimes mix the two languages in the same sentences, as the following examples from French-English bilingual children illustrate. In the first example, a French word appears in an otherwise English sentence. In the other two examples, all of the words are English but the syntax is French.

His nose is perdu.	"His nose is lost."
A house pink	"A pink house"
That's to me.	"That's mine."

In early studies of bilingualism, this kind of language mixing was viewed negatively. It was taken as an indication that the child was confused or having difficulty with the two languages. In fact, many parents, sometimes on the advice of educators or psychologists, would stop raising their children bilingually when faced with this issue. However, it now seems clear that some amount of language mixing is a normal part of the early bilingual acquisition process and not necessarily an indication of any language problem.

Theories of Bilingual Development

These mixed utterances raise an interesting question about the grammars of bilingual children. Does the bilingual child start out with only one grammar that is eventually differentiated, or does she construct a separate grammar for each language right from the start? The **unitary system hypothesis** says that the child initially constructs only one lexicon and one grammar. The presence of mixed utterances such as the ones just given is often taken as support for this hypothesis. In addition, at the early stages, bilingual children often have words for particular objects in only one language. For example, a Spanish-English bilingual child may know the Spanish word for milk, *leche*, but not the English word, or she may have the word *water* but not *agua*. This kind of complementarity has also been taken as support for the idea that the child has only one lexicon.

However, careful examination of the vocabularies of bilingual children reveals that although they may not have exactly the same words in both languages, there is enough overlap to make the single lexicon idea implausible. The reason children may not have the same set of words in both languages is that they use their two languages in different circumstances and acquire the vocabulary appropriate to each situation. For example, the bilingual English-Spanish child may hear only Spanish during mealtime, and so he will first learn the Spanish words for foods. Also, bilingual children have smaller vocabularies in each of their languages than the monolingual child has in her one language. This makes sense because a child can only learn so many words a day, and the bilingual child has two lexicons to build. For these reasons the bilingual child may have more lexical gaps than the monolingual child at a comparable stage of development, and those gaps may be different for each language.

The **separate systems hypothesis** says that the bilingual child builds a distinct lexicon and grammar for each language. To test the separate systems hypothesis, it is necessary to look at how the child acquires those pieces of grammar that are different in his two languages. For example, if both languages have SVO word order, this would not be a good place to test this hypothesis. Several studies have shown that where the two languages diverge, children acquire the different rules of each language. Spanish-English and French-German bilingual children have been shown to use the word orders appropriate to each language, as well as the correct agreement morphemes for each language. Other studies have found that children set up two distinct sets of phonemes and phonological rules for their languages.

The separate systems hypothesis also receives support from the study of the LSQ-French bilinguals discussed earlier. These children have semantically equivalent words in the two languages, just as bilinguals acquiring two spoken languages do. In addition, these children, like all bilingual children, were able to adjust their language choice to the language of their addressees, showing that they differentiated the two languages. Like most bilingual children, the LSQ-French bilinguals produced mixed utterances that had words from both languages. What is especially interesting is that these children showed simultaneous language mixing. They would produce an LSQ sign and a French word at the same time, something that is only possible if one language is spoken and the other signed. However, this finding has implications for bilingual language acquisition in general. It shows that the language mixing of bilingual children is not caused by confusion, but is rather the result of two grammars operating simultaneously.

If bilingual children have two grammars and two lexicons, what explains the mixed utterances? Various explanations have been offered. One suggestion is that children mix because they have lexical gaps; if the French-English bilingual child does not know the English word *lost*, she will use the word she does know, *perdu*—the "any port in a storm" strategy. Another possibility is that the mixing in child language is similar to **codeswitching** used by many adult bilinguals (discussed in chapter 10). In specific social situations, bilingual adults may switch back and forth between their two languages in the same sentence, for example, "I put the forks en las mesas" (I put the forks on the tables). Codeswitching reflects the grammars of both languages working simultaneously; it is not "bad grammar" or "broken English." Adult bilinguals codeswitch only when speaking to other bilingual speakers. It has been suggested that the mixed utterances of bilingual children are a form of codeswitching. In support of this proposal, various studies have shown that bilingual children as young as two make contextually appropriate language choices: In speaking to monolinguals the children use one language, and in speaking to bilinguals they mix the two languages.

Two Monolinguals in One Head

Although we must study many bilingual children to reach any firm conclusions, the evidence accumulated so far seems to support the idea that children construct multiple grammars from the outset. Moreover, it seems that bilingual children develop their grammars along the same lines as monolingual children. They go through a babbling stage, a holophrastic stage, a telegraphic stage, and so on. During the telegraphic stage they show the same characteristics in each of their languages as the monolingual children. For example, monolingual English-speaking children omit verb endings in sentences such as "Eve play there" and "Andrew want that," and German-speaking children use infinitives as in "S[ch]okolade holen" (chocolate get-infinitive). Spanish- and Italian-speaking monolinguals never omit verbal inflection or use infinitives in this way. Remarkably, two-year-old German-Italian bilinguals use infinitives when speaking German but not when they speak Italian. Young Spanish-English bilingual children drop the English verb endings but not the Spanish ones, and German-English bilinguals omit verbal inflection in English and use the infinitive in German. Results such as these have led some researchers to suggest that from a grammar-making point of view, the bilingual child is like "two monolinguals in one head."

The Role of Input

One issue that concerns researchers studying bilingualism, as well as parents of bilingual children, is the relationship between language input and proficiency. What role does input play in helping the child to separate the two languages? One input condition that is thought to promote bilingual development is *une personne–une langue* (one person, one language)—as in, Mom speaks only language A to the child and Dad speaks only language B. The idea is that keeping the two languages separate in the input will make it easier for the child to acquire each without influence from the other. Whether this method influences bilingual development in some important way has not been established. In practice this "ideal" input situation may be difficult to attain. It may also be unnecessary. We saw earlier that babies are attuned to various phonological properties of the input language such as prosody and phonotactics. Various studies suggest that this sensitivity provides a sufficient basis for the bilingual child to keep the two languages separate.

Another question is, how much input does a child need in each language to become "native" in both? The answer is not straightforward. It seems intuitively clear that if a child hears twelve hours of English a day and only two hours of Spanish, he will probably develop English much more quickly and completely than Spanish. In fact, under these conditions he may never achieve the kind of grammatical competence in Spanish that we associate with the normal monolingual Spanish speaker. In reality, bilingual children are raised in a variety of circumstances. Some may have more or less equal exposure to the two languages; some may hear one language more than the other but still have sufficient input in the two languages to become "native" in both; some may ultimately have one language that is dominant to a lesser or greater degree. Researchers simply do not know how much language exposure is necessary in the two languages to produce a balanced bilingual. For practical purposes, the rule of thumb is that the child should receive roughly equal amounts of input in the two languages to achieve native proficiency in both.

Cognitive Effects of Bilingualism

> Bilingual Hebrew-English-speaking child: "I speak Hebrew and English."
> Monolingual English-speaking child: "What's English?"
>
> **SOURCE UNKNOWN**

Another issue is the effect of bilingualism on intellectual or cognitive development. Does being bilingual make you more or less intelligent, more or less creative, and so on? Historically, research into this question has been fraught with methodological problems and has often been heavily influenced by the prevailing political and social climate. Many early studies (before the 1960s) showed that bilingual children did worse than monolingual children on IQ and other cognitive and educational tests. The results of more recent research indicate that bilingual children outperform monolinguals in certain kinds of problem solving. Also, bilingual children seem to have better **metalinguistic awareness**, which refers to a speaker's conscious awareness *about* language rather than *of* language. This is illustrated in the epigraph to this section. Moreover, bilingual children have an earlier understanding of the arbitrary relationship between an object and its name. Finally, they have sufficient metalinguistic awareness to speak the contextually appropriate language, as noted earlier.

Whether children enjoy some cognitive or educational benefit from being bilingual seems to depend in part on extralinguistic factors such as the social and economic position of the child's group or community, the educational situation, and the relative "prestige" of the two languages. Studies that show the most positive effects (e.g., better school performance) generally involve children reared in societies where both languages are valued and whose parents were interested and supportive of their bilingual development.

Second Language Acquisition

In contrast to the bilinguals just discussed, many people are introduced to a second language (L2) after they have achieved native competence in a first language (L1). If you have had the experience of trying to master a second language as an adult, no doubt you found it to be a challenge quite unlike your first language experience.

Is L2 Acquisition the Same as L1 Acquisition?

With some exceptions, adults do not simply pick up a second language. It usually requires conscious attention, if not intense study and memorization, to become proficient in a second language. Again, with the exception of some remarkable individuals, adult second-language learners (L2ers) do not often achieve native-like grammatical competence in the L2, especially with respect to pronunciation. They generally have an accent, and they may make syntactic or morphological errors that are unlike the errors of children acquiring their first language

(L1ers). For example, L2ers often make word order errors, especially early in their development, as well as morphological errors in grammatical gender and case. L2 errors may **fossilize** so that no amount of teaching or correction can undo them.

Unlike L1 acquisition, which is uniformly successful across children and languages, adults vary considerably in their ability to acquire an L2 completely. Some people are very talented language learners. Others are hopeless. Most people fall somewhere in the middle. Success may depend on a range of factors, including age, talent, motivation, and whether you are in the country where the language is spoken or sitting in a classroom five mornings a week with no further contact with native speakers. For all these reasons, many people, including many linguists who study L2 acquisition, believe that second language acquisition is something different from first language acquisition. This hypothesis is referred to as the **fundamental difference hypothesis** of L2 acquisition.

In certain important respects, however, L2 acquisition is like L1 acquisition. Like L1ers, L2ers do not acquire their second language overnight; they go through stages. Like L1ers, L2ers construct grammars. These grammars reflect their competence in the L2 at each stage, and so their language at any particular point, though not native-like, is rule-governed and not haphazard. The intermediate grammars that L2ers create on their way to the target have been called **interlanguage grammars**.

Consider word order in the interlanguage grammars of Romance (e.g., Italian, Spanish, and Portuguese) speakers acquiring German as a second language. The word order of the Romance languages is Subject-(Auxiliary)-Verb-Object (like English). German has two basic word orders depending on the presence of an auxiliary. Sentences with auxiliaries have Subject-Auxiliary-Object-Verb, as in (1). Sentences without auxiliaries have Subject-Verb-Object, as in (2). (Note that as with the child data above, these L2 sentences may contain various "errors" in addition to the word order facts we are considering.)

1. Hans hat ein Buch gekauft. "Hans has a book bought."
2. Hans kauft ein Buch. "Hans is buying a book."

Studies show that Romance speakers acquire German word order in pieces. During the first stage they use German words but the S-Aux-V-O word order of their native language, as follows:

Stage 1: Mein Vater hat gekauft ein Buch.
"My father has bought a book."

At the second stage, they acquired the VP word order Object-Verb.

Stage 2: Vor Personalrat auch meine helfen.
in the personnel office [a colleague] me helped
"A colleague in the personnel office helped me."

At the third stage they acquired the rule that places the verb or (auxiliary) in second position.

Stage 3: Jetzt kann sie mir eine Frage machen.
now can she me a question ask
"Now she can ask me a question."
I kenne nich die Welt.
I know not the world.
"I don't know the world."

These stages differ from those of children acquiring German as a first language. For example, German children know early on that the language has SOV word order.

Like L1ers, L2ers also attempt to uncover the grammar of the target language, but with varying success, and they often do not reach the target. Proponents of the *fundamental difference hypothesis* believe that L2ers construct grammars according to different principles than those used in L1 acquisition, principles that are not specifically designed for language acquisition, but for the problem-solving skills used for tasks like playing chess or learning math. According to this view, L2ers lack access to the specifically linguistic principles of UG that L1ers have to help them.

Opposing this view, others have argued that adults are superior to children in solving all sorts of nonlinguistic problems. If they were using these problem-solving skills to learn their L2, shouldn't they be uniformly more successful than they are? Also, linguistic savants such as Christopher, discussed in chapter 2, argue against the view that L2 acquisition involves only nonlinguistic cognitive abilities. Christopher's IQ and problem-solving skills are minimal at best, yet he has become proficient in several languages.

Many L2 acquisition researchers do not believe that L2 acquisition is fundamentally different from L1 acquisition. They point to various studies that show that interlanguage grammars do not generally violate principles of UG, which makes the process seem more similar to L1 acquisition. In the German L2 examples above, the interlanguage rules may be wrong for German, or wrong for Romance, but they are not impossible rules. These researchers also note that although L2ers may fall short of L1ers in terms of their final grammar, they appear to acquire rules in the same way as L1ers.

Native Language Influence in L2 Acquisition

One respect in which L1 acquisition and L2 acquisition are clearly different is that adult L2ers already have a fully developed grammar of their first language. As discussed in chapter 1, linguistic competence is unconscious knowledge. We cannot suppress our ability to use the rules of our language. We cannot decide not to understand English. Similarly, L2ers—especially at the beginning stages of acquiring their L2—seem to rely on their L1 grammar to some extent. This is shown by the kinds of errors L2ers make, which often involve the **transfer** of grammatical rules from their L1. This is most obvious in phonology. L2ers generally speak with an accent because they may transfer the phonemes, phonological rules, or syllable structures of their first language to their second language. We see this in the Japanese speaker, who does not distinguish between *write* [raɪt] and *light* [laɪt] because the r/l distinction is not phonemic in Japanese; in the French speaker, who says "ze cat in ze hat" because French does not have [ð];

in the German speaker, who devoices final consonants, saying [hæf] for *have*; and in the Spanish speaker, who inserts a schwa before initial consonant clusters, as in [əskul] for *school* and [əsnab] for *snob*.

Similarly, English speakers may have difficulty with unfamiliar sounds in other languages. For example, in Italian long (or double) consonants are phonemic. Italian has minimal pairs such as the following:

ano	"anus"	anno	"year"
pala	"shovel"	palla	"ball"
dita	"fingers"	ditta	"company"

English-speaking L2 learners of Italian have difficulty in hearing and producing the contrast between long and short consonants. This can lead to very embarrassing situations, for example on New Year's Eve, when instead of wishing people *buon anno* (good year), you wish them *buon ano*.

Native language influence is also found in the syntax and morphology. Sometimes this influence shows up as a wholesale transfer of a particular piece of grammar. For example, a Spanish speaker acquiring English might drop subjects in nonimperative sentences because this is possible in Spanish, as illustrated by the following examples:

Hey, is not funny.
In here have the mouth.
Live in Colombia.

Or speakers may begin with the word order of their native language, as we saw in the Romance-German interlanguage examples.

Native language influence may show up in more subtle ways. For example, people whose L1 is German acquire English yes-no questions faster than Japanese speakers do. This is because German has a verb movement rule for forming yes-no questions that is very close to the English Aux movement rule, while in Japanese there is no syntactic movement in question formation.

The Creative Component of L2 Acquisition

It would be an oversimplification to think that L2 acquisition involves only the transfer of L1 properties to the L2 interlanguage. There is a strong creative component to L2 acquisition. Many language-particular parts of the L1 grammar do not transfer. Items that a speaker considers irregular, infrequent, or semantically difficult are not likely to transfer to the L2. For example, speakers will not typically transfer L1 idioms such as *He hit the roof* meaning "He got angry." They are more likely to transfer structures in which the semantic relations are transparent. For example, a structure such as (1) will transfer more readily than (2).

1. It is awkward to carry this suitcase.
2. This suitcase is awkward to carry.

In (1) the NP "this suitcase" is in its logical direct object position, while in (2) it has been moved to the subject position away from the verb that selects it.

Many of the "errors" that L2ers do make are not derived from their L1. For example, in one study Turkish speakers at a particular stage in their development of German used S-V-Adv (Subject-Verb-Adverb) word order in embedded clauses (the *wenn* clause in the following example) in their German interlanguage, even though both their native language and the target language have S-Adv-V order:

Wenn	ich	geh	zuruck	ich	arbeit elektriker	in der Türkei.
if	I	go	back,	I	work (as an) electrician	in Turkey

(Cf. *Wenn ich **zuruck geh** ich arbeit elektriker*, which is grammatically correct German.)

The embedded S-V-Adv order is most likely an overgeneralization of the verb-second requirement in German main clauses. As we noted earlier, overgeneralization is a clear indication that a rule has been acquired.

Why certain L1 rules transfer to the interlanguage grammar and others don't is not well understood. It is clear, however, that although construction of the L2 grammar is influenced by the L1 grammar, developmental principles—possibly universal—also operate in L2 acquisition. This is best illustrated by the fact that speakers with different L1s go through similar L2 stages. For example, Turkish, Serbo-Croatian, Italian, Greek, and Spanish speakers acquiring German as an L2 all drop articles to some extent. Because some of these L1s have articles, this cannot be caused by transfer but must involve some more general property of language acquisition.

Is There a Critical Period for L2 Acquisition?

> I don't know how you manage, Sir, amongst all the foreigners; you never know what they are saying. When the poor things first come here they gabble away like geese, although the children can soon speak well enough.
>
> **MARGARET ATWOOD,** *Alias Grace*, 1996

Age is a significant factor in L2 acquisition. The younger a person is when exposed to a second language, the more likely she is to achieve native-like competence.

In an important study of the effects of age on ultimate attainment in L2 acquisition, Jacqueline Johnson and Elissa Newport tested several groups of Chinese and Korean speakers who had acquired English as a second language. The subjects, all of whom had been in the United States for at least five years, were tested on their knowledge of specific aspects of English morphology and syntax. They were asked to judge the grammaticality of sentences such as:

The little boy is speak to a policeman.
The farmer bought two pig.
A bat flewed into our attic last night.

Johnson and Newport found that the test results depended heavily on the age at which the person had arrived in the United States. The people who arrived as children (between the age of three and eight) did as well on the test as American native speakers. Those who arrived between the ages of eight and fifteen did not perform like native speakers. Moreover, every year seemed to make a difference for this group. The person who arrived at age nine did better than the one who arrived at age ten; those who arrived at age eleven did better than those who arrived at age twelve, and so on. The group that arrived between the ages of seventeen and thirty-one had the lowest scores.

Does this mean that there is a critical period for L2 acquisition, an age beyond which it is *impossible* to acquire the grammar of a new language? Most researchers would hesitate to make such a strong claim. Although age is an important factor in achieving native-like L2 competence, it is certainly possible to acquire a second language as an adult. Many teenage and adult L2 learners become proficient, and a few highly talented ones even manage to pass for native speakers. Also, the Newport and Johnson studies looked at the end state of L2 acquisition, after their subjects had been in an English-speaking environment for many years. It is possible that the ultimate attainment of adult L2ers falls short of native competence, but that the process of L2 acquisition is not fundamentally different from L1 acquisition.

It is more appropriate to say that L2 acquisition abilities gradually decline with age and that there are "sensitive periods" for the native-like mastery of certain aspects of the L2. The sensitive period for phonology is the shortest. To achieve native-like pronunciation of an L2 generally requires exposure during childhood. Other aspects of language, such as syntax, may have a larger window.

Recent research with learners of their "heritage language" (the ancestral language not learned as a child, such as Gaelic in Ireland) provides additional support for the notion of sensitive periods in L2 acquisition. This finding is based on studies into the acquisition of Spanish by college students who had overheard the language as children (and sometimes knew a few words), but who did not otherwise speak or understand Spanish. The *overhearers* were compared to people who had no exposure to Spanish before the age of fourteen. All of the students were native speakers of English studying their heritage language as a second language. These results showed that the overhearers acquired a more native-like accent than the other students did. However, the overhearers did not show any advantage in acquiring the grammatical morphemes of Spanish. Early exposure may leave an imprint that facilitates the late acquisition of certain aspects of language.

Recent research on the neurological effects of acquiring a second language shows that left hemisphere cortical density is increased in bilinguals relative to monolinguals and that this increase is more pronounced in early versus late second-language learners. The study also shows a positive relationship between brain density and second-language proficiency. The researchers conclude that the structure of the human brain is altered by the experience of acquiring a second language.

Summary

When children acquire a language, they acquire the grammar of that language—the phonological, morphological, syntactic, and semantic rules. They also acquire the pragmatic rules of the language as well as a lexicon. Children are not taught language. Rather, they extract the rules (and much of the lexicon) from the language around them.

Several learning mechanisms have been suggested to explain the acquisition process. Imitations of adult speech, reinforcement, and analogy have all been proposed. None of these possible learning mechanisms account for the fact that children creatively form new sentences according to the rules of their language, or for the fact that children make certain kinds of errors but not others. Empirical studies of the motherese hypothesis show that grammar development does not depend on structured input. **Connectionist models** of acquisition also depend on the child having specially structured input.

The ease and rapidity of children's language acquisition and the uniformity of the stages of development for all children and all languages, despite the **poverty of the stimulus** they receive, suggest that the language faculty is innate and that the infant comes to the complex task already endowed with a Universal Grammar. UG is not a grammar like the grammar of English or Arabic, but represents the principles to which all human languages conform. Language acquisition is a creative process. Children create grammars based on the linguistic input and are guided by UG.

Language development proceeds in stages, which are universal. During the first year of life, children develop the sounds of their language. They begin by producing and perceiving many sounds that do not exist in their language input, the **babbling stage**. Gradually, their productions and perceptions are fine-tuned to the environment. Children's late babbling has all the phonological characteristics of the input language. Deaf children who are exposed at birth to sign languages also produce manual babbling, showing that babbling is a universal first stage in language acquisition that is dependent on the linguistic input received.

At the end of the first year, children utter their first words. During the second year, they learn many more words and they develop much of the phonological system of the language. Children's first utterances are one-word "sentences" (the **holophrastic** stage).

Many experimental studies show that children are sensitive to various linguistic properties such as stress and phonotactic constraints, and to statistical regularities of the input that enable them to segment the fluent speech that they hear into words. One method of segmenting speech is **prosodic bootstrapping**. Other bootstrapping methods can help the child to learn verb meaning based on syntactic context (**syntactic bootstrapping**), or syntactic categories based on word meaning (**semantic bootstrapping**) and distributional evidence such as word frames.

After a few months, the child puts two or more words together. These early sentences are not random combinations of words—the words have definite patterns and express both syntactic and semantic relationships. During the telegraphic stage, the child produces longer sentences that often lack function or grammatical morphemes. The child's early grammar still lacks many of the rules of the adult grammar, but is not qualitatively different from it. Children at this stage have correct word order and rules for agreement and case, which show their knowledge of structure.

Children make specific kinds of errors while acquiring their language. For example, they will **overgeneralize** morphology by saying *bringed* or *mans*. This shows that they are acquiring rules of their particular language. Children never make errors that violate principles of Universal Grammar.

In acquiring the lexicon of the language children may **overextend** word meaning by using *dog* to mean any four-legged creature. As well, they may **underextend** word meaning and use dog only to denote the family pet and no other dogs, as if it were a proper noun. Despite these categorization "errors," children's word learning, like their grammatical development, is guided by general principles.

Deaf children exposed to **sign language** show the same stages of language acquisition as hearing children exposed to spoken languages. That all children go through similar stages regardless of language shows that they are equipped with special abilities to know what generalizations to look for and what to ignore, and how to discover the regularities of language, irrespective of the modality in which their language is expressed.

Children may acquire more than one language at a time. **Bilingual** children seem to go through the same stages as monolingual children except that they develop two grammars and two lexicons simultaneously. This is true for children acquiring two spoken languages as well as for children acquiring a spoken language and a sign language. Whether the child will be equally proficient in the two languages depends on the input he or she receives and the social conditions under which the languages are acquired.

In **second language acquisition**, **L2** learners construct grammars of the target language—called **interlanguage grammars**—that go through stages, like the grammars of first-language learners. Influence from the speaker's first language makes L2 acquisition appear different from L1 acquisition. Adults often do not achieve native-like competence in their L2, especially in pronunciation. The difficulties encountered in attempting to learn languages after puberty may be because there are sensitive periods for L2 acquisition. Some theories of second language acquisition suggest that the same principles operate that account for first language acquisition. A second view suggests that the acquisition of a second language in adulthood involves general learning mechanisms rather than the specifically linguistic principles used by the child.

The universality of the language acquisition process, the stages of development, and the relatively short period in which the child constructs a complex grammatical system without overt teaching suggest that the human species is innately endowed with special language acquisition abilities and that language is biologically and genetically part of the human neurological system.

All normal children learn whatever language or languages they are exposed to, from Afrikaans to Zuni. This ability is not dependent on race, social class, geography, or even intelligence (within a normal range). This ability is uniquely human.

References for Further Reading

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9

Language Processing: Humans and Computers

> No doubt a reasonable model of language use will incorporate, as a basic component, the generative grammar that expresses the speaker-hearer's knowledge of the language; but this generative grammar does not, in itself, prescribe the character or functioning of a perceptual model or a model of speech production.
>
> **NOAM CHOMSKY,** *Aspects of the Theory of Syntax*, 1965

The Human Mind at Work: Human Language Processing

Psycholinguistics is the area of linguistics that is concerned with linguistic performance—how we use our linguistic competence—in speech (or sign) production and comprehension. The human brain is able not only to acquire and store the mental lexicon and grammar, but also to access that linguistic storehouse to speak and understand language in real time.

How we process knowledge depends largely on the nature of that knowledge. If, for example, language were not open-ended, and were merely a finite store of fixed phrases and sentences in memory, then speaking might simply consist of finding a sentence that expresses a thought we wished to convey. Comprehension could be the reverse—matching the sounds to a stored string that has been memorized with its meaning. Of course, this is ridiculous! It is not possible because of the creativity of language. In chapter 8, we saw that children do not learn language by imitating and storing sentences, but by constructing a grammar. When we speak, we access our lexicon to find the words, and we use the rules of grammar to construct novel sentences and to produce the sounds that

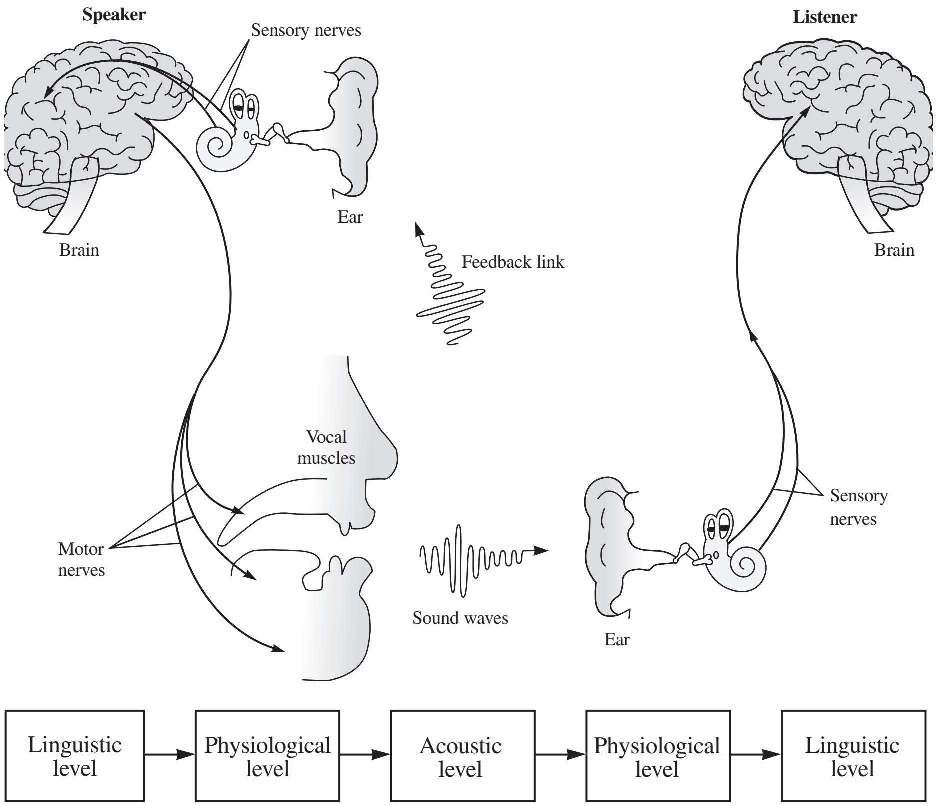


FIGURE 9.1 | The speech chain.[1] A spoken utterance starts as a message in the speaker's brain/mind. It is put into linguistic form and interpreted as articulation commands, emerging as an acoustic signal. The signal is processed by the listener's ear and sent to the brain/mind, where it is interpreted.

express the message we wish to convey. When we listen to speech and understand what is being said, we also access the lexicon and grammar to assign a structure and meaning to the sounds we hear.

Speaking and comprehending speech can be viewed as a speech chain, a kind of "brain-to-brain" linking, as shown in Figure 9.1.

The grammar relates sounds and meanings, and contains the units and rules of the language that make speech production and comprehension possible. However, other psychological processes are used to produce and understand utterances. Certain mechanisms enable us to break the continuous stream of speech sounds into linguistic units such as phonemes, syllables, and words in order to comprehend, and to compose sounds into words in order to produce meaningful speech. Other mechanisms determine how we pull words from the mental lexi-

[1]The figure is taken from P. B. Denes and E. N. Pinson, eds. 1963. The Speech Chain. Philadelphia, PA: Williams & Wilkins, p. 4. Reprinted with permission of Alcatel-Lucent USA Inc.

con, and still others explain how we construct a phrase structure representation of the words we retrieve.

We usually have no difficulty understanding or producing sentences in our language. We do it without effort or conscious awareness of the processes involved. However, we have all had the experience of making a speech error, of having a word on the "tip of our tongue," or of failing to understand a perfectly grammatical sentence, such as sentence (1):

1. The horse raced past the barn fell.

Many individuals, on hearing this sentence, will judge it to be ungrammatical, yet will judge as grammatical a sentence with the same syntactic structure, such as:

2. The bus driven past the school stopped.

Similarly, people will have no problem with sentence (3), which has the same meaning as (1).

3. The horse that was raced past the barn fell.

Conversely, some ungrammatical sentences are easily understandable, such as sentence (4). This mismatch between grammaticality and interpretability tells us that language processing involves more than grammar.

4. *The baby seems sleeping.

A theory of linguistic performance tries to detail the psychological mechanisms that work with the grammar to facilitate language production and comprehension.

Comprehension

> "I quite agree with you," said the Duchess; "and the moral of that is—'Be what you would seem to be'—or, if you'd like it put more simply—'Never imagine yourself not to be otherwise than what it might appear to others . . . to be otherwise.'"
> "I think I should understand that better," Alice said very politely, "if I had it written down: but I can't quite follow it as you say it."
>
> **LEWIS CARROLL,** *Alice's Adventures in Wonderland,* 1865

The sentence uttered by the Duchess provides another example of a grammatical sentence that is difficult to understand. The sentence is very long and contains several words that require extra resources to process, for example, multiple uses of negation and words like *otherwise*. Alice notes that if she had a pen and paper she could "unpack" this sentence more easily. One of the aims of psycholinguistics is to describe the processes people normally use in speaking and understanding language. The various breakdowns in performance, such as tip of the tongue phenomena, speech errors, and failure to comprehend tricky sentences, can tell us a great deal about how the language processor works, just as children's acquisition errors tell us a lot about the mechanisms involved in language development.

The Speech Signal

Understanding a sentence involves analysis at many levels. To begin with, we must comprehend the individual speech sounds we hear. We are not conscious of the complicated processes we use to understand speech any more than we are conscious of the complicated processes of digesting food and utilizing nutrients. We must study these processes deliberately and scientifically. One of the first questions of linguistic performance concerns segmentation of the acoustic signal. To understand this process, some knowledge of the signal can be helpful.

In chapter 6 we described speech sounds according to the ways in which they are produced. These involve the position of the tongue, the lips, and the velum; the state of the vocal cords; whether the articulators obstruct the free flow of air; and so on. All of these articulatory characteristics are reflected in the physical characteristics of the sounds produced.

Speech sounds can also be described in physical, or **acoustic**, terms. Physically, a sound is produced whenever there is a disturbance in the position of air molecules. The ancient philosophers asked whether a sound is produced if a tree falls in the middle of the forest with no one to hear it. This question has been answered by the science of acoustics. Objectively, a sound is produced; subjectively, there is no sound. In fact, there are sounds we cannot hear because our ears are not sensitive to the full range of frequencies. *Acoustic phonetics* is concerned only with speech sounds, all of which can be heard by the normal human ear.

When we push air out of the lungs through the glottis, it causes the vocal cords to vibrate; this vibration in turn produces pulses of air that escape through the mouth (and sometimes the nose). These pulses are actually small variations in the air pressure caused by the wavelike motion of the air molecules.

The sounds we produce can be described in terms of how fast the variations of the air pressure occur. This determines the **fundamental frequency** of the sounds and is perceived by the hearer as *pitch*. We can also describe the magnitude, or **intensity**, of the variations, which determines the loudness of the sound. The quality of the speech sound—whether it's an [i] or an [a] or whatever—is determined by the shape of the vocal tract when air is flowing through it. This shape modulates the fundamental frequency into a spectrum of frequencies of greater or lesser intensity, and the particular combination of "greater or lesser" is heard as a particular sound. (Imagine smooth ocean waves with regular peaks and troughs approaching a rocky coastline. As they crash upon the rocks they are "modulated" or broken up into dozens of "sub-waves" with varying peaks and troughs. That is similar to what is happening to the glottal pulses as they "crash" through the vocal tract.)

An important tool in acoustic research is a computer program that decomposes the speech signal into its frequency components. When speech is fed into a computer (from a microphone or a recording), an image of the speech signal is displayed. The patterns produced are called **spectrograms** or, more vividly, **voiceprints**. A spectrogram of the words *heed*, *head*, *had*, and *who'd* is shown in Figure 9.2.

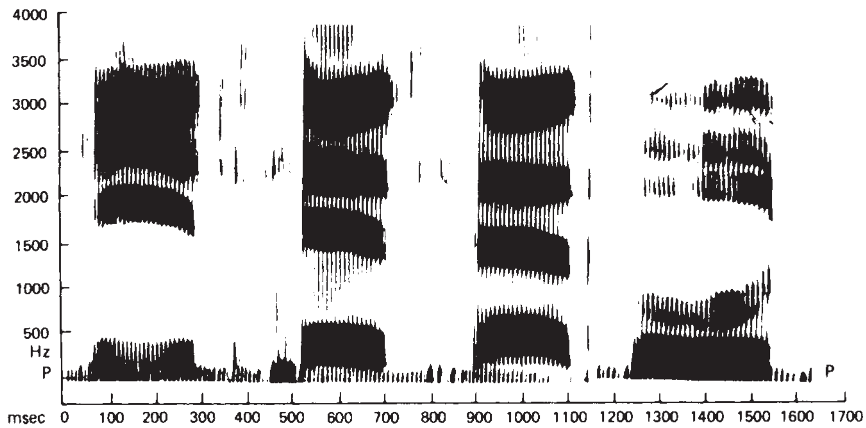


FIGURE 9.2 | A spectrogram of the words *heed*, *head*, *had*, and *who'd*, spoken with a British accent (speaker: Peter Ladefoged, February 16, 1973).
Courtesy of Peter Ladefoged.

Time in milliseconds moves horizontally from left to right on the x axis; on the y axis the graph represents pitch (or, more technically, frequency). The intensity of each frequency component is indicated by the degree of darkness: the more intense, the darker. Each vowel is characterized by dark bands that differ in their placement according to their frequency. They represent the strongest harmonics (or sub-waves) produced by the shape of the vocal tract and are called the **formants** of the vowels. (A harmonic is a special frequency that is a multiple (2, 3, etc.) of the fundamental frequency.) Because the tongue is in a different position for each vowel, the formant frequencies differ for each vowel. The frequencies of these formants account for the different vowel qualities you hear. The spectrogram also shows, although not very conspicuously, the pitch of the entire utterance (intonation contour) on the voicing bar marked P. The striations are the thin vertical lines that indicate a single opening and closing of the vocal cords. When the striations are far apart, the vocal cords are vibrating slowly and the pitch is low; when the striations are close together, the vocal cords are vibrating rapidly and the pitch is high.

By studying spectrograms of all speech sounds and many different utterances, acoustic phoneticians have learned a great deal about the basic acoustic components that reflect the articulatory features of speech sounds.

Speech Perception and Comprehension

Do what you know and perception is converted into character.

RALPH WALDO EMERSON (1803–1882)

Speech is a continuous signal. In natural speech, sounds overlap and influence each other, and yet listeners have the impression that they are hearing discrete units such as words, morphemes, syllables, and phonemes. A central problem of speech perception is to explain how listeners carve up the continuous speech signal into meaningful units. This is referred to as the "segmentation problem."

Another question is, how does the listener manage to recognize particular speech sounds when they occur in different contexts and when they are spoken by different people? For example, how can a speaker tell that a [d] spoken by a man with a deep voice is the same unit of sound as the [d] spoken in the high-pitched voice of a child? Acoustically, they are distinct. In addition, a [d] that occurs before the vowel [i] is somewhat acoustically different from a [d] that occurs before the vowel [u]. How does a listener know that two physically distinct instances of a sound are the same? This is referred to as the "lack of invariance problem."

In addressing the latter problem, experimental results show that listeners can calibrate their perceptions to control for differences in the size and shape of the vocal tract of the speaker. Similarly, listeners adjust how they interpret timing information in the speech signal as a function of how quickly the speaker is talking. These *normalization* procedures enable the listener to understand a [d] as a [d] regardless of the speaker or the speech rate. More complicated adjustments are required to factor out the effects of a preceding or following sound.

As we might expect, the units we can perceive depend on the language we know. Speakers of English can perceive the difference between [l] and [r] because these phones represent distinct phonemes in the language. Speakers of Japanese have great difficulty in differentiating the two because they are allophones of one phoneme in their language. Recall from our discussion of language development in chapter 8 that these perceptual biases develop during the first year of life.

Returning to the segmentation problem, spoken words are seldom surrounded by boundaries such as pauses. Nevertheless, words are obviously units of perception. The spaces between them in writing support this view. How do we find the words in the speech stream?

Suppose you heard someone say:

A sniggle blick is procking a slar.

and you were able to perceive the sounds as

[ə s n ɪ g ə l b l ɪ k ɪ z pʰ r a k ĩ ŋ ə s l a r]

You would still be unable to assign a meaning to the sounds, because the meaning of a sentence relies mainly on the meaning of its words, and the only English lexical items in this string are the morphemes *a*, *is*, and *-ing*. The sentence lacks any English content words. (However, you would accept it as grammatically well-formed because it conforms to the rules of English syntax.)

You can decide that the sentence has no meaning only if you attempt (unconsciously or consciously) to search your mental lexicon for the phonological strings you decide are possible words. This process is called **lexical access**, or word recognition, discussed in detail later. Finding that there are no entries for *sniggle*, *blick*, *prock*, and *slar*, you can conclude that the sentence contains nonsense strings. The segmentation and search of these "words" relies on knowing the grammatical morphemes and the syntax.

If instead you heard someone say

The cat chased the rat

and you perceived the sounds as

[ð ə k^h æ ʔ $tʃ^h$ e s t ð ə r æ t]

a similar lexical look-up process would lead you to conclude that an event concerning a cat, a rat, and the activity of chasing had occurred. You could know this only by segmenting the words in the continuous speech signal, analyzing them into their phonological word units, and matching these units to similar strings stored in your lexicon, which also includes the meanings attached to these phonological representations. (This still would not enable you to understand who chased whom, because that requires syntactic analysis.)

Stress and intonation provide some clues to syntactic structure. We know, for example, that the different meanings of the sentences *He lives in the white house* and *He lives in the White House* can be signaled by differences in their stress patterns. Such prosodic aspects of speech also help to segment the speech signal into words and phrases. For example, syllables at the end of a phrase are longer in duration than at the beginning, and intonation contours mark boundaries of clauses.

Bottom-up and Top-down Models

I have experimented and experimented until now I know that [water] never does run uphill, except in the dark. I know it does in the dark, because the pool never goes dry; which it would, of course, if the water didn't come back in the night. It is best to prove things by experiment; then you know; whereas if you depend on guessing and supposing and conjecturing, you will never get educated.

MARK TWAIN, *Eve's Diary,* 1906

In this laboratory the only one who is always right is the cat.

MOTTO IN THE LABORATORY OF ARTURO ROSENBLUETH

Language comprehension is very fast and automatic. We understand an utterance as fast as we hear it or read it. But we know this understanding must involve (at least) the following sub-operations: segmenting the continuous speech signal into phonemes, morphemes, words, and phrases; looking up the words and morphemes in the mental lexicon; finding the appropriate meanings of ambiguous words; parsing them into tree structures; choosing among different possible structures when syntactic ambiguities arise; interpreting the sentence; making a mental model of the discourse and updating it to reflect the meaning of the new sentence; and other matters beyond the scope of our introductory text.

This seems like a great deal of work to be done in a very short time: we can understand spoken language at a rate of twenty phonemes per second. One might conclude that there must be some sort of a trick that makes it all possible. In a certain sense there is. Because of the sequential nature of language, a certain amount of guesswork is involved in real-time comprehension. Many psycholinguists suggest that language perception and comprehension involve both **top-down processing** and **bottom-up processing**.

Top-down processes proceed from semantic and syntactic information to the lexical information gained from the sensory input. Through use of such higher-level information, we can try to predict what is to follow in the signal. For example, upon hearing the determiner *the*, the speaker begins constructing an NP and expects that the next word could be a noun, as in *the boy*. In this instance the knowledge of phrase structure would be the source of information.

Bottom-up processing moves step-by-step from the incoming acoustic (or visual) signal, to phonemes, morphemes, words and phrases, and ultimately to semantic interpretation. Each step of building toward a meaning is based on the sensory data and accompanying lexical information. According to this model the speaker waits until hearing *the* and *boy* before constructing an NP, and then waits for the next word, and so on.

Evidence for top-down processing is found in experiments that require subjects to identify spoken words in the presence of noise. Listeners make more errors when the words occur in isolation than when they occur in sentences. Moreover, they make more errors if the words occur in anomalous, or nonsense, sentences; and they make the most errors if the words occur in ungrammatical sentences. Also, as discussed further below, when subjects are asked to "shadow" sentences, that is, to repeat each word of a sentence immediately upon hearing it, they often produce words in anticipation of the input. Based on a computation of the meaning of the sentence to that point, they can guess what is coming next. Apparently, subjects are using their knowledge of syntactic and semantic relations to help them narrow down the set of candidate words.

Top-down processing is also supported by a different kind of experiment. Subjects hear recorded sentences in which some part of the signal is removed and a cough or buzz is substituted, such as the underlined "s" in the sentence *The state governors met with their respective legislatures convening in the capital city*. Their experience is that they "hear" the sentence as complete, without any phonemes missing, and, in fact, have difficulty saying exactly where in the word the noise occurred. This effect is called *phoneme restoration*. It would not be surprising simply to find that subjects can guess that the word containing the cough was *legislatures*. What is remarkable is that they really believe they are hearing the [s], even when they are told it is not there. In this case, top-down information apparently overrides bottom-up information.

There is also a role for context (top-down information) in segmentation. In some instances even an utterance containing all familiar words can be divided in more than one way. For example, the phonetic sequence [g r e d e] in a discussion of meat or eggs is likely to be heard as *Grade A*, but in a discussion of the weather as *grey day*. In other cases, although the sequence of phonemes might be compatible with two segmentations (e.g., [n aɪ t$^{(h)}$ r e t]), the phonetic details of pronunciation can signal where the word boundary is. In *night rate*, the first *t* is part of the coda of the first syllable and thus unaspirated, whereas in *nitrate* it begins the onset of the second syllable, which is stressed and therefore the *t* is aspirated.

Lexical Access and Word Recognition

Oh, are you from Wales?
Do you know a fella named Jonah?
He used to live in whales for a while.

GROUCHO MARX (1890–1977)

Psycholinguists have conducted a great deal of research on *lexical access* or *word recognition*, the process by which we obtain information about the meaning and syntactic properties of a word from our mental lexicon. Several experimental techniques have been used in studies of lexical access.

One technique involves asking subjects to decide whether a string of letters (or sounds if auditory stimuli are used) is or is not a word. They must respond by pressing one button if the stimulus is an actual word and a different button if it is not, so they are making a **lexical decision**. During these and similar experiments, measurements of *response time*, or *reaction time* (often referred to as RTs), are taken. The assumption is that the longer it takes to respond to a particular task, the more processing is involved. RT measurements show that lexical access depends to some extent on word *frequency*; more commonly used words (both spoken and written) such as *car* are responded to more quickly than words that we rarely encounter such as *fig*.

Many properties of lexical access can be examined using lexical decision experiments. In the following example, the relationship between the current word and the immediately preceding word is manipulated. For example, making a lexical decision on the word *doctor* will be faster if you just made a lexical decision on *nurse* than if you just made one on a semantically unrelated word such as *flower*. This effect is known as **semantic priming**: we say that the word *nurse* primes the word *doctor*. This effect might arise because semantically related words are located in the same part of the mental lexicon, so when we hear a priming word and look it up in the lexicon, semantically related, nearby words are "awakened" and more readily accessible for a few moments.

Recent neurolinguistic research is showing the limits of the lexical decision technique. It is now possible to measure electrical brain activity in subjects while they perform a lexical decision experiment, and compare the patterns in brain responses to patterns in RTs. (The technique is similar to the event-related brain potentials mentioned in chapter 2.) Such experiments have provided results that directly conflict with the RT data. For example, measures of brain activity show priming to pairs of verb forms such as *teach/taught* during the early stages of lexical access, whereas such pairs do not show priming in lexical decision RTs. This is because lexical decision involves several stages of processing, and patterns in early stages may be obscured by different patterns in later stages. Brain measures, by contrast, are taken continuously and therefore allow researchers to separately measure early and later processes.

One of the most interesting facts about lexical access is that listeners retrieve all meanings of a word even when the sentence containing the word is biased toward one of the meanings. This is shown in experiments in which the ambiguous word primes words related to both of its meanings. For example, suppose a subject hears the sentence:

The gypsy read the young man's palm for only a dollar.

Palm primes the word *hand*, so in a lexical decision about *hand*, a shorter RT occurs than in a comparable sentence not containing the word *palm*. However, a shorter RT also occurs for the word *tree*. The other meaning of *palm* (as in *palm tree*) is apparently activated even though that meaning is not a part of the meaning of the priming sentence.

In listening or reading, then, all of the meanings represented by a string of letters and sounds will be triggered. This argues for a limit on the effects of top-down processing because the individual word *palm* is heard and processed somewhat independently of its context, and so is capable of priming words related to all its lexical meanings. However, the disambiguating information in the sentence is used very quickly (within 250 milliseconds) to discard the meanings that are not appropriate to the sentence. If we check for priming after the word *only* instead of right after the word *palm* in the previous example, we find it for *hand* but no longer for *tree*.

Another experimental technique, called the **naming task**, asks the subject to read aloud a printed word. (A variant of the naming task is also used in studies of people with aphasia, who are asked to name the object shown in a picture.) Subjects read irregularly spelled words like *dough* and *steak* just slightly more slowly than regularly spelled words like *doe* and *stake*, but still faster than invented strings like *cluff*. This suggests that people can do two different things in the naming task. They can look for the string in their mental lexicon, and if they find it (i.e., if it is a real word), they can pronounce the stored phonological representation for it. They can also "sound it out," using their knowledge of how certain letters or letter sequences (e.g., "gh," "oe") are most commonly pronounced. The latter is obviously the only way to come up with a pronunciation for a nonexisting word.

The fact that irregularly spelled words are read more slowly than regularly spelled real words suggests that the mind "notices" the irregularity. This may be because the brain is trying to do two tasks—lexical look-up and sounding out the word—in parallel in order to perform naming as fast as possible. When the two approaches yield inconsistent results, a conflict arises that takes some time to resolve.

Syntactic Processing

Teacher Strikes Idle Kids
Enraged Cow Injures Farmer with Ax
Killer Sentenced to Die for Second Time in 10 Years
Stolen Painting Found by Tree

AMBIGUOUS HEADLINES

Psycholinguistic research has also focused on syntactic processing. In addition to recognizing words, the listener must figure out the syntactic and semantic relations among the words and phrases in a sentence, what we earlier referred to as "parsing." The parsing of a sentence is largely determined by the rules of the grammar, but it is also strongly influenced by the sequential nature of language.

Listeners actively build a phrase structure representation of a sentence as they hear it. They must therefore decide for each "incoming" word what its grammatical category is and how it attaches to the tree that is being constructed. Many sentences present temporary ambiguities, such as a word or words that belong to more than one syntactic category. For example, the string *The warehouse fires* . . . could continue in one of two ways:

1. . . . were set by an arsonist.
2. . . . employees over sixty.

Fires is part of a compound noun in sentence (1) and is a verb in sentence (2). As noted earlier, experimental studies of such sentences show that both meanings and categories are activated when a subject encounters the ambiguous word. The ambiguity is quickly resolved (hence the term *temporary ambiguity*) based on syntactic and semantic context, and on the frequency of the two uses of the word. The disambiguations are so quick and seamless that unintentionally ambiguous newspaper headlines such as those at the head of this section are scarcely noticeable except to linguists who collect them.

Another important type of temporary ambiguity concerns sentences in which the phrase structure rules allow two possible attachments of a constituent, as illustrated by the following example:

After the child visited the doctor prescribed a course of injections.

Experiments that track eye movements of people when they read such sentences show that there may be attachment preferences that operate independently of the context or meaning of the sentence. When the mental syntactic processor, or parser, receives the word *doctor*, it attaches it as a direct object of the verb *visit* in the subordinate clause. For this reason, subjects experience a strange perceptual effect when they encounter the verb *prescribed*. They must "change their minds" and attach *the doctor* as subject of the main clause instead. Sentences that induce this effect are called **garden path sentences**. The sentence presented at the beginning of this chapter, *The horse raced past the barn fell*, is also a garden path sentence. People naturally interpret *raced* as the main verb, when in fact the main verb is *fell*.

The initial attachment choices that lead people astray may reflect general principles used by the parser to deal with syntactic ambiguity. Two such principles that have been suggested are known as **minimal attachment** and **late closure**. Minimal attachment says, "Build the simplest structure consistent with the grammar of the language." In the string *The horse raced* . . . , the simpler structure is the one in which *the horse* is the subject and *raced* the main verb; the more complex structure is similar to *The horse that was raced*. . . . We can think of simple versus complex here in terms of the amount of structure in the syntactic tree for the sentence so far.

The second principle, late closure, says "Attach incoming material to the phrase that is currently being processed." Late closure is exemplified in the following sentence:

The doctor said the patient will die yesterday.

Readers often experience a garden path effect at the end of this sentence because their initial inclination is to construe *yesterday* as modifying *will die*, which is semantically incongruous. Late closure explains this: The hearer encounters *yesterday* as he is processing the embedded clause, of which *die* is the main verb. On the other hand, the verb *said*, which *yesterday* is supposed to modify, is part of the root clause, which hasn't been worked on for the past several words. The hearer must therefore backtrack to attach *yesterday* to the clause containing *said*.

The comprehension of sentences depends on syntactic processing that uses the grammar in combination with special parsing principles to construct trees. Garden path sentences like those we have been discussing suggest that the mental parser sometimes makes a strong commitment to one of the possible parses. Whether it always does so, and whether this means it completely ignores all other parses, are open questions that are still being investigated by linguists.

Another striking example of processing difficulty is a rewording of a Mother Goose poem. In its original form we have:

This is the dog that worried the cat that killed the rat that ate the malt that lay in the house that Jack built.

No problem understanding that? Now try this equivalent description:

Jack built the house that the malt that the rat that the cat that the dog worried killed ate lay in.

No way, right?

Although the confusing sentence follows the rules of relative clause formation—you have little difficulty with *the cat that the dog worried*—it seems that once is enough; when you apply the same process twice, getting *the rat that the cat that the dog worried killed*, it becomes quite difficult to process. If we apply the process three times, as in *the malt that the rat that the cat that the dog worried killed ate*, all hope is lost.

The difficulty in parsing this kind of sentence is related to memory constraints. In processing the sentence, you have to keep *the malt* in mind all the way until *ate*, but while doing that you have to keep *the rat* in mind all the way until *killed*, and while doing that. . . . It's a form of structure juggling that is difficult to perform; we evidently don't have enough memory capacity to keep track of all the necessary items. Though we have the competence to create such sentences—in fact, we have the competence to make a sentence with 10,000 words in it—performance limitations prevent creation of such monstrosities.

Various experimental techniques are used to study sentence comprehension. In addition to the priming and reading tasks, in a **shadowing task** subjects are asked to repeat what they hear as rapidly as possible. Exceptionally good shadowers can follow what is being said only about a syllable behind (300 milliseconds). Most of us, however, shadow with a delay of 500 to 800 milliseconds, which is still quite fast. More interestingly, fast shadowers often correct speech errors or mispronunciations unconsciously and add inflectional endings if they are absent. Even when they are told that the speech they are to shadow includes errors and they should repeat the errors, they are rarely able to do so. Corrections are more likely to occur when the target word is predictable from what has been said previously.

These shadowing experiments make at least two points: (1) they support extremely rapid use of top-down information: differences in predictability have an effect within about one-quarter of a second; and (2) they show how fast the mental parser does grammatical analysis, because some of the errors that are corrected, such as missing agreement inflections, depend on successfully parsing the immediately preceding words.

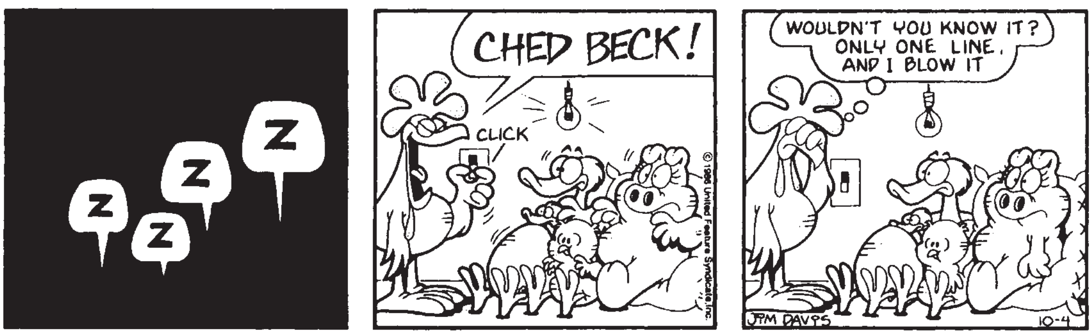
The ability to comprehend what is said to us is a complex psychological process involving the internal grammar, parsing principles such as minimal attachment and late closure, frequency factors, memory, and both linguistic and nonlinguistic context.

Speech Production

> Speech was given to the ordinary sort of men, whereby to communicate their mind; but to wise men, whereby to conceal it.
>
> **ROBERT SOUTH,** sermon at Westminster Abbey, April 30, 1676

As we saw, the speech chain starts with a speaker who, through some complicated set of neuromuscular processes, produces an acoustic signal that represents a thought, idea, or message to be conveyed to a listener, who must then decode the signal to arrive at a similar message. It is more difficult to devise experiments that provide information about how the speaker proceeds than to do so for the listener's side of the process. Much of the best information has come from observing and analyzing spontaneous speech.

Planning Units



"U.S. Acres" copyright © Paws. All rights reserved.

We might suppose that speakers' thoughts are simply translated into words one after the other via a semantic mapping process. Grammatical morphemes would be added as demanded by the syntactic rules of the language. The phonetic representation of each word in turn would then be mapped onto the neuromuscular commands to the articulators to produce the acoustic signal representing it.

We know, however, that this is not a true picture of speech production. Although sounds within words and words within sentences are linearly ordered, speech errors, or slips of the tongue (also discussed in chapter 7), show that the prearticulation stages involve units larger than the single phonemic segment or even the word, as illustrated by the "U.S. Acres" cartoon. That error is an example of a **spoonerism**, named after William Archibald Spooner, a distinguished dean of an Oxford college in the early 1900s who is reported to have referred to Queen Victoria as "That queer old dean" instead of "That dear old queen," and berated his class of students by saying, "You have hissed my mystery lecture. You have tasted the whole worm" instead of the intended "You have missed my history lecture. You have wasted the whole term."

Indeed, speech errors show that features, segments, words, and phrases may be conceptualized well before they are uttered. This point is illustrated in the following examples of speech errors (the intended utterance is to the left of the arrow; the actual utterance, including the error, is to the right of the arrow):

1. The ***h***iring of minority faculty. → The ***f***iring of minority faculty.
   (The intended *h* is replaced by the *f* of *faculty*, which occurs later in the intended utterance.)
2. ***a***d h***o***c → ***o***dd h***a***ck
   (The vowels /æ/ of the first word and /a/ of the second are exchanged or reversed.)
3. ***b***ig and ***f***at → ***p***ig and ***v***at
   (The values of a single feature are switched: in *big* [+voiced] becomes [–voiced] and in *fat* [–voiced] becomes [+voiced].)
4. There are many ministers in our church. → There are many churches in our minister.
   (The root morphemes *minister* and *church* are exchanged; the grammatical plural morpheme remains in its intended place in the phrase structure.)
5. salute smartly → smart salutely (heard on *All Things Considered*, National Public Radio (NPR), May 17, 2007.)
   (The root morphemes are exchanged, but the *-ly* affix remains in place.)
6. Seymour sliced the salami with a knife. → Seymour sliced a knife with the salami.
   (The entire noun phrases—article + noun—were exchanged.)

In these errors, the intonation contour (primary stressed syllables and variations in pitch) remained the same as in the intended utterances, even when the words were rearranged. In the intended utterance of (6), the highest pitch would be on *knife*. In the misordered sentence, the highest pitch occurred on the second syllable of *salami*. The pitch rise and increased loudness are thus determined by the syntactic structure of the sentence and do not depend on the individual words. Syntactic structures exist independently of the words that occupy them, and intonation contours can be mapped onto those structures without being associated with particular words.

Errors like those just cited are constrained in interesting ways. Phonological errors involving segments or features, as in (1), (2), and (3), primarily occur in content words, and not in grammatical morphemes, showing the distinction between these lexical classes. In addition, while words and lexical morphemes may be interchanged, grammatical morphemes may not be. We do not find errors like *The boying are sings* for *The boys are singing*. Typically, as example (4) illustrates, the inflectional endings are left behind when lexical morphemes switch and subsequently attach, in their proper phonological form, to the moved lexical morpheme.

Errors like those in (1)–(6) show that speech production operates in real time with features, segments, morphemes, words, phrases—the very units that exist in the grammar. They also show that when we speak, words are chosen and sequenced ahead of when they are articulated. We do not select one word from our mental dictionary and say it, then select another word and say it.

Lexical Selection

> Humpty Dumpty's theory, of two meanings packed into one word like a portmanteau, seems to me the right explanation for all. For instance, take the two words "fuming" and "furious." Make up your mind that you will say both words but leave it unsettled which you will say first. Now open your mouth and speak. If . . . you have that rarest of gifts, a perfectly balanced mind, you will say "frumious."
>
> **LEWIS CARROLL,** Preface to *The Hunting of the Snark*, 1876

In chapter 5, word substitution errors were used to illustrate the semantic properties of words. Such substitutions are seldom random; they show that in our attempt to express our thoughts by speaking words in the lexicon, we may make an incorrect lexical selection based on partial similarity or relatedness of meanings.

Blends, in which we produce part of one word and part of another, further illustrate the lexical selection process in speech production; we may select two or more words to express our thoughts and instead of deciding between them, we produce them as "portmanteaus," as Humpty Dumpty calls them. Such blends are illustrated in the following errors:

1.	splinters/blisters	→	splisters
2.	edited/annotated	→	editated
3.	a swinging/hip chick	→	a swip chick
4.	frown/scowl	→	frowl

These blend errors are typical in that the segments stay in the same position within the syllable as they were in the target words. This is not true in the previous example made up by Lewis Carroll: a much more likely blend of *fuming* and *furious* would be *fumious* or *furing*.

Application and Misapplication of Rules

> I thought . . . four rules would be enough, provided that I made a firm and constant resolution not to fail even once in the observance of them.
>
> **RENÉ DESCARTES,** *Discourse on Method*, 1637

Spontaneous errors show that the rules of morphology and syntax, discussed in earlier chapters as part of competence, may also be applied (or misapplied) when we speak. It is difficult to see this process in normal error-free speech, but when someone says *groupment* instead of *grouping*, *ambigual* instead of *ambiguous*, or *bloodent* instead of *bloody*, it shows that regular rules are applied to combine morphemes and form possible but nonexistent words.

Inflectional rules also surface. The UCLA professor who said **We swimmed in the pool* knows that the past tense of *swim* is *swam*, but he mistakenly applied the regular rule to an irregular form.

Morphophonemic rules also appear to be performance rules as well as rules of competence. Consider the *a/an* alternation rule in English. Errors such as *an istem* for the intended *a system* or *a burly bird* for the intended *an early bird* show that when segmental misordering changes a noun beginning with a consonant to a noun beginning with a vowel, or vice versa, the indefinite article is also changed so that it conforms to the grammatical rule.

Speakers hardly ever produce errors like **an burly bird* or **a istem*, which tells us something about the stages in the production of an utterance. The rule that determines whether *a* or *an* should be produced (*an* precedes a vowel; *a* precedes a consonant) must apply after the stage at which *early* has slipped to *burly*; that is, the stage at which /b/ has been anticipated. If *a/an* were selected first, the article would be *an* (or else the rule must reapply after the initial error has occurred). Similarly, an error such as *bin beg* for the intended *Big Ben* shows that phonemes are misordered before allophonic rules apply. That is, the intended *Big Ben* phonetically is [bɪg bɛ̃n] with an oral [ɪ] before the [g], and a nasal [ɛ̃] before the [n]. In the utterance that was produced, however, the [ɪ] is nasalized because it now occurs before the misordered [n], whereas the [ɛ̃] is oral before the misordered [g]. If the misordering occurred after the phonemes had undergone allophonic rules such as nasalization, the result would have been the phonetic utterance [bɪn bɛ̃g].

Nonlinguistic Influences

Our discussion of speech comprehension suggested that nonlinguistic factors can be involved in—and sometimes interfere with—linguistic processing. They also affect speech production. The individual who said *He made hairlines* instead of *He made headlines* was referring to a barber. The fact that the two compound nouns both start with the same sound, are composed of two syllables, have the same stress pattern, and contain the identical second morphemes undoubtedly played a role in producing the error, but the relationship between hairlines and barbers may also have been a contributing factor. Similar comments apply to the congressional representative who said, "It can deliver a large *payroll*" instead of "It can deliver a large *payload*," in reference to a bill to fund the building of bomber aircraft.

Other errors show that thoughts unrelated in form to the intended utterance may have an influence on what is said. One speaker said, "I've never heard of classes *on April 9*" instead of the intended *on Good Friday*. Good Friday fell on April 9 that year. The two phrases are not similar phonologically or morphologically, yet the nonlinguistic association seems to have influenced what was said.

Both normal conversational data and experimentally elicited data provide the psycholinguist with evidence for the construction of models both of speech production and of comprehension, the beginning and ending points of the speech chain of communication.

Computer Processing of Human Language

> Man is still the most extraordinary computer of all.
>
> **JOHN F. KENNEDY** (1917–1963)

Until a few decades ago, language was strictly "humans only—others need not apply." Today, it is common for computers to process language. **Computational linguistics** is a subfield of linguistics and computer science that is concerned with the interactions of human language and computers.

Computational linguistics includes the analysis of written texts and spoken discourse, the translation of text and speech from one language into another, the use of *human* (not computer) languages for communication between computers and people, and the modeling and testing of linguistic theories.

Computers That Talk and Listen

> The first generations of computers had received their inputs through glorified typewriter keyboards, and had replied through high-speed printers and visual displays. HAL could do this when necessary, but most of his communication with his shipmates was by means of the spoken words. Poole and Bowman could talk to HAL as if he were a human being, and he would reply in the perfect idiomatic English he had learned during the fleeting weeks of his electronic childhood.
>
> **ARTHUR C. CLARKE,** *2001: A Space Odyssey,* 1968

The ideal computer is multilingual; it should "speak" computer languages such as FORTRAN and Java, and human languages such as French and Japanese. For many purposes it would be helpful if we could communicate with computers as we communicate with other humans, through our native language. But as of the year 2010, the computers portrayed in films and on television as capable of speaking and understanding human language do not exist.

Computational linguistics is concerned with the interaction between language and computers in all dimensions, from phonetics to pragmatics, from producing speech to comprehending speech, from spoken (or signed) utterances to written forms. **Computational phonetics and phonology** is concerned with processing speech. Its main goals are converting speech to text on the comprehension side, and text to speech on the production side. The areas of **computational morphology**, **computational syntax**, **computational semantics**, and **computational pragmatics**, discussed below, are concerned with higher levels of linguistic processing.

Computational Phonetics and Phonology

The two sides of computational phonetics and phonology are **speech recognition** and **speech synthesis**. Speech recognition is the process of analyzing the speech signal into its component phones and phonemes, and producing, in effect, a phonetic transcription of the speech. Further processing may convert the transcription into ordinary text for output on a screen, or into words and phrases for further processing, as in a speech understanding application. (*Note*: Speech recognition is *not* the same as speech understanding, as is commonly thought. Rather, speech recognition is a necessary precursor to the far more complex process of comprehension.)

Speech synthesis is the process of creating electronic signals that simulate the phones and prosodic features of speech and assemble them into words and phrases for output to an electronic speaker, or for further processing as in a speech generation application.

Speech Recognition

When Frederic was a little lad he proved so brave and daring,
His father thought he'd 'prentice him to some career seafaring.
I was, alas! his nurs'rymaid, and so it fell to my lot
To take and bind the promising boy apprentice to a pilot—
A life not bad for a hardy lad, though surely not a high lot,
Though I'm a nurse, you might do worse than make your boy a pilot.
I was a stupid nurs'rymaid, on breakers always steering,
And I did not catch the word aright, through being hard of hearing;
Mistaking my instructions, which within my brain did gyrate
I took and bound this promising boy apprentice to a pirate.

GILBERT AND SULLIVAN, *The Pirates of Penzance,* 1879

When you listen to someone speak a foreign language, you notice that it is continuous except for breath pauses, and that it is difficult to segment the speech into sounds and words. It's all run together. The computer faces this situation when it tries to do speech recognition.

Early speech recognizers were not designed to "hear" individual sounds. Rather, the computers were programmed to store the acoustic patterns of entire words or even phrases in their memories, and then further instructed to look for those patterns in any subsequent speech they were asked to recognize. The computers had a fixed, small vocabulary. Moreover, they best recognized the speech of the same person who provided the original word patterns. They would have trouble "understanding" a different speaker, and if a word outside the vocabulary was uttered, the computers were clueless. If the words were run together, recognition accuracy also fell, and if the words were not fully pronounced, say *missipi* for Mississippi, failure generally ensued. Coarticulation effects also muddied the waters. The computers might have [hɪz] as their representation of the word *his*, but in the sequence *his soap*, pronounced [hɪssop], the *his* is pronounced [hɪs] with a voiceless [s]. In addition, the vocabulary best consisted of words that were not too similar phonetically, avoiding confusion between words like *pilot* and *pirate*, which might, as with the young lad in the song, have grave consequences.

Today, many interactive phone systems have a speech recognition component. They will invite you to "press 1 or say 'yes'; press 2 or say 'no,'" or perhaps offer a menu of choices triggered by one or more spoken word responses. Sophisticated mobile phones allow their owners to preprogram complete phrases such as "call my office" or "display the calendar." These systems have very small vocabularies and so can search the speech signal for anything resembling prestored acoustic patterns of a keyword and generally get it right.

The more sophisticated speech recognizers that can be purchased for use on a personal computer have much larger vocabularies, often the size of an abridged dictionary. To be highly accurate they must be trained to the voice of a specific person, and they must be able to detect individual phones in the speech signal. The training consists in the user making multiple utterances known in advance to the computer, which extracts the acoustic patterns of each phone typical of that user. Later the computer uses those patterns to aid in the recognition process.

Because no two utterances are ever identical, and because there is generally noise (nonspeech sounds) in the signal, the matching process that underlies speech recognition is statistical. On the phonetic level, the computations may classify some stretch of sound in its input as [l] with 65 percent confidence and [r] with 35 percent confidence. Other factors may be used to help the decision. For example, if the computer is confident that the preceding sound is [d] and begins the word, then [r] is the likely candidate, because no words begin with /dl/ in English. The system takes advantage of its (i.e., the programmer's) knowledge of sequential constraints (see chapter 7). If, on the other hand, the sound occurs at the beginning of the word, further information is needed to determine whether it is the phoneme /l/ or /r/. If the following sounds are [up] then /l/ is the one, because *loop* is a word but **roop* is not. If the computer is unable to decide, it may offer a list of choices such as *late* and *rate* and ask the person using the system to decide.

Advanced speech recognizers may utilize syntactic rules to further disambiguate an utterance. If the *late/rate* syntactic context is "It's too ___" the choice is *late* because *too* may be followed by an adjective but not by a noun or verb. Statistical disambiguation may also be used. For example, in a standard corpora of English there will be far more occurrences of "It's too late . . ." than there might be of, say, "It's to rate . . ." A statistical model can be built based on such facts that would lead the machine to give weight to the choice of *late* rather than *rate*.

Even these modern systems, with all the computing power behind them, are brittle. They break when circumstances become unfavorable. If the user speaks rapidly with lots of coarticulation (*whatcha* for *what are you*), and there is a lot of background noise, recognition accuracy plummets. People do better. If someone mumbles, you can generally make out what they are saying because you have context to help you. In a noisy setting such as a party, you are able to converse with your dance partner despite the background noise because your brain has the ability to filter out irrelevant sounds and zero in on the voice of a single speaker. This effect is so striking it is given a name: the **cocktail party effect**. Computers are not nearly as capable as people in coping with noise, although research directed at the problem is beginning to show positive results.

Speech Synthesis

> Machines which, with more or less success, imitate human speech, are the most difficult to construct, so many are the agencies engaged in uttering even a single word—so many are the inflections and variations of tone and articulation, that the mechanician finds his ingenuity taxed to the utmost to imitate them.
>
> ***SCIENTIFIC AMERICAN***, January 14, 1871

Early efforts toward building "talking machines" were concerned with machines that could produce sounds that imitated human speech. In 1779, Christian Gottlieb Kratzenstein won a prize for building such a machine. It was "an instrument constructed like the vox humana pipes of an organ which . . . accurately express the sounds of the vowels." In building this machine he also answered a question posed by the Imperial Academy of St. Petersburg, Russia: "What is the nature and character of the sounds of the vowels *a*, *e*, *i*, *o*, *u* [that make them] different from one another?" Kratzenstein constructed a set of "acoustic resonators" similar to the shapes of the mouth when these vowels are articulated and set them resonating by a vibrating reed that produced pulses of air similar to those coming from the lungs through the vibrating vocal cords.

Nearly a century later, a young Alexander Graham Bell, always fascinated with speech and its production, fabricated a "talking head" from a cast of a human skull. He used various materials to form the velum, palate, teeth, lips, tongue, cheeks, and so on, and installed a metal larynx with vocal cords made by stretching a slotted piece of rubber. A keyboard control system manipulated all the parts with an intricate set of levers. This ingenious machine produced vowel sounds, some nasal sounds, and even a few short combinations of sounds.

With the advances in the acoustic theory of speech production and the technological developments in electronics, machine production of speech sounds has made great progress. We no longer have to build physical models of the speech-producing mechanism; we can now imitate the process by producing the physical signals electronically.

Speech sounds can be reduced to a small number of acoustic components. One way to produce synthetic speech is to mix these components together in the proper proportions, depending on the speech sounds to be imitated. It is rather like following a recipe for making soup, which might read: "Take two quarts of water, add one onion, three carrots, a potato, a teaspoon of salt, a pinch of pepper, and stir it all together."

This method of producing synthetic speech would include a recipe that might read:

1. Start with a tone at the same frequency as vibrating vocal cords (higher if a woman's or child's voice is being synthesized, lower for a man's).
2. Emphasize the harmonics corresponding to the formants required for a particular vowel, liquid, or nasal quality.
3. Add hissing or buzzing for fricatives.
4. Add nasal resonances for nasal sounds.
5. Temporarily cut off sound to produce stops and affricates.
6. and so on. . . .

All of these ingredients are blended electronically, using computers to produce highly intelligible, more or less natural-sounding speech. Because item (2) is central to the process, this method of speech synthesis is called **formant synthesis**.

Most synthetic speech still has a machinelike quality or accent, caused by small inaccuracies in simulation, and because suprasegmental factors such as changing intonation and stress patterns are not yet fully understood. If not correct, such factors may be more confusing than mispronounced phonemes. Currently, the chief area of research in speech synthesis is concerned precisely with discovering and programming the rules of rhythm and timing that native speakers apply. Still, speech synthesizers today are no harder to understand than a person speaking a dialect slightly different from one's own, and when the context is sufficiently narrow, as in a synthetic voice reading a weather report (a common application), there are no problems.

An alternative approach to formant synthesis is **concatenative synthesis**. The basic units of concatenative synthesis are recorded units such as phones, diphones, syllables, morphemes, words, phrases, and sentences. A diphone is a transitional unit comprising the last portion of one phone plus the first portion of another, used to smooth coarticulation effects. There may be hundreds or even thousands of these little acoustic pieces. The recordings are made by human speakers. The synthesis aspect is in the assembling of the individual units to form the desired computer-spoken utterance. This would not be possible without the increased computational power now available, and today's synthesizers are generally of this type.

The challenge in concatenative synthesis is achieving the fluidity of human speech. This requires electronic fine tuning of speech prosody, that is, duration, intonation, pitch, and loudness on which naturalness is based. At this time much concatenative speech sounds stilted as the units do not always fit together seamlessly, and the perfection of prosodic effects remains elusive.

Text-to-Speech

Speak clearly, if you speak at all; carve every word before you let it fall.

OLIVER WENDELL HOLMES, SR. (1809–1894)

To provide input to the speech synthesizer, a computer program called **text-to-speech** converts written text into the basic units of the synthesizer. For formant synthesizers, the text-to-speech process translates the input text into a phonetic representation. This task is like the several exercises at the end of chapter 6, in which we asked you for a phonetic transcription of written words. Naturally, the text-to-speech process *precedes* the electronic conversion to sound.

For concatenative synthesizers, the text-to-speech process translates the input text into a representation based on whatever units are to be concatenated. For a syllable-based synthesizer, the text-to-speech program would take *The number is 5557766* as input and produce [θə] [nʌ̃m] [bər] [ɪz] [faɪv] [faɪv] [faɪv] [sɛv] [ə̃n] [sɛv] [ə̃n] [sɪks] [sɪks] as output. The "synthesizer" (a computer program) would look up the various syllables in its memory and concatenate them, with further electronic processing supplied for realistic prosody and to smooth over the syllable boundaries.

The difficulties of text-to-speech are legion. We will mention two. The first is the problem of words spelled alike but pronounced differently. *Read* may be pronounced as [rɛd] in *She has read the book*, but like [ri:d] in *She will read the book*. How does the text-to-speech system know which is which? Make no mistake about the answer; the machine must have structural knowledge of the sentence to make the correct choice, just as humans must. Unstructured, linear knowledge will not suffice. For example, we might program the text-to-speech system to pronounce *read* as [rɛd] when the previous word is a form of *have*, but this approach fails in several ways. First, the *have* governs the pronunciation at a distance, both from the left and the right, as in *Has the girl with the* *flaxen hair read the book?* and *Oh, read a lot of books, has he!* The underlying structure needs to be known, namely that *has* is an auxiliary verb for the main verb *to read*. If we try the strategy "pronounce *read* as [rɛd] whenever *have* is 'in the vicinity,'" we would induce an error in sentences like *The teacher said to have the girl read the book by tomorrow*, where [riːd] is the required pronunciation. Even worse for the linear analysis are sentences like *Which girl did the teacher have read from the book?* where the words *have read* occur next to each other, but the correct version is [riːd]. Of course you know that this occurrence of *read* is [riːd], because you know English and therefore know English syntactic structures. Only through structural knowledge can the "spelled-the-same-pronounced-differently" problem be approached effectively. We'll learn more about this in the section on computational syntax later in the chapter.

The second difficulty is inconsistent spelling, which is well illustrated by the first two lines of a longer poem:

> I take it you already know
> Of tough and bough and cough and dough

Each of the *ough* words is phonetically different, but it is difficult to find rules that dictate when *gh* should be [f] and when it is silent, or how to pronounce the *ou*. Modern computers have sufficient storage capacity to store the recorded pronunciation of every word in the language, its alternative pronunciations, and its likely pronunciations, which may be determined by an extensive statistical analysis. This list may include acronyms, abbreviations, foreign words, proper names, numbers including fractions, and special symbols such as #, &, *, %, and so on. Such a list is helpful—it is like memorizing rather than figuring out the pronunciations—and encompasses a large percentage of items, including the *ough* words. This is the basis of word-level concatenative synthesis. However, the list can never be complete. New words, new word forms, proper names, abbreviations, and acronyms are constantly being added to the language and cannot be anticipated. The text-to-speech system requires conversion rules for items not in its dictionary, and these must be output by a formant synthesizer or a concatenative synthesizer based on units smaller than the word if they are to be spoken. The challenges here are similar to those faced when learning to read aloud, which are considerable and, when it comes to the pronunciation of proper names or foreign words, utterly daunting.

Speech synthesis has important applications. It benefits visually impaired persons in the form of "reading machines," now commercially available, and vocal output of what is displayed on a computer screen. Mute patients with laryngectomies or other medical conditions that prevent normal speech can use synthesizers to express themselves. For example, researchers at North Carolina State University developed a communication system for an individual with so severe a form of multiple sclerosis that he could utter no sound and was totally paralyzed except for nodding his head. Using a head movement for "yes" and its absence as "no," this individual could select words displayed on a computer screen and assemble sentences to express his thoughts, which were then spoken by a synthesizer.

Computational Morphology

If we wish our computers to speak and understand grammatical English, we must teach them morphology (see chapter 3). We can't have machines going around saying "*The cat is sit on the mat" or "*My five horse be in the barn." Similarly, if computers are to understand English, they need to know that *sitting* contains two morphemes, *sit* + *ing*, whereas *spring* is one morpheme, and *reinvent* is two but they are *re* + *invent*, not *rein* + *vent*.

The processing of word structures by computers is computational morphology. The computer needs to understand the structure of words both to understand the words and to use the words in a grammatically correct way. To process words, the computer is programmed to look for roots and affixes. In some cases this process is straightforward. *Books* is easily broken into *book* + *s*, *walking* into *walk* + *ing*, *fondness* into *fond* + *ness*, and *unhappy* into *un* + *happy*. These cases, and many like them, are the easy ones, because the spelling is well behaved, and the morphological processes are general. Other words are more difficult, such as *profundity* = *profound* + *ity*, *galactic* = *galaxy* + *ic*, and *democracy* = *democrat* + *y*.

One approach is to place all the morphological forms of all the words in the language into the computer's dictionary. Although today's computers can handle such a high computational load—many millions of forms—there would still be problems because of the generality of the processes. As soon as a new word enters the language, as *fax* did some years ago, a whole family of words is possible: *faxes*, *fax's*, *faxing*, *faxed*, *refax*, and *faxable*; and many others are not possible: **faxify*, **exfax*, **disfax*, and so on. The dictionary would be continually out of date.

Moreover, not all forms are predictable. Although *heaten* is not a dictionary word, if you hear it you know, and the computer should know, that it means "to make hot." Likewise, compounding is a general process, and it would be impossible to predict all possible compounds of English. When *podcast* was coined from *pod* + *cast*, no computer could have had it in its dictionary.

The computer needs to have the ability to break words correctly into their component morphemes, and to understand each morpheme and its effect on the word's meaning, and where the word can be placed in a sentence. Computational morphology, then, is a host of interwoven rules, exceptions, and word/morpheme forms, all with the purpose of comprehending the internal structure of words.

One method of morphological analysis is called **stemming**. Here, affixes are detected and repeatedly stripped of the beginnings and ends of words, checking the work against computer's dictionary. For example, if the word to be analyzed were *befriended*, the computer would recognize and verify the prefix *be-* and the suffix *-ed*, leaving behind the root *friend*, all of which would be verified in a dictionary of words and morphemes. More complex words such as *unsystematically* would be repeatedly broken down in *-ly* (an adverb-former), *-al*, *-atic* (both adjective-formers), *system* (a root word), and *un-* (a negative morpheme).

Difficult problems always remain. If the computer sees *resent*, how does it know if it's the monomorphemic *resent* (with a /z/), or *re* + *sent*? A broader context is needed, and that is the topic of the next section.

Computational Syntax

Good order is the foundation of all things.

EDMUND BURKE, *Reflections on the Revolution in France,* 1790

In the beginning, there was ELIZA.

PATIENT:	Men are all alike.
ELIZA:	In what way?
PATIENT:	They're always bugging me about something or other.
ELIZA:	Can you think of a specific example?
PATIENT:	Well, my boyfriend made me come here.
ELIZA:	Your boyfriend made you come here?
PATIENT:	He says I'm depressed much of the time.
ELIZA:	I am sorry to hear you are depressed.

ELIZA is a computer program designed to simulate a nondirective psychiatrist talking to a patient. ELIZA has a collection of prepared phrases stored in memory such as "In what way?" or "Tell me more" that help keep the conversation going when it doesn't "understand" the patient. When ELIZA recognizes certain syntactic patterns, however, it turns them around to make a sensible response, as when it echoes "Your boyfriend made you come here?" ELIZA was programmed with a small bit of syntactic knowledge, which allowed it to make grammatical utterances based on the patient's statements, but no semantic knowledge at all. If a patient says "My sniggle is untherible," ELIZA would respond with "How long has your sniggle been untherible?" ELIZA was designed by the MIT scientist Joseph Weizenbaum (1923–2008) in the 1960s. Though its syntactic sophistication is low by today's standards, ELIZA is one of the earliest attempts at human-machine communication that took the syntax of English into account.

Twenty-five years after ELIZA, computer scientists at Duke University and North Carolina State University programmed the "Circuit Fix-It Shop," a system designed to help a technician repair a faulty circuit. Unlike ELIZA, which accepted only typed input and produced printed output, the Circuit Fix-It Shop accepted speech input and spoke its responses. It had its own syntax and was capable both of understanding and speaking syntactically complex utterances, as the following excerpt from a repair session shows:

COMPUTER:	This is the Circuit Fix-It Shop. How may I help you?
TECHNICIAN:	I need to fix the RS111 circuit.
COMPUTER:	I am familiar with that circuit. The LED is supposed to be displaying alternately blinking one and seven.
TECHNICIAN:	Where is the LED?
COMPUTER:	In the middle right of the blue region is the LED.
TECHNICIAN:	No light.
COMPUTER:	What is the switch at when the LED is off?
TECHNICIAN:	The switch is down.
COMPUTER:	You put up the switch.

Once the computer has understood the technician's utterance, it uses rules of semantics and syntax, together with a lexicon of words and morphemes, to formulate a grammatical, sensible response, which it then speaks through its synthesizer. The rules in many cases are similar to the phrase structure rules seen in chapter 4, such as "Form a noun phrase from an article followed by a noun." It also has semantic rules that tell it to use *the* with the word *switch* since its "world knowledge" tells it that there is only one switch in that particular circuit.

Computational linguists at East Carolina University continue to broaden and improve this prototype of a natural language, interactive repair manual.

To understand a sentence, you must know its syntactic structure. If you didn't know the structure of *dogs that chase cats chase birds*, you wouldn't know whether dogs or cats chase birds. Similarly, machines that understand language must also determine syntactic structure. A **parser** is a computer program that attempts to replicate what we have been calling the "mental parser." Like the mental parser, the parser in a computer uses a grammar to assign a phrase structure to a string of words. Parsers may use a phrase structure grammar and lexicon similar to those discussed in chapter 4.

For example, a parser may contain the following rules: S → NP VP, NP → Det N, and so forth. Suppose the machine is asked to parse *The child found the kittens*. A *top-down* parser proceeds by first consulting the grammar rules and then examining the input string to see if the first word could begin an S. If the input string begins with a Det, as in the example, the search is successful, and the parser continues by looking for an N, and then a VP. If the input string happened to be *child found the kittens*, the parser would be unable to assign it a structure because it doesn't begin with a determiner, which is required by this grammar to begin an S. It would report that the sentence is ungrammatical.

A *bottom-up* parser takes the opposite tack. It looks first at the input string and finds a Det (*the*) followed by an N (*child*). The rules tell it that this phrase is an NP. It would continue to process *found*, *the*, and *kittens* to construct a VP, and would finally combine the NP and VP to make an S.

Parsers may run into difficulties with words that belong to several syntactic categories. In a sentence like *The little orange rabbit hopped*, the parser might mistakenly assume *orange* is a noun. Later, when the error is apparent, the parser backtracks to the decision point, and retries with *orange* as an adjective. Such a strategy works on confusing but grammatical sentences like *The old man the boats* and *The Russian women loved died*, which cause a garden path effect for human (mental) parsers.

Another way to handle such ambiguous situations is for the computer to try every parse that the grammar allows *in parallel*. Only parses that finish are accepted as valid. In such a strategy, two parses of *The Russian women loved died* would be explored simultaneously: *Russian* would be an adjective in one and a noun in the other. The adjective parse would get as far as *The Russian women loved* but then fail since *died* cannot occur in that position of a verb phrase. (The parser must not allow ungrammatical sentences such as **The young women loved died*.) This parse does not finish because it leaves the word *died* without an analysis. The other parse, when it sees the two nouns *Russian women* together, deduces the presence of a relative clause, which would have been obvious if the word *that* had preceded *women* (but English allows it to be left out). The parser is then able to assign the category of noun phrase to *The Russian women loved*. The sentence is completed with the verb *died*, which can form a verb phrase, and the parse finishes successfully.

Interestingly, it is not established within psycholinguistics whether the human parser uses backtracking or parallelism to deal with ambiguity, or perhaps a combination, or some alternative strategy. This remains a challenge for psycholinguists. Figuring this out is difficult because people usually handle ambiguity and arrive at the intended meaning easily, and we do not see much evidence that they are doing lots of extra work to deal with additional possible meanings. Fiendish linguists must toil long and hard to come up with examples like the garden path sentences discussed earlier that confuse the human parser.

Computers may outperform humans in certain cases, however, because they are still semantically naïve. For example, try to figure out all the possible meanings of the sentence *Time flies like an arrow.* A computer parser does it easily. (*Hint*: Several of the words can belong to more than one syntactic category.) It turns out there are five (at least). The usual sense is "The way that time flies is the way that an arrow flies" (i.e., quickly). But it can also mean that a particular species of flies, namely "time flies," are fond of an arrow. Or, it can be a command: "(Please) time (a bunch of) flies in the same way that you would time an arrow!" (e.g., with a stopwatch). Another reading is again a command to time something, but in this case the things to be timed are "flies (that are) like an arrow." There is one more (even less plausible) reading: can you find it?[2]

We not only want computers to understand language, we also want them to be able to produce new sentences—ones that are not pre-stored—and this also requires knowledge of the syntactic rules of the grammar. In some cases the programming may be done simplistically. For example, a computer program to generate insults in the style of Shakespeare takes three columns of words, where the first column is a list of simple adjectives, the second a list of hyphenated adjectives, and the third a list of nouns:

Simple Adjectives	**Hyphenated Adjectives**	**Nouns**
bawdy	beetle-headed	baggage
churlish	clay-brained	bladder
goatish	fly-bitten	codpiece
lumpish	milk-livered	hedge-pig
mewling	pox-marked	lout
rank	rump-fed	miscreant
villainous	toad-spotted	varlet

The program chooses a word from each column at random to produce a noun phrase insult. Instantaneous insults guaranteed: you goatish, pox-marked bladder, you lumpish, milk-livered hedge-pig.

In less simplistic language generation, the computer works from the meaning of what is to be said, such as the information that the computer is to supply during a Circuit Fix-It Shop dialogue.

The generation system first assigns lexical items to the ideas and concepts to be expressed. These, then, must be fit into phrases and sentences that comply with the syntax of the output language. As in parsing, there are two approaches: top-down and bottom-up. In the top-down approach, the system begins with the highest-level categories such as S(entence). Lower levels are filled in progressively, beginning with noun phrases and verb phrases, and descending to determiners, nouns, verbs, and other sentence parts, always conforming to the syntactic rules. The bottom-up approach begins with the lexical items needed to

[2]"(Please) time (a bunch of) flies in the same way that an (animate) arrow with a stopwatch would time them."

express the desired meaning, and proceeds to combine them to form the higher-level categories. (Here, too, it is not yet known to what extent human language production employs one or other of these approaches.)

A **transition network** is a convenient way to visualize and program the use of a grammar to ensure proper syntactic output. A transition network is a complex of **nodes** (circles) and **arcs** (arrows). A network equivalent to the phrase structure rule S → NP VP is illustrated in Figure 9.3.

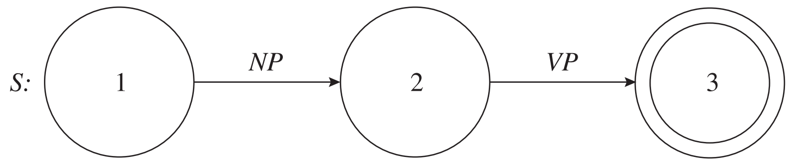


FIGURE 9.3 | Transition network for S → NP VP.

The nodes are numbered to distinguish them; the double circle is the "final" node. The object of the generation is to traverse the arcs from the first to the final node.

The generator would start at node 1 and realize that a noun phrase is necessary to begin the output. A noun phrase is chosen to express the appropriate concept. Other transition networks, in particular one for NP, determine the structure of the noun phrase. For example, one part of a transition network for a noun phrase would state that an NP may be a pronoun, corresponding to the phrase structure rule NP → Pronoun. It would look like Figure 9.4.

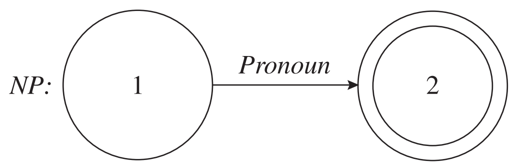


FIGURE 9.4 | Transition network for NP → Pronoun.

To satisfy the NP *arc* in the S network, the *entire NP network* is traversed. In this case, the NP is to be a Pronoun, as determined by the concept needed. The NP arc is then traversed in the S network, and the system is at node 2. To finish, an appropriate verb phrase must be constructed according to the concept to be communicated. That concept is made to comply with the structure of the VP, which is also expressed as a transition network. To get past the VP arc in the S network, the entire VP network is traversed. Figure 9.5 shows one part of the VP complex of transition networks, corresponding to VP → V NP:

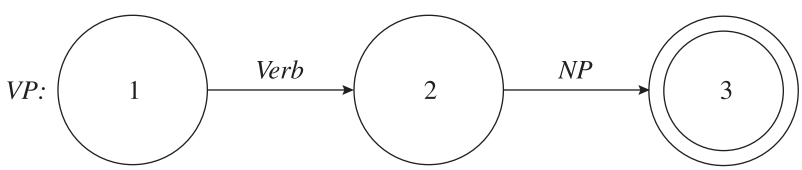


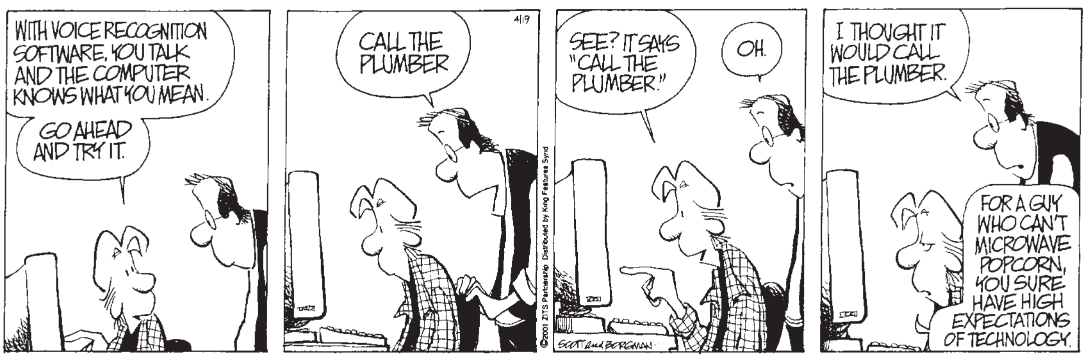
FIGURE 9.5 | Transition network for VP → V NP.

Once the VP network is completed, the VP arc in the S network is traversed to the final node, and the system sends the sentence out to be spoken or printed.

The final sentence of the Circuit Fix-It Shop dialogue is, *You put up the switch.* The concept is a command to the user (*you*) to move the switch to the up position. It chooses the verb *put up* to represent this concept, and the noun phrase *the switch* to represent the switch that the computer knows the user is already familiar with. The syntax begins in the S network, then moves to the NP network, which is finished by producing the subject of the sentence, the pronoun *you*. The NP arc is traversed to node 2 in the S network. Now the syntax requires a VP. The scene of action moves to the VP network. The first arc is traversed and gives the verb *put up*. An NP network is again required so that the VP can finish up. This network (not shown) indicates that an NP may be a determiner followed by a noun, in this case, *the* + *switch*. When that network is finished, the NP arc in the VP network is traversed, the VP network is finished, the VP arc in the S network is traversed, the S network is finished, and the final output is the sentence *You put up the switch*. Yes, it's complicated. Language is complex, and nowhere better does complexity reveal itself than when one tries to computerize it.

Because a reference to any network may occur in any other network, or even in the same network (thus capturing the recursive property of the syntax), a relatively small number of networks can generate the large number of sentences that may be needed by a natural language system. The networks must be designed so that they generate only grammatical, never ungrammatical, utterances.

Computational Semantics



The question of how to represent meaning is one that has been debated for thousands of years, and it continues to engender much research in linguistics, philosophy, psychology, cognitive science, and computer science. In chapter 5 we discussed many of the semantic concepts that a natural language system would incorporate into its operation. For simplicity's sake, we consider computational semantics to be the representation of the meaning of words and morphemes in the computer, as well as the meanings derived from their combinations.

Computational semantics has two chief concerns. One is to produce a semantic representation in the computer of language input; the other is to take a semantic representation and produce natural language output that conveys the meaning. In a dialogue system such as the Circuit Fix-It Shop, the computer must create a semantic representation of the user's input, act on it, and produce another semantic representation, which it then outputs to the user in ordinary language.

To generate sentences, the computer tries to find words that fit the concepts incorporated into its semantic representation. In the Circuit Fix-It Shop system, the computer had to decide what it wanted to talk about next: the switch, the user, the light, wire 134, or whatever. It needed to choose words corresponding to whether it wanted to declare the state of an object, ask about the state of an object, make a request of the user, tell the user what to do next, and so forth. If the query involved the user, the pronoun *you* would be chosen; if the state of the switch were the chief concern, the words *the switch*, or *a switch above the blue light*, would be chosen. When the components of meaning are assembled, the syntactic rules that we have seen already are called upon to produce grammatical output.

To achieve **speech understanding**, the computer tries to find concepts in its semantic representation capabilities that fit the words and structures of the input. When the technician says *I need to fix the RS111 circuit*, the system recognizes that *I* means the user, that *need* represents something that the user lacks and the computer must provide. It further knows that if fixing is what is needed, it has to provide information about the workings of something. It recognizes *the RS111 circuit* as a circuit with certain properties that are contained in certain of its files. It infers that the workings of that particular circuit will be central to the ensuing dialogue.

A computer can represent concepts in numerous ways, none of them perfect or preferable to others. All methods share one commonality: a lexicon of words and morphemes that it is prepared to speak or understand. Such a lexicon would contain morphological, syntactic, and semantic information, as discussed in chapters 3, 4, and 5. Exactly how that information is structured depends on the particular applications it is to be suited for.

On a higher level, the relationships between words are conveniently represented in networks similar (but different in objective) to the transition networks we saw previously. The nodes represent words, and the arcs represent thematic roles (see chapter 5) between the words. *You put up the switch*, then, might have the representation in Figure 9.6.

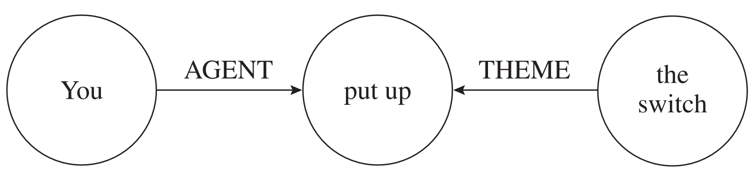


FIGURE 9.6 | Semantic network for *You put up the switch.*

This means that the user (*you*) is the agent, or doer, and *put up* is what is to be done, and it is to be done to the theme, which is *the switch.*

Some systems draw on formal logic for semantic representations. *You put up the switch* would be represented in a function/argument form, which is its logical form:

PUT UP (YOU, THE SWITCH)

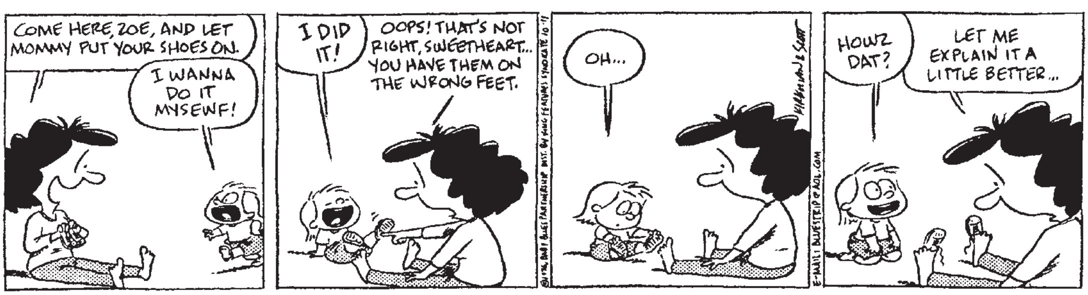
where PUT UP is a "two-place predicate," in the jargon of logicians, and the arguments are YOU and THE SWITCH. The lexicon indicates the appropriate relationships between the arguments of the predicate PUT UP.

A two-place predicate is the logical form of a transitive verb, with the first argument being the subject, and the second argument being the direct object. In chapter 5 on semantics we noted that one way to represent the meaning of a transitive verb such as *put up* was the set of pairs of elements (x,y) for which it is true that "x puts up y." This is consistent with the current notation in that the argument of the predicate is in the form of a pair of entities. Thus given the sentence "you put up the switch," and representing it as PUT UP (YOU, THE SWITCH), its meaning—whether it is true or false—is easily computed by seeing if the pair comprising the meaning of YOU and the meaning of THE SWITCH is in the set of ordered pairs that represent the meaning of PUT UP.

Two well-known natural language processing systems have used the predicate-argument approach to semantic representation. One, named SHRDLU by its developer Terry Winograd, demonstrated several abilities, such as being able to interpret questions, draw inferences, learn new words, and even explain its actions. It operated in the context of a "blocks world," consisting of a table, blocks of various shapes, sizes, and colors, and a robot arm for moving the blocks. Using simple sentences, one could ask questions about the blocks and give commands to have blocks moved from one location to another.

The second system, LUNAR, developed by William Woods, was capable of answering questions phrased in simple English about the lunar rock samples brought back from the moon by astronauts. LUNAR translated English questions into a logical representation, which it then used to query a database of information about the lunar samples.

Computational Pragmatics



Pragmatics, as discussed in chapter 5, is the interaction of the "real world" with the language system. In the Circuit Fix-It Shop, the computer knows that there is only one switch, that there is no other switch in the (its) universe, and hence that the determiner *the* is correct for this item. If the human mentioned *a wire*, however, the computer would ask *which wire* because it knows that there are several wires in the circuit. This is simple, computational pragmatics in action.

When a sentence is structurally ambiguous, such as *He saw the boy with a bicycle* ("use a bicycle to see the boy," or "see a boy and a bicycle"), the parser will compute each structure. Semantic processing may eliminate some of the structures if they are anomalous (in this case, a bicycle is not a tool for viewing objects, so one parse can be ruled out). *He saw the boy with a telescope* is semantically sensible in both parses and situational—pragmatic—knowledge is needed to determine the intended meaning.

Many natural language processing systems have a knowledge base of contextual and world knowledge. The semantic processing routines can refer to the knowledge base in cases of ambiguity. For example, the syntactic component of the Circuit Fix-It Shop will have two structures for *The LED is in the middle of the blue region at the top*. The sentence is ambiguous. Both meanings are semantically well formed and conceivable. However, the Circuit Fix-It Shop's knowledge base "knows" that the LED is in the middle of the blue region, and the blue region is at the top of the work area, rather than that the LED is in the top of the middle part of the blue region. It uses pragmatic knowledge—knowledge of the world—to disambiguate the sentence.

Another of the many tasks of computational pragmatics is to determine when two expressions refer to the same object, for example, determining the referents of pronouns (see chapter 5). This task of **reference resolution** combines morphological, syntactic, and semantic knowledge, as well as situational context. If the dialogue in the Circuit Fix-It Shop is:

COMPUTER: I am familiar with those circuits. The LED is supposed to be displaying alternately blinking one and seven.
TECHNICIAN: Where is **it**?

the computer must resolve the reference of *it*. The algorithm is to examine previous noun phrases for likely candidates, eliminating them based on both linguistic factors and situation. In this case the two possibilities are *those circuits* and *the LED*, but only the latter matches the singular pronoun.

In a discourse like:

It seems that the man loves the woman.
Many people think he loves her.

the semantic knowledge of gender is needed to resolve the references. If the second sentence were *Many people think they love each other*, the more daunting task of resolving the plural pronoun *they* to "the man and the woman" rather than "many people" would require not only semantic knowledge of plurality, but the pragmatic knowledge that because the focus of the dialogue is on the man and woman, rather than on people in general, *they* must refer to the couple.

Computational Sign Language

Research linguists at Boston University are working on computer algorithms that will recognize sign language much in the same way that speech may be recognized. Signers may sign in front of a camera (like speaking into a microphone) and the computer will attempt to match the sign from a set of prestored signs via visual processing, just as it will attempt to match a sound from a set of prestored acoustic wave forms via audio processing. Visual processing in this case means detecting the shapes and gestures of the hands, their trajectories, and their orientations. These are difficult algorithms to construct and success has so far been limited.

The purpose of this enterprise is twofold. One is to produce a video dictionary of signs. Someone who can imitate a sign but doesn't know its meaning can look it up in the video dictionary just as one uses an ordinary dictionary to look up a written word. Both native and non-native ASL "speakers" could use such a dictionary. The second purpose is to enable a computer to search through ASL videos for a particular sign, just as a search engine like Google searches for certain key words in text documents.

One challenge the ASL dictionary makers must meet is the dialectal variations that signers exhibit. This is analogous to the different spelling systems of American, British, and Australian English, which occasionally challenge the written dictionary user. The visual processing system must take into account the nonlinguistic differences of signs to achieve a proper lookup. Once again we see that signed languages share all the advantages and disadvantages that are part of language in general.

Applications of Computational Linguistics

The usefulness of computers in every imaginable language-related field is unquestioned. We have already touched upon several of these in our investigation into the various subfields of computational linguistics, such as natural language interfaces to various kinds of computer programs.

In this section we discuss some of the more common application areas, ranging from the use of computers to test a linguist's grammar for faithfulness to the actual language, to the use of computers to solve language crimes—the field of computational forensic linguistics.

Computer Models of Grammar

> I am never content until I have constructed a . . . model of the subject I am studying. If I succeed in making one, I understand; otherwise I do not.
>
> **WILLIAM THOMSON (LORD KELVIN),** *Molecular Dynamics and the Wave Theory of Light,* 1904

> A theory has only the alternative of being right or wrong. A model has a third possibility: it may be right, but irrelevant.
>
> **MANFRED EIGEN,** *The Physicist's Conception of Nature,* 1973

The grammars used by computers for parsing may not be the same as the grammars linguists construct for human languages, which are models of linguistic competence; nor are they similar, for the most part, to models of linguistic performance. Computers and people are different, and they achieve similar ends differently. Just as an efficient flying machine is not a replica of any bird, efficient grammars for computers do not resemble human language grammars in every detail.

Computers are often used to model a physical or biological system, which allows researchers to study those systems safely and sometimes even cheaply. For example, the performance of a new aircraft can be simulated and the test pilot informed about safe limits in advance of actual flight.

Computers can also be programmed to model the grammar of a language. An accurate grammar—one that is a true model of a speaker's mental grammar—should be able to generate all and only the sentences of the language. Failure to generate a grammatical sentence indicates an error in the grammar, because the human mental grammar has the capacity to generate all possible grammatical sentences—an infinite set. In addition, if the grammar produces a string that speakers consider ungrammatical, that too indicates a defect in the grammar. Even though in actual speech performance we often produce ungrammatical strings—sentence fragments, slips of the tongue, and so on—we will judge them to be ill-formed if we notice them. Our grammars do not generate these strings.

Computer models of grammars date back to the 1960s, when programs to test a generative grammar of English were designed by syntacticians at UCLA. Such models are still being developed to test newer theories of grammar. Computer models of grammar are useful to the theoretical linguist because they oblige him or her to formulate rules very explicitly. Otherwise the computer will not be able to implement them. With this goal in mind, computational linguists develop computer programs to generate the sentences of a language and to simulate human parsing of these sentences using the rules included in various current linguistic theories. The computational models show that it is possible to use a written-down grammar in language production and comprehension, but it is still controversial whether such grammars are true models of human language processing.

Because linguistic competence and performance are so complex, computers are being used as a tool in the attempt to understand human language and its use. We have emphasized some of the differences in the ways human beings and computers process language. For example, humans appear to do speech recognition, parsing, semantic interpretation, and contextual disambiguation more or less simultaneously and smoothly while hearing and comprehending speech. Computers, on the other hand, usually have different components, loosely connected, and perform these functions individually.

One reason for this is that, typically, computers have only a single, powerful processor, capable of performing a single task at a time. Currently, computers are being designed with multiple, interconnected processors that can do several things at once, much more like the human brain. The power of these computers lies both in the individual processors and in the connections. Such computers are capable of **parallel processing**, or carrying out several tasks simultaneously.

With a parallel architecture, computational linguists may be better able to program machine understanding in ways that blend all the stages of processing, from speech recognition through contextual interpretation, and hence approach more closely the way humans process language.

Frequency Analysis, Concordances, and Collocations

> [The professor had written] all the words of their language in their several moods, tenses and declensions [on tiny blocks of wood, and had] emptied the whole vocabulary into his

frame, and made the strictest computation of the general proportion there is in books between the numbers of particles, nouns, and verbs, and other parts of speech.

JONATHAN SWIFT, *Gulliver's Travels,* 1726

Jonathan Swift prophesied one application of computers to language: statistical analysis. The relative frequencies (i.e., the "general proportions") of letters and sounds, morphemes, words, word categories, types of phrases, and so on may be swiftly and accurately computed for any **corpus** (body of language data), whether textual or spoken.

A frequency analysis of one million words of written American English reveals the ten most frequently occurring words: *the*, *of*, *and*, *to*, *a*, *in*, *that*, *is*, *was*, and *he*. These "little" words accounted for about 25 percent of the words in the corpus, with *the* leading the pack at 7 percent. A similar analysis of *spoken* American English produced somewhat different results. The "winners" were *I*, *and*, *the*, *to*, *that*, *you*, *it*, *of*, *a*, and *know*, accounting for nearly 30 percent. This is but one of the differences between spoken and written language demonstrated by corpus analysis. All English prepositions except *to* occur more frequently in written than in spoken English, and not surprisingly, profane and taboo words (see chapter 10) were far more numerous in spoken than written language.

A **concordance** takes frequency analysis one step further by specifying the location within the text of each word and its surrounding context. A concordance of the previous paragraph would not only show that the word *words* occurred five times, but would indicate in which line of the paragraph it appeared, and provide its context. If one chose a "window" of three words on either side for context, the concordance would look like this for *words*:

of one million	**words**	of written American
most frequently occurring	**words**	the, of, and,
These "little"	**words**	accounted for about
percent of the	**words**	in the corpus,
profane and taboo	**words**	(see chapter 10)

A concordance, as you can see, might be of limited usefulness because of its "raw" nature. A way to refine a concordance is through **collocation analysis**. A collocation is the occurrence of two or more words within a short space of each other in a corpus. The point is to find evidence that the presence of one word in the text affects the occurrence of other words. Such an analysis must be statistical and involve large samples to show significant results. In the previous concordance of *words*, there is not enough data to be significant. If we performed a concordance on this entire book, patterns would emerge that would show that *words* and *written*, *words* and *taboo*, and *words* and *of* are more likely to occur close together than, say, *words* and *million*.

Frequency analyses of enormous corpuses are easily accomplished with today's computing power—we're talking trillions if not quadrillions of words if we take into account written texts available on the Internet. With such size, statistical information becomes more valid and more useful. If the computer "hears" the sounds [riʔɛnt] in the context *They* _______ *the message* and is unsure whether the question mark is [z] as in *resent* or [s] as in *re-sent*, a frequency analysis would (presumably) show that the phrase *re-sent the message* occurs more frequently in the corpus than *resent the message*, making *re-sent* the better guess. The use of such methodology in speech recognition and speech understanding systems is becoming pervasive as we enter the second decade of the twenty-first century.

Such analyses can be conducted on existing texts (such as the works of Shakespeare or the Bible) or on any corpus of utterances gathered from spoken or written sources. Authorship attribution is another motivation for these studies. By analyzing the various books of the Bible, for instance, it is possible to get a sense of who wrote what passages. In a notable study of the Federalist Papers, the authorship of a disputed paper was attributed to James Madison rather than to Alexander Hamilton. This was accomplished by comparing the statistical analyses of the paper in question with those of known works by the two writers.

A concordance of sounds by computer may reveal patterns in poetry that would be nearly impossible for a human to detect. An analysis of the *Iliad* showed that many of the lines with an unusual number of etas (/i/) were related to youth and lovemaking; the line with the most alphas (/a/) was interpreted as being an imitation of stamping feet, the marching of armies. The use of computers permits literary scholars to study poetic and prosaic features such as assonance, alliteration, meter, and rhythm. Today, computers can do the tedious mechanical work that once had to be done painstakingly with paper and pencil.

Computational Lexicography

In chapter 3 we discussed the nature and history of lexicography—the making of dictionaries—from the first dictionaries of Samuel Johnson to the updated *Oxford English Dictionary* (OED). Nowadays every lexicographer is a computational lexicographer. Writing a dictionary without a computer makes no more sense today than writing a dictionary without a quill would have made in 1755.

Lexicography was once the science of a thousand slips of paper, and of eyesight gone bad from the continual reading of texts and searching for words. Today, thankfully, the computer does much of the work and the quality of dictionaries has never been higher. Moreover, many dictionaries are now available in machine-readable (electronic) form, easily accessed from any computer. A not uncommon sight is a commuter in a train using a mobile phone to access an online dictionary to assist in the working of a crossword puzzle.

Standard dictionaries, it turns out, are not entirely suitable for the needs of computational linguists, who need a wealth of information about individual words and morphemes that is not generally available in standard dictionaries to accomplish their goals of computer understanding, natural language generation, machine translation, and so on. The field of **computational lexicography**, then, is concerned not only with the making of standard dictionaries but also with the building of electronic dictionaries specifically designed to be useful to computational linguists.

Some of the information computational linguists need follows:

- phonemic transcription
- phonetic variants (dialectal, societal)
- syllabification

- syntactic categories
- semantic properties such as *abstract*, *human*, *animate*, etc. (see chapter 5)
- number, e.g., *people* is plural, *person* is singular
- gender, e.g., *ship* is female
- c-selection (*murder* requires a direct object) (see chapter 4)
- s-selection (*murder* requires a human subject and object) (see chapter 4)
- stylistic level (*ain't* is informal, *rad* is slang, *fuck* is taboo, etc.)
- synonyms, antonyms, possible homophones, etc.

Wordnet is an online dictionary (developed at Princeton University) with tens of thousands of entries that attempts to satisfy some of the needs of computational linguists, with emphasis on semantic relationships. Other similar projects are ongoing at various institutions. Over the next few years, expect to see significant progress in electronic lexicography for computational linguistic applications.

Information Retrieval and Summarization

Hired
Tired
Fired

A CAREER SUMMARY, *source obscure*

Many people use the search features of the Internet to find information. Typically, one enters a keyword, or perhaps several, and magically the computer returns the location of Web sites that contain information relating to that keyword. This process is an example of **information retrieval**. It may be as trivial as finding Web sites that contain the keyword exactly as it is entered, but more often advanced linguistic analysis is applied. Web sites are returned, and even ranked, according to the frequency of occurrence of the keyword, different morphological forms of the keyword, synonyms of the keyword, and concepts semantically related to the keyword. For example, the keyword *bird* might retrieve information based on *bird*, *birds*, *to bird* (verb infinitive), *bird feeders*, *water birds*, *avian*, *sparrow*, *feathers*, *flight*, *migration*, and so on.

In general, information retrieval is the use of computers to locate and display data gleaned from possibly very large databases. The input to an information retrieval system consists of words, statements, or questions, which the computer analyzes linguistically and then uses the results to sift through the database for pertinent information. Nowadays, complex information retrieval systems identify useful patterns or relationships in corpuses or other computer repositories using advanced linguistic and statistical analyses. The term **data mining** is used currently for the highly evolved information retrieval systems.

A keyword as general as *bird* may return far more information than could be read in ten lifetimes if a thorough search of the Web occurs. (A search on the day of this writing produced 200 million hits, compared to 122 million four years prior.) Much of the data would repeat, and some information would outweigh other information. Through **summarization** programs, computers can eliminate redundancy and identify the most salient features of a body of information. World leaders, corporate executives, and even university professors—all of whom may wish to digest large volumes of textual material such as reports, newspapers, and scholarly articles—can benefit through summarization processes, providing the material is available in computer-readable form, which is increasingly the case as we enter the second decade of the twenty-first century.

A typical scenario would be to use information retrieval to access, say, a hundred articles about birds. The articles may average 5,000 words each. Summarization programs, which can be set to reduce an article by a certain amount, say 1/10 or 1/100, are applied. The human reads the final output. Thus 500,000 words can be reduced to 5,000 or 10,000 words containing the most pertinent information, which may then be read in ten or twenty minutes. Former President Bill Clinton—a fast reader—could absorb the contents of relevant articles from more than 100 news sources from around the world with the help of aides using computer summarizations.

Summarization programs range from the simplistic "print the first sentence of every paragraph" to complex programs that analyze the document semantically to identify the important points, often using "concept vectors." A *concept vector* is a list of meaningful keywords whose presence in a paragraph is a measure of the paragraph's significance, and therefore an indication of whether the content of that paragraph should be included in a summarization. The summary document contains concepts from as many of the key paragraphs as possible, subject to length constraints.

Spell Checkers

> Take care that you never spell a word wrong . . . It produces great praise to a lady to spell well.
>
> **THOMAS JEFFERSON,** in a letter to his daughter Martha, 1783

Spell checkers, and perhaps in the future, pronunciation checkers, are applications of computational linguistics that vary in sophistication from mindless, brute-force lookups in a dictionary, to enough intelligence to flag *your* when it should be *you're*, or *bear* when *bare* is intended. One often finds spell checkers as front ends to information retrieval systems, checking the keywords to prevent misspellings from misleading the search. Most e-mail systems also do spell checking, though that feature may be undesirable when texting because of so many nonstandard usages. Moreover, as the following poem reveals, spell checkers cannot replace careful editing:

I have a spelling checker.
It came with my PC.
It plane lee marks four my revue
Miss steaks aye can knot sea.
A checker is a bless sing,
It freeze yew lodes of thyme.
It helps me right awl stiles to reed,
And aides me when aye rime.
To rite with care is quite a feet

Of witch won should bee proud,
And wee mussed dew the best wee can,
Sew flaws are knot aloud.[3]

Machine Translation

Egad, I think the interpreter is the hardest to be understood of the two!

R. B. SHERIDAN, *The Critic,* 1779

Robert Rodman

World leaders require information from sources written in many languages, and translators work hard to fulfill their demands. Scholars and business personnel have a similar need, and that need has existed since the dawn of human writing (see chapter 12).

The first use of computers for natural language processing began in the 1940s with the attempt to develop **automatic machine translation**. During World War II, Allied scientists, without the assistance of computers, deciphered coded enemy communications and proved their skill in coping with difficult language problems. The idea of using deciphering techniques to translate from one language into another was expressed in a letter written to cyberneticist Norbert Wiener by

[3]Candidate for a pullet surprise. *The Journal of Irreproducible Results* (http://www.jir.com).

Warren Weaver, a pioneer in the field of computational linguistics: "When I look at any article in Russian, I say: 'This is really written in English, but it has been coded in some strange symbols. I will now proceed to decode it.'"[4]

The aim in automatic translation is to input a spoken utterance or a written passage in the **source language** and to receive a grammatical passage of equivalent meaning in the **target language** (the output). In the early days of machine translation, it was believed that this task could be accomplished by entering into the memory of a computer a dictionary of a source language and a dictionary with the corresponding morphemes and words of a target language. The translating program attempted to match the morphemes of the input sentence with those of the target language. Unfortunately, what often happened was a process that early experimenters with machine translation called "language in, garbage out."

Translation is more than word-for-word replacement. Often there is no equivalent word in the target language, and the order of words may differ, as in translating from an SVO language like English to an SOV language like Japanese. There is also difficulty in translating idioms, metaphors, jargon, and so on. Human translators cope with these problems because they know the grammars of the two languages and draw on general knowledge of the subject matter and the world to arrive at the intended meaning. Machine translation is often impeded by lexical and syntactic ambiguities, structural disparities between the two languages, morphological complexities, and other cross-linguistic differences. It is often difficult to get good translations even when humans do the translating, as is illustrated by some "garbage out"-type signs posted as "aids" to tourists in non-English-speaking countries:

> The lift is being fixed for the next day. During that time we regret that you will be unbearable. (Bucharest hotel lobby)
> The nuns harbor all diseases and have no respect for religion. (Swiss nunnery hospital)
> All the water has been passed by the manager. (German hotel)
> Because of the impropriety of entertaining guest of the opposite sex in the bedroom, it is suggested that the lobby be used for this purpose. (Hotel in Zurich)
> The government bans the smoking of children. (Sign in Istanbul)

Similar problems are evident in this brief excerpt of the translation of an interview of the entertainer Madonna in the Hungarian newspaper *Blikk*:

> BLIKK: Madonna, let's cut toward the hunt: Are you a bold hussy-woman that feasts on men who are tops?
>
> MADONNA: Yes, yes, this is certainly something that brings to the surface my longings. In America it is not considered to be mentally ill when a woman advances on her prey in a discotheque setting with hardy cocktails present.

[4]Locke, W. N., and A. D. Boothe (eds.). 1955. *Machine translation of languages*. New York: Wiley.

Such "translations" represent the difficulties of finding the right words, but word choice is not the only problem in automatic translation. There are challenges in morphology when translating between languages. A word like *ungentlemanliness* is certainly translatable into any language, but few languages are likely to have an exact word with that meaning, so a phrase of several words is needed. Similarly, *mbuki-mvuki* is a Swahili word that means "to shuck off one's clothes in order to dance." English does not have a word for that practice, but not for lack of need.

Syntactic problems are equally challenging. English is a language that allows possessive forms of varying syntactic complexity, such as *that man's son's dog's food dish*, or *the guy that my roommate is dating's cousin*. Translating these sentences without a loss of meaning into languages that prohibit such structures requires a great deal of sentence restructuring.

We have been implicitly discussing translation of written texts. What about the translation of speech from one language to another? On the one side, speech recognition is needed—or "speech-to-text." On the other side, "text-to-speech" is required. The most general machine translation scenario—that of speech-to-speech—encapsulates the areas of computational linguistics concerned with computers utilizing human grammars to communicate with humans, or to assist humans in communicating with each other. Diagrammatically, we have a progression like the flowchart in Figure 9.7.

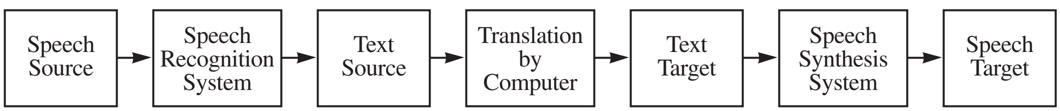


FIGURE 9.7 | Logic flow of machine translation of speech.

Computational Forensic Linguistics

Forensic linguistics is a subfield of linguistics that applies to language as used in the legal and judicial fields. It includes authorships studies, interpretation of legal language, language rights and usage in the courtroom, statement analysis (e.g., suicide notes), trademark protection and infringement (McWho?), speaker identification (who left that bomb threat?), text authentication (e.g., questions of plagiarism), legality of lip-reading, and so on.

Computational forensic linguistics is a sub-area that concerns itself with computer applications in forensic linguistics. In this section we will look at three such applications: trademarks, interpreting legal terms, and speaker identification.

Trademarks

> There is a risk that the word "Google" could become so commonly used that it becomes synonymous with the word "search." If this happens, we could lose protection for this trademark, which could result in other people using the word "Google" to refer to their own products, thus diminishing our brand.
>
> **QUOTED IN *THE GUARDIAN WEEKLY*,** July 21, 2006

Google is not alone in being required to defend its trademarked name in various courts of law. McDonald's has also fought in the courts to defend against the use of the bound morpheme *Mc-* from *McBagel* to *McSleep*. The latter was to be the name of a chain of basic hotels when the subpoenas were served to the Quality Inns International, Inc. In helping to defend the hotel chain, forensic linguist Roger Shuy used a computer to search a huge corpus for words containing the precious morpheme. He found a large number of already accepted usages such as *McMansions*, *McArt*, *McCinema*, and *McPrisons*, and based on those data argued that the morpheme *Mc-* had entered the language with its own meaning, "basic, inexpensive," and was therefore available to the public at large. The judge did not agree and ruled against the hotel chain because market research showed that the public's perception of the morpheme *Mc-* was nonetheless strongly associated with McDonald's.

Interpreting Legal Terms

> A Daniel come to judgment! yea, a Daniel!
>
> **WILLIAM SHAKESPEARE,** *The Merchant of Venice*, Act IV, Scene 1, c. 1596

The nuances of meaning of legal language have been disputed throughout the entire history of judicial systems. The legal definition of "a pound of flesh" is central to the plot of Shakespeare's play *The Merchant of Venice*.

A recent case hinged on the legitimate use of the word *visa*, not as a credit card trademark, but as a legal term relevant to international travel. The point in question was whether a visa gives a traveler an unconditional right to enter the visa-issuing country, or if it is something subtly, but significantly, different. A computational linguist examined the multimillion-word Bank of England corpus and found seventy-four instances of *visa* and *visas* collocated with common verbs like *issue*, *refuse*, *apply for*, *need*, and *require*, and was able to argue successfully that the meaning of *visa* was, in the mind of the average traveler, *a kind of permit to enter a country*, not *a permit* ***to request permission*** *to enter a country*, for if that were the case even with a visa a traveler could be denied entry. This finding of one British court continues to have repercussions in the world of international law, though the question is by no means entirely settled.

This analysis and many like it show the usefulness of a corpus-based, computer-driven approach to thorny legal problems. It has become increasingly common for computational forensic linguists to search databases in various, often ingenious ways, to make legal points.

Speaker Identification

> Good morning. There are three bombs to go off today at three pharmaceuticals in North Carolina. Please be aware. Advise your people or go to their funerals. Goodbye.
>
> **TRANSCRIPT OF A VOICE MAIL MESSAGE TO A PHARMACEUTICAL DISTRIBUTION COMPANY IN RALEIGH, NORTH CAROLINA**

Many crimes involve anonymous recorded messages in which it is important to identify the speaker. **Speaker identification** is the use of computers to assist in such a task, as opposed to **ear witnessing**, which relies on the judgment of human listeners.

Two computational tools are commonly applied to assist in speaker identification. One displays the wave form of an utterance, which shows the amplitude changes of the speech over time; the second displays a spectrogram, discussed earlier in this chapter, which shows the frequencies of speech over time. Both of these graphical displays can reveal to the eye what the ear may be unsure of hearing, and because of that can be an effective device in a judicial setting.

The bomb threat in the epigraph provides us with a case study. An African American man, born and raised in North Carolina, was accused of leaving the threat. The defense employed a computational forensic linguist as an expert witness to perform a speaker identification analysis. After analyzing many segments of speech, the expert determined that not only was the suspect unlikely to have been the speaker of the bomb threat, but that there was a high probability that the speaker was not a native speaker of English. Here is an excerpt from the expert witness's report:

> The word "goodbye" occurs in wthe bomb threat.
> <u>Caller</u>: Inserts an epenthetic vowel so that the pronunciation is "good-a-bye," clearly seen in the wave form and spectrogram. No native speaker of English is likely to have this pronunciation. The caller also pronounces 'bye' with a fully diphthongized /ay/—the way foreigners are taught.
> <u>Suspect</u>: His "goodbye" is "goobah," without the /d/ and certainly without the epenthetic vowel. His "bye" is monophthongized and somewhat lengthened as in much speech of the south, black and white.

The expert took exemplars from the suspect, and put the wave forms side by side, as shown in Figure 9.8. The figure on the left is the caller's "goodbye." The figure on the right is the suspect's:

The well-enunciated /d/ of the caller begins at 0.40 seconds with a stop closure (silence) of about 80 milliseconds. (The amplitude is small, but not zero owing to noise.) The epenthetic vowel is seen between 0.52 and 0.64 seconds. At 0.64 seconds the stop closure for the /b/ of "bye" begins. On the right there is no /d/ visible, nor is there an extra vowel. The "gooh" is followed by the stop closure of the /b/ in bye at 2.55 seconds. Figure 9.9 is the wave form with its spectrogram beneath it.

Recall that the dark bands are the formants, and they occur with vowel sounds. On the caller's side, the near silence of the stop closure of the /d/ is readily apparent in the white space at around 0.40 seconds, and the epenthetic vowel, probably a schwa ([ə]), is clearly visible as a vowel since its first four formants are apparent. The diverging first and second formants at the end of the caller's "good-a-bye" make the diphthong visible.

In the suspect's spectrogram there is no evidence of a /d/ at all, nor of an extra vowel. The only period of silence precedes the stop closure of the /b/ in "bye." Finally, the flatness of all the formants in the vowel of "bye" indicates a monophthongal sound, quite unlike the caller's.

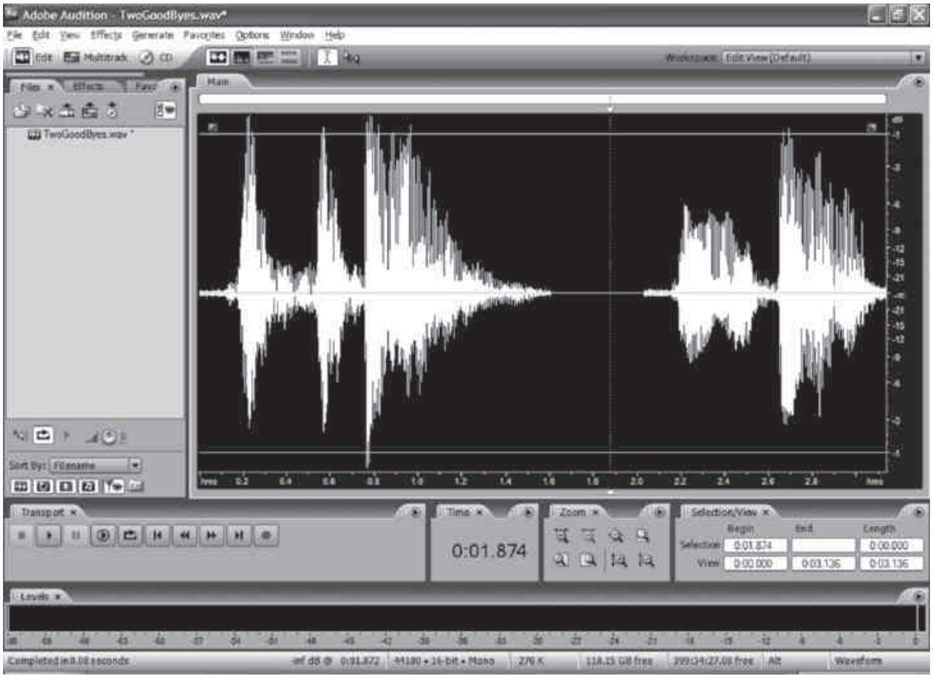


FIGURE 9.8 | Wave forms showing the word “goodbye” spoken by a bomb-threat caller (left) and the suspect arrested for that incident (right).

Adobe product screen shot reprinted with permission from Adobe Systems Incorporated

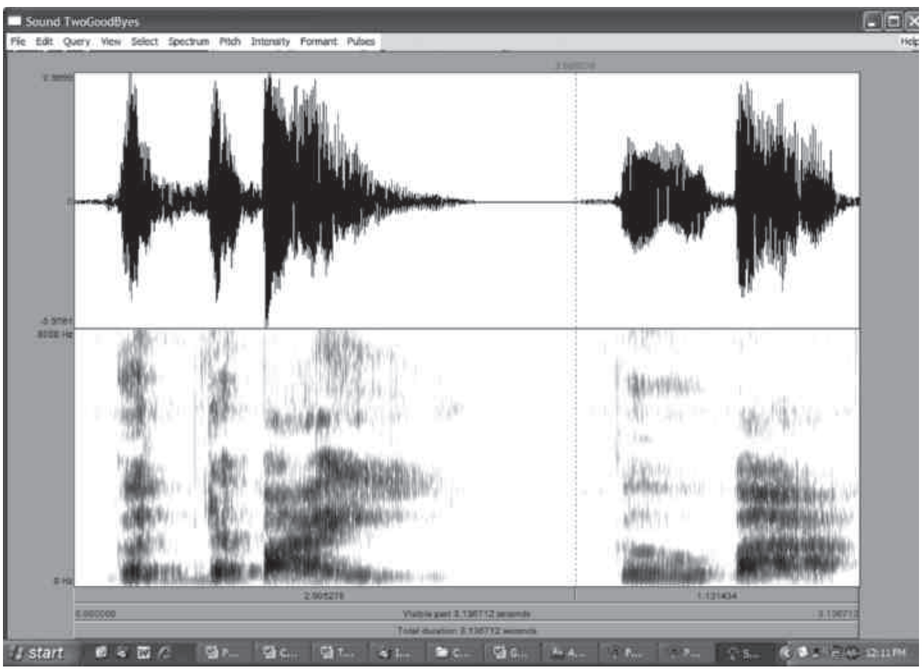


FIGURE 9.9 | Top: wave forms of the word “goodbye.” Bottom: spectrogram of the same utterance.

Adobe product screen shot reprinted with permission from Adobe Systems Incorporated

The suspect was convicted of the crime, but an appeals court reversed the verdict based on the forensic linguistic evidence. And after signing a statement not to pursue a false-arrest suit, the suspect was released after serving twenty months in prison.

Summary

Psycholinguistics is concerned with **linguistic performance** or processing, which is the use of linguistic knowledge (competence) in speech production and comprehension.

Comprehension, the process of understanding an utterance, requires the ability to access the mental lexicon to match the words in the utterance to their meanings. Comprehension begins with the perception of the **acoustic speech signal**. The speech signal can be described in terms of the **fundamental frequency**, perceived as pitch; the intensity, perceived as loudness; and the quality, perceived as differences in speech sounds, such as between an [i] and an [a]. The speech wave can be displayed visually as a **spectrogram**, sometimes called a **voiceprint**. In a spectrogram, vowels exhibit dark bands where frequency intensity is greatest. These are called **formants** and result from the emphasis of certain *harmonics* of the fundamental frequency, as determined by the shape of the vocal tract. Each vowel has a unique formant pattern.

The speech signal is a continuous stream of sounds. Listeners have the ability to segment the stream into linguistic units and to recognize acoustically distinct sounds as the same linguistic unit.

The perception of the speech signal is necessary but not sufficient for the comprehension of speech. To get the full meaning of an utterance, we must **parse** the string into syntactic structures, because meaning depends on word order and constituent structure in addition to the meaning of words. Some psycholinguists believe we use both **top-down processing** and **bottom-up processing** during comprehension. Top-down processing uses semantic and syntactic information in addition to the lexical information drawn from the sensory input; bottom-up processing uses only information contained in the sensory input.

Psycholinguistic experimental studies are aimed at uncovering the units, stages, and processes involved in linguistic performance. Several experimental techniques have proven to be very helpful. In a **lexical decision** task, subjects are asked to respond to spoken or written stimuli by pressing a button if they consider the stimulus to be a word. In **naming** tasks, subjects read from printed stimuli. The measurement of response times, RTs, in naming and other tasks shows that it takes longer to process less frequent words compared to more frequent words, longer to produce irregularly spelled versus regularly spelled words, and longer to pronounce nonsense forms as opposed to real words. In addition to using behavioral data such as RT, researchers can now use various measures of electrical brain activity to learn about language processing.

A word may **prime** another word if the words are related in some way such as semantically, phonetically, or even through similar spelling. The semantic priming effect is shown by experiments in which a word such as *nurse* is spoken in a sentence, and it is found that words related to *nurse* such as *doctor* have lower RTs in lexical decision tasks. If an ambiguous word like *mouse* is used in an unambiguous context such as *My spouse has been chasing a mouse*, words related to both meanings of mouse are primed (e.g., *rat* and *computer*).

Eye tracking techniques can determine the points of a sentence at which readers have difficulty and have to backtrack to an earlier point of the sentence. These experiments provide strong evidence that the parser has preferences in how it constructs trees, which may give rise to **garden path** effects.

Another technique is **shadowing**, in which subjects repeat as fast as possible what is being said to them. Subjects often correct errors in the stimulus sentence, suggesting that they use linguistic knowledge rather than simply echoing sounds they hear. Other experiments reveal the processes involved in accessing the mental grammar and the influence of nonlinguistic factors in comprehension.

The units and stages in speech production have been studied by analyzing spontaneously produced speech errors. Anticipation errors, in which a sound is produced earlier than in the intended utterance, and **spoonerisms**, in which sounds or words are exchanged or reversed, show that we do not produce one sound or one word or even one phrase at a time. Rather, we construct and store larger units with their syntactic structures specified.

Word substitutions and blends show that words are connected to other words phonologically and semantically. The production of ungrammatical utterances also shows that morphological, inflectional, and syntactic rules may be wrongly applied or fail to apply when we speak, but at the same time shows that such rules are actually involved in speech production.

Computational linguistics is the study of how computers can process language, thus allowing natural language human-computer interfaces. As well, computers help scholars to analyze literature and language, to translate between languages, to extract useful information from large corpuses, and to assist with judicial affairs.

When communicating with a human being, computers must be capable of **speech recognition**, processing the speech signal into phonemes, morphemes, and words. They also must be able to speak its output. **Speech synthesis** is a two-step process in which a **text-to-speech** program first converts text to phones or other basic units such as words or syllables. **Formant synthesis** simulates the sounds of phones electronically; **concatenative synthesis** is based on assembling prerecorded units such as words to produce complete utterances.

To recognize speech is not to understand speech, and to speak a text does not necessarily mean that the computer knows what it is saying. To either understand or generate speech, the computer must process phonemes, morphemes, words, phrases, and sentences, and it must be aware of the meanings of these units (except for phonemes). The computational linguistics of speech understanding and speech generation has the subfields of **computational phonetics and phonology**, **computational morphology**, **computational syntax**, **computational semantics**, and **computational pragmatics**.

Computational phonetics and phonology relates phonemes to the acoustic signal of speech. It is fundamental to speech recognition and synthesis. Computational morphology deals with the structure of words, so it determines that the meaning of *bird* applies as well to *birds*, which has in addition the meaning of plural. Computational syntax is concerned with the syntactic categories of words and with the larger syntactic units of phrases and sentences. It is further concerned with analyzing a sentence into these components for speech understanding, or assembling these components into larger units for speech generation. A formal device called a **transition network** may be used to model the actions of syntactic processing.

Computational semantics is concerned with representing meaning inside the computer, or **semantic representation**. To communicate with a person, the computer creates a semantic representation of what the person says to it, and another semantic representation of what it wants to say back. In a machine translation environment, the computer produces a semantic representation of the source language input, and outputs that meaning in the target language.

Semantic representations may be based on logical expressions involving predicates and arguments, on **semantic networks**, or on other formal devices to represent meaning.

Computational pragmatics may influence the understanding or the response of the computer by taking into account knowledge that the computer system has about the real world, for example, that there is a unique element in the environment, so the determiner *the* can be used appropriately to refer to it.

There are many applications of computational linguistics. Computational lexicography is the use of computers both to construct "ordinary" dictionaries, but also to construct electronic dictionaries with far more information, suitable for the goals of language understanding and generation.

Computers may be programmed to model a grammar of a human language and thus rapidly and thoroughly test that grammar. Modern computer architectures include **parallel processing** machines that can be programmed to process language more as humans do, insofar as carrying out many linguistic tasks simultaneously.

To analyze a **corpus**, or body of data, a computer can do a frequency analysis of words, compute a **concordance**, which locates words in the corpus and gives their immediate context, and compute a **collocation**, which measures how the occurrence of one word affects the probability of the occurrence of other words. Computers are also useful for **information retrieval** based on keywords, automatic **summarization**, and **spell checking**.

Soon after their invention, computers were used to try to translate from one language to another. This is a difficult, complex task, and the results are often humorous as the computer struggles to translate text (or speech) in the **source language** into the **target language**, without loss of meaning or grammaticality.

Other applications of computational linguistics are found in the forensic fields, where computational forensic linguists takes up such legal problems as trademark protection and infringement, in which computers are used to examine huge corpuses to infer how people interpret trademarks such as the *Mc-* in McDonald's; and **speaker identification**, where a computational analysis of speech used in a crime such as a bomb threat can assist in identifying, or exonerating, a suspect.

References for Further Reading

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4

Language and Society

Language is not an abstract construction of the learned, or of dictionary-makers, but is something arising out of the work, needs, ties, joys, affections, tastes, of long generations of humanity, and has its bases broad and low, close to the ground.

WALT WHITMAN, *"Slang in America,"* 1885

10

Language in Society

Language is a city to the building of which every human being brought a stone.

RALPH WALDO EMERSON, *Letters and Social Aims*, 1876

Dialects

A language is a dialect that has an army and a navy.

MAX WEINREICH (1894–1969)

All speakers of English can talk to each other and pretty much understand each other. Yet, no two of us speak exactly alike. Some differences are the result of age, sex, social situation, and where and when the language was learned. These differences are reflected in word choices, the pronunciation of words, and grammatical rules. The language of an individual speaker with its unique characteristics is referred to as the speaker's **idiolect**. English may then be said to consist of anywhere from 450 million to 850 million idiolects, or the number of speakers of English (which seems to be growing every day and is difficult to estimate).

Like individuals, different groups of people who speak the same language speak it differently. Bostonians, New Yorkers, Texans, blacks in Chicago, whites in Denver, and Hispanics in Albuquerque all exhibit variation in the way they speak English. When there are systematic differences in the way groups speak a language, we say that each group speaks a **dialect** of that language. Dialects are *mutually intelligible* forms of a language that *differ in systematic ways*. *Every* speaker, whether rich or poor, regardless of region or racial origin, speaks at least one dialect, just as each individual speaks an idiolect. A dialect is *not* an inferior or degraded form of a language, and logically could not be so because a language is a collection of dialects.

It is not always easy to decide whether the differences between two speech communities reflect two dialects or two languages. Sometimes this rule-of-thumb definition is used: When dialects become mutually *un*intelligible—when the speakers of one dialect group can no longer understand the speakers of another dialect group—these dialects become different languages.

However, this rule of thumb does not always jibe with how languages are officially recognized, which is determined by political and social considerations. For example, Danes speaking Danish and Norwegians speaking Norwegian and Swedes speaking Swedish can converse with each other. Nevertheless, Danish and Norwegian and Swedish are considered separate languages because they are spoken in separate countries and because there are regular differences in their grammars. Similarly, Hindi and Urdu are mutually intelligible "languages" spoken in Pakistan and India, although the differences between them are not much greater than those between the English spoken in America and the English spoken in Australia.

The recent history of Serbo-Croatian, the language of the former nation of Yugoslavia, illustrates the factors that can determine if a particular way of speaking is considered to be a dialect or a language. From a linguistic point of view, Serbo-Croatian is a single Slavic language: Even though Croats use Roman script (like English) while Serbs use Cyrillic script (like Russian), in speech the varieties are mutually intelligible, differing slightly in vocabulary just as the British and American English dialects do. But from a sociopolitical point of view, following the breakup of Yugoslavia in the 1990s, the Serbo-Croatian language "broke up" as well. After years of conflict, the two now-independent nations declare that they speak not just different dialects but different languages.

On the other hand, linguistically distinct languages in China, such as Mandarin and Cantonese, although mutually unintelligible when spoken, are nevertheless referred to as dialects of Chinese in the media and elsewhere because they have a common writing system that can be read by all speakers (because it's ideographic—see chapter 12), and because they are spoken in a single country.

It is also not easy to draw a distinction between dialects and languages on strictly linguistic grounds. Dialects and languages reflect the underlying grammars and lexicons of their speakers. It would be completely arbitrary to say, for example, that grammars that differ from one another by, say, twenty rules represent different languages whereas grammars that differ by less than twenty rules are dialects. Why not ten rules or thirty rules? In reality, what one finds is that there is no sudden major break between dialects. Rather, dialects merge into each other, forming a **dialect continuum**. Imagine, for example, a traveler journeying from Vienna to Amsterdam by bicycle. She would notice small changes in the German spoken as she bicycled from village to village, and the people in adjacent villages would have no trouble communicating with one another. Yet by the time our traveler reached Dutch-speaking Amsterdam, she would realize that the accumulated differences made the German of Vienna and the Dutch of Amsterdam nearly mutually unintelligible.

Because neither mutual intelligibility, nor degree of grammatical difference, nor the existence of political or social boundaries is decisive, it is not possible to precisely define the difference between a language and a dialect. We shall, however, use the rule-of-thumb definition and refer to dialects of one language as mutually intelligible linguistic systems, with systematic differences among them.

As we will discuss in the next chapter, languages change continually but these changes occur gradually. They may originate in one geographic region or in one social group and spread slowly to others, and often over the life spans of several generations of speakers. Dialect diversity develops when the changes that occur in one region or group do not spread. When speakers are in regular contact with one another, linguistic properties spread and are acquired by children. However, when some communication barrier separates groups of speakers—be it a physical barrier such as an ocean or a mountain range, or social barriers of a political, racial, class, educational, or religious kind—linguistic changes do not spread so readily, and the differences between groups are reinforced and grow in number.

Dialect leveling is movement toward greater uniformity and less variation among dialects. Though one might expect dialect leveling to occur as a result of the ease of travel and mass media, this is not generally the case. Dialect variation in the United Kingdom is maintained although only a few major dialects are spoken on national radio and television. There may actually be an increase in dialects in urban areas, where different groups attempt to maintain their distinctness and group identity.

Regional Dialects

> Phonetics . . . the science of speech. That's my profession. . . . (I) can spot an Irishman or a Yorkshireman by his brogue. I can place any man within six miles. I can place him within two miles in London. Sometimes within two streets.
>
> **GEORGE BERNARD SHAW,** *Pygmalion,* 1912

> The educated Southerner has no use for an r except at the beginning of a word.
>
> **MARK TWAIN,** *Life on the Mississippi,* 1883

When various linguistic differences accumulate in a particular geographic region (e.g., the city of Boston or the southern area of the United States), the language spoken has its own character. Each version of the language is referred to as a **regional dialect**. The hypothetical journey from Vienna to Amsterdam discussed previously crossed regional dialects. In the United States, most dialectal differences are based on geographic region.

The origins of many regional dialects of American English can be traced to the people who settled in North America in the seventeenth and eighteenth centuries. Because they came from different parts of England, these early settlers already spoke different dialects of English, and these differences were carried to the original thirteen American colonies. By the time of the American Revolution, there were three major dialect areas in the British colonies: the Northern dialect spoken in New England and around the Hudson River; the Midland dialect spoken in Pennsylvania; and the Southern dialect. These dialects differed from one another and from the English spoken in England in systematic ways. Some of the changes that occurred in British English spread to the colonies; others did not.

How dialects develop is illustrated by the pronunciation of words with an *r* in different parts of United States. As early as the eighteenth century, the British in southern England were dropping their *r*'s before consonants and at the ends of words. Words such as *farm*, *farther*, and *father* were pronounced as [faːm], [faːðə], and [faːðə], respectively. By the end of the eighteenth century, *r*-drop was a general rule among the early settlers in New England and the southern Atlantic seaboard. Close commercial ties were maintained between the New England colonies and London, and Southerners sent their children to England to be educated, which reinforced the *r*-drop rule. The *r*-less dialect still spoken today in Boston, New York, and Savannah maintains this characteristic. Later settlers, however, came from northern England, where the *r* had been retained; as the frontier moved westward, so did the *r*. Pioneers from all three dialect areas spread westward. The mingling of their dialects leveled many of their dialect differences, which is why the English used in large sections of the Midwest and the West is similar.

Regional phonological or phonetic distinctions are often referred to as different **accents**. A person is said to have a Boston or Brooklyn or Midwestern accent, a Southern drawl, an Irish brogue, and so on. Thus, *accent* refers to the characteristics of speech that convey information about the speaker's dialect, which may reveal in what country or in what part of the country the speaker grew up, or to which sociolinguistic group the speaker belongs. People in the United States often refer to someone as having a British accent or an Australian accent; in Britain they refer to an American accent.

The term *accent* is also used to refer to the speech of non-native speakers, who have learned a language as a second language. For example, a native French speaker's English is described as having a French accent. In this sense, *accent* refers to phonological differences caused by one's native language. Unlike regional dialect accents, such foreign accents do not reflect differences in the speech of the community where the language was learned.

Regional dialects may differ not only in their pronunciation but also in their lexical choices and grammatical rules. A comedian once remarked that "the Mason-Dixon line is the dividing line between *you-all* and *youse-guys*." In the following sections we discuss the different linguistic levels at which dialects may vary.

Phonological Differences

> I have noticed in traveling about the country a good many differences in the pronunciation of common words. . . . Now what I want to know is whether there is any right or wrong about this matter. . . . If one way is right, why don't we all pronounce that way and compel the other fellow to do the same? If there isn't any right or wrong, why do some persons make so much fuss about it?
>
> **LETTER QUOTED IN "THE STANDARD AMERICAN,"** in J. V. Williamson and V. M. Burke, eds., *A Various Language,* 1971

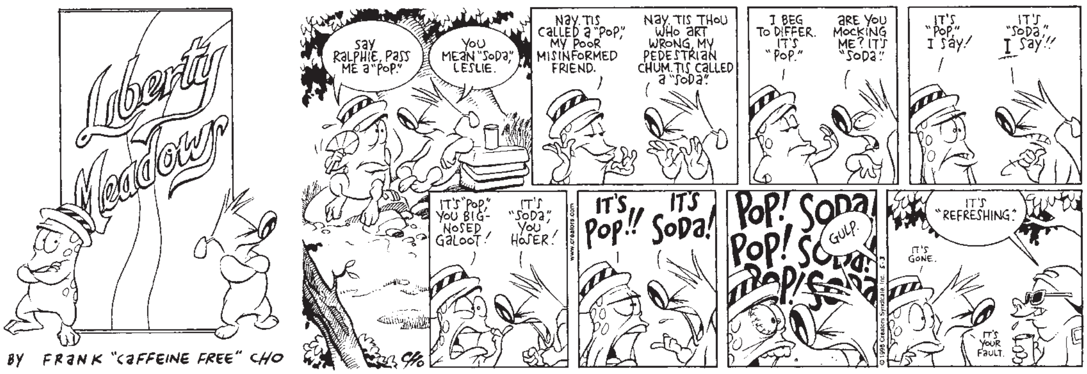
A comparison of the *r*-drop and other dialects illustrates the many phonological differences among dialects of American English. These variations created difficulties for us in writing chapter 6 (phonetics), where we wished to illustrate the different sounds of English by using key words in which the sounds occur. As mentioned, some people pronounce *caught* [kɔt] with the vowel [ɔ] and *cot* [kat] with [a], whereas others pronounce them both [kat]. Some pronounce *Mary*, *merry*, and *marry* the same; others pronounce the three words differently as [meri], [mɛri], and [mæri]; and still others pronounce two of them the same. In the southern area of the country, *creek* is pronounced with a tense [i] as [krik], and in the north Midlands, it is pronounced with a lax [ɪ] as [krɪk]. Many speakers of American English pronounce *pin* and *pen* identically, whereas others pronounce the first [pĩn] and the second [pɛ̃n].

The pronunciation of British English (or many dialects of it) differs in systematic ways from pronunciations in many dialects of American English. In a survey of hundreds of American and British speakers conducted via the Internet, 48 percent of the Americans pronounced the mid consonants in *luxury* as voiceless [lʌkʃəri], whereas 96 percent of the British pronounced them as voiced [lʌgʒəri]. Sixty-four percent of the Americans pronounced the first vowel in *data* as [e] and 35 percent as [æ], as opposed to 92 percent of the British pronouncing it with an [e] and only 2 percent with [æ]. The most consistent difference occurred in the placement of primary stress, with most Americans putting stress on the first syllable and most British on the second or third in polysyllabic words like *cigarette*, *applicable*, *formidable*, and *laboratory*.

The United Kingdom also has many regional dialects. The British vowels described in the phonetics chapter are used by speakers of the dialect called RP for "received pronunciation" because it is "received" (accepted) in the court of the monarch. In this dialect, *h* is pronounced at the beginning of both *head* and *herb*, whereas in most American English dialects *h* is not pronounced in *herb*. In some British English dialects the *h* is regularly dropped from most words in which it is pronounced in American, such as *house*, pronounced [aʊs], and *hero*, pronounced [iro]. As is true of the origin of certain American dialects, many of the regional dialects of British English, such as the West Country dialect, the East Anglia dialect, and the Yorkshire dialect, are not deviations from the "standard" dialect spoken in London, but are direct descendants of earlier varieties that existed alongside London English as far back as the eleventh century.

English is the most widely spoken language in the world (as a first or second language). It is the national language of several countries, including the United States, large parts of Canada, the British Isles, Australia, and New Zealand. For many years it was the official language in countries that were once colonies of Britain, including India, Nigeria, Ghana, Kenya, and the other "anglophone" countries of Africa. There are many other phonological differences in the various dialects of English used around the globe.

Lexical Differences



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Regional dialects may differ in the words people use for the same object, as well as in phonology. Hans Kurath, an eminent dialectologist, in his paper "What Do You Call It?" asked:

> Do you call it a *pail* or a *bucket*? Do you draw water from a *faucet* or from a *spigot*? Do you pull down the *blinds*, the *shades*, or the *curtains* when it gets dark? Do you *wheel* the baby, or do you *ride* it or *roll* it? In a *baby carriage*, a *buggy*, a *coach*, or a *cab*?

People take a *lift* to the *first floor* (our *second floor*) in England, but an *elevator* in the United States; they fill up with *petrol* (not *gas*) in London; in Britain a *public school* is "private" (you have to pay), and if a student showed up there wearing *pants* ("underpants") instead of *trousers* ("pants"), he would be sent home to get dressed.

If you ask for a *tonic* in Boston, you will get a drink called *soda* or *soda-pop* in Los Angeles; and a *freeway* in Los Angeles is a *thruway* in New York, a *parkway* in New Jersey, a *motorway* in England, and an *expressway* or *turnpike* in other dialect areas.

Dialect Atlases

Linguist Hans Kurath published **dialect maps** and **dialect atlases** of a region on which dialect differences are geographically plotted (see Figure 10.1). The dialectologists who created the map noted the places where speakers use one word or another word for the same item. For example, the area where the term *Dutch cheese* is used is not contiguous; there is a small pocket mostly in West Virginia where speakers use that term for what other speakers call *smearcase* (from the Dutch word *smeerkaas*, a compound made from the verb *smeren* "to spread" and *kaas* "cheese").

In similar maps, areas were differentiated based on the variation in pronunciation of the same word, such as [krik] and [krɪk] for *creek*. The concentrations defined by different word usages and varying pronunciations, among other linguistic differences, form **dialect areas**.

A line drawn on the map to separate the areas is called an **isogloss**. When you cross an isogloss, you are passing from one dialect area to another. Sometimes several isoglosses coincide, often at a political boundary or at a natural barrier such as a river or mountain range. Linguists call these groupings a *bundle* of isoglosses. Such a bundle can define a regional dialect.

DARE is the acronym for the *Dictionary of American Regional English*, whose chief editor was the distinguished American dialectologist Frederick G. Cassidy (1907–2000). This work represents decades of research and scholarship by Cassidy and other American dialectologists and is a major resource for those interested in American English dialects. Its first four volumes, covering *A* through *Sk*, are published; volume 5, covering *Sk* through *Z*, is due to be published in 2011. Its purpose is described on its Web site as follows:

> The *Dictionary of American Regional English (DARE)* is a reference tool unlike any other. Its aim is not to prescribe how Americans should speak, or even to describe the language we use generally, the "standard" language. Instead, it seeks to document the varieties of English that are **not** found everywhere in the United States—those words, pronunciations, and phrases that vary from one region to another, that we learn at home rather than at school, or that are part of our oral rather than our written culture. Although American English is remarkably homogeneous considering the tremendous size of the country, there are still many thousands of differences that characterize the various dialect regions of the United States. It is these differences that *DARE* records.

While Professor Cassidy did not live to see the completion of DARE, he took his life's work with him to the grave, where on his tombstone is inscribed "On to Z!"

Syntactic Differences

Dialects can also be distinguished by systematic syntactic differences. In most American dialects, sentences may be conjoined as follows:

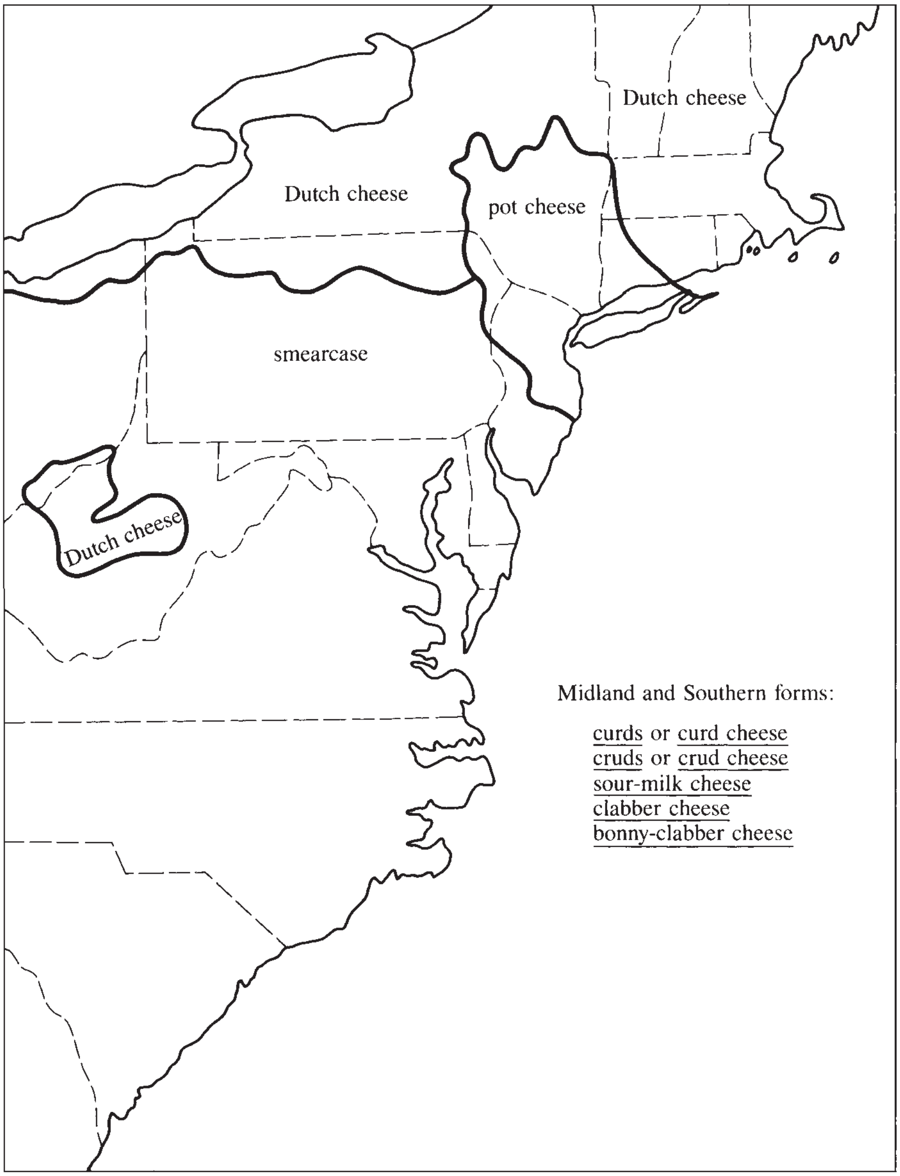


FIGURE 10.1 | A dialect map showing the isoglosses separating the use of different words that refer to the same cheese.

Kurath, Hans. *A Word Geography of the Eastern United States*. Ann Arbor, MI: University of Michigan Press, copyright © 1949. Reprinted with permission of University of Michigan Press.

1. John will eat and Mary will eat. → John and Mary will eat.

In the Ozark dialect of southern Missouri, the following conjoining is also possible:

2. John will eat and Mary will eat. → John will eat and Mary.

In (1) the VP *will eat* in the first conjunct is deleted, while in (2) the VP in the second conjunct is deleted. Most dialects of English allow deletion of only the first conjunct and in those dialects *John will eat and Mary* is ungrammatical. The Ozark dialect differs in allowing the second VP to delete.

Speakers of some American dialects say *Have them come early!* where others would say *Have them **to** come early!* Many speakers of the latter dialect also exhibit "double modals," and expressions like *He **might could** do it* or *You **might should** go home* are grammatical. While Aux recursion (see chapter 4) is permitted in all English dialects, most dialects constrain verb phrases to contain no more than one modal verb.

Some of the dialects that permit double modals (e.g., Appalachian English) also exhibit double objects (e.g., *I caught me a fish*); and *a*-prefixing with progressives, *He came a-runnin'*. Several distinguishing syntactic characteristics contribute to a *bundle* of syntactic isoglosses that separate these regional dialects.

In some American English dialects, the pronoun *I* occurs when *me* would be used in other dialects. This difference is a syntactically conditioned morphological difference.

Dialect 1	**Dialect 2**
between you and I	between you and me
Won't he let you and I swim?	Won't he let you and me swim?
*Won't he let I swim?	

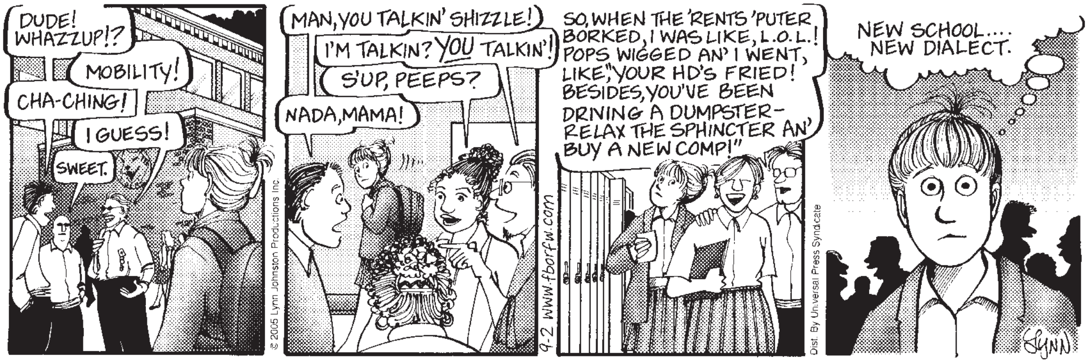
The use of *I* in these structures is only permitted in a conjoined NP, as the starred (ungrammatical) sentence shows. *Won't he let me swim?*, however, is grammatical in both dialects. Dialect 1 is growing, and these forms are becoming Standard English, spoken by TV announcers, political leaders, and university professors, although language purists still frown on this usage.

In British English the pronoun *it* in the sentence *I could have done it* can be deleted. British speakers say *I could have done*, which is not in accordance with the syntactic rules of American English. American English, however, permits the deletion of *done it*, and Americans say *I could have*, which does not accord with the British syntactic rules.

Despite such differences, we are still able to understand speakers of other English dialects. Although regional dialects differ in pronunciation, vocabulary, and syntactic rules, the differences are minor when compared with the totality of the grammar. Dialects typically share most rules and vocabulary, which explains why the dialects of a language are mutually intelligible.

Social Dialects

> The limits of my language mean the limits of my world.
>
> **LUDWIG WITTGENSTEIN,** *Tractatus Logico-Philosophicus,* 1922



In many respects, social boundaries and class differences are as confining as the physical barriers that often define regional dialects. It is therefore not surprising that different dialects of a language evolve within social groups.

The social boundaries that give rise to dialect variation are numerous. They may be based on socioeconomic status, religious, ethnic or racial differences, country of origin, and even gender. Middle-class American and British speakers are often distinguishable from working-class speakers; in Baghdad the Christian, Muslim, and Jewish groups all speak different varieties of Arabic; in India people often use different dialects of a standard regional language such as Hindi, Gujarati, or Bengali depending on the social *caste* they belong to; in America, many speakers of African descent speak a different dialect than those of European, Asian, or Hispanic descent; and, as we shall see, women and men each have their own distinguishing speech characteristics.

Dialect differences that seem to come about because of social factors are called **social dialects**, as opposed to *regional dialects*, which are spawned by geographical factors. However, there are regional aspects to social dialects and, clearly, social aspects to regional dialects, so the distinction is not entirely cut and dried.

The "Standard"

> We don't talk fancy grammar and eat anchovy toast. But to live under the kitchen doesn't say we aren't educated.
>
> **MARY NORTON,** *The Borrowers,* 1952

Even though every language is a composite of dialects, many people talk and think about a language as if it were a well-defined fixed system with various dialects diverging from this norm. This is false, although it is a falsehood that is widespread. One writer of books on language accused the editors of *Webster's Third New International Dictionary*, published in 1961, of confusing "to the point of obliteration the older distinction between standard, substandard, colloquial, vulgar, and slang," attributing to them the view that "good and bad, right and wrong, correct and incorrect no longer exist." In the next section we argue that such criticisms are ill founded.

Language Purists

> A woman who utters such depressing and disgusting sounds has no right to be anywhere—no right to live. Remember that you are a human being with a soul and the divine gift of articulate speech: that your native language is the language of Shakespeare and Milton and the Bible; and don't sit there crooning like a bilious pigeon.
>
> **GEORGE BERNARD SHAW,** *Pygmalion,* 1912

Prescriptive grammarians, or language purists, usually consider the dialect used by political leaders and national newscasters as the correct form of the language. (See chapter 1 for a discussion of prescriptive grammars.) This is the dialect taught in "English" or "grammar" classes in school, and it is closer to the written form of the language than many other dialects, which also lends it an air of superiority.

Otto Jespersen, the great Danish linguist, ridiculed the view that a particular dialect is better than any other when he wrote: "We set up as the best language that which is found in the best writers, and count as the best writers those that best write the language. We are therefore no further advanced than before."

The dominant, or **prestige**, dialect is often called the standard dialect. **Standard American English (SAE)** is a dialect of English that many Americans *nearly* speak; divergences from this "norm" are labeled "Philadelphia dialect," "Chicago dialect," "African American English," and so on.

SAE is an idealization. Nobody speaks this dialect; and if somebody did, we would not know it, because SAE is not defined precisely (like most dialects, none of which are easy to clarify). Teachers and linguists held a conference in the 1990s that attempted to come up with a precise definition of SAE. This meeting did not succeed in satisfying everyone's view of SAE. SAE was once represented by the language used by national news broadcasters, but today many of them speak a regional dialect or a style of English that is not universally accepted as "standard." For example, the British Broadcasting Corporation (BBC) once used mostly speakers of RP English, but today speakers of Irish, Welsh, Scottish, and other regional dialects of English are commonly heard on BBC programs. The BBC describes its English as "the speech of educated professionals."

A standard dialect (or prestige dialect) of a particular language may have social functions. Its use in a group may bind people together or provide a common written form for multidialectal speakers. If it is the dialect of the wealthy, influential, and powerful members of society, this may have important implications for the entire society. All speakers who aspire to become successful may be required to speak that dialect even if it isn't their own.

In 1954 the British scholar Alan Ross published *Linguistic Class-Indicators in Present-Day English*, in which he compared the speech habits of the English upper class, whom he labeled "U," with the speech habits of "non-U" speakers. Ross concluded that although the upper class had words and pronunciations peculiar to it, the main characteristic of U speech is the avoidance of non-U speech; and the main characteristic of non-U speech is, ironically, the effort to sound U. "They've a lovely home," for example, is pure non-U, because it is an attempt to be refined. Non-U speakers say "wealthy" and "ever so"; U speakers say "rich" and "very." Non-U speakers "recall"; U-speakers simply "remember."

Non-U speech habits often include **hypercorrections**, deviations from the norm *thought* to be "proper English," such as pronouncing *often* with a [t], or saying *between you and I*, while U speakers, who are generally more secure about their dialect, say [ɔfə̃n] and *between you and me*. Ironically, in some cases non-U speech is so pervasive it eventually becomes part of the prestige dialect, as we are seeing today with *often* and *between you and I/me*.

No dialect, however, is more expressive, less corrupt, more logical, more complex, or more regular than any other dialect or language. They are simply different. More precisely, dialects represent different set of rules or lexical items represented in the minds of its speakers. Any judgments, therefore, as to the superiority or inferiority of a particular dialect or language are social judgments, which have no linguistic or scientific basis.

To illustrate the arbitrariness of "standard usage," consider the English *r*-drop rule discussed earlier. Britain's prestigious RP accent omits the *r* in words such as "car," "far," and "barn." Thus an *r*-less pronunciation is thought to be better than the less prestigious rural dialects that maintain the *r*. However, *r*-drop in the northeast United States is generally considered substandard, and the more prestigious dialects preserve the *r*, though this was not true in the past when *r*-drop was considered more prestigious. This shows that there is nothing inherently better or worse about one pronunciation over another, but simply that one variant is perceived of as better or worse depending on a variety of social factors.

Banned Languages

Language purists wish to prevent language or dialect differentiation because of their false belief that some languages are better than others, or that change leads to corruption. Languages and dialects have also been banned as a means of political control. Russian was the only legal language permitted by the Russian tsars, who banned the use of Ukrainian, Lithuanian, Georgian, Armenian, Azeri, and all the other languages spoken by national groups under the rule of Russia.

Cajun English and French were once banned in southern Louisiana by practice if not by law. Even as recently as August 8, 2006, Mary Tutwiler writes in a blog entitled "The French Connection," "Many local French speakers were so traumatized by the experience of being punished for speaking their mother tongue in school that they suppress their linguistic knowledge in public."

For many years, American Indian languages were banned in federal and state schools on reservations. Speaking Faroese was formerly forbidden in the Faroe Islands. A proscription against speaking Korean was imposed by the Japanese during their occupation of Korea between 1910 and 1945. Throughout history many languages and dialects have been banned to various degrees.

In France, a notion of the "standard" (the dialect spoken in Paris) as the only correct form of the language is promoted by the French Academy, an official panel of "scholars" who determine what usage constitutes the "official French language." Some years ago, the Academy enacted a law forbidding the use of "Franglais," which are words of English origin like *le parking*, *le weekend*, and *le hotdog*. The French, of course, continue to use them, and because such words are notorious, they are widely used in advertising, where being noticed is more important than being correct. Only in government documents can these proscriptions be enforced.

In the past (and to some extent in the present), a French citizen from the provinces who wished to succeed in French society nearly always had to learn the prestigious Parisian French dialect. Then, several decades ago, members of regional autonomy movements demanded the right to use their own languages in their schools and for official business. In the section of France known as l'Occitanie, the popular singers sing in Langue d'oc, a Romance language of the region, both as a protest against the official language policy and as part of the cultural revival movement.

In many places in the world (including the United States), the use of sign languages of the deaf was once banned. Children in schools for the deaf were often punished if they used any gestures at all. The aim of these schools was to teach deaf children to read lips and to communicate through sound. This view prevented early exposure to language. It was mistakenly thought that children, if exposed to sign, would not learn to read lips or produce sounds. Individuals who become deaf after learning a spoken language are often able to use their knowledge to learn to read lips and continue to speak. This is, however, very difficult if one has never heard speech sounds. Furthermore, even the best lip readers can comprehend only about one-third of the sounds of spoken language. Imagine trying to decide whether *lid* or *led* was said by reading the speaker's lips. Mute the sound on a TV set and see what percentage of a news broadcast you can understand, even if recorded and played back in slow motion, and even if you know the subject matter.

In recent years in the United States, a movement has arisen to establish English as an official language by amending the Constitution. An "Official English" initiative was passed by the electorate in California in 1986; in Colorado, Florida, and Arizona in 1988; and in Alabama in 1990. Such measures have also been adopted by seventeen state legislatures. This kind of linguistic chauvinism is opposed by civil rights minority-group advocates, who point out that such a measure could be used to prevent large numbers of non-English-speaking citizens from participating in civil activities such as voting, and from receiving the benefits of a public education, for which they pay through taxes. Fortunately, as of this writing, the movement appears to have lost momentum.

African American English

> The language, only the language. . . . It is the thing that black people love so much—the saying of words, holding them on the tongue, experimenting with them, playing with them. It's a love, a passion. Its function is like a preacher's: to make you stand up out of your seat, make you lose yourself and hear yourself. The worst of all possible things that could happen would be to lose that language.
>
> **TONI MORRISON,** interviewed in *The New Republic,* March 21, 1981

Most regional dialects of the United States are largely free from stigma. Some regional dialects, like the *r*-less NewYorkese, are the victims of so-called humor, and speakers of one dialect may ridicule the "drawl" of southerners or the "nasal twang" of Texans (even though not all speakers of southern dialects drawl, nor do all Texans twang).

There is, however, a *social* dialect of North American English that has been a victim of prejudicial ignorance. This dialect, **African American English** (**AAE**),[1] is spoken by a large population of Americans of African descent. The distinguishing features of this English dialect persist for social, educational, and economic reasons. The historical discrimination against African Americans has created the social boundaries that permit this dialect to thrive. In addition, particularly in recent years, many blacks have embraced their dialect as a means of positive group identification. AAE is generally used in casual and informal situations, and is much more common among working class people. African Americans from middle class backgrounds and with higher levels of education are now more likely to be speakers of SAE. U.S. President Barack Obama and First Lady Michelle Obama are cases in point.

Since the onset of the civil rights movement in the 1960s, AAE has been the focus of national attention. Some critics attempt to equate its use with inferior genetic intelligence and cultural deprivation, justifying these incorrect notions by stating that AAE is a "deficient, illogical, and incomplete" language. Such epithets cannot be applied to any language, and they are as unscientific in reference to AAE as to Russian, Chinese, or Standard American English. The cultural-deprivation myth is as false as the idea that some dialects or languages are inferior. A person may be "deprived" of one cultural background, but be rich in another.

Some people, white and black, think they can identify the race of a person by speech alone, believing that different races inherently speak differently. This belief is patently false. A black child raised in Britain will speak the British dialect of the household. A white child raised in an environment where AAE is spoken will speak AAE. Children construct grammars based on the language they hear.

AAE is discussed here more extensively than other American dialects because it provides an informative illustration of the morphological and syntactic regularities of a dialect of a major language, and the systematic differences from the so-called standard dialects of that language. A vast body of research shows that there are the same kinds of linguistic differences between AAE and SAE as occur between many of the world's major dialects.

Phonological Differences between African American English and SAE

Because AAE is not a single, monolithic dialect, but rather refers to a collection of tightly related dialects, not everything discussed in this section applies to all speakers of AAE.

r-Deletion

Like several dialects of both British and American English, AAE includes a rule of *r-deletion* that deletes /r/ everywhere except before a vowel. Pairs of words like *guard* and *god*, *nor* and *gnaw*, *sore* and *saw*, *poor* and *Poe*, *fort* and *fought*,

[1] AAE is actually a group of closely related dialects also variously called African American Vernacular English (AAVE), Black English (BE), Inner City English (ICE), and Ebonics.

and *court* and *caught* are pronounced identically in AAE because of this phonological rule. There is also an *l-deletion* rule for some speakers of AAE, creating identically pronounced pairs like *toll* and *toe*, *all* and *awe*, *help* and *hep*.

A *consonant cluster reduction* rule in AAE simplifies consonant clusters, particularly at the ends of words and when one of the two consonants is an alveolar (/t/, /d/, /s/, /z/). The application of this rule may delete the past-tense morpheme so that *meant* and *mend* are both pronounced as *men*, and *past* and *passed* (*pass + ed*) may both be pronounced like *pass*. When speakers of this dialect say *I pass the test yesterday*, they are not showing an ignorance of past and present-tense forms of the verb, but are pronouncing the past tense according to this rule in their grammar.

The deletion rule is optional; it does not always apply, and studies have shown that it is more likely to apply when the final [t] or [d] does not represent the past-tense morpheme, as in nouns like *paste* [pest] as opposed to verbs like *chased* [tʃest], where the final past tense [t] will not always be deleted. This has also been observed with final [s] or [z], which will be retained more often by speakers of AAE in words like *seats* /sit + s/, where the /s/ represents plural, than in words like *Keats* /kits/, where it is more likely to be deleted to yield the surface form [kit].

Consonant cluster reduction is not unique to AAE. It exists optionally for many speakers of other dialects including SAE. For example, in SAE the medial [d] in *didn't* is often deleted, producing [dĩnt]. Furthermore, nasals are commonly deleted before final voiceless stops, to result in [hĩt] versus [hĩnt].

Neutralization of [ɪ] and [ɛ] before Nasal Consonants

AAE shares with many regional dialects a lack of distinction between /ɪ/ and /ɛ/ before nasal consonants, producing identical pronunciations of *pin* and *pen*, *bin* and *Ben*, *tin* and *ten*, and so on. The vowel sound in these words is roughly between the [ɪ] of *pit* and the [ɛ] of *pet*.

Diphthong Reduction

AAE has a rule that reduces the diphthong /ɔɪ/ (particularly before /l/) to the simple vowel [ɔ] without the glide, so that *boil* and *boy* are pronounced [bɔ].

/ɔɪ/ → /ɔ/

This rule is common throughout the regional dialects of the South irrespective of race and social class.

Loss of Interdental Fricatives

A regular feature is the change of a /θ/ to /f/ and /ð/ to /v/ so that *Ruth* is pronounced [ruf] and *brother* is pronounced [brʌvər]. This [θ]-[f] correspondence also holds in some dialects of British English, where /θ/ is not even a phoneme in the language. *Think* is regularly [fĩnk] in Cockney English.

Initial /ð/ in such words as *this*, *that*, *these*, and *those* are pronounced as [d]. This is again not unique to AAE, but a common characteristic of certain regional, nonethnic dialects of English, many found in the state of New Jersey as well as in New York City and Boston.

Another regular feature found in many varieties of AAE (and non-AAE) is the substitution of a glottal stop for an alveolar stop at the end of non-word-final syllables; thus the name *Rodman* is pronounced [raʔmə̃n], but the word *rod* is pronounced [rad]. In fact, we observed in chapter 6 on phonetics that the glottal stop [ʔ] is a common allophone of /t/ in many dialects of English.

All of these differences are rule-governed and similar to the kinds of phonological variations that are found in languages all over the world, including Standard English.

Syntactic Differences between AAE and SAE

And of his port as meeke as is a mayde
He nevere yet no vileynye ne sayde

GEOFFREY CHAUCER, Prologue to *The Canterbury Tales,* 14th century

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Syntactic differences also exist between dialects. They have often been used to illustrate the illogic of AAE, and yet these differences are evidence that AAE is as syntactically complex and as logical as SAE.

Multiple Negatives

Constructions with multiple negatives akin to AAE *He don't know nothing* are commonly found in languages of the world, including French, Italian, and the English of Chaucer, as illustrated in the epigraph from *The Canterbury Tales*. The multiple negatives of AAE are governed by rules of syntax and are not illogical.

Deletion of the Verb "Be"

In most cases, if in Standard English the verb can be contracted, in African American English sentences it is deleted; where it can't be contracted in SAE, it can't be deleted in AAE, as shown in the following sentences:

SAE	AAE
He is nice/He's nice.	He nice.
They are mine/They're mine.	They mine.
I am going to do it/I'm gonna do it.	I gonna do it.
He is/he's as nice as he says he is.	He as nice as he say he is.
*He's as nice as he says he's	*He as nice as he say he
How beautiful you are.	How beautiful you are.
*How beautiful you're	*How beautiful you
Here I am.	Here I am.
*Here I'm	*Here I

These examples show that syntactic reduction rules operate in both dialects although they show small systematic differences.

Habitual "Be"

In SAE, the sentence *John is happy* can be interpreted to mean *John is happy now* or *John is generally happy*. One can make the distinction clear in SAE only by lexical means, that is, the addition of words. One would have to say *John is generally happy* or *John is a happy person* to disambiguate the meaning from *John is presently happy*.

In AAE, this distinction is made syntactically; an uninflected form of *be* is used if the speaker is referring to *habitual* state.

John be happy.	"John is always happy."
John happy.	"John is happy now."
*John be happy at the moment.	
He be late.	"He is habitually late."
He late.	"He is late this time."
*He be late this time.	
Do you be tired?	"Are you generally tired?"
You tired?	"Are you tired now?"
*Do you be tired today?	

The ungrammatical sentences are caused by a conflict of the habitual meaning with the momentary meaning conveyed by *at the moment*, *this time*, and *today*. The syntactic distinction between habitual and nonhabitual aspect also occurs in SAE, but with verbs other than *be*. In SAE eventive verbs such as *eat* and *dance*, when marked with the present-tense *-s* morpheme, have only a habitual meaning and cannot refer to an ongoing situation, in contrast to stative verbs such as *think* or *love*, as exemplified by the following sentences:

John dances every Saturday night.
*John dances now.
John loves Mary now and forever.

"There" Replacement

Some AAE dialects replace SAE *there* with *it's* in positive sentences, and *don't* or *ain't* in negative sentences.

It's a fly messing with me.	"There's a fly messing with me."
Ain't no one going to help you.	
Don't no one going to help you.	"There's no one going to help you."

Combined with multiple negatives, consonant cluster simplification, and complement deletion, speakers produce highly condemned, but clear, logically sound sentences like *Ain't no hard worker never get no good payin' job*: "There isn't a hard worker who never gets a good paying job."

Latino (Hispanic) English

A major group of American English dialects is spoken by native Spanish speakers or their descendants. For more than a century large numbers of immigrants from Spanish-speaking countries of South and Central America and the Caribbean islands have been enriching the United States with their language and culture. Among these groups are native speakers of Spanish who have learned or are learning English as a second language. There are also those born in Spanish-speaking homes whose native language is English, some of whom are monolingual, and others who speak Spanish as a second language.

One cannot speak of a homogeneous Latino dialect. In addition to the differences between bilingual and monolingual speakers, the dialects spoken by Puerto Rican, Cuban, Guatemalan, and El Salvadoran immigrants or their children are somewhat different from one another and also from those spoken by many Mexican Americans in the Southwest and California, called Chicano English (ChE).

Although ChE is not homogeneous, we can still recognize it as a distinct dialect of American English with systematic differences from other dialects of English.

Chicano English (ChE)

Chicano English is acquired as a first language by many children, making it the native language of hundreds of thousands, if not millions, of Americans. It is not English with a Spanish accent but, like African American English, a mutually intelligible dialect that differs systematically from SAE. Many of the differences, however, depend on the social context of the speaker. (This is also true of AAE and most "minority" dialects.) Linguistic differences of this sort that vary with the social situation of the speaker are termed **sociolinguistic variables**. For example, the use of nonstandard forms like double negation is often associated with pride of ethnicity, which is part of the social context. Many Chicano speakers (and speakers of AAE) are **bidialectal**; they can use either ChE (or AAE) or SAE, depending on the social situation.

Phonological Variables of ChE

Phonological differences between ChE and SAE reveal the influence of Spanish on ChE. For example, as discussed in chapters 6 and 7, English has eleven vowel phonemes (not counting the diphthongs): /i, ɪ, e, ɛ, æ, u, ʊ, o, ɔ, a, ʌ/. Spanish, however, has only five: /i, e, u, o, a/. Chicano speakers whose native language is Spanish may substitute the Spanish vowel system for the English. When this is done, several homonyms result that have distinct pronunciations in SAE. Thus *ship* and *sheep* are both pronounced like *sheep*; *rid* is pronounced like *read*, and so on. Chicano speakers whose native language is English may *choose to speak the ChE dialect* despite having knowledge of the full set of American English vowels.

Other differences involve consonants. The affricate /tʃ/ and the fricative /ʃ/ are interchanged, so that *shook* is pronounced as if spelled with a *ch* and *check* as if spelled with an *sh*. Also, some consonants are devoiced; for example, /z/ is pronounced [s] in words like *easy* [isi] and *guys* [gaɪs]. Another difference is the substitution of /t/ for /θ/, and /d/ for /ð/ word initially, so *thin* is pronounced like *tin* or *teen* and *they* is pronounced *day*.

ChE has word-final consonant cluster reduction. *War* and *ward* are both pronounced like *war*; *star* and *start* like *star*. This process may also delete past-tense suffixes (*poked* is pronounced like *poke*) and third-person singular agreement suffixes (*He loves her* becomes *he love her*). Word-final alveolar-cluster reduction (e.g., pronouncing *fast* as if it were spelled *fas*s) has become widespread among all dialects of English, including SAE. Although this process is often singled out for speakers of ChE and AAE, it is actually no longer dialect specific.

Prosodic aspects of speech in ChE such as vowel length and intonation patterns may also differ from SAE and give ChE a distinctive flavor. The Spanish sequential constraint, which does not permit a word to begin with an /s/ cluster, is sometimes carried over to ChE in speakers who acquire English after early childhood. Thus *scare* may be pronounced as if it were spelled *escare*, and *school* as if it were spelled *eschool*.

Syntactic Variables in ChE

There are also regular syntactic differences between ChE and SAE. In Spanish, a negative sentence uses a negative morpheme before the verb even if another negative appears; thus negative concord (the multiple negatives mentioned earlier) is a regular rule of ChE syntax:

SAE	**ChE**
I don't have any money.	I don have no money.
I don't want anything.	I no want nothin.

Lexical differences also occur, such as the use of *borrow* in ChE for *lend* in SAE (*Borrow me a pencil*), or *barely* in ChE for *just* in SAE (*The new Prius had barely come out when I bought one*), as well as many other often subtle differences.

Genderlects

Dialects are defined in terms of groups of speakers, and speakers are most readily grouped by geography. Thus, regional dialects are the most apparent and generally are what people mean when they use the word *dialect*. Social groups are more amorphous, and social dialects correspondingly less well delineated and, until recently, less well studied. Surprisingly, the most obvious division of humankind into groups—women and men—has not engendered (if you'll pardon the expression) much dialectal attention until relatively recently.

In 1973, the linguist Robin Lakoff wrote the first article specifically concerned with women and language to be published in a major linguistics journal.[2] Lakoff identified a number of features that occurred more frequently in women's speech than in men's. For example, women "hedge" their speech more often than men do, with expressions like *I suppose*, *I would imagine*, *This is probably wrong, sort of, but . . .* , and so on. Women also use tag questions more frequently to qualify their statements (*He's not a very good actor, is he?*), as well as words of politeness (e.g., *please*, *thank you*) and intensifying adjectives such as *really* and *so* (*It's a really good film*, *It's so nice of you*). Lakoff claimed that the use of these devices was due to uncertainty and a lack of confidence on the part of women.

Since Lakoff's study, an increasing number of scholars have been conducting research on language, gender, and sexism, investigating the differences between male and female speech and their underlying causes. Many sociolinguists studying gender differences in speech now believe that women use hedges and other, similar devices not because they lack confidence but in order to express friendliness and solidarity, a sharing of attitudes and values, with their listeners.

There is a widespread belief that when men and women converse, women talk more and also that they tend to interrupt more than men in conversation. This is a frequent theme in sitcoms and the subject of jokes and sayings in various cultures, such as the English proverb "Women's tongues are like lambs' tails—they are never still," or the Chinese proverb "The tongue is the word of a woman and she never lets it become rusty." However, serious studies of mixed-sex conversations show that in a number of different contexts men dominate the talking, particularly in non-private conversation such as television interviews, business meetings, and conference discussion where talking can increase one's status.

This dominance of males in mixed speech situations seems to develop at an early age. It occurs in classroom situations in which boys dominate talk time with the teachers. One study found that boys were eight times more likely to call out answers than girls. There is also evidence that teachers encourage this dominant behavior, reprimanding girls more often than boys when they call out.

It has also been observed that women are more conservative in their speech style. For example, they are less likely to use vernacular forms such as the reduction of *-ing* to *-in'* or *him* to *'im* as in *I was walkin' down the street when I saw 'im*. Some dialects of British English drop word initial "h" in casual speech as in *'arf an hour* (half an hour), *'enry* (Henry), *'appy* (happy). This *h*-less pronunciation happens more frequently in the speech of men than women. The tendency for women to speak more "properly" than men has been confirmed in many studies and appears to develop at an early age. Children as young as six show this pattern, with girls avoiding the vernacular forms used more commonly by boys from the same background.

Lakoff observed this effect in her early study and proposed that women spoke more "proper" English than men because of an insecurity caused by sexism in

[2]Lakoff, R. 1973. Language and woman's place. *Language in Society* 2:45–80.

society. This explanation is generally supported by other linguists who have elaborated on this general idea. Among the more specific reasons that have been suggested are that women use more standard language to gain access to senior-level jobs that are often less available to them, that society tends to expect "better" behavior in general from women than men, that people who find themselves in subordinate roles (as women do in many societies) must be more polite, and that men prefer to use more vernacular forms because it helps to identify them as tough and strong. The linguist Janet Holmes has also suggested that most sociolinguistic experiments are conducted by middle-class, well-educated academics and it is possible that the women who are interviewed "accommodate" to the interviewer, changing their speech to be more like the interviewer's or simply in response to the more formal nature of the interview situation. Men, on the other hand, may be less responsive to these perceived pressures.

The linguist Deborah Tannen calls the different variants of English used by men and women "genderlects" (a blend of *gender* and *dialect*). Variations in the language of men and women occur in many, if not all, languages. In Japanese, women may choose to speak a distinct female dialect, although they know the standard dialect used by both men and women. The Japanese language has many *honorific* words—words intended to convey politeness, respect, humility, and lesser social status in addition to their regular meaning. As noted earlier, women tend to use polite forms more often than men. Japanese has formal and informal verbal inflections (see exercise 17, chapter 7), and again, women use the formal forms more frequently. There are also different words in Japanese used in males and female speech, for example,

	Women's Word	**Men's Word**
stomach	onaka	hara
delicious	oishii	umai
I/me	watashi	boku

and phrases such as:

eat a meal	gohan-o taberu	meshi-o kuu
be hungry	onaka-ga suita	hara-ga hetta
	stomach become empty	stomach decrease

One effect of the different genderlects of Japanese shows up in the training of guide and helper dogs. The animals learn their commands in English because the sex of the owner is not known in advance, and it is easier for an impaired person to use English commands than it is for trainers to train the dog in both language styles.

The differences discussed thus far have more to do with language use—lexical choices and conversational style—than with grammatical rules. There are, however, cases in which the language spoken by men and women differ in their grammars. In the Muskogean language Koasati, spoken in Louisiana, words that end in an /s/ when spoken by men, end in /l/ or /n/ when used by women; for example, the word meaning "lift it" is *lakawhol* for women and *lakawhos* for men. Similarly, in Bengali women often use an [l] at the beginning of words where men use an [n].

In Yana, women's words are sometimes shorter than men's because of a suffix that men use. For example, the women's form for "deer" is *ba*, the men's *ba-na*, for "person" we find *yaa* versus *yaa-na*, and so on. Early explorers reported that the men and women of the Carib Indians used different dialects. The historical reason for this is that long ago a group of Carib-speaking men invaded an area inhabited by Arawak-speaking people and killed all the men. The women who remained then continued to use Arawak while their new husbands spoke Carib.

In Chiquitano, a Bolivian language, the grammar of male language includes a noun-class gender distinction, with names for males and supernatural beings morphologically marked in one way, and nouns referring to females marked in another. In Thai, utterances may end with "politeness particles," k^h*rap* for men and k^h*a* for women (tones omitted). Thai also has different pronouns and fixed expressions like *please* and *thank you* that give each genderlect a distinctive character.

One obvious phonetic characteristic of female speech is its relatively higher pitch, caused mainly by shorter vocal tracts. Nevertheless, studies have shown that the difference in pitch between male and female voices is generally greater than could be accounted for by physiology alone, suggesting that some social factors may be at work, possibly beginning during language acquisition.

Margaret Thatcher, the former prime minister of England, is a well-known example of a woman altering her vocal pitch, in this case for political reasons. Thatcher's regular speaking voice was quite high and a little shrill. She was counseled by her advisors to lower her voice and to speak more slowly and monotonously in order to sound more like an authoritative man. This artificial speaking style became a strong characteristic of her public addresses.

Sociolinguistic Analysis

Speakers from different socioeconomic classes often display systematic speech differences, even when region and ethnicity are not factors. These social-class dialects differ from other dialects in that their sociolinguistic variables are often statistical in nature. With regional and social dialects, a differing factor is either present or absent (for the most part), so regional groups who say *faucet* say it pretty much all the time, as do the regional groups who say *spigot*. Speakers of AAE dialects will say *she pretty* meaning "she is pretty" with great regularity, other factors being equal. But social-class dialects differentiate themselves in a more quantitative way; for example, one class of speakers may apply a certain rule 80 percent of the time to distinguish it from another that applies the same rule 40 percent of the time.

The linguist William Labov carried out a sociolinguistic analysis in New York City that focused on the rule of *r*-dropping that we discussed earlier, and its use by upper-, middle-, and lower-class speakers.[3] In this classic study, a model for subsequent sociolinguistic analyses, Labov first identified three department stores that catered primarily to the three classes: Saks Fifth Avenue, Macy's, and S. Klein—upper, middle, and lower, respectively. To elicit data, he would go to the three stores and ask questions that he knew would evoke the words *fourth* and

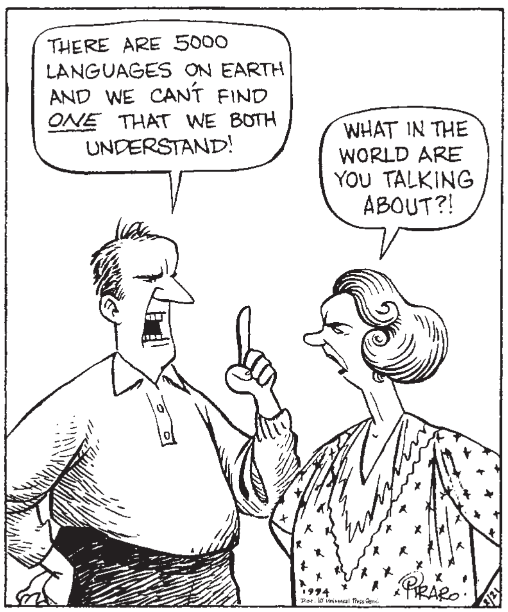
[3]Labov, W. 1966. *The social stratification of English in New York City*. Washington, DC: Center for Applied Linguistics.

floor. People who applied the *r*-dropping rule would pronounce these words [fɔθ] and [flɔ], whereas ones who did not apply the rule would say [fɔrθ] and [flɔr].

The methodology behind much of Labov's research is important to note. Labov interacted with all manner of people in their own environment where they were comfortable, although he took care when analyzing the data to take into account ethnic and gender differences. In gathering data he was careful to elicit naturally spoken language through his casual, unassuming manner. Finally, he would evoke the same answer twice by pretending not to hear or understand, and in that way was able to collect both informal, casual utterances, and utterances spoken (the second time) with more care.

In Saks, a high-end department store, 62 percent of respondents pronounced the *r* at least some of the time; in Macy's, a less expensive store, it was 52 percent, and in Klein's, a lower-end retailer, a mere 21 percent. The *r*-dropping rule, then, is socially "stratified," to use Labov's terminology, with the lower socio-class dialects applying the rule most often. What makes Labov's work so distinctive is his methodology and his discovery that the differences among dialects can be usefully defined on a quantitative basis of rule applications rather than the strict presence or absence of a rule. He also showed that social context and the sociolinguistic variables that it governs play an important role in language change (discussed in chapter 11).

Languages in Contact



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> Even a dog we do know is better company than a man whose language we know not.
>
> **ST. AUGUSTINE,** *City of God,* 5th century

Human beings are great travelers and traders and colonizers. The mythical tales of nearly all cultures tell of the trials and tribulations of travel and exploration, such as those of Odysseus (Ulysses) in Homer's *Odyssey*. Surely one of the tribulations of ranging outward from your home is that sooner or later you will encounter people who do not speak your language, nor you theirs. In some parts of the world, for example in bilingual communities, you may not have to travel very far at all to find the language disconnect, and in other parts you may have to cross an ocean. Because this situation is so common in human history and society, several solutions for bridging this communication gap have arisen.

Lingua Francas

> Language is a steed that carries one into a far country.
>
> **ARAB PROVERB**

Many areas of the world are populated by people who speak diverse languages. In such areas, where groups desire social or commercial communication, one language is often used by common agreement. Such a language is called a **lingua franca**.

In medieval times, a trade language based largely on the languages that became modern Italian and Provençal came into use in the Mediterranean ports. That language was called Lingua Franca, "Frankish language." The term *lingua franca* was generalized to other languages similarly used. Thus, any language can be a lingua franca.

English has been called "the lingua franca of the whole world" and is standardly used at international business meetings and academic conferences. French, at one time, was "the lingua franca of diplomacy." Russian serves as the lingua franca in the countries of the former Soviet Union, where many different local languages are spoken. Latin was a lingua franca of the Roman Empire and of western Christendom for a millennium, just as Greek served eastern Christendom as its lingua franca. Yiddish has long served as a lingua franca among Jewish people, permitting Jews of different nationalities to communicate with one another.

More frequently, lingua francas serve as trade languages. East Africa is populated by hundreds of villages, each speaking its own language, but most Africans of this area learn at least some Swahili as a second language, and this lingua franca is used and understood in nearly every marketplace. A similar situation exists in Nigeria, where Hausa is the lingua franca.

Hindi and Urdu are the lingua francas of India and Pakistan. The linguistic situation of this area of the world is so complex that there are often regional lingua francas—usually a local language surrounding a commercial center. Thus the Dravidian language Kannada is a lingua franca for the area surrounding the southwestern Indian city of Mysore. A similar situation existed in Imperial China.

In modern China, 94 percent of the people speak Han languages, which can be divided into eight major language groups that for the most part are mutually unintelligible. Within each language group there are hundreds of dialects. In addition to the Han languages, there are more than fifty "national minority" languages, including the five principal ones: Mongolian, Uighur, Tibetan, Zhuang, and Korean.

The situation is complex, and therefore the government inaugurated an extensive language reform policy to establish as a lingua franca the Beijing dialect of Mandarin, with elements of grammar from northern Chinese dialects, and enriched with the vocabulary of modern colloquial Chinese. They called this dialect "Putonghua," meaning "common speech." The native languages and dialects are not considered inferior. Rather, the approach is to spread the "common speech" so that all may communicate with one another in this lingua franca.

Certain lingua francas arise naturally; others are instituted by government policy and intervention. In many parts of the world, however, people still cannot speak with their neighbors only a few miles away.

Contact Languages: Pidgins and Creoles

I include "pidgin-English" . . . even though I am referred to in that splendid language as "Fella bilong Mrs. Queen."

PRINCE PHILIP, husband of Queen Elizabeth II

A lingua franca is typically a language with a broad base of native speakers, likely to be used and learned by persons with different native languages (usually in the same language family). Often in history, however, speakers of mutually unintelligible languages have been brought into contact under specific socioeconomic and political conditions and have developed a language to communicate with one another that is not native to anyone. Such a language is called a **pidgin**.

Many pidgins developed during the seventeenth, eighteenth, and nineteenth centuries, in trade colonies along the coasts of China, Africa, and the New World. These pidgins arose through contact between speakers of colonial European languages such as English, French, Portuguese, and Dutch, and the indigenous, non-European languages. Some pidgins arose among extended groups of slaves and slave owners in the United States and the Caribbean in the nineteenth century. Other cases include Hawaiian Pidgin English, which was established on the pineapple plantations of Hawaii among immigrant workers from Japan, China, Portugal, and the Philippines; Chinook Jargon, which evolved among the Indian tribes of the Pacific Northwest as a lingua franca among the tribes themselves as well as between the tribes and European traders; and various pidgins that arose during the Korean and Vietnam Wars for use between foreign soldiers and local civilians.

In all these cases the contact is too specialized and the cultures too widely separated for the native language of any one group to function effectively as a lingua franca. Instead, the two or more groups use their native languages as a basis for developing a rudimentary lingua franca with reduced grammatical structures and small lexicons. Also in these situations, it is generally the case that one linguistic group is in a more powerful position, economically or otherwise, such as the relationship of plantation owner to worker or slave owners to slaves. Most of the lexical items of the pidgin come from the language of the dominant group. This language is called **superstrate** or **lexifier language**. For example, English (the language of the plantation owners) is the superstrate language for Hawaiian Pidgin English, Swahili for the various forms of Pidgin Swahili spoken in East and Central Africa, and Bazaar Malay for pidgins spoken in Malaysia, Singapore, and Indonesia. The other language or languages also contribute to the lexicon and grammar, but in a less obvious way. These are called **substrate languages**. Japanese, Chinese, Tagalog, and Portuguese were the substrate languages of Hawaiian Pidgin English and all contributed to its grammar. Chinook Jargon had features both from indigenous languages of the area such as Chinook and Nootka, as well as French and English.

Many linguists believe that pidgins form part of a linguistic “life cycle.” In the very early stage of development the pidgin has no native speakers and is strictly a contact language. Its use is reserved for specialized functions, such as trading or work-oriented tasks, and its speakers speak their (respective) native languages in all other social contexts. In this early stage the pidgin has little in the way of clear grammatical rules and few (usually specialized) words. Later, however, if the language continues to exist and be necessary, a much more regular and complex form of pidgin evolves, what is sometimes called a “stabilized pidgin,” and this allows it to be used more effectively in a variety of situations. Further development leads to the creation of a **creole**, which most linguists believe has all the grammatical complexity of ordinary languages. **Pidginization** (the creation of a pidgin) thus involves a *simplification* of languages and a reduction in the number of domains of use. **Creolization**, in contrast, involves the linguistic *expansion* in the lexicon and grammar of existing pidgins, and an increase in the contexts of use. We discuss creoles and creolization further in the next section.

Although pidgins are in some sense rudimentary, they are not devoid of rules. The phonology is rule-governed, as in any human language. The inventory of phonemes is generally small; for example, whereas Standard English has fourteen distinct vowel sounds, pidgins commonly have only five to seven, and each phoneme may have many allophonic pronunciations. In one English-based pidgin, for example, [s], [ʃ], and [tʃ] are all possible pronunciations of the phoneme /s/; [masin], [maʃin], and [matʃin] all mean “machine.” Sounds that occur in both the superstrate and substrate languages will generally be maintained, but if a sound occurs in the superstrate but not in the substrates, it will tend to be eliminated. For example, the English sounds [ð] and [θ] as in “this” and “thing” are quite uncommon across languages. Many speakers of English pidgins convert these “th” sounds to more common ones, pronouncing “this thing” as dis ting.

Typically, pidgins lack grammatical words such as auxiliary verbs, prepositions, and articles, and inflectional morphology including tense and case endings, as in

He bad man.	“He is a bad man.”
I no go bazaar.	“I'm not going to the market.”

Affixal morphology is largely absence. For example, some English pidgins have the word *sus* from the English "shoes," but *sus* does not include a plural morpheme as it is used to refer to both a single shoe as well as multiple shoes. Note that this has happened in the development of English, too. Originally, the ending *-en* in *chicken* was a plural marker (as in *oxen*) referring to more than one chick, but it has lost that function and the plural of *chicken* is now *chickens*.

Verbs and nouns usually have a single shape and are not altered to mark tense, number, gender, or case. The set of pronouns is often simpler in pidgins. In Kamtok, an English-based pidgin spoken in Cameroon, the pronoun system does not show gender or all the case differences that exist in Standard English (SE).

	Kamtok			**SE**	
a	mi	ma	I	me	my
yu	yu	yu	you	you	your
i	i/am	i	he	him	his
i	i/am	i	she	her	her
wi	wi	wi	we	us	our
wuna	wuna	wuna	you	you	your
dem	dem/am	dem	they	them	their

Pidgins also may have fewer prepositions than the languages on which they are based. In Kamtok, for example, fɔ means "to," "at," "in," "for," and "from," as shown in the following examples:

Gif di buk fɔ mi.	"Give the book to me."
I dei fɔ fam.	"She is at the farm."
Dɛm dei fɔ chɔs.	"They are in the church."
Du dis wan fɔ mi, a bɛg.	"Do this for me, please."
Di mɔni dei fɔ tebul.	"The money is on the table."
You fit muf tɛn frank fɔ ma kwa.	"You can take ten francs from my bag."

Other morphological processes are more productive in pidgins. Reduplication is common, often to indicate emphasis. For example, in Komtok, *big* means "big" and *big-big* means "enormous"; *luk* means "look" and *luk-luk* means "stare at." Compounding is also productive and serves to increase the otherwise small lexicons. The reference to Prince Philip in the epigraph at the beginning of this section is an example (*fella bilong* [meaning "husband"] *Mrs. Queen*), as are the following:

big ai	greedy
drai ai	brave
gras bilong fes	beard
gras antap long ai	eyebrow
gras bilong head	hair
han bilong pisin	wing (of a bird)

Most words in pidgin languages also function as if they belong to several syntactic categories. For example, the Kamtok word *bad* can function as an adjective, noun, or adverb:

Adjective	tu bad pikin	two bad children
Noun	We no laik dis kain bad.	We don't like this kind of badness.
Adverb	A liakam bad.	I liked it very much.

In terms of syntax, early pidgins have a simple clausal structure, lacking embedded sentences and other complex complements. And word order may be variable so that speakers from different linguistic backgrounds can adopt the order of their native language and still be understood. For example, Japanese is an SOV (verb last) language, and a Japanese speaker of an English-based pidgin may put the verb last, as in *The poor people all potato eat*. On the other hand, a Filipino speaker of Tagalog, a VSO language, may put the verb first, as in *Work hard these people*. Word order becomes more rigid in stabilized pidgins and creoles, which are more like other languages with respect to the range of clause types.

Pidgin has come to have negative connotations, perhaps because many pidgins were associated with European colonial empires. The *Encyclopedia Britannica* once described pidgins as "an unruly bastard jargon, filled with nursery imbecilities, vulgarisms and corruptions." It no longer uses such a definition. In recent times there is greater recognition that pidgins reflect human creative linguistic ability and show many of the same design properties as other languages.

Pidgins also serve a useful function. For example, it is possible to learn an English-based pidgin well enough in six months to begin many kinds of semiprofessional training. Learning English for the same purpose might take ten times as long. In areas with many mutually unintelligible languages, a pidgin can play a vital role in unifying people of different cultures and ethnicities.

In general, pidgins are short-lived, perhaps spanning several human generations, though a few have lasted much longer. Pidgins may die out because the speakers all come to share a common language. This was the fate of Chinook Jargon, whose speakers all learned English. Also, because pidgins are often disdained, there is social pressure for speakers to learn a "standard" language, usually the one on which the pidgin is based. For example, through massive education, English replaced a pidgin spoken on New Zealand by the Maoris. Though it failed to succumb to years of government interdiction, Chinese Pidgin English could not resist the onslaught of English that fueled its demise by the close of the nineteenth century. Finally, and ironically, the death of a pidgin language may come about because of its success in uniting diverse communities; the pidgin proves so useful and becomes so widespread that successive generations in the communities in which it is spoken adopt it as their native tongue, elaborating its lexicon and grammar to become a creole.

Creoles and Creolization

Padi dɛm; kɔntri; una ɔl we de na Rom.
Mɛk una ɔl kak una yes. A kam bɛr Siza,
a nɔ kam prez am.

WILLIAM SHAKESPEARE, *Julius Caesar*, translated to Krio by Thomas Decker

> Creoles are particularly interesting because they represent an extreme of language change, but it is the mechanisms of language change, which are ubiquitous in the history of every language and every language family, that have made creoles what they are.
>
> **IAN ROBERTS,** "Verb Movement and Markedness," in Michel DeGraff, ed., *Language Creation and Language Change*, 1999

A creole is defined as a language that has evolved in a contact situation to become the native language of a generation of speakers. The traditional view is that creoles are the creation of children who, exposed to an impoverished and unstable pidgin, develop a far richer and more complex language that shares the fundamental characteristics of a "regular" human language and allows speakers to use the language in all domains of daily life.

In contrast to pidgins, creoles may have inflectional morphology for tense, plurality, and so on. For example, in creoles spoken in the South Pacific the affix *-im* is added to transitive verbs, but when the verb has no object the *-im* ending does not occur:

Man i pairip**im** masket.
man be fired-him musket
"The man fired the musket."

Masket i pairip.
"The gun was fired."

The same affix *-im* is used derivationally to convert adjectives into verbs like English *-en* in "redden":

bik	big	bikim	to make something big
daun	down	daunim	to lower something down
nogut	no good	nogutim	to spoil, damage

Creoles typically develop more complex pronoun systems. For example, in the creoles of the South Pacific there are two forms of the pronoun "we," inclusive we referring to speaker and listener, and exclusive we referring to the speaker and other people but not the listener. The Portuguese-based Cape Verdean Creole has three classes of pronouns: strong, weak, and clitic (meaning affixed to another word, like the possessive *'s* of English), as illustrated in the following table.

	Emphatic (Strong) Forms	Free (Weak) Forms	Subject Clitics	Object Clitics
1sg	ami	mi	N-	-m
2sg (informal)	abo	bo	bu-	-bu/-u
2sg (formal, masc.)	anho	nho	nhu-	
2sg (formal, fem.)	anha	nha		
3sg	ael	el	e-	-l
1pl	anos	nos	nu-	-nu
2pl	anhos	nhos		
3pl	aes	es	-s	

The compounds of pidgins often reduce in creoles; for example, *wara bilong skin* (water belong skin) meaning "sweat" becomes *skinwara*. The compound *baimbai* (by and by), used to indicate future time, becomes a tense inflection *ba* in the creole. Thus, the sentence *baimbai yu go* ("you will go") becomes *yu bago*. The phrasal structure of creoles is also vastly enriched, including embedded and relative clauses, among many other features of "regular" languages.

How are children able to construct a creole based on the rudimentary input of the pidgin? One answer is that they used their innate linguistic capacities to rapidly transform the pidgin into a full-fledged language. This would account for the many grammatical properties that creoles have in common, for example, SVO word order and tense and aspect distinctions.

It should be noted that defining pidgins and creoles in terms of whether they are native (creoles) versus non-native second languages (pidgins) is not without problems. There are languages such as Tok Pisin, widely spoken in New Guinea, which are first languages to many speakers, but also used as a second contact language by other speakers. Some linguists have also rejected the idea that creoles derive from pidgins, claiming that the geographic areas and social conditions under which they develop are different.

Moreover, the view that children are the creators of creoles is not universally accepted. Various linguists believe that creoles are the result of imperfect second language learning of the lexifier or dominant language by adults and the "transfer" of grammatical properties from their native non-European languages. This hypothesis would account for some of the characteristics that creoles share with L2 "interlanguages" (see chapter 8), for example, invariant verb forms, lack of determiners, and the use of adverbs rather than verbs and auxiliaries to express tense and modality.

Although some linguists believe that creoles are simpler systems than "regular" languages, most researchers who have closely examined the grammatical properties of various creoles argue that they are not structurally different from non-creole languages and that the only exceptional property of creoles is the sociohistorical conditions under which they evolve.

Creoles often arose on slave plantations where Africans of many different tribes spoke mutually incomprehensible African languages. Haitian Creole, based on French, developed in this way, as did the "English" spoken in parts of Jamaica. Gullah is an English-based creole spoken by the descendants of African slaves on islands off the coast of Georgia and South Carolina. Louisiana Creole, related to Haitian Creole, is spoken by large numbers of blacks and whites in Louisiana. Krio, the language spoken by as many as a million Sierra Leoneans, and illustrated in the epigraph to this section, developed at least in part from an English-based pidgin.

One of the theories concerning the origins of African American English is that it derives from an earlier English-based creole that developed when Africans slaves had no common language other than the English spoken by their colonial masters. Proponents of this hypothesis point out that many of the unique features of AAE are traceable to influences of the West African languages spoken by the slaves. Also, several of the features of AAE, such as aspect marking (distinct from that which occurs in Standard English), are typical of creole languages. The alternative view is that AAE formed directly from

English without any pidgin/creole stage. It is apparent that AAE is closer to Southern dialects of American English than to other dialects. It is possible that the African slaves learned the English of white Southerners as a second language. It is also possible that many of the distinguishing features of Southern dialects were acquired from AAE during the many decades in which a large number of Southern white children were raised by black women and played with black children.

Tok Pisin, originally a pidgin, was gradually creolized throughout the twentieth century. It evolved from Melanesian Pidgin English, once a widely spoken lingua franca of Papua New Guinea used by English-speaking traders and the native population. Because New Guinea is so linguistically diverse—more than eight hundred different languages were once spoken throughout the island—the pidgin came to be used as a lingua franca among the indigenous population as well.

Tok Pisin has its own writing system, its own literature, and its own newspapers and radio programs; it has even been used to address a United Nations meeting. Papers in (not *on*!) Tok Pisin have been presented at linguistics conferences in Papua New Guinea, and it is commonly used for debates in the parliament of the country. Today, Tok Pisin is one of the three recognized national languages of The Independent State of Papua New Guinea, alongside English and Kiri Motu, another creole.

Sign languages may also be pidgins. In Nicaragua in the 1980s, adult deaf people came together and constructed a crude system of "home" signs and gestures in order to communicate. It had the characteristics of a pidgin in that different people used it differently and the grammatical rules were few and varied. However, when young deaf children joined the community, an amazing event took place. The crude sign language of the adults was tremendously enhanced by the children learning it, so much so that it emerged as a rich and complex sign language called Idioma de Signos Nicaragüense (ISN), or Nicaraguan Sign Language. ISN provides an impressive demonstration of the development of a grammatically complex language from impoverished input and the power of human linguistic creativity.

The study of pidgins and creoles has contributed a great deal to our understanding of the nature of human language and the processes involved in language creation and language change, and of the sociohistorical conditions under which these instances of language contact occurred.

Bilingualism

> He who has two languages has two souls.
>
> **ANONYMOUS**

The term **bilingualism** refers to the ability to speak two (or more) languages, either by an individual speakers, **individual bilingualism**, or within a society, **societal bilingualism**. In chapter 8 we discussed how bilingual children may simultaneously acquire their two languages, and how second languages are acquired by children and adults. There are various degrees of individual bilingualism. Some people have native-like control of two languages, whereas others make regular use of two languages with a high degree of proficiency but lack the linguistic competence of a native or near native speaker in one or the other language. Also, some bilinguals may have oral competence but not read or write one or more of their languages.

The situations under which people become bilingual may vary. Some people grow up in a household in which more than one language is spoken; others move to a new country where they acquire the local language, usually from people outside the home. Still others learn second languages in school. In communities with rich linguistic diversity, contact between speakers of different languages may also lead to bilingualism.

Bilingualism (or multilingualism) also refers to the situation in nations in which two (or more) languages are spoken and recognized as official or national languages. Societal bilingualism exists in many countries, including Canada, where English and French are both official languages, and Switzerland, where French, German, Italian, and Romansch all have official status.

Interestingly, research shows that there are fewer bilingual individuals in bilingual countries than in so-called "unilingual" countries. This makes sense when you consider that in unilingual countries such as the United States, Italy, and France, people who do not speak the dominant language must learn some amount of it to function. Also, the main concern of multilingual states has been the maintenance and use of two or more languages, rather than the promotion of individual bilingualism among its citizens.

The United States is broadly perceived as a monolingual English-speaking society even though there is no reference to a national language in the Constitution. However, there are numerous bilingual communities with long histories throughout the country. According to the 2000 U.S. Census, about 18 percent of those age five and over, or 47 million people, speak a language other than English at home. Sixty percent of these, about 25 million people (8 percent of the U.S. population), profess to being bilingual in English and Spanish with varying degrees of English proficiency. Between 1990 and 2000 the number of Spanish speakers in the United States increased by about 60 percent, and the number of speakers other than Spanish by about 50 percent. It should be noted that not all Latinos are bilingual; as many as 20 percent may be monolingual English speakers. Recent studies also show that the shift to monolingual English is growing rapidly and that knowledge of Spanish is being lost faster in the twenty-first century than was seen with speakers of Dutch, Italian, German, and Polish in the first half of the twentieth century.

Codeswitching

Codeswitching is a speech style unique to bilinguals, in which fluent speakers switch languages between or within sentences, as illustrated by the following sentence:.

Sometimes I'll start a sentence in English and termino en español.
Sometimes I'll start a sentence in English and finish it in Spanish.

Codeswitching is a universal language-contact phenomenon that reflects the grammars of both languages working simultaneously. Bilingual Spanish-English speakers may switch between English and Spanish as in the above example, whereas Quebecois in Canada switch between French and English:

I mean, c'est un idiot, ce mec-là.
I mean he's an idiot, that guy.

The following examples are from German-English, Korean-English, and Mandarin-English bilinguals:

Johan hat mir gesagt that you were going to leave.
Johan told me you were going to leave.

Chigum ton-uls ops-nunde, I can't buy it.
As I don't have money now, I can't buy it.

Women zuotian qu kan de movie was really amazing.
The movie we went to see yesterday was really amazing.

Codeswitching occurs wherever groups of bilinguals speak the same two languages. Furthermore, codeswitching occurs in specific social situations, enriching the repertoire of the speakers.

A common misconception is that codeswitching is indicative of a language disability of some kind, for example, that bilinguals use codeswitching as a coping strategy for incomplete mastery of both languages, or that they are speaking "broken" English. These characterizations are completely inaccurate. Recent studies of the social and linguistic properties of codeswitching indicate that it is a marker of bilingual identity, and has its own internal grammatical structure. For example, bilinguals will commonly codeswitch between a subject and a verb as in:

Mis amigos finished first.   My friends finished first.

but would judge ungrammatical a switch between a subject pronoun and a verb as in:

*Ellos finished first.   They finished first.

Codeswitchers also follow the word order rules of the languages. For example, in a Spanish noun phrase, the adjective usually follows the noun, as opposed to the English NP in which it precedes, as shown by the following:

English: My mom fixes **green tamales**.   Adj N
Spanish: Mi mamá hace **tamales verdes**.   N Adj

A speaker might codeswitch as follows:

My mom fixes **tamales verdes**.
or   Mi mamá hace **green tamales**.

but would not accept or produce such utterances as

*My mom fixes **verdes tamales**.
or *Mi mamá hace **tamales green**.

because the word order within the NPs violates the rules of the language.

Codeswitching is to be distinguished from (bilingual) **borrowing**, which occurs when a word or short expression from one language occurs embedded among the words of a second language and adapts to the regular phonology, morphology, and syntax of the second language. In codeswitching, in contrast, the two languages that are interwoven preserve their own phonological and other grammatical properties. Borrowing can be easily distinguished from codeswitching by the pronunciation of an element. Sentence (1) involves borrowing, and (2) codeswitching.

(**1**) I love biscottis [bɪskaɾiz] with my coffee.
(**2**) I love biscotti [bɪskoːti] with my coffee.

In sentence (1) *biscotti* takes on an (American) English pronunciation and plural *-s* morphology, while in (2) it preserves the Italian pronunciation and plural morpheme *-i* (plural for *biscotto* "cookie").

What needs to be emphasized is that people who codeswitch have knowledge not of one but of two (or more) languages, and that codeswitching, like linguistic knowledge in general, is highly structured and rule-governed.

Language and Education

Outside of a dog, a book is a man's best friend; inside of a dog, it's too dark to read.

GROUCHO MARX (1890–1977)

The study of language has important implications in various educational arenas. An understanding of the structure, acquisition, and use of language is essential to the teaching of foreign and second languages, as well as to reading instruction. It can also promote a fuller understanding of language variation and use in the classroom and inform the often heated debates surrounding issues such as how to teach reading to children, bilingual education, and Ebonics.

Second-Language Teaching Methods

Many approaches to second or foreign language teaching have been developed over the years. Though these methods can differ significantly from one another, many experts believe that there is no single best method for teaching a second language. All methods have something to offer, and virtually any method can succeed with a gifted teacher who is a native or near-native speaker, motivated students, and appropriate teaching materials. All methods are most effective when they fit a given educational setting and when they are understood and embraced by the teacher.

Second-language teaching methods fall into two broad categories: the *synthetic approach* and the *analytic approach.* As the name implies, the synthetic approach stresses the teaching of the grammatical, lexical, phonological, and functional units of the language step by step. This is a bottom-up method. The task of the learner is to put together—or synthesize—the discrete elements that make up the language. The more traditional language teaching methods, which stress grammar instruction, fall into this category.

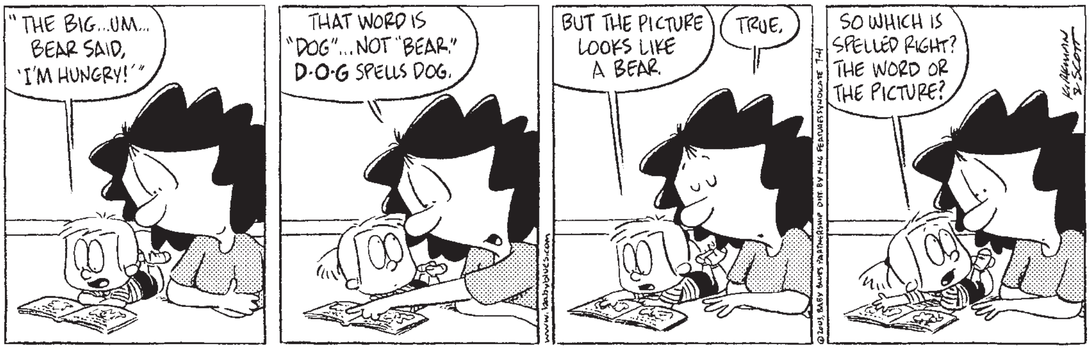
An extreme example of the synthetic approach is the **grammar translation** method favored up until the mid-1960s, in which students learned lists of vocabulary, verb paradigms, and grammatical rules. Learners translated passages from the target language into their native language. The teacher typically conducted class in the students' native language, focusing on the grammatical parsing of texts, and there was little or no contextualization of the language being taught. Reading passages were carefully constructed to contain only vocabulary and structures to which learners had already been exposed, and errors in translation were corrected on the spot. Learners were tested on their mastery of rules, verb paradigms, and vocabulary. The students did not use the target language very much except in reading translated passages aloud.

Analytic approaches are more top-down. The goal is not to explicitly teach the component parts or rules of the target language. Rather, the instructor selects topics, texts, or tasks that are relevant to the needs and interests of the learner, whose job then is to discover the constituent parts of the language. This approach assumes that adults can extract the rules of the language from unstructured input, more or less like a child does when acquiring his first language.

Currently, one of the most widely practiced analytic approaches is *content-based instruction*, in which the focus is on making the language meaningful and on getting the student to communicate in the target language. Learners are encouraged to discuss issues and express opinions on various topics of interest to them in the target language. Topics for discussion might include "Online Romance" or "Taking Responsibility for Our Environment." Grammar rules are taught on an as-needed basis, and fluency takes precedence over grammatical accuracy. Classroom texts (both written and aural) are generally taken from sources that were not created specifically for language learners, on the assumption that these will be more interesting and relevant to the student. Assessment is based on the learner's comprehension of the target language.

Not all second-language teaching methods fall clearly into one or the other category. The synthetic and analytic approaches should be viewed as the opposite ends of a continuum along which various second-language methods may fall. Also, teachers practicing a given method may not strictly follow all the principles of the method. Actual classroom practices tend to be more eclectic, with teachers using techniques that work well for them and to which they are accustomed—even if these techniques are not in complete accordance with the method they are practicing.

Teaching Reading



In chapter 8 we discussed how young children acquire their native language. We noted that language development (whether of a spoken or sign language) is a biologically driven process with a substantial innate component. Parents do not teach their children the grammatical rules of their language. Indeed, they are not even aware of the rules themselves. Rather, the young child is naturally predisposed to uncover these rules from the language he hears around him. The way we learn to read and write, however, is quite different from the way we acquire the spoken/signed language.

First, and most obviously, children learn to talk (or sign) at a very young age, while reading typically begins when the child is school-age (around five or six years old in most cases, although some children are not reading-ready until even later). A second important difference is that across cultures and languages, all children acquire a spoken/signed language while many children never learn to read or write. This may be because they are born into cultures for which there is no written form of their language. It is also unfortunately the case that even some children born into literate societies do not learn to read, either because they suffer from a specific reading disability—**dyslexia**—or because they have not been properly taught. It is important to recognize, however, that even illiterate children and adults have a mental grammar of their language and are able to speak/sign and understand perfectly well.

The most important respect in which spoken/signed language development differs from learning to read is that reading requires specific instruction and conscious effort, whereas language acquisition does not. Which kind of instruction works best for teaching reading has been a topic of considerable debate for many decades. Three main approaches have been tried.

The first—the *whole-word approach*—teaches children to recognize a vocabulary of some fifty to one hundred words by rote learning, often by seeing the words used repeatedly in a story, for example, *Run, Spot, Run* from the Dick and Jane series well-known to people who learned to read in the 1950s. Other words are acquired gradually. This approach does not teach children to "sound out" words according to the individual sounds that make up the words. Rather, it treats the written language as though it were a logographic system, such as Chinese, in which a single written character corresponds to a whole word or word root. In other words, the whole-word approach fails to take advantage of the fact that English (and the writing systems of most literate societies) is based on an alphabet, in which the symbols correspond to the individual sounds (roughly phonemes) of the language. This is ironic because alphabetic writing systems are the easiest to learn and are maximally efficient for transcribing any human language.

A second approach—*phonics*—emphasizes the correspondence between letters and the sounds associated with them. Phonics instruction begins by teaching children the letters of the alphabet and then encourages them to sound out words based on their knowledge of the sound-letter correspondences. So, if you have learned to read the word *gave* (understanding that the *e* is silent), then it is easy to read *save* and *pave*.

However, English and many other languages do not show a perfect correspondence between sounds and letters. For example, the rule for *gave*, *save*, and *pave* does not extend to *have*. The existence of many such exceptions has encouraged some schools to adopt a third approach to reading, the *whole-language approach* (also called "literature-based" or "guided reading"), which was most popular in the 1990s. The key principle is that phonics should not be taught directly. Rather, the child is supposed to make the connections between sounds and letters herself based on exposure to text. For example, she would be encouraged to figure out an unfamiliar word based on the context of the sentence or by looking for clues in the story line or the pictures rather than by sounding it out, as illustrated in the cartoon.

The philosophy behind the whole-language approach is that learning to read, like learning to speak, is a natural act that children can basically do on their own—an assumption that, as we noted earlier, is questionable at best. With the whole-language approach, the main job of the teacher is to make the reading experience an enjoyable one. To this end, children are presented with engaging books and are encouraged to write stories of their own as a way of instilling a love of reading and words.

Despite the intuitive appeal of the whole-language approach—after all, who would deny the educational value of good literature and creative expression in learning?—research has clearly shown that understanding the relationship between letters and sounds is critically important in reading. One of the assumptions of the whole-language approach is that skilled adult readers do not sound out words when reading, so proponents question the value of focusing on sounding out in reading instruction. However, research shows that the opposite is true: skilled adult readers *do* sound out words mentally, and they do so very rapidly. Another study compared groups of college students who were taught to read unfamiliar symbols such as Arabic letters, one group by a phonics approach and the other with a whole-word approach. Those trained with phonics could read many more new words. Similar results have been obtained through computer modeling of how children learn to read. Classroom studies have also compared phonics with whole-word or whole-language approaches and have shown that phonics instruction produces better results for beginning readers.

The advantage of phonics is not contradicted by studies showing that deaf children who have fully acquired a sign language have difficulty learning to read. This is understandable because the alphabetic principle requires an understanding of sound-symbol regularities, which deaf children do not have. It seems reasonable, then, that hearing children should not be deprived of the advantage they would have if their unconscious knowledge of phonemes is made conscious.

At this point, the consensus among psychologists and linguists who do research on reading—and a view shared by many teachers—is that reading instruction must be grounded in a firm understanding of the connections between letters and sounds, and that whole-language activities that make reading fun and meaningful for children should be used to supplement phonics instruction. Based on such research, the federal government now promotes the inclusion of phonics in reading programs across the United States.

Bilingual Education

As discussed earlier, there are many bilingual communities in the United States and members of these communities typically have varying levels of English proficiency. People who have recently arrived in the United States may have virtually no knowledge of English, other individuals may have only limited knowledge, and others may be fully bilingual. Native language development is untutored and happens before children begin school, but many children find themselves in classroom situations in which their native language is not the language of instruction. There has been a great deal of debate among researchers, teachers, parents, and the general public over the best methods for teaching English to school-age children as well as over the value of maintaining and promoting their native language abilities.

There are several kinds of bilingual programs in American schools for immigrant children. In **Transitional Bilingual Education** (**TBE**) programs, students receive instruction in both English and their native language, and the native language support is gradually phased out over two or three years. In **Bilingual Maintenance** (BM) programs, students remain in bilingual classes for their entire educational experience. Another program, **Dual Language Immersion**, enrolls English-speaking children and students who are native in another language in roughly equal numbers. The goal here is for all the students to become bilingual. This kind of program serves as a BM program for non-English speakers and a foreign language immersion program for the English-speaking children.

Many studies have shown that immigrant children benefit from instruction in their native language. Bilingual classes allow the children to first acquire in their native language school-related vocabulary, speech styles, and other aspects of language that are specific to a school environment while they are learning English. It also allows them to learn content material and keep up with other children during the time it takes them to master English. Recent studies that compared the effectiveness of different types of programs have found that children enrolled in bilingual programs outperformed children in English-only programs, and that children enrolled in BM programs did better than TBE students.

Despite the benefits that a bilingual education affords immigrant students, these programs have been under increasing attack since the 1970s. In the past few years measures against bilingual education have been passed in several states, including California, Arizona, and Massachusetts. These measures mandate that immigrant students "be taught English by being taught in English" in an English-only approach known as Sheltered English Immersion (SEI). Proponents claim that one year of SEI is sufficient for children, especially young children, to learn English well enough to be transferred to a mainstream classroom. Research does not bear out these claims, however. Studies show that only a small minority of children, around 3 percent to 4 percent of children in SEI programs and 13 percent to 14 percent in bilingual programs, acquire English within a year. A considerable body of research shows that for the vast majority of children it takes from two to five years to develop oral proficiency in English and four to seven years to develop proficiency in academic English.

There are several possible causes for the chasm between research results and public policy regarding bilingual education. Bilingual programs can be poorly implemented and so not achieve the desired results. There may also be a public perception that it is too costly to implement bilingual programs. It is likely that some of the backlash against bilingual education is due to anti-immigrant sentiment, but there are also many well-intentioned people who mistakenly believe that bilingualism is a handicap and that children will be more successful academically and socially if they are quickly and totally immersed in the more prestigious majority language.

"Ebonics"

Children who speak a dialect of English that differs from the language of instruction—usually close to Standard English—may also be disadvantaged in a school setting. Literacy instruction is generally based on SAE. It has been argued that the phonological and grammatical differences between African American English (AAE)—termed "Ebonics" in the popular press—and SAE make it harder for AAE-speaking children to learn to read and write.

One approach to this problem has been to discourage children from speaking AAE and to correct each departure from SAE that the children produce. SAE is presented as the "correct" way to speak and AAE as substandard or incorrect. This approach has been criticized as being psychologically damaging to the child as well as impractical. Attempts to consciously correct children's nonstandard dialect speech are routinely met with failure. Moreover, one's language/dialect expresses group identity and solidarity with friends and family. A child may take a rejection of his language as a rejection of him and his culture.

A more positive approach to teaching literacy to speakers of nonstandard dialects is to encourage **bidialectalism**. This approach teaches children to take pride in their language, encouraging them to use it in informal circumstances, with family and friends, while also teaching them a second dialect—SAE—that is necessary for reading, writing, and classroom discussion. As a point of comparison, in many countries, including Switzerland, Germany, and Italy, children grow up speaking a nonstandard dialect at home but learn the standard language once they enter school. This underscores that bidialectalism that combines a home dialect and a school/national language is entirely feasible. Educational programs that respect the home language may better facilitate the acquisition of a standard dialect. Ideally, the bidialectal method would also include class discussion of the phonological and grammatical differences between the two dialects, which would require that teachers understand the linguistic properties of AAE, as well as some linguistics in general.

Language in Use

One of the themes of this book is that you have a lot of linguistic knowledge that you may not be aware of, but that can be made explicit through the rules of phonology, morphology, syntax, and semantics. You also have a deep social knowledge of your language. You know the appropriate way to talk to your parents, your friends, your clergy, and your teachers. You know about "politically correct" (PC) language, to say "mail *carrier*," "fire*fighter*," and "police *officer*," and not to say "nigger," "wop," and "bitch." In short, you know how to *use* your language appropriately, even if you sometimes choose not to. This section discusses some of the many ways in which the use of language varies in society.

Styles

Most speakers of a language speak one way with friends, another on a job interview or presenting a report in class, another talking to small children, another with their parents, and so on. These "situation dialects" are called **styles**, or **registers**.

Nearly everybody has at least an informal and a formal style. In an informal style, the rules of contraction are used more often, the syntactic rules of negation and agreement may be altered, and many words are used that do not occur in the formal style.

Informal styles, although permitting certain abbreviations and deletions not permitted in formal speech, are also rule-governed. For example, questions are often shortened with the subject *you* and the auxiliary verb deleted. One can ask *Running the marathon?* or *You running the marathon?* instead of the more formal *Are you running the marathon?* but you cannot shorten the question to **Are running the marathon?* Informal talk is not anarchy. It is rule-governed, but the rules of deletion, contraction, and word choice are different from those of the formal language.

It is common for speakers to have competence in several styles, ranging between the two extremes of formal and informal. The use of styles is often a means of identification with a particular group (e.g., family, gang, church, team), or a means of excluding groups believed to be hostile or undesirable (cops, teachers, parents).

Many cultures have rules of social behavior that govern style. Some Indo-European languages distinguish between "you (familiar)" and "you (polite)." German *du* and French *tu* are to be used only with "intimates"; *Sie* and *vous* are more formal and used with nonintimates. Thai has three words meaning "eat" depending on the social status of who is speaking with whom.

Social situations affect the details of language usage, but the core grammar remains intact, with a few superficial variations that lend a particular flavor to the speech.

Slang

Slang is a language that rolls up its sleeves, spits on its hands, and goes to work.

CARL SANDBURG, quoted in "Minstrel of America: Carl Sandburg," *New York Times*, February 13, 1959

One mark of an informal style is the frequent occurrence of **slang**. Slang is something that nearly everyone uses and recognizes, but nobody can define precisely. It is more metaphorical, playful, elliptical, vivid, and shorter-lived than ordinary language.

The use of slang has introduced many new words into the language by recombining old words into new meanings. *Spaced out*, *right on*, *hang-up*, and *rip-off* have all gained a degree of acceptance. Slang also introduces entirely new words such as *barf*, *flub*, and *dis*. Finally, slang often consists of ascribing entirely new meanings to old words. *Rave* has broadened its meaning to "an all-night dance party," where *ecstasy* (slang for a kind of drug) is taken to provoke wakefulness; *crib* refers to one's home and *posse* to one's cohorts. *Grass* and *pot* widened their meaning to "marijuana"; *pig* and *fuzz* are derogatory terms for "police officer"; *rap*, *cool*, *dig*, *stoned*, *bread*, *split*, and *suck* have all extended their semantic domains.

The words we have cited may sound slangy because they have not gained total acceptability. Words such as *dwindle*, *freshman*, *glib*, and *mob* are former slang words that in time overcame their "unsavory" origin. It is not always easy to know where to draw the line between slang words and regular words. The borderland between slang and formal language is ill-defined and is more of a continuum than a strict boundary.

There are scads (another slang word) of sources of slang. It comes from the underworld: *crack*, *payola*, *to hang paper*. It comes from college campuses: *crash*, *wicked*, *peace*. It even comes from the White House: *pencil* (writer), *still* (photographer), *football* (black box of security secrets).

Slang is universal. It is found in all languages and all time periods. It varies from region to region, and from past to present. Slang meets a variety of social needs and rather than a corruption of the language, it is yet further evidence of the creativity of the human language user.

Jargon and Argot

Practically every conceivable science, profession, trade, and occupation uses specific slang terms called **jargon**, or **argot**. Linguistic jargon, some of which is used in this book, consists of terms such as *phoneme*, *morpheme*, *case*, *lexicon*, *phrase structure rule*, and so on. Part of the reason for specialized terminology is for clarity of communication, but part is also for speakers to identify themselves with persons with whom they share interests.

Because the jargon used by different professional and social groups is so extensive (and so obscure in meaning), court reporters in the Los Angeles Criminal Courts Building have a library that includes books on medical terms, guns, trade names, and computer jargon, as well as street slang.

The computer age not only ushered in a technological revolution, it also introduced a slew of jargon, called, slangily, "computerese," used by computer "hackers" and others. So vast is this specialized vocabulary that *Webster's New World Computer Dictionary* has four hundred pages and contains thousands of computer terms as entries. A few such words that are familiar to most people are *modem* (from ***mo**dulator-**dem**odulator*), *bit* (from ***bi**nary digi**t***), and *byte* (eight *bits*). Acronyms and alphabetic abbreviations abound in computer jargon. *ROM* (read-only memory), *RAM* (random-access memory), *CPU* (central processing unit), and *DVD* (digital video disk) are a small fraction of what's out there.

Some jargon may over time pass into the standard language. Jargon, like all types of slang, spreads from a narrow group that originally embraced it until it is used and understood by a large segment of the population.

Taboo or Not Taboo?

Sex is a four-letter word.

BUMPER STICKER SLOGAN

"There are some words I will not tolerate in this house—and 'awesome' is one of them."

An item in a newspaper once included the following paragraph:

> "This is not a Sunday school, but it is a school of law," the judge said in warning the defendants he would not tolerate the "use of expletives during jury selection." "I'm not going to have my fellow citizens and prospective jurors subjected to filthy language," the judge added.

How can language be filthy? In fact, how can it be clean? The filth or beauty of language must be in the ear of the listener, or in the collective ear of society. The writer Paul Theroux points this out:

> A foreign swear-word is practically inoffensive except to the person who has learned it early in life and knows its social limits.

Nothing about a particular string of sounds makes it intrinsically clean or dirty, ugly or beautiful. If you say that you pricked your finger when sewing, no one would raise an eyebrow, but if you refer to your professor as a prick, the judge quoted previously would undoubtedly censure this "dirty" word.

You know the obscene words of your language, and you know the social situations in which they are desirable, acceptable, forbidden, and downright dangerous to utter. This is true of all speakers of all languages. All societies have their taboo words. (*Taboo* is a Tongan word meaning "forbidden.") People everywhere seem to have a need for undeleted expletives to express their emotions or attitudes.

Forbidden acts or words reflect the particular customs and views of the society. Among the Zuni Indians, it is improper to use the word *takka*, meaning "frogs," during a religious ceremony. In the world of Harry Potter, the evil Voldemort is not to be named, but is referred to as "You-Know-Who." In some religions believers are forbidden to "take the Lord's name in vain," and this prohibition often extends to other religious jargon. Thus the taboo words *hell* and *damn* are changed to *heck* and *darn*, though the results are sometimes not euphonious. Imagine the last two lines of Act II, Scene 1, of *Macbeth* if they were "cleaned up":

Hear it not, Duncan; for it is a knell
That summons thee to heaven, or to heck

Words relating to sex, sex organs, and natural bodily functions make up a large part of the set of taboo words of many cultures. Often, two or more words or expressions can have the same linguistic meaning, with one acceptable and the other taboo. In English, words borrowed from Latin sound "scientific" and therefore appear to be technical and "clean," whereas native Anglo-Saxon counterparts are taboo. Such pairs of words are illustrated as follows:

Anglo-Saxon Taboo Words	**Latinate Acceptable Words**
cunt	vagina
cock	penis
prick	penis
tits	mammaries
shit	feces, defecate

There is no grammatical reason why the word *vagina* [vədʒãɪnə] is "clean" whereas *cunt* [kʌ̃nt] is "dirty," or why *balls* is taboo but *testicles* acceptable. Although there is no grammatical basis for such preferences, there certainly are sociolinguistic reasons to embrace or eschew such usages, just as there are sociolinguistic reasons for speaking formally, respectfully, disrespectfully, informally, jargon riddled, and so on.

Euphemisms

Banish the use of the four-letter words
Whose meaning is never obscure.
The Anglos, the Saxons, those bawdy old birds
Were vulgar, obscene, and impure.
But cherish the use of the weaseling phrase
That never quite says what it means;
You'd better be known for your hypocrite ways
Than vulgar, impure, and obscene.

FOLK SONG ATTRIBUTED TO WARTIME ROYAL AIR FORCE OF GREAT BRITAIN

The existence of taboo words and ideas motivates the creation of **euphemisms**. A euphemism is a word or phrase that replaces a taboo word or serves to avoid frightening or unpleasant subjects. In many societies, because death is feared, there are many euphemisms related to this subject. People are less apt to *die* and more apt to *pass on* or *pass away*. Those who take care of your loved ones who have passed away are more likely to be *funeral directors* than *morticians* or *undertakers*. And then there's *feminine protection* . . .

The use of euphemisms is not new. It is reported that the Greek historian Plutarch in the first century C.E. wrote that "the ancient Athenians . . . used to cover up the ugliness of things with auspicious and kindly terms, giving them polite and endearing names. Thus they called harlots *companions*, taxes *contributions*, and prison a *chamber*."

Just as surely as all languages and societies have taboo words, they have euphemisms. The aforementioned taboo word *takka*, meaning "frogs," is replaced during a Zuni religious ceremony by a complex compound word that literally translates as "several-are-sitting-in-a-shallow-basin-where-they-are-in-liquid." The euphemisms for bodily excretions and sexual activity are legion, and lists of them may be found in online dictionaries of slang. There you will find such gems for urination as *siphon the python* and *point Percy at the porcelain*, and for intercourse *shag*, *hide the ferret* (*salami*, *sausage*), and *toss a little leg*, among a gazillion others.

These euphemisms, as well as the difference between the accepted Latinate "genteel" terms and the "dirty" Anglo-Saxon terms, show that a word or phrase has not only a linguistic **denotative meaning** but also a **connotative meaning** that reflects attitudes, emotions, value judgments, and so on. In learning a language, children learn which words are taboo, and these taboo words differ from one child to another, depending on the value system accepted in the family or group in which the child grows up.

Racial and National Epithets

The use of epithets for people of different religions, nationalities, or races tells us something about the speakers. Words like *kike* (for Jew), *wop* (for Italian), *nigger* or *coon* (for African American), *slant* (for Asian), *towelhead* (for Middle Eastern Arab), and so forth reflect racist and chauvinist views of society.

Even words that sound like epithets are perhaps to be avoided (see exercise 13). An administrator in Washington, D.C. described a fund he administers as "niggardly," meaning stingy. He resigned his position under fire for using a word "so close to a degrading word."

Language, however, is creative, malleable, and ever changing. The epithets used by a majority to demean a minority may be reclaimed as terms of bonding and friendship among members of the minority. Thus, for some—we emphasize *some*—African Americans, the word *nigger* is used to show affection. Similarly, the ordinarily degrading word *queer* is used among *some* gay persons as a term of endearment, as is *cripple* or *crip* among *some* individuals who share a disability.

Language and Sexism

> doctor, n. . . . a man of great learning.
>
> ***THE AMERICAN COLLEGE DICTIONARY***, 1947

> A businessman is aggressive; a businesswoman is pushy. A businessman is good on details; she's picky. . . . He follows through; she doesn't know when to quit. He stands firm; she's hard. . . . He isn't afraid to say what is on his mind; she's mouthy. He exercises authority diligently; she's power mad. He's closemouthed; she's secretive. He climbed the ladder of success; she slept her way to the top.
>
> **FROM "HOW TO TELL A BUSINESSMAN FROM A BUSINESSWOMAN,"** *The Balloon*, Graduate School of Management, UCLA, 1976

The discussion of obscenities, blasphemies, taboo words, and euphemisms showed that words of a language are not intrinsically good or bad, but reflect individual or societal values. This is also seen where a woman may be referred to as a *castrating female*, *ballsy women's libber*, or *courageous feminist advocate*, depending on who is talking.

Early dictionaries often gave clues to the social attitudes of that time. In some twentieth-century dictionaries, examples used to illustrate the meaning of words include "manly courage" and "masculine charm," as opposed to "womanish tears" and "feminine wiles." Contemporary dictionaries are far more enlightened and try to be scrupulous in avoiding sexist language.

Until recently, most people who heard "My cousin is a professor (or a doctor, or the chancellor of the university, or a steelworker)" would assume that the cousin is a man; if they heard "My cousin is a nurse (or elementary school teacher, or clerk-typist, or house worker)," they would conclude that the cousin is a woman. This is changing because society is changing and people of either sex commonly hold jobs once held primarily by one sex.

Despite flashes of enlightenment, words for women abound with abusive or sexual overtones: *dish*, *piece*, *piece of ass*, *piece of tail*, *bunny*, *chick*, *pussy*, *bitch*, *doll*, *slut*, *cow*—to name just a few. Far fewer such sexual terms exist for men, and those that do, such as *boy toy*, *stud muffin*, *hunk*, or *jock*, are not pejorative in the same way.

It's clear that language reflects sexism. It reflects any societal attitude, positive or negative; languages are infinitely flexible and expressive. But is language itself amoral and neutral? Or is there something about language, or a particular language, that abets sexism? Before we attempt to answer that question, let's look more deeply into the subject, using English as the illustrative language.

Marked and Unmarked Forms

> If the English language had been properly organized . . . then there would be a word which meant both "he" and "she," and I could write, "If John or Mary comes, heesh will want to play tennis," which would save a lot of trouble.
>
> **A. A. MILNE,** *The Christopher Robin Birthday Book,* 1930

In chapter 5 we saw that with gradable antonyms such as *high*/*low*, one is marked (*low*) and the other unmarked. Ordinarily, the unmarked member of the pair is the one used in questions (*How high is the building?*), measurements (*The building is twenty stories high*), and so on.

Similar to this is an asymmetry between male and female terms in many languages where there are male/female pairs of words. The male form is generally unmarked and the female term is created by adding a bound morpheme. We have many such examples in English:

Male	**Female**
heir	heir**ess**
major	major**ette**
hero	hero**ine**
Robert	Robert**a**
equestrian	equestri**enne**
aviator	avia**trix**

When referring in general to the profession of acting, or flying, or riding horseback, the unmarked terms *actor*, *aviator*, and *equestrian* are used. The marked terms are used to emphasize the female gender.

Moreover, the unmarked third person pronoun in English is male (*he*, *him*, *his*). *Everybody had better pay his fee next time* allows for the client to be male or female, but *Everybody had better pay her fee next time* presupposes a female client. While there has been some attempt to neutralize the pronoun by using *they*, as in *Every teenager loves their first car*, most teachers find this objectionable and it is unlikely to become common practice. Other attempts to find a suitable genderless third person pronoun have produced such attempts as *e*, *hesh*, *po*, *tey*, *co*, *jhe*, *ve*, *xe*, *he'er*, *thon*, *na*, none of which speakers have the least inclination to adopt, and it appears likely that *he* and *she* are going to be with us for a while.

Since the advent of the feminist movement, many of the marked female forms have been replaced by the male forms, which are used to refer to either sex. Thus women, as well as men, are authors, actors, poets, heroes, and heirs. Women, however, remain countesses, duchesses, and princesses, if they are among this small group of female aristocrats.

The Sapir-Whorf hypothesis, discussed in chapter 1, proposes that the way a language encodes—puts into words—different categories like male and female subtly affects the way speakers of the language think about those categories. Thus, it may be argued that because English speakers are often urged to choose *he* as the unmarked pronoun (*Everyone should respect* ***himself***), and to choose *she* only when the referent is overtly female, they tend to think of the male sex as predominant. Likewise, the fact that nouns require special affixes to make them feminine forces people to think in terms of male and female, with the female somehow more derivative because of affixing. The different titles, Mr., Mrs., Miss, and Ms., also emphasize the male/female distinction. Finally, the preponderance of words denigrating females in English and many other languages may create a climate that is more tolerant of sexist behavior.

Nevertheless, although people can undoubtedly be sexist and even cultures can be sexist, can language be sexist? That is, can we be molded by our language to be something we may not want to be? Or does language merely facilitate any natural inclinations we may have? Is it simply a reflection of societal values? These questions are disputed today by linguists, anthropologists, psychologists, and philosophers, and no definitive answer has yet emerged.

Secret Languages and Language Games

Throughout the world and throughout history, people have invented secret languages and language games. They have used these special languages as a means of identifying with their group and/or to prevent outsiders from knowing what is being said. One such case is *Nushu*, the women's secret writing of Chinese, which originated in the third century as a means for women to communicate with one another in the sexually repressive societies of imperial China (see exercise 17, chapter 12). American slaves developed an elaborate code that could not be understood by the slave owners. References to "the promised land" or the "flight of the Israelites from Egypt" sung in spirituals were codes for the North and the Underground Railroad.

Language games such as Pig Latin[4] and Ubbi Dubbi (see exercise 7) are used for amusement by children and adults. They exist in all the world's languages and take a wide variety of forms. In some, a suffix is added to each word; in others a syllable is inserted after each vowel. There are rhyming games and games in which phonemes are reversed. A game in Brazil substitutes an /i/ for all the vowels.

The Walbiri, natives of central Australia, play a language game in which the meanings of words are distorted. In this play language, all nouns, verbs, pronouns, and adjectives are replaced by a semantically contrastive word. Thus, the sentence *Those men are small* means *This woman is big.*

[4]Dog is pronounced *og-day*, parrot as *arrot-pay*, and elephant as *elephant-may*, etc., but see exercise 6.

These language games provide evidence for the phonemes, words, morphemes, semantic features, and so on that are posited by linguists for descriptive grammars. They also illustrate the boundless creativity of human language and human speakers.

Summary

Every person has a unique way of speaking, called an **idiolect**. The language used by a group of speakers is a **dialect**. The dialects of a language are the mutually intelligible forms of that language that differ in systematic ways from each other. Dialects develop because languages change, and the changes that occur in one group or area may differ from those that occur in another. **Regional dialects** and **social dialects** develop for this reason. Some differences in U.S. regional dialects may be traced to the dialects spoken by colonial settlers from England. Those from southern England spoke one dialect and those from the north spoke another. In addition, the colonists who maintained close contact with England reflected the changes occurring in British English, while earlier forms were preserved among Americans who spread westward and broke communication with the Atlantic coast. The study of regional dialects has produced **dialect atlases**, with **dialect maps** showing the areas where specific dialect characteristics occur in the speech of the region. A boundary line called an **isogloss** delineates each area.

Social dialects arise when groups are isolated socially, such as Americans of African descent in the United States, many of whom speak dialects collectively called African American (Vernacular) English, which are distinct from the dialects spoken by non-Africans.

Dialect differences include phonological or pronunciation differences (often called **accents**), vocabulary distinctions, and syntactic rule differences. The grammar differences among dialects are not as great as the similarities, thus permitting speakers of different dialects to communicate.

In many countries, one dialect or dialect group is viewed as the **standard**, such as **Standard American English** (**SAE**). Although this particular dialect is not linguistically superior, some language purists consider it the only correct form of the language. Such a view has led to the idea that some nonstandard dialects are deficient, as is erroneously suggested regarding **African American English** (sometimes referred to as **Ebonics**), a collection of dialects used by some African Americans. A study of African American English shows it to be as logical, complete, rule-governed, and expressive as any other dialect. This is also true of the dialects spoken by Latino Americans whose native language or those of their parents is Spanish. There are bilingual and monolingual Latino speakers of English. One Latino dialect spoken in the Southwest, referred to as **Chicano English** (**ChE**), shows systematic phonological and syntactic differences from SAE that stem from the influence of Spanish. Other differences are shared with many nonstandard ethnic and nonethnic dialects. **Codeswitching** is shifting between languages within a single sentence or discourse by a bilingual speaker. It reflects both grammars working simultaneously and does not represent a form of "broken" English or Spanish or whatever language.

Attempts to legislate the use of a particular dialect or language have been made throughout history and exist today, even extending to banning the use of languages other than the preferred one.

In areas where many languages are spoken, one language may become a **lingua franca** to ease communication among people. In other cases, where traders, missionaries, or travelers need to communicate with people who speak a language unknown to them, a **pidgin** may develop. A pidgin is a simplified system with properties of both the **superstrate** (**lexifier**) and **substrate** languages. When a pidgin is widely used, and constitutes the primary linguistic input to children, it is *creolized*. The grammars of **creole** languages are similar to those of other languages, and languages of creole origin now exist in many parts of the world and include sign languages of the deaf.

The study of language has important implications for education especially as regards reading instruction, and the teaching of second language learners, language-minority students, and speakers of nonstandard dialects. Several second-language teaching methods have been proposed for adult second language learners. Some of them focus more on the grammatical aspects of the target language, and others focus more on getting students to communicate in the target language, with less regard for grammatical accuracy.

Writing and reading, unlike speaking and understanding, must be deliberately taught. Three methods of teaching reading have been used in the United States: *whole-word*, *whole-language*, and *phonics*. In the whole-word and whole-language approaches, children are taught to recognize entire words without regard to individual letters and sounds. The phonics approach emphasizes the spelling-sound correspondences of the language, and thus draws on the child's innate phonological knowledge.

Immigrant children must acquire English (or whatever the majority language is in a particular country). Younger students must at the same time acquire literacy skills (reading and writing), and students of all ages must learn content material such as math, science, and so on. This is a formidable task. **Bilingual education** programs are designed to help achieve these multiple aims by teaching children literacy and content material in their native language while they are acquiring English. Research has shown that immigrant children benefit from instruction in their native language, but many people oppose these programs.

Children who speak a nonstandard dialect of English that differs from the language of instruction may also be at a disadvantage in a school setting, especially in learning reading and writing. There have been contentious debates over the use of Ebonics in the classroom as a method for helping speakers of AAE learn Standard English.

Besides regional and social dialects, speakers may use different **styles**, or **registers**, depending on the context. **Slang** is not often used in formal situations or writing but is widely used in speech; **argot** and **jargon** refer to the unique vocabulary used by particular groups of people to facilitate communication, provide a means of bonding, and exclude outsiders.

In all societies, certain acts or behaviors are frowned on, forbidden, or considered **taboo**. The words or expressions referring to these taboo acts are then also avoided or considered "dirty." Language cannot be obscene or clean; attitudes toward specific words or linguistic expressions reflect the views of a culture or society toward the behaviors and actions of the language users. At times, slang words may be taboo where scientific or standard terms with the same meaning are acceptable in "polite society." Taboo words and acts give rise to **euphemisms**, which are words or phrases that replace the expressions to be avoided. Thus, *powder room* is a euphemism for *toilet*, which started as a euphemism for *lavatory*, which is now more acceptable than its replacement.

Just as the use of some words may indicate society's views toward sex, natural bodily functions, or religious beliefs, some words may also indicate racist, chauvinist, or sexist attitudes. Language is not intrinsically racist or sexist but reflects the views of various sectors of a society. However, the availability of offensive terms, and particular grammatical peculiarities such as the lack of a genderless third-person singular pronoun, may perpetuate and reinforce biased views and be demeaning and insulting to those addressed. Thus culture influences language, and, arguably, language may have an influence on the culture in which it is spoken.

The invention or construction of secret languages and language games like Pig Latin attest to human creativity with language and the unconscious knowledge that speakers have of the phonological, morphological, and semantic rules of their language.

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11

Language Change: The Syllables of Time

> No language as depending on arbitrary use and custom can ever be permanently the same, but will always be in a mutable and fluctuating state; and what is deem'd polite and elegant in one age, may be accounted uncouth and barbarous in another.
>
> **BENJAMIN MARTIN** (1704–1782)

All living languages change with time. It is fortunate that they do so rather slowly compared to the human life span. It would be inconvenient to have to relearn our native language every twenty years. Stargazers find a similar situation. Because of the movement of individual stars, the constellations are continuously changing their shape. Fifty thousand years from now we would hardly recognize Orion or the Big Dipper, but from season to season the changes are imperceptible. Linguistic change is also slow, in human—if not astronomical—terms. As years pass we hardly notice any change. Yet if we were to turn on a radio and miraculously receive a broadcast in our "native language" from the year 3000, we would probably think we had tuned into a foreign language station. Many language changes are revealed in written records. We know a great deal of the history of English because it has been a written language for about 1,000 years. Old English, spoken in England around the end of the first millennium, is scarcely recognizable as English. (Of course, our linguistic ancestors did not call their language Old English!) A speaker of Modern English would find the language unintelligible. There are college courses in which Old English is studied as a foreign language.

A line from *Beowulf* illustrates why Old English must be translated:[1]

[1]The letter þ is called *thorn* and is pronounced [θ] in this example.

Wolde guman findan þone þe him on sweofote sare geteode.
"He wanted to find the man who harmed him while he slept."

Approximately five hundred years after *Beowulf*, Chaucer wrote *The Canterbury Tales* in what is now called Middle English, spoken from around 1100 to 1500. It is more easily understood by present-day readers, as seen by reading the opening of the *Tales*:

Whan that Aprille with his shoures soote
The droght of March hath perced to the roote . . .
"When April with its sweet showers
The drought of March has pierced to the root . . ."

Two hundred years after Chaucer, in a language that is considered an earlier form of Modern English, Shakespeare's Hamlet says:

A man may fish with the worm that hath eat of a king, and eat of the fish that hath fed of that worm.

The stages of English are Old English (449–1100 C.E.), Middle English (1100–1500), and Modern English (1500–present). This division is somewhat arbitrary, being marked by important dates in English history, such as the Norman Conquest of 1066, the results of which profoundly influenced the English language.

The branch of linguistics that deals with how languages change, what kinds of changes occur, and why they occurred is called **historical and comparative linguistics**. It is "historical" because it deals with the history of particular languages; it is "comparative" because it deals with relations among languages.

Changes in a language are changes in the grammars and the lexicon of people who speak the language and are perpetuated as new generations of children acquire the altered language and make further changes. All parts of the grammar are subject to change over the course of time—the phonological, morphological, syntactic, and semantic components may be affected. Although most of the examples in this chapter are from English, the histories of all languages show similar effects. This is true of sign languages as well as spoken languages. Like all living languages, American Sign Language continues to change. Not only have new signs entered the language over the past two hundred years, but also the forms of the signs have changed in ways similar to spoken languages.

The Regularity of Sound Change

That's not a regular rule: you invented it just now.

LEWIS CARROLL, *Alice's Adventures in Wonderland*, 1865

The southern United States represents a major dialect area of American English. For example, words pronounced with the diphthong [aɪ] in non-Southern English will usually be pronounced with the monophthong [aː] in the South. Local radio and TV announcers at the 1996 Olympics in Atlanta called athletes to the [haː]

"high" jump, and local natives invited visitors to try Georgia's famous pecan [paː] "pie." The [aɪ]-[aː] correspondence of these two dialects is an example of a **regular sound correspondence**. When [aɪ] occurs in a word in non-Southern dialects, [aː] occurs in the Southern dialect, and *this is true for all such words*.

The different pronunciations of *I*, *my*, *high*, *pie*, and so on did not always exist in English. In this chapter we will discuss how such dialect differences arose and why the sound differences are usually regular and not confined to just a few words. We will also consider changes that occur in other parts of the grammar and in the lexicon.

Sound Correspondences

In Middle English a *mouse* [maʊs] was called a *mūs* [muːs], and this *mūs* may have lived in someone's *hūs* [huːs], as *house* [haʊs] was pronounced at that time. In general, Middle English speakers pronounced [uː] where we now pronounce [aʊ]. This is a regular correspondence like the one between [aɪ] and [aː]. Thus *out* [aʊt] was pronounced [uːt], *south* [saʊθ] was pronounced [suːθ], and so on. Many such regular correspondences show the relation of older and newer forms of English.

The regular sound correspondences we observe between older and modern forms of a language are the result of phonological changes that affect certain sounds, or classes of sounds, rather than individual words. Centuries ago English underwent a phonological change called a **sound shift** in which [uː] became [aʊ].

Phonological changes can also account for dialect differences. At an earlier stage of American English a sound shift of [aɪ] to [aː] took place among certain speakers in the southern region of the United States. The change did not spread beyond the South because the region was somewhat isolated. Many dialect differences in pronunciation result from sound shifts whose spread is limited.

Regional dialect differences may also arise when innovative changes occur everywhere but in a particular region. The regional dialect may be conservative relative to other dialects. The pronunciation of *it* as *hit*, found in the Appalachian region of the United States, was standard in older forms of English. The dropping of the [h] was the innovation.

Ancestral Protolanguages

Many modern languages developed from regional dialects that became widely spoken and highly differentiated, finally becoming separate languages. The Romance languages—French, Spanish, and so on—were once dialects of Latin spoken in the Roman Empire. There is nothing degenerate about regional pronunciations. They are the result of natural sound changes that occur wherever human language is spoken.

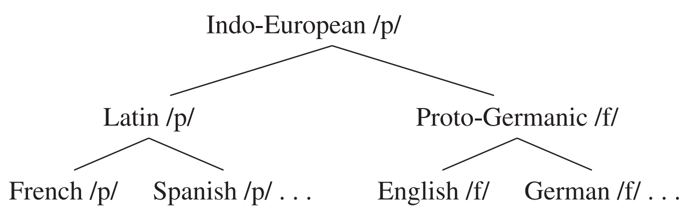
In a sense, the Romance languages are the offspring of Latin, their metaphorical parent. Because of their common ancestry, the Romance languages are **genetically related**. Early forms of English and German, too, were once dialects of a common ancestor called **Proto-Germanic**. A **protolanguage** is the ancestral language from which related languages have developed. Both Latin and Proto-Germanic were descendants of an older language called **Indo-European** or

Proto-Indo-European. Thus, Germanic languages such as English and German are genetically related to the Romance languages such as French and Spanish. All these national languages were once regional dialects.

How do we know that the Germanic and Romance languages have a common ancestor? One clue is the large number of sound correspondences. If you have studied a Romance language such as French or Spanish, you may have noticed that where an English word begins with *f*, the corresponding word in a Romance language often begins with *p*, as shown in the following examples:

English /f/	**French /p/**	**Spanish /p/**
Father	Père	Padre
Fish	Poisson	Pescado

This /f/-/p/ correspondence is another example of a regular sound correspondence. There are many such correspondences between the Germanic and Romance languages, and their prevalence cannot be explained by chance. What then accounts for them? A reasonable guess is that a common ancestor language used a *p* in words for *fish*, *father*, and so on. We posit a /p/ rather than an /f/ because more languages show a /p/ in these words. At some point speakers of this language separated into two groups that lost contact with each other. In one of the groups a sound change of *p* → *f* took place. The language spoken by this group eventually became the ancestor of the Germanic languages. This ancient sound change left its trace in the *f*-*p* sound correspondence that we observe today, as illustrated in the diagram.



Phonological Change

Etymologists . . . for whom vowels did not matter and who cared not a jot for consonants.

VOLTAIRE (1694–1778)

Regular sound correspondences illustrate changes in the phonological system of a language. In earlier chapters we discussed speakers' knowledge of phonology, including knowledge of the phonemes and phonological rules of the language. Either of these aspects of the phonology is subject to change.

The velar fricative /x/ is no longer part of the phonemic inventory of most Modern English dialects. Night used to be pronounced [nɪxt] and drought was pronounced [druxt]. This phonological change—the loss of /x/—took place between the times of Chaucer and Shakespeare. All words that were once pronounced with an /x/ no longer include this sound. In some cases it disappeared altogether, as in *night* and *light*. In other cases the /x/ became a /k/, as in *elk* (Old

English *eolh* [ɛɔlx]). In yet other cases it disappeared to be replaced by a vowel, as in *hollow* (Old English *holh* [hɔlx]). Dialects of Modern English spoken in Scotland have retained the /x/ sound in some words, such as *loch* [lɔx] meaning "lake."

These examples show that changes in the inventory of sounds in a language can occur through the loss of phonemes. The inventory can also change through the addition of phonemes. Old English did not have the phoneme /ʒ/ of *leisure* [liʒər]. Through a process of palatalization—a change in place of articulation to the palatal region—certain occurrences of /z/ were pronounced [ʒ]. Eventually the [ʒ] sound became a phoneme in its own right, reinforced by the fact that it occurs in French words familiar to many English speakers such as *azure* [æʒər].

An allophone of a phoneme may, through sound change, become a separate phoneme, thus adding to the phonemic inventory. Old English lacked a /v/ phoneme. The phoneme /f/, however, had the allophone [v] when it occurred between vowels. Thus *ofer* /ofer/ meaning "over" was pronounced [ɔvər]. Old English also had a long consonant phoneme /fː/ that contrasted with /f/ between vowels. The name *Offa* /ofːa/ was pronounced [ɔfːa]. A sound change occurred in which the pronunciation of /fː/ was simplified to [f]. Now /fː/ was pronounced [f] between vowels so it contrasted with [v]. This made it possible for English to have minimal pairs involving [f] and [v] such as *feel* and *veal*. Speakers therefore perceived the two sounds as separate phonemes, in effect creating a new phoneme /v/.

Similar changes occur in the history of all languages. Neither /tʃ/ nor /ʃ/ were phonemes of Latin, but /tʃ/ is a phoneme of modern Italian and /ʃ/ a phoneme of modern French, both of which descended from Latin. In American Sign Language many signs that were originally formed at the waist or chest level are now produced at a higher level near the neck or upper chest, a reflection of changes in the "phonology."

Phonological Rules

An interaction of phonological rules may result in changes in the lexicon. The nouns *house* and *bath* were once differentiated from the verbs *house* and *bathe* by the fact that the verbs ended with a short vowel sound. Furthermore, the same rule that realized /f/ as [v] between vowels also realized /s/ and /θ/ as the allophones [z] and [ð] between vowels. This general rule added voicing to intervocalic fricatives. Thus the /s/ in the verb *house* was pronounced [z], and the /θ/ in the verb *bathe* was pronounced [ð].

Later, a rule was added to the grammar of English deleting unstressed short vowels at the end of words (even though the final vowel still appears in the written words). A contrast between the voiced and voiceless fricatives resulted, and the new phonemes /z/ and /ð/ were added to the phonemic inventory. The verbs *house* [haʊz] and *bathe* [beð] were now represented in the mental lexicon with final voiced consonants.

Eventually, both the unstressed vowel deletion rule and the intervocalic-voicing rule were lost from the grammar of English. The set of phonological rules can change both by addition and loss of rules.

Changes in phonological rules can, and often do, result in dialect differences. In the previous chapter we discussed the addition of an *r*-dropping rule in English (/r/ is not pronounced unless followed by a vowel) that did not spread throughout the language. Today, we see the effect of that rule in the *r*-less pronunciation of British English and of American English dialects spoken in the northeastern and the southern United States.

From the standpoint of the language as a whole, phonological changes occur gradually over the course of many generations of speakers, although any given speaker's grammar may or may not reflect the change. The changes are not planned any more than we are presently planning what changes will take place in English by the year 2300. In a single generation changes are evident only through dialect differences.

The Great Vowel Shift

Between 1400 and 1600 a major change took place in English that resulted in new phonemic representations of words and morphemes. This phonological restructuring is known as the **Great Vowel Shift**. The seven long, or tense, vowels of Middle English underwent the following change:

Shift			**Example**			
Middle English		**Modern English**	**Middle English**		**Modern English**	
[iː]	→	[aɪ]	[miːs]	→	[maɪs]	mice
[uː]	→	[aʊ]	[muːs]	→	[maʊs]	mouse
[eː]	→	[iː]	[geːs]	→	[giːs]	geese
[oː]	→	[uː]	[goːs]	→	[guːs]	goose
[ɛː]	→	[eː]	[brɛːken]	→	[breːk]	break
[ɔː]	→	[oː]	[brɔːken]	→	[broːk]	broke
[aː]	→	[eː]	[naːmə]	→	[neːm]	name

By diagramming the Great Vowel Shift on a vowel chart (Figure 11.1), we can see that the high vowels [iː] and [uː] became the diphthongs [aɪ] and [aʊ], while

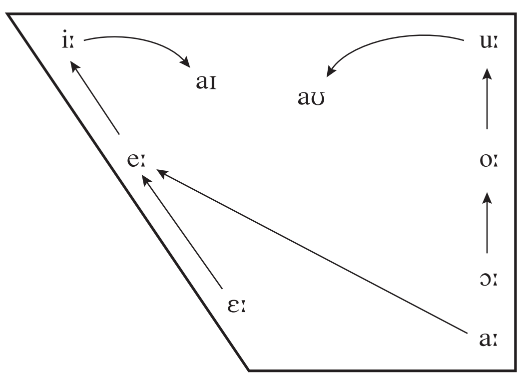


FIGURE 11.1 | The Great Vowel Shift.

TABLE 11.1 | Effect of Vowel Shift on Modern English

Middle English Vowel	Shifted Vowel	Short Vowel	Word with Shifted Vowel	Word with Short Vowel
ī	aɪ	ɪ	divine	divinity
ū	aʊ	ʌ	abound	abundant
ē	i	ɛ	serene	serenity
ō	u	a	fool	folly
ā	e	æ	sane	sanity

the long vowels underwent an increase in tongue height, as if to fill in the space vacated by the high vowels. In addition, [aː] was fronted to become [eː].

These changes are among the most dramatic examples of regular sound shift. The phonemic representation of many thousands of words changed. Today, some reflection of this vowel shift is seen in the alternating forms of morphemes in English: *please—pleasant*; *serene—serenity*; *sane—sanity*; *crime—criminal*; *sign—signal*; and so on. Before the Great Vowel Shift, the vowels in each pair were pronounced the same. Then the vowels in the second word of each pair were shortened by the **Early Middle English Vowel Shortening** rule. As a result, the Great Vowel Shift, which occurred later and applied only to long vowels, affected only the first word in each pair. This is why the vowels in the morphologically related words are pronounced differently today, as shown in Table 11.1.

The Great Vowel Shift is a primary source of many spelling inconsistencies of English because our spelling system still reflects the way words were pronounced before it occurred. In general, the written language is more conservative, that is, slower to change, than the spoken language.

Morphological Change

And is he well content his son should find
No nourishment to feed his growing mind,
But conjugated verbs and nouns declin'd?

WILLIAM COWPER, "Tirocinium," 1785

Like phonological rules, rules of morphology may be lost, added, or changed. We can observe some of these changes by comparing older and newer forms of the language or by looking at different dialects.

Extensive changes in morphology have occurred in the history of the Indo-European languages. Latin had **case endings**, suffixes on the noun based on its thematic role or its grammatical relationship to the verb. These are no longer found in the Romance languages. (See chapter 5 for a more extensive discussion of thematic roles; the terms used by historical linguists are somewhat different than those used by modern semanticists.) The following is a **declension**, or list of cases, for the Latin noun *lupus*, "wolf":

Noun	**Noun Stem**		**Case Ending**	**Case**	**Example**
lupus	lup	+	us	nominative	The *wolf* runs.
lupī	lup	+	ī	genitive	A sheep in *wolf's* clothing.
lupō	lup	+	ō	dative	Give food to *the wolf*.
lupum	lup	+	um	accusative	I love *the wolf*.
lupō	lup	+	ō	ablative	She walked with *the wolf*.
lupe	lup	+	e	vocative	*Wolf*, come here!

In *Alice's Adventures in Wonderland*, Lewis Carroll has Alice give us a brief lesson in grammatical case. Alice has become very small and is swimming around in a pool of her own tears with a mouse that she wishes to befriend:

> "Would it be of any use, now," thought Alice, "to speak to this mouse? Everything is so out-of-the-way down here, that I should think very likely it can talk: at any rate, there's no harm in trying." So she began: "O Mouse, do you know the way out of this pool? I am very tired of swimming about here, O Mouse!" (Alice thought this must be the right way of speaking to a mouse: she had never done such a thing before, but she remembered having seen in her brother's Latin Grammar, "A mouse-of a mouse-to a mouse-a mouse-O mouse!")

Alice gives the English corresponding to the nominative, genitive, dative, accusative, and vocative cases, which existed in Latin and in Old English but not in Modern English, where word order and prepositions convey the same information.

Ancient Greek and Sanskrit also had extensive case systems expressed through noun suffixing, as did Old English, as illustrated by the following noun forms:

Case	**OE Singular**		**OE Plural**	
nominative	stān	"stone"	stānas	"stones"
genitive	stānes	"stone's"	stāna	"stones'"
dative	stāne	"stone"	stānum	"stones"
accusative	stān	"stone"	stānas	"stones"

Lithuanian and Russian retain much of the early Indo-European case system, but it is all but obliterated in most modern Indo-European languages. In English, phonological changes over the centuries resulted in the loss of many case endings.

English retains the genitive case, which is written with an apostrophe *s*, as in *Robert's dog*, but that's all that remains as far as nouns are concerned. Pronouns retain a few more case distinctions: *he/she* are nominative, *him/her* accusative and dative, and *his/hers* genitive.

English has replaced its depleted case system with an equally expressive system of prepositions. For example, what would be the dative case is often indicated by the preposition *to*, the genitive case by the preposition *of*, and the accusative case by no preposition together with the word order V—NP in d-structure.

English and most of the Indo-European languages have undergone extensive morphological changes over the past 1,000 years, many of them induced by changes that took place in the phonological rules of the language.

Syntactic Change

> Understanding changes in grammar is a key component in understanding changes in language.
>
> **DAVID LIGHTFOOT,** *The Development of Language*, 1999

When we see a word-for-word translation of older forms of English, we are most struck by the differences in word order. Consider again the opening lines of *The Canterbury Tales*, this time translated word-for-word:

When that Aprille with his shoures soote
"When that April with its showers sweet"
The droght of March hath perced to the roote . . .
"The drought of March has pierced to the root . . ."

In modern English, adjectives generally precede the nouns they modify, thus we would say *sweet showers* in place of *showers sweet*. Moreover, direct objects now generally follow their verb, so *has pierced the drought of March to the root* would be a modern rendering of the second line.

However, there are some exceptions to the Adj-Noun order in Modern English; examples such as the following:

a man alone	*an alone man	a lone man
no man alive	*no alive man	no live man
a lion asleep	*an asleep lion	a sleeping lion
the passengers aboard	*the aboard passengers	the boarded passengers

The adjectives that must occur following the noun all begin with *a*-. According to the UCLA linguist Ed Keenan, these *a*- adjectives originated as prepositional phrases in Old English:

on + weg → away   on + slep → asleep   on + life → alive

The preposition *on* weakened to a prefix *a*- in these cases, but the original position of the PP, which followed the Noun in OE (and also in Modern English), was preserved. In some cases, the PP still exists alongside the derived adjective, for example, *on board/aboard* and *on fire/afire*.

These exceptions aside, it is safe to say that syntactic change in English and other languages is most evident in the changes of permitted word orders.

Syntactic change in English is a good illustration of the interrelationship of the various modules of the grammar. Changes in syntax were often influenced by changes in morphology, and these in turn by changes in the phonology of the language.

When the rich system of case-endings of Old English became simplified in part because of phonological changes, speakers of English were forced to rely more heavily on word order to convey the function of noun phrases. A sentence such as

sē	man	þone	kyning	sloh
the (nominative)	man	the (accusative)	king	slew

was understood to mean "the man slew the king" because of the case markings (given in parentheses). There would have been no confusion on the listeners' part as to who did what to whom. Also, in earlier stages of English the verb had a richer system of subject-verb agreement. For example, the verb *to sing* had the following forms: *singe* (I sing), *singest* (you sing), *singeth* (he sings), and *singen* (we, plural you, they sing). It was therefore also possible in many cases to identify the subject on the basis of verb inflection. In Modern English the only marker of agreement is the third person singular *-s* in *He sings*.

Thus, in Modern English *the man the king slew* is only grammatical as a relative clause meaning "the man that the king slew," with the subject and object of *slew* reversed. To convey the meaning "the man slew the king," Modern English speakers must rely on word order—subject-verb-object—or other syntactic devices such as the ones that generate sentences like *It was the king that the man slew*.

The change in English word order reflects a change in the rules of grammar. In Old English the VP was head final, as indicated by the following PS rule:

VP → NP V

The Old English phrase structure was like the phrase structure of Dutch and German, closely related languages. The English VP (but not German and Dutch) underwent a change in parameter setting and became head initial as follows:

VP → V NP

As a result Modern English has SVO word order whereas Old English (and modern Dutch and German) have a basic SOV word order. However, Modern English still has remnants of the original SOV word order in "old-fashioned" kinds of expressions such as *I thee wed*. In short, as morphological distinctions vanished over the centuries, word order became stricter.

As discussed in chapter 4, in today's English we form questions by moving an auxiliary verb, if there is one, before the NP subject:

Can the girl kiss the boy?
Will the girl kiss the boy?
Has the girl kissed the boy yet?
Was the girl kissing the boy when you arrived?

However, if an auxiliary verb is absent, modern English requires the word *do* to spell out the tense of the sentence:

Does the girl kiss the boy often?
*Kisses the girl the boy often?

Older forms of English had a more general rule that moved the first verbal element, which meant that if no auxiliary occurred in the sentence, then the main verb moved. The question

Kisses the girl the boy often?

was grammatical in English through the time of Shakespeare. This more general verb movement rule still exists in languages like Dutch and German. In English the rule of question formation changed, so that now only auxiliary verbs move and if no auxiliary verb is present, a *do* fills its role. This rule change was motivated in part by the fact that in Old English, *the girl* and *the boy* would have been marked for case, so there was no possibility of misunderstanding who was kissing whom. In effect, the sentence would be:

Kisses the (nominative) girl the (accusative) boy often?

Modern English, with its rudimentary case system, defines grammatical relations structurally: the direct object is the NP that is sister to the verb. If the main verb were to move, this sisterhood configuration would be violated. The introduction of *do* allows the verb to remain in its base position, and the sentence thus retains the SVO word order that most plainly indicates the subject and object of the sentence. Another syntactic change in English affected the rules of comparative and superlative constructions. Today we form the comparative by adding *-er* to the adjective or by inserting *more* before it; the superlative is formed by adding *-est* or by inserting *most*. In Malory's *Tales of King Arthur*, written in 1470, double comparatives and double superlatives occur, which today are ungrammatical: *more gladder*, *more lower*, *moost royallest*, *moost shamefullest*.

Both Old English and Middle English permitted *split genitives*, that is, possessive constructs in which the words that describe the possessor occur on both sides of the head noun:

Inwæres	broþur	ond	Healfdenes (Old English)
Inwær's	brother	and	Healfden's

"Inwær's and Healfden's brother"

The Wife's tale of Bath (Middle English)
"The Wife of Bath's tale"

Modern English does not allow such structures, but it does permit rather complex genitive expressions to precede the head noun:

The man with the two small children's hat
The girl whose sister I'm dating's roommate
When does you guys's party begin? (Cf. When does your (pl.) party begin?)

When we study a language solely from written records, which is necessarily the case with languages such as Old or Middle English, we see only sentences that are grammatical unless ungrammatical sentences are used deliberately, perhaps as lines for a buffoon character in a play. Without native speakers to query, we can only infer what was ungrammatical. Such inference leads us to believe that expressions like *the Queen of England's crown* were ungrammatical in earlier periods of English. The title *The Wife's Tale of Bath* (rather than *The Wife of Bath's Tale*) in *The Canterbury Tales* supports this inference.

Once again it was the loss of case endings that resulted in this syntactic change. As the case system weakened, there was insufficient noun morphology to carry the semantic burden of expressing possession. Over the centuries the use of *'s* replaced the defunct genitive case, and in so doing generalized to syntactic units larger than merely the noun. The word order allowed in possessive constructs became more fixed and split genitives are now ungrammatical.

The big picture is that the loss of information that accompanies morphological simplification can be compensated for by more rigid rules of word order. Such syntactic changes may take centuries to be completed, and there are often intermediate stages.

Modern Brazilian Portuguese (BP) may illustrate one such intermediate stage of language change. Until the middle of the nineteenth century, speakers of BP didn't need to explicitly mention a subject pronoun because that information came from the person and number agreement on the verb, as illustrated for the verb *cozinhar* meaning "to cook."

cozinho	I cook	cozinhamos	we cook
cozinhas	you cook		
cozinha	he/she cooks	cozinham	they/you (pl.) cook

At that time speakers dropped subjects in about 80 percent of their sentences, as in the second sentence of the following example:

A	Clara	sabe	fazer	tudo	muito	bem.
the	Clara	knows how	to do	everything	very	well

Cozinha	que	é	uma	maravilha.
cooks (3rd per.)	that	is	a	marvel

"Clara knows how to do everything well. She cooks wonderfully."

By the end of the twentieth century, subject-drop was reduced to 20 percent and the agreement endings were also reduced. In certain dialects only a two-way distinction is maintained: first-person singular is marked with *-o*, as in *cozinho*, and all other grammatical persons are marked with *-a*. While sentences without subjects are still grammatical in European Portuguese (spoken in Portugal), they are ungrammatical for most speakers of Modern BP, which requires the expression of an overt subject, for example *ela* "she" as follows:

A Clara sabe fazer tudo muito bem. Ela cozinha que é uma maravilha.

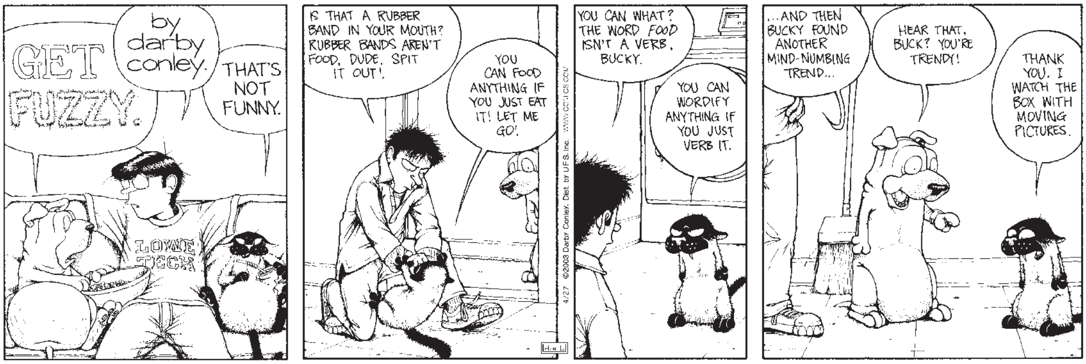
Many of the other Romance languages, including Italian, Spanish, Catalan, and European Portuguese, are still null-subject languages and maintain a rich verb morphology as illustrated for Italian in chapter 3. In the future null subjects may become ungrammatical for all speakers in BP. If so, BP will follow the route of another Romance language, French, which evolved from a richly inflected null-subject language in the thirteenth century to a language that now requires subject pronouns and that in its spoken form also has a very impoverished verb morphology.

Just as the loss of Old English noun and verb morphology resulted in stricter word order in Modern English, so the loss of agreement morphology in Brazilian Portuguese, and earlier in French, gave rise to a syntactic change from a null-subject grammar to one that requires subjects. In this respect Brazilian Portuguese is diverging from the other Romance languages, as French did in earlier times.

Lexical Change

Changes in the lexicon also occur, among which are changes in the lexical categories of words (i.e., their "parts of speech"), addition of new words, the "borrowing" of words from another language, the loss of words, and the shift in the meaning of words over time.

Change in Category



"Get Fuzzy" © Darby Conley/Dist. by United Feature Syndicate, Inc.

The words *food* and *verb* are ordinarily used as nouns, but Bucky the cat refuses to be so restricted and "wordifies" them into verbs. If we speakers of English adopt Bucky's usage, then *food* and *verb* will become verbs in addition to nouns. Recently, a radio announcer said that Congress was "to-ing and fro-ing" on a certain issue, to mean "wavering." This strange compound verb is derived from the adverb *to and fro*. In British English, *hoover* is a verb meaning "to vacuum up," derived from the proper noun *Hoover*, the name of a vacuum cleaner manufacturer. American police *Mirandize* arrested persons, meaning to read them their rights according to the Miranda rule. The judicial ruling was made in 1966, so we have a complete history of how a proper name became a verb. More recently the noun *text* has been "verbed" and means "to communicate by text message," and even more recent is the hijacking of the verb *twitter* as the name of a social networking and micro-blogging service.

Addition of New Words

> And to bring in a new word by the head and shoulders, they leave out the old one.
>
> **MONTAIGNE** (1533–1592)

One of the most obvious ways a language changes is through the addition of new words. Unlike grammatical change, which may take generations to notice, new words are readily apparent. Societies often require new words to describe changes in technology, sports, entertainment, and so on. Languages are accommodating and inventive in meeting these needs.

In chapter 3 we discussed some ways in which new words are born, such as through derivational processes, back-formations, and compounding. There are other ways that words may enter the vocabulary of a language, thus adding to the inventory of lexical items. These include out-and-out word coinage, deriving words from names, blending words to form new words, shortening old words to form new ones, forming acronyms, and borrowing words from other languages.

Word Coinage

Words may be created outright to fit some purpose. The advertising industry has added many words to English, such *as Kodak*, *nylon*, *Orlon*, and *Dacron*. Specific brand names such as *Xerox*, *Band-Aid*, *Kleenex*, *Jell-O*, *Brillo*, and *Vaseline* are now sometimes used as the generic name for different brands of these types of products. Some of these words were actually created from existing words (e.g., *Kleenex* from the word *clean* and *Jell-O* from *gel*).

The sciences have given us a raft of newly coined words over the ages. Words like *asteroid*, *neutron*, *genome*, *krypton*, *brontosaurus*, and *vaccine* were created to describe the objects or processes arising from scientific investigation.

A word so new that its spelling is still in doubt is *dot-com*, also seen in magazines as *.com*, *dot.com*, and even *dot com* without the hyphen. It means "a company whose primary business centers on the Internet." *Bling* (or *bling-bling*), meaning "gaudy jewelry," was a possible but nonexistent word like *blick* until a few years ago, and unless you have a recently published dictionary or use an online dictionary, you won't find an entry for *bling*. (Indeed, the word processor on which we are typing your book tells us that *bling* is a misspelling by underlining it in red.) Also new to this millennium are *Bollywood*, "the film industry of India," and *sudoku*, a "certain kind of puzzle." Sometimes words originally coined for one purpose, such as the company name *Google*, are put to work to serve a related purpose, such as *google*, meaning "to search on the Internet."

Greek roots borrowed into English have also provided a means for coining new words. *Thermos* "hot" plus *metron* "measure" gave us *thermometer*. From *akros* "topmost" and *phobia* "fear," we get *acrophobia*, "dread of heights." To avoid going out on Friday the thirteenth, you may say that you have *triskaidekaphobia*, a profound fear of the number 13. An ingenious cartoonist, Robert Osborn, has "invented" some phobias, to each of which he gives an appropriate name:[2]

logizomechanophobia	"fear of reckoning machines" from Greek *logizomai* "to reckon or compute" + *mekhane* "device" + *phobia*
ellipsosyllabophobia	"fear of words with a missing syllable" from Greek *elleipsis* "a falling short" + *syllabē* "syllable" + *phobia*
pornophobia	"fear of prostitutes" from Greek *porne* "harlot" + *phobia*

[2]From *An Osborn Festival of Phobias* by Robert Osborn and Eve Wengler. Copyright © 1971 Robert Osborn. Text copyright © 1971 Eve Wengler. Used by permission of Liveright Publishing Corporation.

Without a doubt the phobic TV detective Adrian Monk has, had, or will have all of these phobias in one episode or another.

Latin, like Greek, has also provided prefixes and suffixes that are used productively with both native and nonnative roots. The prefix *ex-* comes from Latin:

ex-husband   ex-wife   ex-sister-in-law   ex-teacher

The suffix *-able/-ible* is also Latin and can be attached to almost any English verb:

writable   readable   answerable   movable   learnable

Even new bound morphemes may enter the language. The prefix *e-*, as in *e-commerce*, *e-mail*, and *e-trade*, meaning "electronic," is barely two decades old, and most interestingly has given rise to the prefix *s-* as in *s-mail* to contrast with *e-mail*. The suffix *-gate*, meaning "scandal," which was derived from the Watergate scandal of the 1970s, may now be suffixed to a word to convey that meaning. Thus *Irangate* means a scandal involving Iran, and *Dianagate*, a British usage, refers to a scandal involving wiretapped conversations of the late Princess of Wales, Diana. A change currently under way is the use of *-peat* to mean "win a championship so many years in succession," as in *threepeat* and *fourpeat*, which we have observed in the newspaper.

Also so new that it hasn't made the dictionaries are words that take *-zilla* as a bound suffix with the meaning "huge or extreme," as in *shopzilla*, *bridezilla*, and the British band *Dogzilla*, with its source being the world-famous Japanese movie monster *Godzilla*. The bound prefix *uber-* of German origin meaning "the best" or "the most" allows myriad new words to be formed by "supersizing" old ones, as in *linguistics is uber-cool*, or *the jokes in this book are uber-lame*.

Words from Names

Eponyms are words that are coined from proper names and are another of the many creative ways that the vocabulary of a language expands. Here are some examples:

sandwich	Named for the fourth Earl of Sandwich, who put his food between two slices of bread so that he could eat while he gambled.
robot	After the mechanical creatures in the Czech writer Karel Capek's play *R.U.R.*, the initials standing for "Rossum's Universal Robots."
gargantuan	Named for Gargantua, the creature with a huge appetite created by Rabelais.
jumbo	After an elephant brought to the United States by P. T. Barnum. ("Jumbo olives" need not be as big as an elephant, however.)

We admit to ignorance of the Susan, an unknown servant from whom the compound *lazy susan* is derived; or the Betty or Charlotte or Chuck from whom we got *brown betty*, *charlotte russe*, or *chuck wagon*. We can point out, however, that *denim* was named for the material used for overalls and carpeting, which originally was imported *de Nîmes* ("from Nîmes") in France, and *argyle* from the kind of socks worn by the chiefs of Argyll of the Campbell clan in Scotland.

The word *paparazzo*, "a freelance photographer who doggedly pursues celebrities," was a little-known word until the death of Princess Diana in 1997, who was hounded by paparazzi (plural) before her fatal automobile accident. This eponym comes from the news photographer character Signor Paparazzo in the motion picture *La Dolce Vita*.

Blends

Blends are similar to compounds in that they are produced by combining two words, but parts of the words that are combined are deleted. *Smog*, from *smoke* + *fog*; *brunch*, from *breakfast* and *lunch*; *motel*, from *motor* + *hotel*; *infomercial*, from *info* + *commercial*; and *urinalysis*, from *urine* + *analysis* are examples of blends that have attained full lexical status in English. *Podcast* (*podcasting*, *podcaster*) is a relatively new word meaning "Internet audio broadcast" and recently joined the English language as a blend of *iPod* and *broadcast*. Lewis Carroll's *chortle*, from *chuckle* + *snort*, has achieved limited acceptance in English. Carroll is famous for both coining and blending words. In *Through the Looking-Glass*, he describes the "meanings" of the made-up words in "Jabberwocky" as follows:

> . . . "Brillig" means four o' clock in the afternoon—the time when you begin broiling things for dinner . . . "Slithy" means "lithe and slimy" . . . You see it's like a portmanteau—there are two meanings packed up into one word. . . . "Toves" are something like badgers—they're something like lizards—and they're something like corkscrews . . . also they make their nests under sun-dials—also they live on cheese. . . . To "gyre" is to go round and round like a gyroscope. To "gimble" is to make holes like a gimlet. And "the wabe" is the grass-plot round a sun-dial . . . It's called "wabe" . . . because it goes a long way before it and a long way behind it. . . . "Mimsy" is "flimsy and miserable" (there's another portmanteau . . . for you).

Carroll's "portmanteaus" are what we have called blends, and such words can become part of the regular lexicon.

Blending is even done by children. The blend *crocogator* from crocodile + alligator is attributed to three-year-old Elijah Peregrine. Grandmothers are not to be left out, and a Jewish one of African descent that we know came up with *shugeleh*, "darling," which we think is a blend of *sugar* + *bubeleh*, and which we confess we don't know how to spell. (*Bubeleh* is a Yiddish term of endearment.) And we recently heard the expression *the* [jʊd] (compare *the 'hood*), which we do not know how to spell (*the yud*, *the yood*?), and was applied to a neighborhood with many speakers of Yiddish, perhaps a blend of *Yiddish* and *neighborhood*. Finally, the social network Twitter has given us the new blend *twitterific*.

Reduced Words

Speakers tend to abbreviate words in various ways to shorten the messages they convey. We used to find this in telegrams and telexes. Now it is seen dramatically in the creativity used on messages typed into cell phones in text messaging and similar communication technologies. However, we will concern ourselves with *spoken* language and observe three reduction phenomena: *clipping*, *acronyms*, and *alphabetic abbreviations*.

Clipping is the abbreviation of longer words into shorter ones, such as *fax* for *facsimile*, the British word *telly* for *television*, *prof* for *professor*, *piano* for *pianoforte*, and *gym* for *gymnasium*. Once considered slang, these words have now become lexicalized, that is, full words in their own right. These are only a few examples of such clipped forms that are now used as whole words. Other examples are *ad*, *bike*, *math*, *gas*, *phone*, *bus*, and *van* (from *advertisement*, *bicycle*, *mathematics*, *gasoline*, *telephone*, *omnibus*, and *caravan*). More recently, *dis* and *rad* (from *disrespect* and *radical*) have entered the language, and *dis* has come to be used as a verb meaning "to show disrespect."

Acronyms are words derived from the initials of several words. Such words are pronounced as the spelling indicates: *NASA* [næsə] from *N*ational *A*eronautics and *S*pace *A*dministration, *UNESCO* [yunɛsko] from *U*nited *N*ations *E*ducational, *S*cientific, and *C*ultural *O*rganization, and *UNICEF* [yunisɛf] from *U*nited *N*ations *I*nternational *C*hildren's *E*mergency *F*und. *Radar* from "*ra*dio *d*etecting *a*nd *r*anging," *laser* from "*l*ight *a*mplification by *s*timulated *e*mission of *r*adiation," *scuba* from "*s*elf-*c*ontained *u*nderwater *b*reathing *a*pparatus," and *RAM* from "*r*andom *a*ccess *m*emory" show the creative efforts of word coiners, as does *snafu*, which was coined by soldiers in World War II and is rendered in polite circles as "*s*ituation *n*ormal, *a*ll *f*ouled *u*p." Recently coined additions are *AIDS* (1980s), from the initials of *a*cquired *i*mmune *d*eficiency *s*yndrome, and *SARS* (2000s), from *s*evere *a*cute *r*espiratory *s*yndrome.

When the string of letters is not easily pronounced as a word, the "acronym" is produced by sounding out each letter, as in *NFL* [ɛ̃nɛfɛl] for *N*ational *F*ootball *L*eague, *UCLA* [yusiɛle] for *U*niversity of *C*alifornia, *L*os *A*ngeles, and *MRI* [ɛ̃maraɪ] for *m*agnetic *r*esonance *i*maging. These special kinds of acronyms are sometimes called **alphabetic abbreviations**.

Acronyms and alphabetic abbreviations are being added to the vocabulary daily with the proliferation of computers and widespread use of the Internet, including *blog* (we*b log*), *jpeg* (*j*oint *p*hotographics *e*xpert *g*roup), *GUI*, pronounced "gooey," for *g*raphical *u*ser *i*nterface, *PDA* (*p*ersonal *d*igital *a*ssistant), and *MP3* for *MP*EG layer *3*, where *MPEG* itself is the acronym for *m*oving *p*icture *e*xperts *g*roup.

Unbelievable though it may seem, acronyms in use somewhere in the English-speaking world number into the tens of thousands if not hundreds of thousands, a dramatic nod to the creativity and changeability of human language.

Borrowings or Loan Words

> Neither a borrower, nor a lender be.
>
> **WILLIAM SHAKESPEARE,** *Hamlet*, c. 1600

Languages pay little attention to Polonius's admonition quoted above, and many are avid borrowers and lenders. **Borrowing** words from other languages is an important source of new words, which are called **loan words**. Borrowing occurs when one language adds a word or morpheme from another language to its own lexicon. This often happens in situations of language contact, when speakers of different languages regularly interact with one another, and especially where there are many bilingual or multilingual speakers.

The pronunciation of loan words is often (but not always) altered to fit the phonological rules of the borrowing language. For example, English borrowed *ensemble* [ãsãbəl] from French but pronounce it [ãnsãmbəl], with [n] and [m] inserted, because English doesn't ordinarily have syllables centered on nasal vowels alone. Other borrowed words such as the composer's name *Bach* will often be pronounced as the original German [bax], with a final velar fricative, even though such a pronunciation does not conform to the rules of English.

Larger units than words may be borrowed. French provides us with *ménage à trois* [mẽnaʒ a tʀa], where [ʀ] is a uvular trill, meaning a "three-way romance," and which is pronounced in the French way by those who know French, but is also anglicized in various ways such as [mẽnadʒ a twa].

When an expression is borrowed and then translated into the borrowing language, such as *worldview* from German *Weltanschauung*, it is called a **loan translation**. *It goes without saying* from French *il va sans dire* is a loan translation from French. On the other hand, Spanish speakers eat *perros calientes*, a loan translation of *hot dogs* with an adjustment reversing the order of the adjective and noun, as required by the rules of Spanish syntax.

The lexicons of most languages can be divided into native words and loan words. A native word is one whose history or **etymology** can be traced back to the earliest known stages of the language.

A language may borrow a word directly or indirectly. A direct borrowing means that the borrowed item is a native word in the language from which it is borrowed. For example, *feast* was borrowed directly from French, along with a host of terms as a result of the Norman conquest. By contrast, the word *algebra* was borrowed from Spanish, which in turn had borrowed it from Arabic. Thus *algebra* was indirectly borrowed from Arabic, with Spanish as an intermediary. Some languages are heavy borrowers. Albanian has borrowed so heavily that few native words are retained. On the other hand, most Native American languages borrowed little from their neighbors.

English has borrowed extensively. Of the 20,000 or so words in common use, about three-fifths are borrowed. But of the 500 most frequently used words, only two-sevenths are borrowed, and because these words are used repeatedly in sentences—they are mostly function words—the actual frequency of appearance of native words is about 80 percent. The frequently used function words *and*, *be*, *have*, *it*, *of*, *the*, *to*, *will*, *you*, *on*, *that*, and *is* are all native to English.

Language may borrow not only words and phrases but other linguistic units as well. We saw earlier how English in effect borrowed the phonemes /v/ and /ʒ/ from French. The bound morpheme suffixes *ible/able* were also borrowed from French, arriving in English by hitchhiking on French words such as *incredible* but soon attaching themselves to native words such as *drinkable*.

History through Loan Words

A morsel of genuine history is a thing so rare as to be always valuable.

THOMAS JEFFERSON, in a letter to John Adams, 1817

We may trace the history of the English-speaking peoples by studying the kinds of loan words in their language, their source, and when they were borrowed. Until the Norman Conquest in 1066, the Angles, the Saxons, and the Jutes inhabited England. They were of Germanic origin when they came to Britain in the fifth century to eventually become the English. Originally, they spoke Germanic dialects, from which Old English developed. These dialects contained some Latin borrowings but few foreign elements beyond that. These Germanic tribes had displaced the earlier Celtic inhabitants, whose influence on Old English was confined to a few Celtic place names. (The modern languages Welsh, Irish, and Scots Gaelic are descended from the Celtic dialects.)

The Normans spoke French, and for three centuries after the Conquest, French was used for all affairs of state and for most commercial, social, and cultural matters. The West Saxon literary language was abandoned, but regional varieties of English continued to be used in homes, churches, and the marketplace. This was a situation of language contact between French, the culturally dominant language at the time, and English. During these three centuries, vast numbers of French words entered English, of which the following are representative:

government	crown	prince	estate	parliament
nation	jury	judge	crime	sue
attorney	saint	miracle	charity	court
lechery	virgin	value	pray	mercy
religion	chapel	royal	money	society

Until the Normans came, when an Englishman slaughtered an ox for food, he ate *ox*. If it was a pig, he ate *pig*. If it was a sheep, he ate *sheep*. However, "ox" served at the Norman tables was *beef* (*boeuf*), "pig" was *pork* (*porc*), and "sheep" was *mutton* (*mouton*). These words were borrowed from French into English, as were the food-preparation words *boil*, *fry*, *stew*, and *roast*. Over the years French foods have given English a flood of borrowed words for menu preparers:

aspic	bisque	bouillon	brie	brioche
canapé	caviar	consommé	coq au vin	coupe
crêpe	croissant	croquette	crouton	escargot
fondue	mousse	pâté	quiche	ragout

English borrowed many "learned" words from foreign sources during the Renaissance. In 1475 William Caxton introduced the printing press in England. By 1640, 55,000 books had been printed in English. The authors of these books used many Greek and Latin words, which consequently entered the language.

From Greek came *drama*, *comedy*, *tragedy*, *scene*, *botany*, *physics*, *zoology*, and *atomic*. Latin loan words in English are numerous. They include:

bonus scientific exit alumnus quorum describe

During the ninth and tenth centuries, Scandinavian raiders, who eventually settled in the British Isles, left their traces in the English language. The pronouns *they*, *their*, and *them* are loan words from Old Norse, the predecessor of modern Danish, Norwegian, and Swedish. This period is the only time that English ever borrowed pronouns.

Bin, *flannel*, *clan*, *slogan*, and *whisky* are all words of Celtic origin, borrowed at various times from Welsh, Scots Gaelic, or Irish. Dutch was a source of borrowed words, too, many of which are related to shipping: *buoy*, *freight*, *leak*, *pump*, *yacht*. From German came *quartz*, *cobalt*, and—as we might guess—*sauerkraut*. From Italian, many musical terms, including words describing opera houses, have been borrowed: *opera*, *piano*, *virtuoso*, *balcony*, and *mezzanine*. Italian also gave us *influenza*, which was derived from the Italian word for "influence" because the Italians were convinced that the disease was *influenced* by the stars.

Many scientific words were borrowed indirectly from Arabic, because early Arab scholarship in these fields was quite advanced. *Alcohol*, *algebra*, *cipher*, and *zero* are a small sample. Spanish has loaned us (directly) *barbecue*, *cockroach*, and *ranch*, as well as *California*, literally "hot furnace." In America, the English-speaking colonists borrowed from Native American languages, another situation of language contact, but in which English is the culturally dominant language. Native American languages provided us with *hickory*, *chipmunk*, *opossum*, and *squash*, to mention only a few. Nearly half the names of U.S. states are borrowed from one American Indian language or another.

English has borrowed from Yiddish. Many non-Jews as well as non-Yiddish-speaking Jews use Yiddish words. There was once even a bumper sticker proclaiming: "Marcel Proust is a yenta." *Yenta* is a Yiddish word meaning "gossipy woman." *Lox*, meaning "smoked salmon," and *bagel*, "a doughnut dipped in cement," now belong to English, as well as Yiddish expressions like *chutzpah*, *schmaltz*, *schlemiel*, *schmuck*, *schmo*, *schlep*, and *kibitz*.

English is a lender of many words to other languages, especially in the areas of technology, sports, and entertainment. Words and expressions such as *jazz*, *whisky*, *blue jeans*, *rock music*, *supermarket*, *baseball*, *picnic*, and *computer* have been borrowed from English into languages as diverse as Twi, Hungarian, Russian, and Japanese.

Loss of Words

Pease porridge hot
Pease porridge cold
Pease porridge in the pot nine days old

NURSERY RHYME

Languages can also lose words, although the departure of an old word is never as striking as the arrival of a new one. When a new word comes into vogue, its unusual presence draws attention, but a word is lost through inattention—nobody thinks of it, nobody uses it, and it fades away.

A reading of Shakespeare's works shows that English has lost many words, such as these taken from *Romeo and Juliet*: *beseem*, "to be suitable," *mammet*, "a doll or puppet," *wot*, "to know," *gyve*, "a fetter," *fain*, "gladly," and *wherefore*, "why," as in Juliet's plaintive cry: "O Romeo, Romeo! wherefore art thou Romeo," in which she is questioning why he is so named, not his current whereabouts.

More recently, there are expressions used by your grandparents that have already been lost. For example, *two bits*, meaning "twenty-five cents," is no longer used; nor is *lickety-split*, meaning "very fast." And even words used by your parents (and us) sound dated, for example, *groovy* ("excellent"), *davenport* ("sofa"), and *grass* and *Mary Jane*, both referring to "marijuana." The word *stile*, meaning "steps crossing a fence or gate," is no longer widely understood. Other similar words for describing rural objects are fading out of the language as a result of urbanization. *Pease*, from which *pea* is a back-formation, is gone, and *porridge*, meaning "boiled cereal grain," is falling out of usage, although it is sustained by a discussion of its ideal serving temperature in the children's story *Goldilocks and the Three Bears* and its appearance on Harry Potter's breakfast table.

Technological change may also be the cause for the loss of words. *Acutiator* once meant "sharpener of weapons," and *tormentum* once meant "siege engine." Advances in warfare have put these terms out of business. Although one still finds the words *buckboard*, *buggy*, *dogcart*, *hansom*, *surrey*, and *tumbrel* in the dictionary—all of them referring to subtly different kinds of horse-drawn carriages—progress in transportation is likely to render these terms obsolete and eventually they will be lost.

Semantic Change

> The language of this country being always upon the flux, the Struldbruggs of one age do not understand those of another, neither are they able after two hundred years to hold any conversation (farther than by a few general words) with their neighbors the mortals, and thus they lie under the disadvantage of living like foreigners in their own country.
>
> **JONATHAN SWIFT,** *Gulliver's Travels*, 1726

We have seen that a language may gain or lose lexical items. Additionally, the meaning or semantic representation of words may change, by becoming broader or narrower, or by shifting.

Broadening

When the meaning of a word becomes broader, it means everything it used to mean and more. The Middle English word *dogge* referred to a specific breed of dog, but was eventually **broadened** to encompass all members of the species *canis familiaris*. The word *holiday* originally meant a day of religious significance, from “holy day.” Today the word refers to any day that we do not have to work. *Picture* used to mean “painted representation,” but now you can take a picture with a camera, not to mention a cell phone. *Quarantine* once had the restricted meaning of “forty days’ isolation,” and *manage* once meant simply to handle a horse.

More recent broadenings, spurred by the computer age, are *computer*, *mouse*, *cookie*, *cache*, *virus*, and *bundle*. *Footage* use to refer to a certain length of film or videotape, but nowadays it means any excerpt from the electronic video media such as DVDs, irrespective of whether its length can be measured in feet. *Google* was broadened first from the name of a company to a verb meaning “to use that company’s search engine on the Internet,” and from there further broadened to simply “search the Internet.”

Narrowing

In the King James Version of the Bible (1611 C.E.), God says of the herbs and trees, “to you they shall be for meat” (Genesis 1:29). To a speaker of seventeenth-century English, *meat* meant “food,” and *flesh* meant “meat.” Since that time, semantic change has narrowed the meaning of *meat* to what it is in Modern English. The word *deer* once meant “beast” or “animal,” as its German cognate *Tier* still does. The meaning of *deer* has been narrowed to a particular kind of animal. Similarly, the word *hound* used to be the general term for “dog,” like German *Hund*. Today *hound* means a special kind of dog, one used for hunting. *Skyline* once meant “horizon” but has been narrowed to mean “the outline of a city at the horizon.”

Meaning Shifts

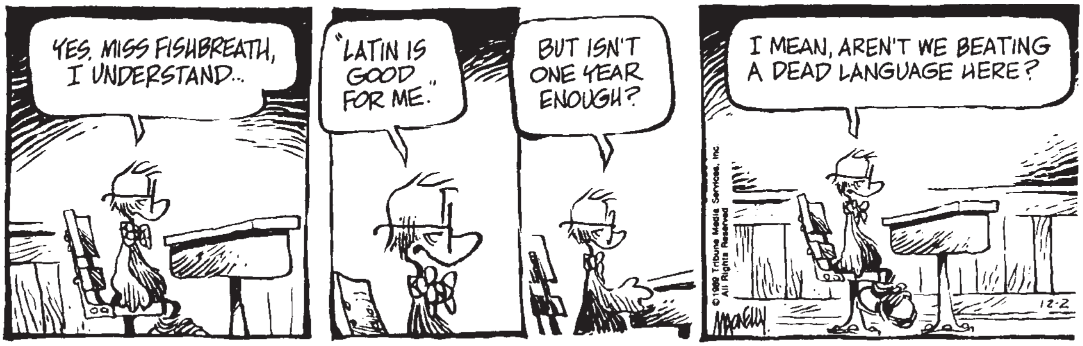
The third kind of semantic change that a lexical item may undergo is a shift in meaning. The word *knight* once meant “youth” but shifted to “mounted man-at-arms.” *Lust* used to mean simply “pleasure,” with no negative or sexual overtones. *Lewd* was merely “ignorant,” and *immoral* meant “not customary.” *Silly* used to mean “happy” in Old English. By the Middle English period it had come to mean “naive,” and only in Modern English does it mean “foolish.” The overworked Modern English word *nice* meant “ignorant” a thousand years ago. When Juliet tells Romeo, “I am too *fond*,” she is not claiming she likes Romeo too much. She means “I am too *foolish*.”

Reconstructing “Dead” Languages

> The living languages, as they were called by the Harvard fellows, were little more than cheap imitations, low distortions. Italian, like Spanish and German, particularly represented the loose political passions, bodily appetites, and absent morals of decadent Europe.
>
> **MATTHEW PEARL,** *The Dante Club*, 2003

None of your living languages for Miss Blimber. They must be dead—stone dead—and then Miss Blimber dug them up like a Ghoul.

CHARLES DICKENS, *Dombey and Son*, 1848



"Shoe" by Gary Brookins/Chris Cassatt. Copyright 1989 Tribune Media Services. Reprinted with permission.

Despite the disdain for the modern languages expressed in Matthew Pearl's book and by Miss Blimber, it is through the comparative study of the living languages that linguists are able to learn about older languages that left no written record, and the changes that occurred over time.

The Nineteenth-Century Comparativists

When agreement is found in words in two languages, and so frequently that rules may be drawn up for the shift in letters from one to the other, then there is a fundamental relationship between the two languages.

RASMUS RASK (1787–1832)

The chief goal of the nineteenth-century historical and comparative linguists was to develop and elucidate the genetic relationships that exist among the world's languages. They aimed to establish the major language families of the world and to define principles for the classification of languages. They based their theories on observations of regular sound correspondences among certain languages. They proposed that languages displaying systematic similarities and differences must have descended from a common source language—that is, were genetically related. Their work grew out of earlier research.

As a child, Sir William Jones had an astounding propensity for learning languages, including so-called dead ones such as Ancient Greek and Latin. While residing in India he added Sanskrit to his studies and observed that Sanskrit bore to Greek and Latin "a stronger affinity . . . than could possibly have been produced by accident." Jones suggested that these three languages had "sprung from a common source" and that probably Germanic and Celtic had the same origin.

Earlier stage:[a]	bh	dh	gh	b	d	g	p	t	k
	↓	↓	↓	↓	↓	↓	↓	↓	↓
Later stage:	b	d	g	p	t	k	f	θ	x (or h)

FIGURE 11.2 | Grimm's Law, an early Germanic sound shift. Grimm's Law can be expressed in terms of natural classes of speech sounds: Voiced aspirates become unaspirated; voiced stops become voiceless; voiceless stops become fricatives.

[a]This "earlier stage" is Indo-European. The symbols bh, dh, and gh are breathy voiced stop consonants. These phonemes are often called "voiced aspirates."

Following up on Jones's research, the German linguist Franz Bopp pointed out relationships among Sanskrit, Latin, Greek, Persian, and Germanic. At the same time, a young Danish scholar named Rasmus Rask corroborated these results, and brought Lithuanian and Armenian into the relationship as well. Rask was the first scholar to describe formally the regularity of certain phonological differences of related languages.

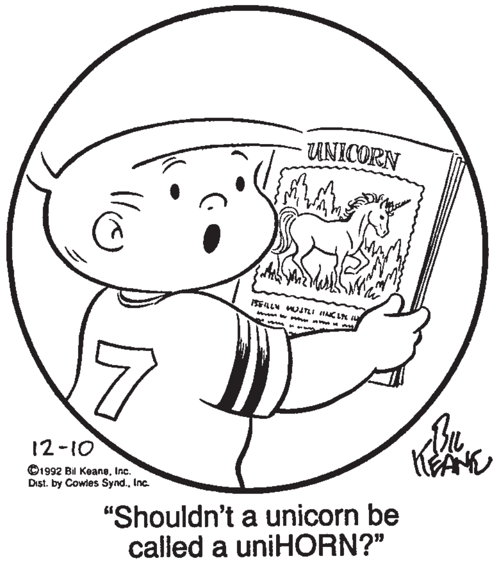
Rask's work inspired the German linguist Jakob Grimm (of fairy-tale fame), who published a four-volume treatise (1819–1822) that specified the regular sound correspondences among Sanskrit, Greek, Latin, and the Germanic languages. Not only did the *similarities* intrigue Grimm, but also the systematic nature of the *differences*. Where Latin has a [p], English often has an [f]; where Latin has a [t], English often has a [θ]; where Latin has a [k], English often has an [h].

Grimm posited a far earlier language (which we now refer to as Indo-European) from which all these languages evolved. He explained the sound correspondences by means of rules of phonological change (which historical linguists called **sound shift**, or **sound change**). Grimm's major discovery was that certain rules of sound change that applied to the Germanic family of languages, including the ancestors of English, did not apply to Sanskrit, Greek, and Latin. This accounted very nicely for many of the regular differences between the Germanic languages and the others. Because the sound changes discovered by Grimm were so strikingly regular, they became known as **Grimm's Law**, illustrated in Figure 11.2.

Cognates

Cognates are words in related languages that developed from the same ancestral root, such as English *horn* and Latin *cornū*. Cognates often, but not always, have the same meaning in the different languages. From cognates we can observe sound correspondences and from them deduce sound changes. In Figure 11.3 the regular correspondence *p-p-f* of cognates from Sanskrit, Latin, and Germanic (represented by English) indicates that the languages are genetically related. Indo-European **p* is posited as the origin of the *p-p-f* correspondence.[3]

[3]The asterisk before a letter indicates a reconstructed sound, not an unacceptable form. This use of the asterisk occurs only in this chapter.



Indo-European	**Sanskrit**	**Latin**	**English**
***p**	**p**	**p**	**f**
	pitar-	**p**ater	**f**ather
	pad-	**p**ed-	**f**oot
	No cognate	**p**iscis	**f**ish
	paśu[a]	**p**ecu	**f**ee

FIGURE 11.3 | Cognates of Indo-European *p.
[a] *ś* is a sibilant pronounced differently from *s*.

Figure 11.4 is a more detailed chart of correspondences, showing an example of each regular correspondence. For each line in the chart linguists can identify many further correspondences such as Sanskrit *pād-*, Latin *ped-*, and English *foot* for p-p-f, thereby showing the consistent and systematic relationships that lead to the reconstruction of the Indo-European sound shown in the first column.

Sanskrit underwent the fewest consonant changes (has more sounds in common with Indo-European), Latin somewhat more, and Germanic (under Grimm's Law) underwent almost a complete restructuring. The changes we observe are changes to the phonemes and phonological rules, and all words with those phonemes will reflect those changes (but see the "caveat" in the following paragraph). If we imagine that the changes happened independently to individual words, rather than individual sounds, we could not explain why so many words

Indo-European	Sanskrit		Latin		English	
*p	p	**p**itar-	p	**p**ater	f	**f**ather
*t	t	**t**rayas	t	**t**rēs	θ	**th**ree
*k	ś	**ś**un	k	**c**anis	h	**h**ound
*b	b	No cognate	b	la**b**ium	p	li**p**
*d	d	**d**va-	d	**d**uo	t	**t**wo
*g	j	a**j**ras	g	a**g**er	k	a**c**re
*bh	bh	**bh**rātar-	f	**f**rāter	b	**b**rother
*dh	dh	**dh**ā	f	**f**ē-ci	d	**d**o
*gh	h	va**h**-	h	ve**h**-ō	g	wa**g**on

FIGURE 11.4 | Some Indo-European sound correspondences.

beginning with /p/ in Sanskrit and Latin just happen to begin with /f/ in Germanic, and so on. It would far exceed the possibilities of coincidence. It is the fact that the changes are in the phonology of the languages that has resulted in the remarkably regular, pervasive correspondences that allow us to reconstruct much of the Indo-European sound system.

Grimm noted that there were exceptions to the regular correspondences he observed. He stated: "The sound shift is a general tendency; it is not followed in every case." Several decades later, in 1875, Karl Verner explained some of the exceptions to Grimm's Law. He formulated **Verner's Law** to show why Indo-European *p*, *t*, and *k* failed to correspond to *f*, *θ*, and *x* in certain cases:

> *Verner's Law*: When the preceding vowel was unstressed *f*, *θ*, and *x* underwent a further change to *b*, *d*, and *g*.

Encouraged by the regularity of sound change, a group of young nineteenth-century linguists proposed the **Neo-Grammarian hypothesis**, which says that sound shifts are not merely tendencies (as Grimm claimed), but apply in *all* words that meet their environment. If exceptions were nevertheless observed, it was trusted that further laws would be discovered to explain them, just as Verner's Law explained the exceptions to Grimm's Law. The **Neogrammarians** viewed linguistics as a natural science and therefore believed that laws of sound change were unexceptionable natural laws. The "laws" they put forth often did have exceptions, however, which could not always be explained as dramatically as Verner's Law explained the exceptions to Grimm's Law. Still, the work of these linguists provides important data and insights into language change and why such changes occur.

The linguistic work that we have been discussing had some influence on Charles Darwin, and in turn, Darwin's theory of evolution had a profound influence on linguistics and on all science. Some linguists thought that languages had a "life cycle" and developed according to evolutionary laws. In addition, it was believed that every language could be traced to a common ancestor. This theory of biological naturalism has an element of truth to it, but it is an oversimplification of how languages change and evolve into other languages.

Comparative Reconstruction

> . . . Philologists who chase
> A panting syllable through time and space
> Start it at home, and hunt it in the dark,
> To Gaul, to Greece, and into Noah's Ark.
>
> **WILLIAM COWPER,** "Retirement," 1782

When languages resemble one another in ways not attributable to chance or borrowing or to general principles of Universal Grammar, we may conclude they are descended from a common source. That is, they evolved via linguistic change from an ancestral protolanguage.

The similarity of the basic vocabulary of languages such as English, German, Danish, Dutch, Norwegian, and Swedish is too pervasive for chance or borrowing. We therefore conclude that these languages have a common parent, Proto-Germanic. There are no written records of Proto-Germanic, and certainly no native speakers alive today. Proto-Germanic is a partially reconstructed language whose properties have been deduced based on its descendants. In addition to related vocabulary, the Germanic languages share grammatical properties such as similar sets of irregular verbs, particularly the verb *to be*, and syntactic rules such as the verb (or auxiliary) movement rule discussed earlier in this chapter, further supporting their relatedness.

Once we know or suspect that several languages are related, their protolanguage may be partially determined by **comparative reconstruction**. One proceeds by applying the **comparative method**, which we illustrate with the following brief example.

Restricting ourselves to English, German, and Swedish, we find the word for "man" is *man* [mæn], *Mann* [man], and *man* [man], respectively. This is one of many word sets in which we can observe the regular sound correspondence [m]-[m]-[m] and [n]-[n]-[n] in the three languages. Based on this evidence, the comparative method has us reconstruct **mVn* as the word for "man" in Proto-Germanic. The *V* indicates a vowel whose quality we are unsure of because, despite the similar spelling, the vowel is phonetically different in the various Germanic languages, and it is unclear how to reconstruct it without further evidence.

Although we are confident that we can reconstruct much of Proto-Germanic with relative accuracy, we can never be sure, and many details remain obscure. To build confidence in the comparative method, we can apply it to Romance languages such as French, Italian, Spanish, and Portuguese. Their protolanguage is the well-known Latin, so we can verify the method by testing it against written records of Latin. Consider the following data, focusing on the initial consonant of each word. In these data, *ch* in French is [ʃ], and *c* in the other languages is [k].

French	Italian	Spanish	Portuguese	English
cher	**c**aro	**c**aro	**c**aro	"dear"
champ	**c**ampo	**c**ampo	**c**ampo	"field"
chandelle	**c**andela	**c**andela	**c**andeia	"candle"

The French [ʃ] corresponds to [k] in the three other languages. This regular sound correspondence, [ʃ]-[k]-[k]-[k], supports the view that French, Italian, Spanish, and Portuguese descended from a common language. The comparative method leads to the reconstruction of [k] in "dear," "field," and "candle" of the parent language, and shows that [k] underwent a change to [ʃ] in French, but not in Italian, Spanish, or Portuguese, which retained the original [k] of the parent language, Latin.

To use the comparative method, analysts identify regular sound correspondences in the cognates of potentially related languages. For each correspondence, they deduce the most likely sound in the parent language. In this way, much of the sound system of the parent may be reconstructed. The various phonological changes in the development of each daughter language as it descended and changed from the parent are then identified. Sometimes the sound that analysts choose in their reconstruction of the parent language is the one that appears most frequently in the correspondence. This is the "majority rules" principle, which we illustrated with the four Romance languages.

Other considerations may outweigh the majority rules principle. The likelihood of certain phonological changes may persuade the analyst to reconstruct a less frequently occurring sound, or even a sound that does not occur in the correspondence. Consider the data in these four hypothetical languages:

Language A	Language B	Language C	Language D
hono	hono	fono	vono
hari	hari	fari	veli
rahima	rahima	rafima	levima
hor	hor	for	vol

Wherever Languages A and B have an *h*, Language C has an *f* and Language D has a *v*. Therefore, we have the sound correspondence *h-h-f-v*. Using the majority rule principle, we might first consider reconstructing the sound *h* in the parent language, but from other data on historical change, and from phonetic research, we know that *h* seldom becomes *v*. The reverse, /f/ and /v/ becoming [h], occurs both historically and as a phonological rule and has an acoustic explanation. Therefore, linguists reconstruct an **f* in the parent, and posit the sound change "*f* becomes *h*" in Languages A and B, and "*f* becomes *v*" in Language D. One obviously needs experience and knowledge to conclude this.

The other correspondences are not problematic as far as these data are concerned:

o-o-o-o   n-n-n-n   a-a-a-e   r-r-r-l   m-m-m-m

They lead to the reconstructed forms **o*, **n*, **a*, **r*, and **m* for the parent language, and the sound changes "*a* becomes *e*" and "*r* becomes *l*" in Language D. These are natural sound changes found in many of the world's languages.

It is now possible to reconstruct the words of the protolanguage. They are **fono*, **fari*, **rafima*, and **for*. In this example, Language D is the most innovative of the three languages, because it has undergone three sound changes.

Language C is the most conservative in that it is identical to the protolanguage insofar as these data are concerned.

The sound changes seen in the previous illustrations are examples of **unconditioned sound change**. The changes occurred irrespective of phonetic context. Following is an example of **conditioned sound change**, taken from three dialects of Italian:

Standard	**Northern**	**Lombard**	
fisːo	fiso	fis	"fixed"
kasːa	kasa	kasə	"cabinet"

The correspondence sets are:

f-f-f   i-i-i   sː-s-s   o-o-<>[4]   k-k-k   a-a-a   a-a-ə

It is straightforward to reconstruct *f, *i, and *k. Knowing that a long consonant like *s*ː commonly becomes *s* (recall Old English *f*ː became *f*), we reconstruct **s*ː for the sː-s-s correspondence. A shortening change took place in the Northern and Lombard dialects.

There is evidence in these (very limited) data for a weakening of word-final vowels, again a change we discussed earlier for English. We reconstruct *o for o-o-<> and *a for a-a-ə. In Lombard, a conditioned sound change took place. The sound *o* was deleted in word-final position, but remained *o* elsewhere. The sound *a* became *ə* in word-final position and remained *a* elsewhere. As far as we can tell from the data presented, the conditioning factor is word-final position. Vowels in other positions do not undergo change.

We reconstruct the protodialect as having had the words **fisːo* meaning "fixed" and **kasːa* meaning "cabinet."

It is by means of the comparative method that nineteenth-century linguists were able to initiate the reconstruction of Indo-European, the long-lost ancestral language so aptly conceived by Jones, Bopp, Rask, and Grimm, a language that flourished about 6,000 years ago.

Historical Evidence

> You know my method. It is founded upon the observance of trifles.
>
> **SIR ARTHUR CONAN DOYLE,** "The Boscombe Valley Mystery," in *The Memoirs of Sherlock Holmes*, 1891

The comparative method is not the only way to explore the history of a language or language family, and it may prove unable to answer certain questions because data are lacking or because reconstructions are untenable. For example, how do we know positively how Shakespeare or Chaucer or the author of *Beowulf* pronounced their versions of English? The comparative method leaves many details in doubt, and we have no recordings that give us direct knowledge.

[4] The empty angled brackets indicate a loss of the sound.

For many languages, written records go back more than a thousand years. Linguists study these records to find out how languages were once pronounced. The spelling in early manuscripts tells us a great deal about the sound systems of older forms of modern languages. Two words spelled differently were probably pronounced differently. Once several orthographic contrasts are identified, good guesses can be made as to actual pronunciation. For example, because we spell *Mary*, *merry*, and *marry* differently, we may conclude that at one time most speakers pronounced them differently, probably [meri], [mɛri], and [mæri]. For at least one modern American dialect, only /ɛ/ can occur before /r/, so the three words are all pronounced [mɛri]. That dialect is the result of a sound shift in which both /e/ and /æ/ shifted to /ɛ/ when followed immediately by /r/. This is another instance of a conditioned sound change.

Various documents from the past can be examined for evidence. Private letters are an excellent source of data. Linguists prefer letters written by naive spellers, who will misspell words according to the way they pronounce them. For instance, at one point in English history, all words spelled with *er* in their stems were pronounced as if they were spelled with *ar*, just as in modern British English *clerk* and *derby* are pronounced "clark" and "darby." Some poor speller kept writing *parfet* for *perfect*, which helped linguists discover the older pronunciation.

Clues are also provided by the writings of the prescriptive grammarians of the period. Between 1550 and 1750 scholars known as orthoepists attempted to preserve the "purity" of English. In prescribing how people should speak, they told us how people actually spoke. An orthoepist alive in the United States today might write in a manual: "It is incorrect to pronounce *Cuba* with a final *r*." Future scholars would know that some speakers of English pronounced it that way.

Some of the best clues to earlier pronunciation are provided by puns and rhymes in literature. Two words rhyme if the vowels and final consonants are the same. When a poet rhymes the verb *found* with the noun *wound*, it strongly suggests that the vowels of these two words were identical:

BENVOLIO: . . . 'tis in vain to seek him here that means not to be found.
ROMEO: He jests at scars that never felt a wound.

Shakespeare's rhymes are helpful in reconstructing the sound system of Elizabethan English. The rhyming of *convert* with *depart* in Sonnet XI strengthens the conclusion that *er* was pronounced as *ar*.

Most powerfully, the above techniques may be combined with the comparative method. Dialect differences discovered through written records may permit comparison of the pronunciation of various words in several dialects. On that basis we can draw conclusions about earlier forms and see what changes took place in the inventory of sounds and in the phonological rules. We illustrated one such case with three Italian dialects on the preceding page.

The historical comparativists working on languages with written records have a challenging job, but not nearly as challenging as that of scholars who are attempting to discover genetic relationships among languages with no written history. Linguists must first transcribe large amounts of language data from all the languages; analyze them phonologically, morphologically, and syntactically;

and establish a basis for relatedness such as similarities in basic vocabulary and regular sound correspondences not resulting from chance or borrowing. Only then can the comparative method be applied to reconstruct the extinct protolanguage.

Proceeding in this manner, linguists have discovered many relationships among Native American languages and have successfully reconstructed Amerindian protolanguages. Similar achievements have been made with the numerous languages spoken in Africa. The large number of African languages have been grouped into four overarching families: Afroasiatic, Nilo-Saharan, Niger-Congo, and Khoisan. For example, Somali is in the Afroasiatic family; Zulu is in the Niger-Congo family; and Hottentot, spoken in South Africa, is in the Khoisan family. These familial divisions are subject to revision if new discoveries or analyses deem it necessary.

Extinct and Endangered Languages

> Any language is the supreme achievement of a uniquely human collective genius, as divine and unfathomable a mystery as a living organism.
>
> **MICHAEL KRAUSS,** in a speech to the Linguistic Society of America, 1991

> I am always sorry when any language is lost, because languages are the pedigree of nations.
>
> **SAMUEL JOHNSON** (1709–1784)

A language dies and becomes extinct when no children learn it. Linguists have identified several ways in which a language might cease to exist, leastwise in its spoken form.

A language may die out more or less suddenly when all of the speakers of the language themselves die or are killed. Such was the case with Tasmanian languages, once spoken on the island of Tasmania, and Nicoleño, a Native American Indian language once spoken in California.

Similarly, a language may cease to exist relatively abruptly when its speakers all stop speaking the language for the duration of their lifetimes. Often the reason for this radical change is survival under the threat of political repression or even genocide. Indigenous languages embedded in other cultures suffer death this way. In order to avoid being identified as "natives," speakers simply stop speaking their native language. Children are unable to learn a language that is not spoken to them, so when the last speaker dies, the language dies.

Most commonly, languages that become extinct do so gradually, often over several generations. This happens to minority languages that are in contact with a dominant language, much as American Indian languages are in contact with English. In each generation, fewer and fewer children learn the language until there are no new learners. The language is said to be dead when the last generation of speakers dies out. Cornish suffered this fate in Britain in the eighteenth century (though recent attempts at revival have resulted in about three hundred nonnative speakers of the language), as have many Native American languages in both North and South America.

While not common, some languages suffer "partial death" in that they survive only in specific contexts, such as a liturgical language. Latin and (at one time) Hebrew are such languages. Latin evolved into the Romance languages and by the ninth century there were few if any peoples speaking Latin in daily situations. Today its use is confined to scholarly and religious contexts.

Many Native American languages are experiencing a reduction in the number of native speakers over time. Only 20 percent of the remaining indigenous languages in the United States are being acquired by children. Hundreds have already ceased to be written or spoken. In the 1500s, at the time of the first European contact, there were over 1,000 indigenous languages spoken throughout the Americas. Once widely spoken American Indian languages such as Comanche, Apache, and Cherokee have fewer native speakers every generation.

Doomed languages have existed throughout time. The Indo-European languages Hittite and Tocharian no longer exist. Hittite disappeared 3,500 years ago, and both dialects of Tocharian gave up the ghost around 1000 C.E.

Dialects, too, may become extinct. Many dialects spoken in the United States are considered endangered by linguists. For example, the sociolinguist Walt Wolfram is studying the dialect spoken on Ocracoke Island off the coast of North Carolina. One reason for the study is to preserve the dialect, which is in danger of extinction because so many young Ocracokers leave the island and raise their children elsewhere, a case of gradual *dialect* death. Vacationers and retirees are diluting the dialect-speaking population, because they are attracted to the island by its unique character, including, ironically, the quaint speech of the islanders.

Linguists have placed many languages on an endangered list. They attempt to preserve these languages by studying and documenting their grammars—the phonetics, phonology, and so on—and by recording for posterity the speech of the last few speakers. Each language provides new evidence on the nature of human cognition through its grammar. In its literature, poetry, ritual speech, and word structure, each language stores the collective intellectual achievements of a culture, offering unique perspectives on the human condition. The disappearance of a language is tragic; not only are these insights lost, but the major medium through which a culture maintains and renews itself is gone as well.

Linguists are not alone in their preservation efforts. Under the sponsorship of language clubs, and occasionally even governments, adults and children learn an endangered language as a symbol of the culture. Gael Linn is a private organization in Ireland that runs language classes in Irish (Gaelic) for adults. Hundreds of public schools in Ireland and Northern Ireland are conducted entirely in Gaelic. In the U.S. state of Hawaii, a movement is under way to preserve and teach Hawaiian, the native language of the islands.

This attempt to slow down or reverse the dying out of a language is also illustrated by the French in Quebec. In 1961, the Quebec Office of the French Language was formed to standardize the dialect of French spoken in Quebec, but ironically refuses to do so for fear of reducing the interintelligibility with other French-speaking communities. It is believed that standardization would linguistically isolate Quebecers and lead to the extinction of French in Canada.

Instead, the office uses its powers to promote the use of French, irrespective of dialect.

A stunning example of the revival of a dormant language occurred in Israel. For centuries, classical Hebrew was used only in religious ceremonies, but today, with some modernization, it has become the national language of Israel. The Academy of the Hebrew Language in Israel undertook a task that had never been done in the history of humanity—to awaken an ancient written language to serve the daily colloquial needs of the people. Twenty-three lexicologists worked with the Bible and the Talmud to add new words to the language. While there is some attempt to keep the language "pure," the academy has given way to popular pressure. Thus, a bank check is called a *check* [tʃɛk] in the singular and pluralized by adding the Hebrew plural suffix *-im* to form *check-im*, although the Hebrew word *hamcha'ah* was proposed. Similarly, *lipstick* has triumphed over *s'faton* and *pajama* over *chalifat-sheinah* (lit. sleeping suit).

The United Nations, too, is concerned about endangered languages. In 1991, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) passed a resolution that states:

> As the disappearance of any one language constitutes an irretrievable loss to mankind, it is for UNESCO a task of great urgency to respond to this situation by promoting . . . the description—in the form of grammars, dictionaries, and texts—of endangered and dying languages.

The documentation and preservation of dying languages is not only important for social and cultural reasons. There is also a scientific reason for studying these languages. Through examining a wide array of different types of languages, linguists can develop a comprehensive theory of language that accounts for both its universal and language-specific properties.

The Genetic Classification of Languages

> The Sanskrit language, whatever be its antiquity, is of a wonderful structure, more perfect than the Greek, more copious than the Latin, and more exquisitely refined than either, yet bearing to both of them a stronger affinity, both in the roots of verbs and in the forms of grammar, than could possibly have been produced by accident; so strong, indeed, that no philologer could examine all three, without believing that they have sprung from some common source, which, perhaps, no longer exists. . . .
>
> **SIR WILLIAM JONES** (1746–1794)

We have discussed how different languages evolve from one language and how historical and comparative linguists classify languages into families such as Germanic or Romance and reconstruct earlier forms of the ancestral language. When we examine the languages of the world, we perceive similarities and differences among them that provide evidence for degrees of relatedness or for nonrelatedness.

Counting to five in English, German, and Vietnamese shows similarities between English and German not shared by Vietnamese (shown with tones omitted):

English	**German**	**Vietnamese**
one	eins	mot
two	zwei	hai
three	drei	ba
four	vier	bon
five	fünf	nam

The similarity between English and German is pervasive. Sometimes it is extremely obvious (*man/Mann*), but at other times a little less obvious (*child/Kind*). No regular similarities or differences apart from those resulting from chance are found between them and Vietnamese.

Pursuing the metaphor of human genealogy, we say that English, German, Norwegian, Danish, Swedish, Icelandic, and so on are sisters in that they descended from one parent and are more closely related to one another than any of them are to non-Germanic languages such as French or Russian.

The Romance languages are also sister languages whose parent is Latin. If we carry the family metaphor to an extreme, we might describe the Germanic languages and the Romance languages as cousins, because their respective parents, Proto-Germanic and early forms of Latin, were siblings.

As anyone from a large family knows, there are cousins, and then there are distant cousins, encompassing nearly anyone with a claim to family bloodlines. This is true of the Indo-European family of languages. If the Germanic and Romance languages are truly cousins, then languages such as Greek, Armenian, Albanian, and even the extinct Hittite and Tocharian are distant cousins. So are Irish, Scots Gaelic, Welsh, and Breton, whose protolanguage, Celtic, was once spoken widely throughout Europe and the British Isles. Breton is spoken in Brittany in the northwest coastal regions of France. It was brought there by Celts fleeing from Britain in the seventh century.

Russian is also a distant cousin, as are its sisters, Bulgarian, Serbo-Croatian, Polish, Czech, and Slovak. The Baltic language Lithuanian is related to English, as is its sister language, Latvian. A neighboring language, Estonian, however, is not a relative. Sanskrit, although far removed geographically, is nonetheless a relative, as pointed out by Sir William Jones. Its offspring, Hindi and Bengali, spoken primarily in South Asia, are distantly related to English. Persian (or Farsi), spoken in modern Iran, is a distant cousin of English, as is Kurdish, which is spoken in Iran, Iraq, and Turkey, and Pashto, which is spoken in Afghanistan and Pakistan. All these languages, except for Estonian, are related, more or less distantly, to one another because they all descended from Indo-European.

Figure 11.5 is an abbreviated family tree of the Indo-European languages that gives a genealogical and historical classification of the languages shown. This diagram is somewhat simplified. For example, it appears that all the Slavic

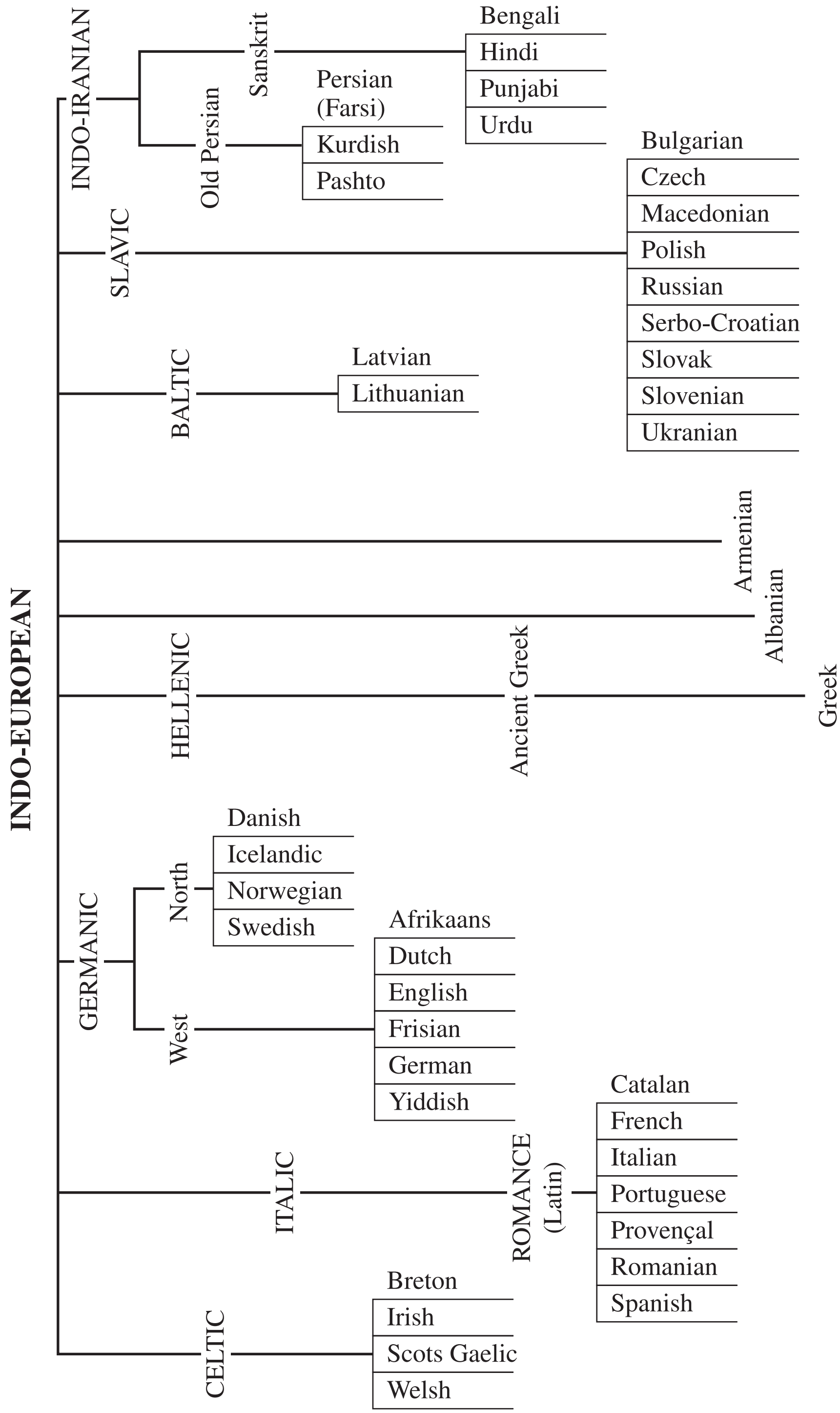


FIGURE 11.5 | The Indo-European family of languages.

languages are sisters. In fact, the nine languages shown can be organized hierarchically, showing some more closely related than others. In other words, the various separations that resulted in the nine Slavic languages we see today occurred several times over a long stretch of time. Similar remarks apply to the other families, including Indo-European.

Another simplification is that the "dead ends"—languages that evolved and died leaving no offspring—are not included. We have already mentioned Hittite and Tocharian as two such Indo-European languages. The family tree also fails to show several intermediate stages that must have existed in the evolution of modern languages. Languages do not evolve abruptly, which is why comparisons with the genealogical trees of biology have limited usefulness. Finally, the diagram fails to show some Indo-European languages because of lack of space.

Languages of the World

> And the whole earth was of one language, and of one speech.
>
> **GENESIS 11:1,** *The Bible,* King James Version

> Let us go down, and there confound their language, that they may not understand one another's speech.
>
> **GENESIS 11:7,** *The Bible,* King James Version

Most of the world's languages do not belong to the Indo-European family. Linguists have also attempted to classify the non-Indo-European languages according to their genetic relationships. The task is to identify the languages that constitute a family and the relationships that exist among them.

The two most common questions asked of linguists are: "How many languages do you speak?" and "How many languages are there in the world?" Both questions are difficult to answer precisely. Most linguists have varying degrees of familiarity with several languages, and many are **polyglots**, persons who speak and understand several languages. Charles V, the Holy Roman Emperor from 1519 to 1558, was a polyglot, for he proclaimed: "I speak Spanish to God, Italian to women, French to men, and German to my horse."

As to the second question, it's difficult to ascertain the precise number of languages in the world because there are no clear criteria to decide what is a language and what is a dialect, as discussed in chapter 10.

With this caveat in mind, recent estimates place the number of spoken languages in the world today (2010) at somewhat less than 7,000, according to the encyclopedia Ethnologue: Languages of the World (see http://www.ethnologue.com/web.asp for more detail). The Ethnologue lists 124 sign languages, from every continent where languages are spoken, though this number is in dispute and may be very much larger. In the city of Los Angeles alone, more than 80 languages are spoken. Students at Hollywood High School go home to hear their parents speak Amharic, Armenian, Arabic, Marshallese, Urdu, Sinhalese, Ibo, Gujarati, Hmong, Afrikaans, Khmer, Ukrainian, Cambodian, Spanish, Tagalog, and Russian, among others.

It is often surprising to discover which languages are genetically related and which ones are not. Nepali, the language of remote Nepal, is an Indo-European language, whereas Hungarian, surrounded on all sides by Indo-European languages, is not.

Some languages have no demonstrable genealogical relationship with other living languages. They are called **language isolates**. Basque, spoken in the Pyrenees Mountains between Spain and France, and Ainu, spoken on the island of Hokkaido, Japan, are among the forty or so isolates mentioned in the Ethnologue. Many sign languages, insofar as it can be determined, are isolates.

It is not possible in an introductory text to give an exhaustive table of families, subfamilies, and individual languages. Besides, some genetic relationships have not yet been firmly established. For example, linguists are divided as to whether Japanese and Turkish are related. We simply mention several language families in the following paragraphs with a few of their members. These language families do not appear to be related to one another or to Indo-European. This, however, may be an artifact of being unable to delve into the past far enough to see common features that time has erased. We cannot eliminate the possibility that the entire world's languages spring ultimately from a single source, an "ur-language" that some have termed **Nostratic**, which is buried, if not concealed, in the depths of the past. Readers interested in this fascinating topic may wish to read the writings of Professor Johanna Nichols of the University of California at Berkeley. And of course more can be found by googling *nostratic*.

Uralic is the other major family of languages, besides Indo-European, that is spoken on the European continent. Hungarian, Finnish, and Estonian are the major representatives of this group.

Afro-Asiatic is a large family of languages spoken in northern Africa and the Middle East. It includes the modern *Semitic* languages of Hebrew and Arabic, as well as languages spoken in biblical times such as Aramaic, Babylonian, Canaanite, and Moabite.

The *Sino-Tibetan* family includes Mandarin, the most populous language in the world, spoken by more than one billion Chinese. This family also includes all of the Chinese languages, as well as Burmese and Tibetan.

Most of the languages of Africa belong to the *Niger-Congo* family, a huge family comprising more than one-fifth of the world's languages (about fifteen hundred). These include more than nine hundred languages grouped into subfamilies such as Kordofanian and Atlantic-Congo. The latter includes individual languages such as Swahili and Zulu.

Nearly as numerous, the *Austronesian* family contains about thirteen hundred languages, spoken over a wide expanse of the globe, from Madagascar, off the coast of Africa, to Hawaii. Hawaiian is an Austronesian language, as are Maori, spoken in New Zealand; Tagalog, spoken in the Philippine Islands; and Malay, spoken in Malaysia and Singapore, to mention just a few.

Surprisingly, the next most numerous family, called *Trans-New Guinea*, is crowded into the relatively small geographic area of New Guinea and neighboring islands, and contains nearly six hundred languages, most of them being Papuan languages. Thus three language families alone make up half of the languages spoken in the world.

Dozens of families and hundreds of languages are, or were, spoken in North and South America. Knowledge of the genetic relationships among these families of languages is often tenuous, and because so many of the languages are approaching extinction, there may be little hope for as thorough an understanding of the Amerindian language families as linguists have achieved for Indo-European.

Types of Languages

> All the Oriental nations jam tongue and words together in the throat, like the Hebrews and Syrians. All the Mediterranean peoples push their enunciation forward to the palate, like the Greeks and the Asians. All the Occidentals break their words on the teeth, like the Italians and Spaniards. . . .
>
> **ISIDORE OF SEVILLE,** 7th century C.E.

There are many ways to classify languages. One way already discussed in this chapter is according to the language family—the genetic classification. This method would be like classifying people according to whether they were related by blood. Another way of classifying languages is by certain linguistic traits, regardless of family. With people, this method would be like classifying them according to height and weight, political preference, religion, degree of wealth, and so on.

So far in this book we have hinted at the different ways that languages might be classified. From a phonological point of view, we have tone languages versus intonation languages—Thai versus English. We have languages with varying numbers of vowel phonemes, from as few as three to as high as a dozen or more. Languages may be classified according the number and kinds of consonants they have and also in terms of what combinations of consonants and vowels may form syllables. Japanese and Hawaiian allow few syllable types (CV and V, mostly), whereas English and most Indo-European languages allow a much wider variety. Languages may use stress phonemically (English), or not (French).

From a morphological standpoint, languages may be classified according to the richness of verb and noun morphology. For example, Vietnamese has little if any word morphology, so its words are monomorphemic; there are no plural affixes on nouns or agreement affixes on verbs. Such languages are referred to as **isolating** or **analytic**. Languages like English have a middling amount of morphology, much less than Old English or Latin once had, or than Russian has today. Languages with more than one morpheme per word are called **synthetic**.

Some synthetic languages are **agglutinative**: words may be formed by a root and multiple affixes where the affixes are easily separated and always retain the same meaning. Swahili is such a language (see exercise 9, chapter 3). The word *ninafika* is *ni* + *na* + *fika*, meaning "I-present-arrive"; *ni* + *ta* + *fika* means "I-will-arrive"; *wa* + *li* + *fika* means "we-past-arrive"; and so on. Each morpheme is unchanging in form and meaning from one word to the next. Turkish is also an agglutinative language, as illustrated in exercise 17 in chapter 3.

In a **fusional** synthetic language the morphemes are, well, fused together, so it is hard to identify their basic shape. Many Indo-European languages are of this type, such as Spanish. In *habl***o**, *habl***an**, *habl***é**, meaning "I speak, they speak, I spoke," the affixes carry a fusion of the meanings "person" and "number" and "tense" so that *-o* means "first person, singular, present," *-an* means "third person, plural, present" and *-e* means "first person, past, singular." The affixes themselves cannot be decomposed into the individual meanings that they bear.

Yet other languages—termed **polysynthetic** by linguists—have extraordinarily rich morphologies in which a single word may have ten or more affixes and carry the semantic load of an entire English sentence. Many native languages of North America are polysynthetic, including Mohawk, Cherokee, and Menominee. For example, the Menominee word *paehtāwāēwesew* means "He is heard by higher powers."

From a lexical standpoint, languages are classifiable as to whether they have articles like *the* and *a* in English; as to their system of pronouns and what distinctions are made regarding person, number, and gender; as to their vocabulary for describing family members; as to whether they have noun classes such as the masculine, feminine, and neuter nouns of German, or the multiple noun classes present in Swahili that we observed in chapter 3, and so on.

Every language has sentences that include a subject (S), an object (O), and a verb (V), although individual sentences may not contain all three elements. From the point of view of syntax, languages have been classified according to the basic or most common order in which these elements occur in sentences. There are six possible orders—SVO (subject, verb, object), SOV, VSO, VOS, OVS, and OSV—permitting, in theory, six possible language types. Of these, SVO and SOV languages make up nearly 90 percent of investigated languages in roughly equal proportions. English, Spanish, and Thai are SVO; German, Dutch, and Japanese illustrate SOV languages.

In SVO languages, auxiliary verbs precede main verbs, adverbs follow main verbs, and prepositions precede their head noun. Here are English examples:

They are eating. (Aux-V)
They sing beautifully. (V-Adv) (Cf. *They beautifully sing.)
They are from Tokyo. (Prep-V)

In SOV languages, the opposite tendencies are true. Auxiliary verbs follow the main verb, adverbs precede main verbs, and "prepositions," now called *postpositions*, follow their head noun. Here are Japanese examples:

Akiko	wa	sakana	o	tabete	iru (V-Aux)
Akiko	*topic marker*	fish	*object marker*	eating	is

"Akiko is eating fish."

Akiko	wa	hayaku	tabemasu	(Adv-V)
Akiko	*topic marker*	quickly	eats	

"Akiko eats quickly."

Akiko	wa	Tokyo	kara	desu	(V-PostP)
Akiko	*topic marker*	Tokyo	from	is	

"Akiko is from Tokyo."

These differences, and many more like them, stem from a single underlying parameter choice: the placement of the head of phrase. SVO languages are head-final; SOV languages are head-initial.

The question of why SVO and SOV languages are dominant is not completely understood, but linguists have observed that two principles or constraints are favored:

(**1**) Subjects precede objects.
(**2**) The verb V is adjacent to the object O.

SVO and SOV are the only two types that obey both principles. The next most common type in appearance is VSO, here illustrated by Tagalog, which is widely spoken in the Philippine Islands:

Sumagot	siya	sa	propesor
answered	he	the	professor

"He answered the professor."

VSO languages account for nearly 10 percent of languages investigated—the lion's share of what's left over after SVO and SOV languages. It is possible, however, that the VSO order is derived from an underlying order in which the verb and object are adjacent, so there is no violation of principle (2).

Malagasy, spoken on the island of Madagascar, has sentences that on the surface translate literally as the VOS sentence *put—the book on the table—the woman*, meaning "The woman put the book on the table." This would violate principle (1). However, linguists have shown that such sentences are derived from a deeper SVO order that is then transformed by a rule that postposes the S. Apparent OVS and OSV languages may also be derived from underlying orders that are either SVO or SOV and conform to the two principles, though this remains a subject for linguistic research.

That a language is SVO does not mean that SVO is the only possible word order in surface structure. The correlations between language type and the word order of syntactic categories in sentences are *preferred* word orders, and for the most part are violable tendencies. Different languages follow them to a greater or lesser degree. Thus, when a famous comedian said "Believe you me" on network TV, he was understood and imitated despite the VSO word order. Yoda, the Jedi Master of *Star Wars* fame, speaks a strange but perfectly understandable style of English that achieves its eccentricity by being OSV. (Objects may be complements other than Noun Phrases.) Some of Yoda's utterances are:

Sick I've become.
Around the survivors a perimeter create.
Strong with The Force you are.
Impossible to see the future is.
When nine hundred years you reach, look as good you will not.

For linguists, the many languages and language families provide essential data for the study of universal grammar. Although these languages are diverse in many ways, they are also remarkably similar in many ways. We find that languages from northern Greenland to southern New Zealand, from the Far East to the Far West, all have similar sounds, similar phonological and syntactic rules, and similar semantic systems.

Why Do Languages Change?

> Some method should be thought on for ascertaining and fixing our language forever. . . . I see no absolute necessity why any language should be perpetually changing.
>
> **JONATHAN SWIFT** (1667–1745)

> Stability in language is synonymous with rigor mortis.
>
> **ERNEST WEEKLEY** (1865–1954)

No one knows exactly how or why languages change. As we have shown, linguistic changes do not happen suddenly. Speakers of English did not wake up one morning and decide to use the word *beef* for "ox meat," nor do all the children of one particular generation grow up to adopt a new word. Changes are more gradual, particularly changes in the phonological and syntactic system.

For any one speaker, certain changes may occur instantaneously. When someone acquires a new word, it is not acquired gradually, although full appreciation for all of its possible uses may come slowly. When a new rule enters a speaker's grammar, it is either in or not in the grammar. It may at first be an optional rule, so that sometimes it is used and sometimes it is not, possibly determined by social context or other external factors, but the rule is either there and available for use or not. What is gradual about language change is the spread of certain changes through an entire speech community.

A basic cause of change is the way children acquire the language. No one teaches a child the rules of the grammar. Each child constructs the grammar of her language alone, generalizing rules from the linguistic input she receives. As discussed in chapter 8, the child's language develops in stages until it approximates the adult grammar. The child's grammar is never exactly like that of the adult community because children receive diverse linguistic input. Certain rules may be simplified or overgeneralized, and vocabularies may show small differences that accumulate over several generations.

The older generation may be using certain rules optionally. For example, at certain times they may say "It's I" and at other times "It's me." The less formal style is usually used with children, who, as the next generation, may use only the "me" form of the pronoun in this construction. In such cases the grammar will have changed.

The reasons for some changes are relatively easy to understand. Before television there was no such word as *television*. It soon became a common lexical item. Borrowed words, too, generally serve a useful purpose, and their entry into the language is not mysterious. Other changes are more difficult to explain, such as the Great Vowel Shift in English.

One plausible source of sound change is *assimilation*, an *ease of articulation* process in which one sound influences the pronunciation of an adjacent or nearby sound. For example, vowels are frequently nasalized before nasal consonants because it is easiest to lower the velum to produce nasality in advance of the actual consonant articulation. Once the vowel is nasalized, the contrast that the nasal consonant provided can be equally well provided by the nasalized vowel alone, and the redundant consonant may no longer be pronounced. The contrast between oral and nasal vowels that exists in many languages of the world today (such as French) resulted from just such a historical sound change.

In reconstructing older versions of French, it has been hypothesized that *bol*, "basin," *botte*, "high boot," *bog*, "a card game," *bock*, "Bock beer," and *bon*, "good," were pronounced [bɔl], [bɔt], [bɔg], [bɔk], and [bɔ̃n], respectively. The nasalized vowel in *bon* resulted from the final nasal consonant. Because of a conditioned sound change that deleted nasal consonants in word-final position, *bon* is pronounced [bɔ̃] in modern French. The nasal vowel alone maintains the contrast with the other words.

Another example from English illustrates how such assimilative processes can change a language. In Old English, word initial [kʲ] (like the initial sound of *cute*), when followed by /i/, was further palatalized to become our modern palatal affricate /tʃ/, as illustrated by the following words:

Old English (c = [kʲ])	**Modern English (ch = [tʃ])**
ciese	cheese
cinn	chin
cild	child

The process of palatalization is found in the history of many languages. In Twi, the word meaning "to hate" was once pronounced [ki]. The [k] became first [kʲ] and then finally [tʃ], so that today "to hate" is [tʃi].

Ease of articulation processes, which make sounds more alike, are countered by the need to maintain contrast. Thus sound change also occurs when two sounds are so acoustically similar that there is a risk of confusion. We saw a sound change of /f/ to /h/ in an earlier example that can be explained by the acoustic similarity of [f] to other sounds.

Analogic change is a generalization of rules that reduces the number of exceptional or irregular morphemes. It was by analogy to *plow/plows* and *vow/vows* that speakers started saying *cows* as the plural of *cow* instead of the earlier plural *kine*. In effect, the plural rule became more general.

The generalization of the plural rule continues today with forms such as *yous* (plural of you) used by many speakers in place of the homophonous *you* for singular and plural.

Plural marking continues to undergo analogic change, as exemplified by the regularization of exceptional plural forms. The plural forms of borrowed words like *datum/data*, *agendum/agenda*, *curriculum/curricula*, *memorandum/memoranda*, *medium/media*, *criterion/criteria*, and *virtuoso/virtuosi* are being replaced by regular plurals by many speakers: *agendas*, *curriculums*, *memorandums*, *criterias*, and *virtuosos*. In some cases the borrowed original plural forms were considered to be the singular (as in *agenda* and *criteria*), and the new plural (e.g., *agendas*) is therefore a “plural-plural.” In addition, many speakers now regard *data* and *media* as nouns that do not have plural forms, like *information*. All these changes are “economy of memory” changes and lessen the number of irregular forms that must be remembered.

The past-tense rule is also undergoing generalization. By analogy to *bake/baked* and *ignite/ignited*, many children and adults now say *I waked last night* (instead of *woke*) and *She lighted the bonfire* (instead of *lit*). These regular past-tense forms are found in today’s dictionaries next to the irregular forms, with which they currently coexist.

Assimilation and analogic change account for some linguistic changes, but they cannot account for others. Simplification and regularization of grammars occur, but so does elaboration or complication. Old English rules of syntax became more complex, imposing a stricter word order on the language, at the same time that case endings were being simplified. A tendency toward simplification is counteracted by the need to limit potential ambiguity. Much of language change is a balance between the two.

Language contact is also a vehicle of language change, particularly with respect to lexical changes due to borrowing, and also phonological changes such as the introduction of new phonemes. As we saw earlier, /v/ came into English owing to its intimate contact with French following the Norman invasion.

Many factors contribute to linguistic change: simplification of grammars, elaboration to maintain intelligibility, borrowing, and so on. Changes are actualized by children learning the language, who incorporate them into their grammar. The exact reasons for linguistic change are still elusive, although it is clear that the imperfect learning of the adult languages by children is a contributing factor. Perhaps language changes for the same reason all things change: it is the nature of things to change. As Heraclitus pointed out centuries ago, “All is flux, nothing stays still. Nothing endures but change.”

Summary

All living languages change. Linguistic change such as **sound shift** is found in the history of all languages, as evidenced by the **regular sound correspondences** that exist between different stages of the same language, different dialects of the same language, and different languages. Languages that evolve from a common source are **genetically related**. Genetically related languages were once dialects of the same language. For example, English, German, and Swedish were dialects of an earlier form of Germanic called **Proto-Germanic**, whereas earlier forms of Romance languages, such as Spanish, French, and Italian, were dialects of Latin. Going back even further in time, earlier forms of Proto-Germanic, Latin, and other languages were dialects of **Indo-European**.

All components of the grammar may change. Phonological, morphological, syntactic, lexical, and semantic changes occur. Words, morphemes, phonemes, and rules of all types may be added, lost, or altered. The meaning of words and morphemes may **broaden**, **narrow**, or shift. The lexicon may expand by **borrowing**, which results in **loan words** in the vocabulary. This is very common in **language contact** situations. It also grows through word coinage, blends, compounding, acronyms, and other processes of word formation. On the other hand, the lexicon may shrink as certain words like *typewriter* and *phone booth* are no longer used and become obsolete.

The study of linguistic change is called **historical and comparative linguistics**. Linguists use the **comparative method** to identify regular sound correspondences among the **cognates** of related languages and systematically reconstruct an earlier **protolanguage**. This **comparative reconstruction** allows linguists to peer backward in time and determine the linguistic history of a language family, which may then be represented in a tree diagram similar to Figure 11.5.

Recent estimates place the number of languages in the world today (2010) at somewhat less than 7,000 plus a hundred or more sign languages. These languages are grouped into families, subfamilies, and so on, based on their genetic relationships. A vast number of these languages are dying out because in each generation fewer children learn them. However, attempts are being made to preserve dying languages and dialects for the knowledge they bring to the study of Universal Grammar and the culture in which they are spoken.

Languages may also be classified according to certain characteristics such as a rich versus an impoverished morphology (**analytic** versus **synthetic**), or according to whether their basic word order is Subject-Verb-Object (SVO) like English, or Subject-Object-Verb (SOV) like Japanese, or possibly some other order.

No one knows all the causes of linguistic change. Some sound changes result from assimilation, a fundamentally physiological process of ease of articulation. Others, like the **Great Vowel Shift**, are more difficult to explain. Some grammatical changes are **analogic changes**, generalizations that lead to more regularity, such as *cows* instead of *kine* and *waked* instead of *woke*.

Change comes about through the restructuring of the grammar and lexicon by children learning the language. Grammars may appear to change in the direction of simplicity and regularity, as in the loss of the Indo-European case morphology, but such simplifications may be compensated for by other complexities, such as stricter word order. A balance is always present between simplicity—languages must be learnable—and complexity—languages must be expressive and relatively unambiguous.

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12

Writing: The ABCs of Language

The Moving Finger writes; and, having writ,
Moves on: nor all thy Piety nor Wit
Shall lure it back to cancel half a Line,
Nor all thy Tears wash out a Word of it.

OMAR KHAYYÁM, *Rubáiyát*, c. 1080 (trans. Edward FitzGerald, 1859)

The palest ink is better than the sharpest memory.

CHINESE PROVERB

Throughout this book we have emphasized the spoken form of language. The grammar, which represents one's linguistic knowledge, is viewed as a system for relating sound (sign) and meaning. The ability to acquire and use language represents a vital evolutionary development. No individual or peoples discovered or created language. The human language faculty appears to be biologically and genetically determined.

This is not true of the written form of human languages. Children learn to speak naturally through exposure to language, without formal teaching. To become literate—to learn to read and write—one must make a conscious effort and receive instruction.

Before the invention of writing, useful knowledge had to be memorized. Messengers carried information in their heads. Crucial lore passed from the older to the newer generation through speaking. Even in today's world, many spoken languages lack a writing system, and oral literature still abounds. However, human memory is short-lived, and the brain's storage capacity is limited.

Writing overcomes such problems and allows communication across space and through time. Writing permits a society to permanently record its literature, its history and science, and its technology. The creation and development of writing systems is therefore one of the greatest of human achievements.

By *writing* we mean a visual system for representing language, including handwriting, printing, and electronic displays of these written forms. (Braille "writing" is a *tactile* system for the visually impaired.) It might be argued that today we have electronic means of recording sound and images, so writing is becoming obsolete. If writing became extinct, however, there would be no knowledge of electronics for engineers to study; there would be, in fact, little technology in years to come. There would be no e-messaging, no literature, no books, no mail, no newspapers. There would be some advantages—no spam, no poison-pen letters, no "fine print"—but the losses would far outweigh the gains.

The History of Writing

> An Egyptian legend relates that when the god Thoth revealed his discovery of the art of writing to King Thamos, the good King denounced it as an enemy of civilization. "Children and young people," protested the monarch, "who had hitherto been forced to apply themselves diligently to learn and retain whatever was taught them, would cease to apply themselves, and would neglect to exercise their memories."
>
> **WILL DURANT,** *The Story of Civilization* vol. 1, 1935

There are many legends and stories about the invention of writing. Greek legend has it that Cadmus, Prince of Phoenicia and founder of the city of Thebes, invented the alphabet and brought it with him to Greece. In one Chinese fable, the four-eyed dragon-god Cang Jie invented writing, but in another, writing first appeared as markings on the back of the chi-lin, a white unicorn of Chinese legend. In other myths, the Babylonian god Nebo and the Egyptian god Thoth gave writing as well as speech to humans. The Talmudic scholar Rabbi Akiba believed that the alphabet existed before humans were created, and according to Hindu tradition the Goddess Saraswati, wife of Brahma, invented writing.

Although these are delightful stories, it is evident that before a single word was written, uncountable billions were spoken. The invention of writing comes relatively late in human history, and its development was gradual. It is highly unlikely that a particularly gifted ancestor awoke one morning and decided, "Today I'll invent a writing system."

Pictograms and Ideograms

> One picture is worth a thousand words.
>
> **CHINESE PROVERB**

The roots of writing were the early drawings made by ancient humans. Cave art, called **petroglyphs**, such as those found in the Altamira cave in northern Spain, created by humans living more than 20,000 years ago, can be "read" today. They are literal portrayals of life at that time. We don't know why they were

FIGURE 12.1 | Six of seventy-seven symbols developed by the National Park Service for use as signs indicating activities and facilities in parks and recreation areas. These symbols denote, from left to right: environmental study area, grocery store, men's restroom, women's restroom, fishing, and amphitheater. Certain symbols are available with a prohibiting slash—a diagonal red bar across the symbol that means that the activity is forbidden.
National Park Service, U.S. Department of the Interior

produced; they may be aesthetic expressions rather than pictorial communications. Later drawings, however, are clearly "picture writings," or **pictograms**. Unlike modern writing systems, each picture or pictogram is a direct image of the object it represents. There is a nonarbitrary relationship between the form and meaning of the symbol. Comic strips minus captions are pictographic—literal representations of the ideas to be communicated. This early form of writing represented objects in the world directly rather than through the linguistic names given to these objects. Thus they did not represent the words and sounds of spoken language.

Pictographic writing has been found throughout the world, ancient and modern: among Africans, Native Americans including the Inuits of Alaska and Canada, the Incas of Peru, the Yukagirians of Siberia, and the people of Oceania. Pictograms are used today in international road signs, where the native language of the region might not be understood by all travelers. Such symbols do not depend on words. For example, a traveler does not need to know English to understand the signs used by the U.S. National Park Service (Figure 12.1).

Once a pictogram was accepted as the representation of an object, its meaning was extended to attributes of that object, or concepts associated with it. A picture of the sun could represent warmth, heat, light, daytime, and so on. Pictograms began to represent ideas rather than objects. Such generalized pictograms are called **ideograms** ("idea pictures" or "idea writing").

The difference between pictograms and ideograms is not always clear. Ideograms tend to be less direct representations, and one may have to learn what a particular ideogram means. Pictograms tend to be more literal. For example, the no parking symbol consisting of a black letter P inside a red circle with a slanting red line through it is an ideogram. It represents the idea of no parking abstractly. A no parking symbol showing an automobile being towed away is more literal, more like a pictogram.

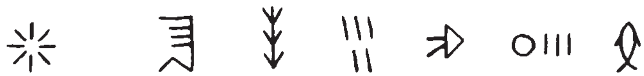
Inevitably, pictograms and ideograms became highly stylized and difficult to interpret without knowing the system. To learn the system, one learned the words of the language that the ideograms represented. Thus the ideograms became linguistic symbols. They stood for the words, both meaning and sounds, that represented the ideas. This stage was a revolutionary step in the development of writing systems.

Cuneiform Writing

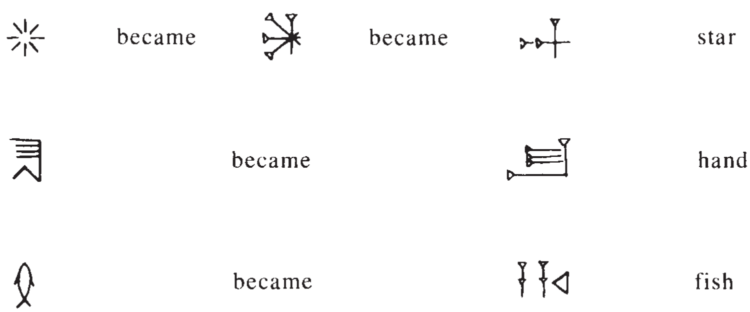
> Bridegroom, let me caress you,
> My precious caress is more savory than honey,
> In the bed chamber, honey-filled,
> Let me enjoy your goodly beauty,
> Lion let me caress you
>
> **TRANSLATION OF A SUMERIAN POEM WRITTEN IN CUNEIFORM**

Much of what we know about writing stems from the records left by the Sumerians, an ancient people of unknown origin, who built a civilization in southern Mesopotamia (modern Iraq) more than 6,000 years ago. They left innumerable clay tablets containing business documents, epics, prayers, poems, proverbs, and so on. So copious are these written records that the Pennsylvania Sumerian Dictionary Project has been able to publish electronically an eighteen-volume online dictionary of their written language. It has been available since June 2006.

The writing system of the Sumerians is the oldest one known. They were a commercially oriented people, and as their business deals became increasingly complex, the need for permanent records arose. An elaborate pictography was developed, along with a system of tallies. Some examples are shown here:



Over the centuries the Sumerians simplified and conventionalized their pictography. They began to produce the symbols of their written language by using a wedge-shaped stylus that was pressed into soft clay tablets. The tablets hardened in the desert sun to produce permanent records that were far hardier than modern paper or electronic documents. Had the original American Declaration of Independence been written this way, it would not be in need of restoration and preservation. This form of writing is called **cuneiform**—literally, "wedge-shaped" (from Latin *cuneus*, "wedge"). Here is an illustration of the evolution of Sumerian pictograms to cuneiform:

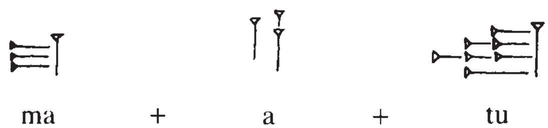


[1]The pictograph for "ox" evolved, much later, into the letter *A*.

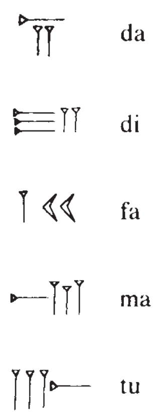
The cuneiform symbols in the third column do little to remind us (or the Sumerians) of the meaning represented. As cuneiform evolved, its users began to think of the symbols more in terms of the name of the things represented than of the things themselves. Eventually cuneiform script came to represent words of the language. Such a system is called **logographic**, or **word writing**. In this oldest type of writing system, the symbol stands for both the word and the concept, which it may still resemble, however abstractly. Thus **logograms**, the symbols of a word-writing system, are ideograms that represent in addition to the concept, the word or morpheme in the language for that concept.

The cuneiform writing system spread throughout the Middle East and Asia Minor. The Babylonians, Assyrians, and Persians borrowed it. In adopting cuneiform characters, the borrowers often used them to represent the sounds of the syllables in their own languages. In this way cuneiform evolved into a **syllabic writing** system.

In a syllabic writing system, each syllable in the language is represented by its own symbol, and words are written syllable by syllable. Cuneiform writing was never purely syllabic. A large residue of symbols remained that stood for whole words. The Assyrians retained many word symbols, even though every word in their language could be written out syllabically if it were desired. Thus they could write  *mātu* "country" as:



The Persians (ca. 600–400 B.C.E.) devised a greatly simplified syllabic alphabet for their language, which made little use of word symbols. By the reign of Darius I (521–486 B.C.E.), this writing system was in wide use. The following characters illustrate it:



Emoticons are strings of text characters that, when viewed sideways, form a face expressing a particular emotion. (Some are fixed symbols such as ☺). They are used mostly in e-mail and text messaging to express a feeling. They are a modern, pictographic system similar to cuneiform in that the same symbols are combined in different manners to convey different concepts. Most everyone who uses e-mail recognizes the smiley face :-) to mean "not serious" or "just joking." Several less common emoticons, and their generally accepted meanings, are shown here:

:'–(	"crying"
:–S	"bizarre"
|:*)	"drunk"
:–)~	"drooling"
@}->——	"a rose"

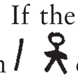
The invention, use, and acceptance of emoticons reflect on a small scale how a writing system such as cuneiform might have spread throughout a country.

The Rebus Principle

WILLIAM SHAKESPEARE, *Hamlet*, c. 1600

When a graphic sign no longer has a visual relationship to the word it represents, it becomes a **phonographic symbol**, standing for the sounds that represent the word. A single sign can then be used to represent all words with the same sounds—the homophones of the language. If, for example, the symbol ⊙ stood for *sun* in English, it could then be used in a sentence like *My ⊙ is a doctor*. This sentence is an example of the **rebus principle**.

A rebus is a representation of words by pictures of objects whose names sound like the word. Thus  might represent *eye* or the pronoun *I*. The sounds of the two words are identical, even though the meanings are not. Similarly,  could represent *belief* (*be* + *lief* = *bee* + *leaf* = /bi/ + /lif/), and  could be *believes*.

Proper names can also be written in such a way. If the symbol  is used to represent *rod* and the symbol  represents *man*, then  could represent *Rodman*, although nowadays the name is unrelated to either rods or men. Such combinations often become stylized or shortened so as to be more easily written. *Rodman*, for example, might be written in such a system as  or even .

Jokes, riddles, and advertising use the rebus principle. A popular ice cream company advertises "31derful flavors."

This is not an efficient system because in many languages words cannot be divided into sequences of sounds that have meaning by themselves. It would be difficult, for example, to represent the word *English* (/ɪŋ/ + /glɪʃ/) in English according to the rebus principle. *Eng* by itself does not mean anything, nor does *glish*.

From Hieroglyphics to the Alphabet

"You'd better phrase that more politely. We no longer use the word."

At the time that Sumerian pictography was flourishing (around 4000 B.C.E.), the Egyptians were using a similar system, which the Greeks later called hieroglyphics (*hiero*, "sacred," + *glyphikos*, "carvings"). These sacred carvings originated as pictography as shown by the following:

''eye'' ''giraffe'' ''to rule''[2] ''fresh'' or ''cool''[3]

[2]The symbol portrays the Pharaoh's staff.

[3]Water trickling out of a vase.

Eventually, these pictograms came to represent both the concept and the word for the concept. Once this happened, hieroglyphics became a bona fide logographic writing system. Through the rebus principle, hieroglyphics also became a syllabic writing system.

The Phoenicians, a Semitic people who lived in what is today Lebanon, were aware of hieroglyphics as well as the offshoots of Sumerian writing. By 1500 B.C.E., they had developed a writing system of twenty-two characters, the West Semitic Syllabary. Mostly, the characters stood for consonants alone. The reader provided the vowels, and hence the rest of the syllable, through knowledge of the language. (Cn y rd ths?) Thus the West Semitic Syllabary was both a **syllabary** and a **consonantal alphabet** (also called **abjad**).

The ancient Greeks tried to borrow the Phoenician writing system, but it was unsatisfactory as a syllabary because Greek has too complex a syllable structure. In Greek, unlike Phoenician, vowels cannot be determined by context, so a writing system for Greek required that vowels be specifically written. Fortuitously, Phoenician had more consonants than Greek, so when the Greeks borrowed the system, they used the leftover consonant symbols to represent vowel sounds. The result was **alphabetic writing**, a system in which both consonants and vowels are symbolized. (The word *alphabet* is derived from *alpha* and *beta*, the first two letters of the Greek alphabet.)

Most alphabetic systems in use today derive from the Greek system. The Etruscans knew this alphabet and through them it became known to the Romans, who used it for Latin. The alphabet spread with Western civilization, and eventually most nations of the world had the opportunity to use alphabetic writing.

According to one view, the alphabet was not invented, it was discovered. If language did not include discrete individual sounds, no one could have invented alphabetic letters to represent them. When humans started to use one symbol for one phoneme, they were making more salient their intuitive knowledge of the phonological system of the language.

Modern Writing Systems

> . . . but their manner of writing is very peculiar, being neither from the left to the right, like the Europeans; nor from the right to the left, like the Arabians; nor from up to down, like the Chinese; nor from down to up, like the Cascagians, but aslant from one corner of the paper to the other, like ladies in England.
>
> **JONATHAN SWIFT,** *Gulliver's Travels*, 1726

We have already mentioned the various types of writing systems used in the world: word or logographic writing, syllabic writing, consonantal alphabet writing, and alphabetic writing. Most of the world's written languages use alphabetic writing. Even Chinese and Japanese, whose native writing systems are not alphabetic, have adopted alphabetic transcription systems for special purposes such as street signs for foreigners and input for computers.

Word Writing

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In a word-writing or logographic writing system, a written character represents both the meaning and pronunciation of each word or morpheme. Such systems are cumbersome, containing thousands of different characters. By contrast, all of the 450,000 entries in *Webster's Third New International Dictionary* may be written using only twenty-six alphabetic symbols and a handful of punctuation marks and other characters. It is understandable why word writing gave way to alphabetic systems in most places in the world.

The major exceptions are the writing systems used in China and Japan. The Chinese writing system has an uninterrupted history of 3,500 years. For the most part it is a word-writing system, each character representing an individual word or morpheme. Longer words are formed by combining two words or morphemes, as shown by the word meaning "business," *mǎimai*, which is formed by combining the words meaning "buy" and "sell." This is similar to compounding in English.

A word-writing system would be awkward for English and other Indo-European languages because of the pervasiveness of inflected verb forms such as *take*, *takes*, *taken*, *took*, and *taking*, and inflected noun forms such as *cat*, *cats*, *cat's*, and *cats'*. These are difficult to represent without a huge proliferation of characters. The Chinese languages, on the other hand, have little inflection.

Even without the need to represent inflectional forms, Chinese dictionaries contain tens of thousands of characters. A person need know "only" about 5,000, however, to read a newspaper. To promote literacy, the Chinese government has undertaken character simplification programs from time to time. This process was first tried in 213 B.C.E., when the scholar Li Si published an official list of over 3,000 characters whose written forms he had simplified by omitting unneeded strokes. This would be analogous to dictionary writers simplifying *amoeba* to *ameba*, eliminating the superfluous *o*. Since that time, successive generations of Chinese scholars have added new characters and modified old ones, creating redundancy, ambiguity, and complexity. Recent character-simplification efforts continue the ages-old tradition of trying to make the system learnable and usable, while retaining its basic form.

The Chinese government has adopted a spelling system using the Roman alphabet called **Pinyin**, which is now used alongside the regular system of characters. By the time of the Summer Olympics of 2008, nearly all public information signs in Beijing, such as the names of streets, parks, restaurants, hotels, and shopping centers, were printed in both systems for the convenience of foreign visitors. It is not the government's intent to replace the traditional writing, which is an integral part of Chinese culture. To the Chinese, writing is an art—**calligraphy**—and thousands of years of poetry, literature, and history are preserved in the old system.

An additional reason for keeping the traditional system is that it permits all literate Chinese to communicate even though their spoken languages are not mutually intelligible. Thus writing has served as a unifying factor throughout Chinese history, in an area where hundreds of languages and dialects coexist. A Chinese proverb states "people separated by a blade of grass cannot understand each other." The unified writing system is a scythe that cuts across linguistic differences and allows the people to communicate.

This use of written Chinese characters is similar to the use of Arabic numerals, which mean the same thing in many countries. For example, the character 5 (or V for that matter) stands for a different sequence of sounds in English, French, and Finnish. It is *five* /faɪv/ in English, *cinq* /sæ̃k/ in French, and *viisi* /viːsi/ in Finnish, but in all these languages 5 means "five" however it is pronounced. Similarly, the spoken word for "rice" is different in the various Chinese languages, but the written character is the same. If the writing system in China were to become alphabetic, each language would be as different in writing as in speaking, and written communication would no longer be possible among the various language communities.

Syllabic Writing

Syllabic writing systems are more efficient than word-writing systems, and they are certainly less taxing on the memory. However, languages with a rich structure of syllables containing many consonant clusters (such as *tr* or *spl*) cannot be efficiently written with a syllabary. To see this difficulty, consider the syllable structures of English:

I	/aɪ/	V	ant	/ænt/	VCC
key	/ki/	CV	pant	/pænt/	CVCC
ski	/ski/	CCV	stump	/stʌmp/	CCVCC
spree	/spri/	CCCV	striped	/straɪpt/	CCCVCC
an	/æn/	VC	ants	/ænts/	VCCC
seek	/sik/	CVC	pants	/pænts/	CVCCC
speak	/spik/	CCVC	sports	/spɔrts/	CCVCCC
scram	/skræm/	CCCVC	splints	/splɪnts/	CCCVCCC

Even this table is not exhaustive; there are syllables whose codas may contain four consonants, such as *strengths* /strɛnkθs/ and *triumphs* /traɪəmpfs/. With more than thirty consonants and over twelve vowels, the number of different possible syllables is astronomical, which is why English, and Indo-European languages in general, are unsuitable for syllabic writing systems.

The Japanese language, on the other hand, is more suited for syllabic writing, because all words in Japanese can be phonologically represented by about one hundred syllables, mostly of the consonant-vowel (CV) type, and there are no underlying consonant clusters. To write these syllables, the Japanese have two syllabaries, each containing forty-six characters, called **kana**. The entire Japanese language can be written using kana. One syllabary, **katakana**, is used for loan words and for special effects similar to italics in European writing. The other syllabary, **hiragana**, is used for native words. Hiragana characters may occur in the same word as ideographic characters, which are called **kanji**, and are borrowed Chinese characters. Thus Japanese writing is part word writing, part syllable writing.

During the first millennium, the Japanese tried to use Chinese characters to write their language. However, spoken Japanese is unlike spoken Chinese. (They are genetically unrelated languages.) A word-writing system alone was not suitable for Japanese, which is a highly inflected language in which verbs may occur in thirty or more different forms. Scholars devised syllabic characters, based on modified Chinese characters, to represent the inflectional endings and other grammatical morphemes. Thus, in Japanese writing, kanji is commonly used for the verb roots, and hiragana symbols for the inflectional markings.

For example, 行 is the character meaning "go," pronounced [i]. The word for "went" in formal speech is *ikimashita*, written 行きました, where the hiragana symbols きました represent the syllables *ki*, *ma*, *shi*, *ta*. Nouns, on the other hand, are not inflected in Japanese, and they can generally be written using Chinese characters alone.

In theory, all of Japanese could be written in hiragana. However, in Japanese, there are many homographs (like *lead* in "lead pipe" or "lead astray"), and the use of kanji disambiguates a word that might be ambiguous if written syllabically, similar to the ambiguity of *can* in "He saw that gasoline can explode." In addition, kanji writing is an integral part of Japanese culture, and it is unlikely to be abandoned.

In America in 1821, the Cherokee Sequoyah invented a syllabic writing system for his native language. Sequoyah's script, which survives today essentially unchanged, proved useful to the Cherokee people and is justifiably a point of great pride for them. The syllabary contains eighty-five symbols, many of them derived from Latin characters, which efficiently transcribe spoken Cherokee. A few symbols are shown here:

Ꭻ	gu
Ꮀ	hu
Ꮺ	we
Ꮣ	ta
Ꮋ	mi

In some languages, an alphabetic character can be used in certain words to write a syllable. In a word such as bar-b-q, the single letters represent syllables (*b* for [bi] or [bə], *q* for [kju]).

Consonantal Alphabet Writing

Semitic languages, such as Hebrew and Arabic, are written with alphabets that consist only of consonants. Such an alphabet works for these languages because consonants form the root of most words. For example, the consonants *ktb* in Arabic form the root of words associated with "write." Thus *katab* means "to write," *aktib* means "I write," *kitab* means "a book," and so on. Inflectional and derivational processes can be expressed by different vowels inserted into the triconsonantal roots.

Because of this structure, vowels can sometimes be figured out by a person who knows the spoken language, jst lk y cn rd ths phrs, prvdng y knw nglsh. English, however, is unrelated to the Semitic languages like Arabic and Hebrew, and its structure is such that vowels are usually crucial for reading and writing. The English phrase *I like to eat out* would be incomprehensible without vowels, viz. *lk t t t*.

Semitic alphabets provide a way to use diacritic marks to express vowels. This is partly out of the desire to preserve the true pronunciations of religious writings, and partly out of deference to children and foreigners learning to read and write. In Hebrew, dots or other small figures are placed under, above, or even in the center of the consonantal letter to indicate the accompanying vowel. For example, ל represents an l-sound in Hebrew writing. Unadorned, the vowel that follows would be determined by context. However, לֶ (with a tiny triangle of dots below it) indicates that the vowel that follows is [ɛ], so in effect לֶ represents the syllable [lɛ].

These systems are called consonantal alphabets because only the consonants are fully developed symbols. Sometimes they are considered syllabaries because once the reader or writer perceives the vowel, the consonantal letter *seems* to stand for a syllable. With a true syllabary, however, a person need know only the phonetic value of each symbol to pronounce it correctly and unambiguously. Once you learn a Japanese syllabary, you can read Japanese in a (more or less) phonetically correct way without any idea of what you are saying. (The syllabic text doesn't always show word boundaries, and there is no indication of prosodic features such as intonation.) This would be impossible for Arabic or Hebrew.

Alphabetic Writing

Alphabetic writing systems are easy to learn, convenient to use, and maximally efficient for transcribing any human language.

The term **sound writing** is sometimes used in place of *alphabetic writing*, but it does not truly represent the principle involved in the use of alphabets. One-sound ↔ one-letter is inefficient and unintuitive, because we do not need to represent the [p^h] in *pit* and the [p] in *spit* by two different letters. It is confusing to represent nonphonemic differences in writing because the sounds are seldom perceptible to speakers. Except for the phonetic alphabets, whose function is to record the sounds of all languages for descriptive purposes, most, if not all, alphabets have been devised on the **phonemic principle**.

In the twelfth century, an Icelandic scholar developed an orthography derived from the Latin alphabet for the writing of the Icelandic language of his day. Other scholars in this period were also interested in orthographic reform, but the Icelander, who came to be known as "the First Grammarian" (because his anonymous paper was the first entry in a collection of grammatical essays), was the only one of the time who left a record of his principles. The orthography he developed was clearly based on the phonemic principle. He used minimal pairs to show the distinctive contrasts. He did not suggest different symbols for voiced and unvoiced [θ] and [ð], nor for [f] or [v], nor for velar [k] and palatal [tʃ], because these pairs, according to him, represented allophones of the phonemes /θ/, /f/, and /k/, respectively. He did not use these modern technical terms, but the letters of this alphabet represent the distinctive phonemes of Icelandic of that century.

King Seijong of Korea (1397–1450) realized that the same principles held true for Korean when, with the assistance of scholars, he designed a phonemic alphabet. The king was an avid reader and realized that the more than 30,000 Chinese characters used to write Korean discouraged literacy. The fruit of the king's labor was the Korean alphabet called **Hangul**, which had seventeen consonants and eleven vowels.

The Hangul alphabet was designed on the phonemic principle. Although Korean has the sounds [l] and [r], Seijong represented them by a single letter because they are allophonic variants of the same phoneme. (See exercise 3, chapter 7.) The same is true for the sounds [s] and [ʃ], and [ts] and [tʃ].

Seijong showed further ingenuity in the design of the characters themselves. The consonants are drawn so as to depict the place and manner of articulation. Thus the letter for /g/ is ㄱ to suggest the raising of the back of the tongue to the velum. The letter for /m/ is the closed figure ㅁ to suggest the closing of the lips. Vowels are drawn as long vertical or horizontal lines, sometimes with smaller marks attached to them. Thus ㅣ represents /i/, ㅜ represents /u/, and ㅏ represents /a/. They are easily distinguishable from the blockier consonants.

In Korean writing, the Hangul characters are grouped into squarish blocks, each corresponding to a syllable. The syllabic blocks, though they consist of alphabetic characters, make Korean look as if it were written in a syllabary. If English were written that way, "Now is the winter of our discontent" would have this appearance:

No	i	th	wi te	o	ou	di co te
w	s	e	n r	f	r	s n nt

The space between letters is less than the space between syllables, which is less than the space between words. An example of Korean writing can be found in exercise 9, item 10 at the end of the chapter, or on the Internet.

These characteristics make Korean writing unique in the world, unlike that of the Europeans, the Arabians, the Chinese, the Cascagians, or even "ladies in England."

Many languages have their own alphabet, and each has developed certain conventions for converting strings of alphabetic characters into sequences of sound (reading), and converting sequences of sounds into strings of alphabetic characters (writing). As we have illustrated with English, Icelandic, and Korean, the rules governing the sound system of the language play an important role in the relation between sound and character.

Most European alphabets use Latin (Roman) letters, adding diacritic marks to accommodate individual characteristics of a particular language. For example, Spanish uses ñ to represent the palatalized nasal phoneme of *señor*, and German has added an umlaut for certain of its vowel sounds that did not exist in Latin (e.g., in *über*). Diacritic marks supplement the forty-six kana of the Japanese syllabaries to enable them to represent the more than 100 syllables of the language. Diacritic marks are also used in writing systems of tone languages such as Thai to indicate the tone of a syllable.

Some languages use two letters together—called a **digraph**—to represent a single sound. English has many digraphs, such as *sh* /ʃ/ as in *she*, *ch* /tʃ/ as in *chop*, *ng* as in *sing* (/sɪŋ/), and *oa* as in *loaf* /lof/.

Besides the European languages, languages such as Turkish, Indonesian, Swahili, and Vietnamese have adopted the Latin alphabet. Other languages that have more recently developed a writing system use some of the IPA phonetic symbols in their alphabet. Twi, for example, uses ɔ, ɛ, and ŋ.

Many Slavic languages, including Russian, use the Cyrillic alphabet, named in honor of St. Cyril, who brought Christianity to the Slavs in the ninth century C.E. It is derived directly from the Greek alphabet without Latin mediation.

Many contemporary alphabets, such as those used for Arabic, Farsi (spoken in Iran), Urdu (spoken in Pakistan), and many languages of the Indian subcontinent are ultimately derived from the ancient Semitic syllabaries.

Figure 12.2 shows a coarse time line of the development of the Roman alphabet.

15000 B.C.E.	—	Cave drawings as pictograms
.		
.		
.		
4000 B.C.E.	—	Sumerian cuneiform
3000 B.C.E.	—	Hieroglyphics
1500 B.C.E.	—	West Semitic Syllabary of the Phoenicians
1000 B.C.E.	—	Ancient Greeks borrow the Phoenician consonantal alphabet
750 B.C.E.	—	Etruscans borrow the Greek alphabet
500 B.C.E.	—	Romans adapt the Etruscan/Greco alphabet to Latin

FIGURE 12.2 | Timeline of the development of the Roman alphabet.

Writing and Speech

ALGERNON: But, my own sweet Cecily, I have never written you any letters.
CECILY: You need hardly remind me of that, Ernest. I remember only too well that I was forced to write your letters for you. I wrote always three times a week, and sometimes oftener.
ALGERNON: Oh, do let me read them, Cecily?

> CECILY: Oh, I couldn't possibly. They would make you far too conceited. The three you wrote me after I had broken off the engagement are so beautiful, and so badly spelled, that even now I can hardly read them without crying a little.
>
> **OSCAR WILDE,** *The Importance of Being Earnest*, 1895

The development of writing freed us from the limitations of time and geography, but spoken language still has primacy and is the principal concern of most linguists. Nevertheless, writing systems are of interest for their own sake.

The written language reflects, to a certain extent, the elements and rules that together constitute the grammar of the language. The letters of the alphabet represent the system of phonemes, although not necessarily in a direct way. The independence of words is revealed by the spaces between them in most writing systems. However, written Japanese and Thai do not require spaces between words, although speakers and writers are aware of the individual words. On the other hand, no writing system shows the individual morphemes within a word in this way, even though speakers know what they are. (The hyphen occasionally serves this purpose in English, as in *ten-speed* or *bone-dry*.)

Languages vary in regard to how much punctuation is used in writing. Some have little or none, such as Chinese. German uses capitalization, a form of punctuation, for all nouns. English uses punctuation to set apart sentences and phrases and to indicate questions, intonation, stress, and contrast.

Consider the difference in meaning between sentences 1 and 2:

1. I don't think I know.
2. I don't think, I know.

In (1), the speaker doesn't know; in (2), the speaker knows. The comma fills in for the pause that would make the meaning clear if spoken.

Similarly, by using an exclamation point or a question mark, the intention of the writer can be made clearer.

3. The children are going to bed at eight o'clock. (a simple statement)
4. The children are going to bed at eight o'clock! (an order)
5. The children are going to bed at eight o'clock? (a question)

In sentences 6 and 7, the use of the comma and quotation marks affects the syntax. In 6 *he* may refer either to John or to someone else, but in sentence 7 the pronoun must refer to someone other than John:

6. John said he's going.
7. John said, "He's going."

The apostrophe used in contractions and possessives also provides syntactic information not always available in the spoken utterance.

8. My cousin's friends (one cousin)
9. My cousins' friends (two or more cousins)

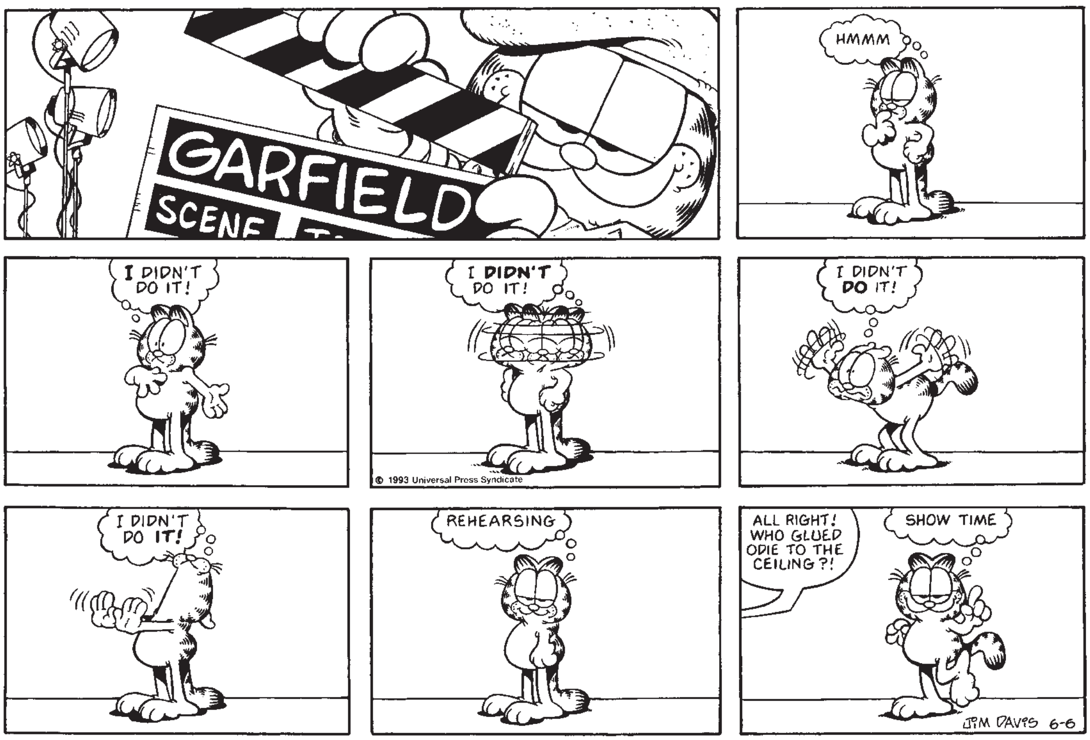
Writing, then, somewhat reflects the spoken language, and punctuation may even distinguish between two meanings not revealed in the spoken forms, as shown in sentences 8 and 9. However, often the spoken language conveys meaning that the written language does not.

In the normal written version of sentence 10,

10. John whispered the message to Bill and then he whispered it to Mary.

he can refer to either John or Bill. In the spoken sentence, if *he* receives extra stress (called **contrastive stress**), it must refer to Bill; if *he* receives normal stress, it refers to John.

A speaker can usually emphasize any word in a sentence by using contrastive stress. Writers sometimes attempt to show emphasis by using all capital letters, italics, or underlining the emphasized word. This is nicely illustrated by the "Garfield" cartoon.



In the first panel we understand Garfield as meaning, "I didn't do it, someone else did." In the second panel the meaning is "I didn't do it, even though you think I did." In the third, the contrastive stress conveys the meaning "I didn't do it, it just happened somehow." In the fourth panel Garfield means, "I didn't do it, though I may be guilty of other things." In each case the boldfaced word is contrasted with something else.

Although such visual devices can help in English, it is not clear that they can be used in a language such as Chinese. In Japanese, however, this kind of emphasis can be achieved by writing a word in katakana.

The use of italics has many functions in written language. One use is to indicate reference to the italicized word, as in "*sheep* is a noun." A children's riddle, which is sung aloud, plays on this distinction:

Railroad crossing, watch out for cars
How do you spell it without any *r*'s?

The answer is "i-t." The joke is that the second line, were it written, would be:

How do you spell *it* without any *r*'s?

Written language is more conservative than spoken language. Once a word is spelled and written down, that spelling remains intact, although the word's pronunciation may change over time. When we write we are more apt to obey the prescriptive rules taught in school than when we speak. We may write "it is I" but we say "it's me." Such informalities abound in spoken language, but in written language may be "corrected" by copy editors, diligent English teachers, and careful writers. A linguist wishing to describe the language that people regularly use therefore cannot depend on written records alone, except when nothing else is available, as in the study of dead languages (see chapter 11).

Spelling

"Do you spell it with a 'v' or a 'w'?" inquired the judge.
"That depends upon the taste and fancy of the speller, my Lord," replied Sam.

CHARLES DICKENS, *The Pickwick Papers*, 1837

If writing represented the spoken language perfectly, spelling reforms would never have arisen. In chapter 6 we discussed some of the problems in the English orthographic system. These problems prompted George Bernard Shaw to observe that:

> [I]t was as a reading and writing animal that Man achieved his human eminence above those who are called beasts. Well, it is I and my like who have to do the writing. I have done it professionally for the last sixty years as well as it can be done with a hopelessly inadequate alphabet devised centuries before the English language existed to record another and very different language. Even this alphabet is reduced to absurdity by a foolish orthography based on the notion that the business of spelling is to represent the origin and history of a word instead of its sound and meaning. Thus an intelligent child who is bidden to spell *debt*, and very properly spells it d-e-t, is caned for not spelling it with a b because Julius Caesar spelt the Latin word for it with a b.[4]

[4]Shaw, G. B. 1948. Preface to R. A. Wilson, *The miraculous birth of language*. New York: Philosophical Library.

The irregularities between graphemes (letters) and phonemes have been cited as one reason "why Johnny can't read." Homographs such as *lead* /lid/ and *lead* /lɛd/ have fueled the flames of spelling reform movements. Different spellings for the same sound, silent letters, and missing letters also are cited as reasons that English needs a new orthographic system. The following examples illustrate the discrepancies between spelling and sounds in English:

Same Sound Different Spelling	Different Sound Same Spelling		Silent Letters	Missing Letters	
/aɪ/	**th**ought	/θ/	lis**t**en	use	/**j**uz/
	though	/ð/	de**b**t	fuse	/f**j**uz/
aye	**Th**omas	/t/	**g**nome		
b**uy**			**k**now		
b**y**	**a**te	/e/	**p**sychology		
d**ie**	**a**t	/æ/	ri**gh**t		
h**i**	f**a**ther	/a/	**m**nemonic		
Th**ai**	m**a**ny	/ɛ/	s**c**ience		
h**ei**ght			ta**l**k		
g**ui**de			**h**onest		
			s**w**ord		
			bom**b**		
			clu**e**		
			We**d**nesday		

The spelling of most English words today is based on English as spoken in the fourteenth, fifteenth, and sixteenth centuries. Spellers in those times saw no need to spell the same word consistently. Shakespeare spelled his own name in several ways. In his plays, he spelled the first person singular pronoun variously as *I*, *ay*, and *aye*.

After Johannes Gutenberg invented the printing press in the mid-fifteenth century, archaic and idiosyncratic spellings became widespread and more permanent. Words in print were frequently misspelled outright because many of the early printers were not native speakers of English.

Spelling reformers saw the need for consistent spelling that correctly reflected the pronunciation of words. To that extent, spelling reform was necessary, but many scholars became overzealous. Because of their reverence for Classical Greek and Latin, these scholars changed the spelling of English words to conform to their etymologies. Where Latin had a *b*, they added a *b* even if it was not pronounced. Where the original spelling had a *c* or *p* or *h*, these letters were added, as shown by these few examples:

Middle English Spelling		Reformed Spelling
indite	→	indict
dette	→	debt
receit	→	receipt
oure	→	hour

Such spelling habits inspired Robert N. Feinstein to compose the following poem, entitled *Gnormal Pspelling*:[5]

Gnus and gnomes and gnats and such
Gnouns with just one G too much.
Pseudonym and psychedelic
P becomes a psurplus relic.
Knit and knack and knife and knocked
Kneedless Ks are overstocked.
Rhubarb, rhetoric and rhyme
Should lose an H from thyme to time.

Many languages have been the subject of **spelling reforms** in the past hundred years, including Dutch, French, Norwegian, and Russian. The motivation is generally to make spelling easier for children or immigrants, and for the convenience of international communications. As recently as 1996 some German-speaking countries imposed spelling reforms that make spelling less archaic (replacing the traditional ß with ss) and more regular (*rauh* → *rau* (rough) because of *blau*, *grau*, *genau*). As is so often the case, there is much resistance to the imposed changes, which continues to this day.

Text messaging, and its offspring twittering, is having a growing effect on spelling. Owing to limited space, the words in a text message are often spelled as tersely as comprehension allows. For example, "wat uz tnk of da wy da englsh lang iz evolvn thru da eva incresin yus of txt msges" (82 keystrokes) for "what do you (all) think of the way the English language is evolving through the ever increasing use of text messages?" (117 keystrokes). Text message spelling is far from standardized. Each person has his own peculiar habits. The need to be understood is paramount, though, and a trick once known only to reading experts has been discovered by the folks who text message: When the letters of a word are scrambled or omitted, retaining the first and last letters is the most important. Try this:

fi yuo cna raed tihs, you porbblay hvae a snees fo txet mssegnig

The rebus principle also pops up in text messaging: *cre8* for "create" or *1der* for "wonder." There is much phonetic spelling: *yusfl* for "useful" or *thru* for "through," and a plethora of acronyms: LOL for "laugh out loud," among thousands of others. And even the most tradition-bound spellers may want to step aside and wink at the keystroke-saving *nite* for "knight," *Wensday* for "Wednesday," and so on.

Although some say—these "some" are always saying—that texting and twittering are wrecking the language, in truth the adaptation to the mobile phone is yet another example of the enormous creativity that is part of our language competence. And truly, there is nothing in texting that hasn't been done before in the history of writing, from rebuses to logographs to syllabic spelling to acronyms to abbreviations to secret code words (used to deceive eavesdropping parents)

[5]"Gnormal Pspelling" by Robert N. Feinstein from "Son of an Oyster." Copyright © 1986 by Robert N. Feinstein. Reprinted by permission of Roger Lathbury DBA Orchises Press as representative for the estate of Robert N. Feinstein.

and so on. An excellent treatment of the subject is to be found in David Crystal's book *Txtng: The Gr8 Db8*.

The current English spelling system is based primarily on the earlier pronunciations of words. The many changes that have occurred in the sound system of English since then are not reflected in the current spelling, which was frozen due to widespread printed material and scholastic conservatism.

For these reasons, modern English orthography does not always represent what we know about the phonology of the language. The disadvantage is partially offset by the fact that the writing system allows us to read and understand what people wrote hundreds of years ago without the need for translations. If there were a one-to-one correspondence between our spelling and the sounds of our language, we would have difficulty reading the works of Shakespeare and Dickens.

Languages change. It is not possible to maintain a perfect correspondence between pronunciation and spelling, nor is it totally desirable. For instance, in the case of homophones, it is helpful at times to have different spellings for the same sounds, as in the following pair:

The book was red. The book was read.

Lewis Carroll makes the point with humor:

> "And how many hours a day did you do lessons?" said Alice.
> "Ten hours the first day," said the Mock Turtle, "nine the next, and so on."
> "What a curious plan!" exclaimed Alice.
> "That's the reason they're called lessons," the Gryphon remarked, "because they lessen from day to day."

There are also reasons for using the same spelling for different pronunciations. A morpheme may be pronounced differently when it occurs in different contexts. The identical spelling reflects the fact that the different pronunciations represent the same morpheme. This is the case with the plural morpheme. It is always spelled with an *s* despite being pronounced [s] in *cats* and [z] in *dogs*. The sound of the morpheme is determined by rules, in this case and elsewhere.

Similarly, the phonetic realizations of the underlined vowels in the following forms follow a regular pattern:

aɪ/ɪ	**i/ɛ**	**e/æ**
divine/divinity	serene/serenity	sane/sanity
child/children	obscene/obscenity	profane/profanity
sign/signature	clean/cleanse	humane/humanity

These considerations have led some scholars to suggest that in addition to being phonemic, English has a **morphophonemic orthography**. To read English correctly, morphophonemic knowledge is required. This contrasts with a language such as Spanish, whose orthography is almost purely phonemic.

Other examples provide further motivation for spelling irregularities. The *b* in *debt* may remind us of the related word *debit*, in which the *b* is pronounced.

The same principle is true of pairs such as *sign/signal*, *bomb/bombardier*, and *gnosis/prognosis/agnostic*.

There are also different spellings that represent the different pronunciations of a morpheme when confusion would arise from using the same spelling. For example, there is a rule in English phonology that changes a /t/ to an /s/ in certain cases:

democrat → democracy

The different spellings have resulted partly because this rule does not apply to all morphemes, so that *art* + *y* is *arty*, not **arcy*. Regular phoneme-to-grapheme rules determine in many cases when a morpheme is to be spelled identically and when it is to be changed.

Other subregularities are apparent. A *c* always represents the /s/ sound when it is followed by a *y*, *i*, or *e*, as in *cynic*, *citizen*, and *censure*. Because it is always pronounced [k] when it is the final letter in a word or when it is followed by any other vowel (*coat*, *cat*, *cut*, and so on), no confusion results. The *th* spelling is usually pronounced voiced [ð] between vowels (the result of an historical intervocalic voicing rule), and in function words such as *the*, *they*, *this*, and *there*. Elsewhere it is the voiceless [θ].

There is another important reason why spelling should not always be tied to the phonetic pronunciation of words. Different dialects of English have divergent pronunciations. Cockneys drop their "(h)aitches," and Bostonians and Southerners drop their *r*'s; *neither* is pronounced [niðər], [naɪðər], and [niðə] by Americans, [naɪðə] by the British, and [neðər] by the Irish; some Scots pronounce *night* [nɪxt]; people say "Chicago" and "Chicawgo," "hog" and "hawg," "bird" and "boyd"; *four* is pronounced [fɔː] by the British, [fɔr] in the Midwest, and [foə] in the South; *orange* is pronounced in at least two ways in the United States: [arəndʒ] and [ɔrəndʒ].

Although dialectal pronunciations differ, the common spellings indicate the intended word. It is necessary for the written language to transcend local dialects. With a uniform spelling system, a native of Atlanta and a native of Glasgow can communicate through writing. If each dialect were spelled according to its pronunciation, written communication among the English-speaking peoples of the world would suffer.

Spelling Pronunciations

> For pronunciation, the best general rule is to consider those as the most elegant speakers who deviate least from written words.
>
> **SAMUEL JOHNSON** (1707–1784)
>
> Write with the learned, pronounce with the vulgar.
>
> **BENJAMIN FRANKLIN,** *Poor Richard's Almanack*, mid-eighteenth century

Despite the primacy of the spoken word over the written language, the written word is often regarded with excessive reverence. The stability, permanency, and graphic nature of writing cause some people to favor it over ephemeral and elusive speech. Humpty Dumpty expressed a rather typical attitude when he said, "I'd rather see that done on paper."

Writing has affected speech only marginally, however, most notably in the phenomenon of **spelling pronunciation**. Since the sixteenth century, we find that spelling has to some extent influenced standard pronunciation. The most important of such changes stem from the eighteenth century under the influence and decrees of the dictionary makers and the schoolteachers. The struggle between those who demanded that words be pronounced according to the spelling and those who demanded that words be spelled according to their pronunciation generated great heat in that century. The preferred pronunciations were given in the many dictionaries printed in the eighteenth century, and the "supreme authority" of the dictionaries influenced pronunciation in this way.

Spelling also has influenced pronunciation of words that are used infrequently in daily speech. In many words that were spelled with an initial *h*, the *h* was silent as recently as the eighteenth century. Then, no [h] was pronounced in *honest*, *hour*, *habit*, *heretic*, *hotel*, *hospital*, and *herb*. Common words like *honest* and *hour* continued *h*-less, despite the spelling. The other less frequently used words were given a "spelling pronunciation," and the *h* is sounded today. *Herb* is currently undergoing this change. In British English the *h* is pronounced, whereas in American English it generally is not.

Similarly, the *th* in the spelling of many words was once pronounced like the /t/ in *Thomas*. Later most of these words underwent a change in pronunciation from /t/ to /θ/, as in *anthem*, *author*, and *theater*. Nicknames may reflect the earlier pronunciations: "Ka*t*e" for "Ca*th*erine," "Be*tt*y" for "Elizabe*th*," "Ar*t*" for "Ar*th*ur." *Often* is often pronounced with the *t* sounded, though historically it is silent, and up-to-date dictionaries now indicate this pronunciation as an alternative.

The clear influence of spelling on pronunciation is observable in the way place-names are pronounced. *Berkeley* is pronounced [bərkli] in California, although it stems from the British [baːkli]; *Worcester* [wʊstər] or [wʊstə] in Massachusetts is often pronounced [wurtʃɛstər] in other parts of the country. *Salmon* is pronounced [sæmən] in most parts of the United States, but many Southern speakers pronounce the [l] and say [sælmən].

Although the written language has some influence on the spoken, it does not change the basic system—the grammar—of the language. The writing system, conversely, reflects, in a more or less direct way, the grammar that every speaker knows.

Summary

Writing is a basic tool of civilization. Without it, the world as we know it could not exist. The precursor of writing was "picture writing," which used **pictograms** to represent objects directly and literally. Pictograms are called **ideograms** when the drawing becomes less literal, and the meaning extends to concepts associated with the object originally pictured. When ideograms become associated with the words for the concepts they signify, they are called **logograms**. Logographic systems are true writing systems in the sense that the symbols stand for words of a language.

The Sumerians first developed a pictographic writing system to keep track of commercial transactions. It was later expanded for other uses and eventually evolved into the highly stylized (and stylus-ized) **cuneiform** writing. Cuneiform was generalized to other writing systems by application of the **rebus principle**, which uses the symbol of one word or syllable to represent another word or syllable pronounced the same.

The Egyptians also developed a pictographic system known as **hieroglyphics**. This system influenced many peoples, including the Phoenicians, who developed the West Semitic Syllabary. The Greeks borrowed the Phoenician system, and in adapting it to their own language they used the symbols to represent both consonant and vowel sound segments, thus inventing the first alphabet.

There are four types of writing systems: (1) **logographic** (word writing), where every symbol or character represents a word or morpheme (as in Chinese); (2) **syllabic**, where each symbol represents a syllable (as in Japanese hiragana); (3) **consonantal alphabetic**, where each symbol represents a consonant and vowels may be represented by diacritical marks (as in Hebrew); and (4) **alphabetic**, where each symbol represents (for the most part) a vowel or consonant (as in English).

Languages change over time, but writing systems tend to be more conservative. In many languages, including English, spelling may no longer accurately reflect pronunciation. This has led to **spelling reforms** in many countries. Also, when the spoken and written forms of the language diverge, some words may be pronounced as they are spelled, sometimes as a result of the efforts of pronunciation reformers.

There are advantages to a conservative spelling system. A common spelling permits speakers whose dialects have diverged to communicate through writing, as is best exemplified in China, where the "dialects" (languages, really) are mutually unintelligible. People are also able to read and understand their language as it was written centuries ago. In addition, despite a certain lack of correspondences between sound and spelling, the spelling often reflects speakers' morphological and phonological knowledge.

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Glossary

AAE Abbreviates **African American English**.[1] See **Ebonics, AAVE**.
AAVE Abbreviates **African American Vernacular English**. See **Ebonics, AAE**.
abbreviation Shortened form of a word, e.g., *prof* from *professor*. See **clipping**.
abjad Consonantal alphabet writing system; the **consonantal alphabet** of such a system.
accent (1) Prominence. See **stressed syllable**; (2) the phonology or pronunciation of a specific **regional dialect**, e.g., Southern accent; (3) the pronunciation of a language by a nonnative speaker, e.g., French accent.
accidental gap Phonological or morphological form that constitutes possible but nonoccurring lexical items, e.g., *blick*, *unsad*.
acoustic Pertaining to physical aspects of sound.
acoustic phonetics The study of the physical characteristics of speech sounds.
acoustic signal The sound waves produced by any sound source, including speech.
acquired dyslexia Loss of ability to read correctly following brain damage in persons who were previously literate.
acronym Word composed of the initials of several words and pronounced as such, e.g., *PET* scan from *p*ositron-*e*mission *t*omography scan. See **alphabetic abbreviation**.
active sentence A sentence in which the noun phrase **subject** in d-structure is also the noun phrase subject in s-structure, e.g., *The dog chased the car*. See **passive sentence**.
adjective (Adj) The syntactic category, also lexical category, of words that function as the head of an **adjective phrase**, and that have the semantic effect of qualifying or describing the referents of nouns, e.g., *tall*, *bright*, *intelligent*. See **adjective phrase**.
adjective phrase (AP) A syntactic category, also phrasal category, whose head is an adjective possibly accompanied by premodifiers, that occurs inside noun phrases and as complements of the verb *to be*, e.g., *worthy of praise*, *several miles high*, *green*, *more difficult*.
adjunction A movement operation that copies an existing node and creates a new level to which the moved category is appended.
adverb (Adv) The syntactic category, also lexical category, of words that qualify the verb such as manner adverbs like *quickly* and time adverbs like *soon*. The position of the adverb in the sentence depends on its semantic type, e.g., *John will soon eat lunch*, *John eats lunch quickly*.
affix A **bound morpheme** attached to a stem or root. See **prefix**, **suffix**, **infix**, **circumfix**, **stem**, **root**.
affricate A sound produced by a stop closure followed immediately by a slow release characteristic of a **fricative**; phonetically a sequence of stop + fricative, e.g., the *ch* in *chip*, which is [tʃ] and like [t] + [ʃ].
African American (Vernacular) English (AA(V)E) Dialects of English spoken by some Americans of African descent, or by any person raised from infancy in a place where AAE is spoken. See **Ebonics**.
agent The **thematic role** of the noun phrase whose referent does the action described by the verb, e.g., *George* in *George hugged Martha*.
agglutinative language A type of **synthetic language** in which words may be formed by a root and multiple affixes where the affixes are easily separated and always retain the same meaning.
agrammatic aphasics Persons suffering from **agrammatism**.

[1]Bold words in definitions have a separate entry in this glossary, regardless of whether the bold word or term is preceded by the expression *See*.

agrammatism (agrammatic) Language disorder usually resulting from damage to Broca's region in which the patient has difficulty with certain aspects of syntax, especially functional categories. See **Broca's area**.

agreement The process by which one word in a sentence is altered depending on a property of another word in that sentence, such as gender or number, e.g., the addition of *s* to a regular verb when the subject is third-person singular (in English).

allomorph Alternative phonetic form of a **morpheme**, e.g., the [-s], [-z], and [əz] forms of the plural morpheme in *cats*, *dogs*, and *kisses*.

allophone A predictable phonetic realization of a **phoneme**, e.g., [p] and [pʰ] are allophones of the phoneme /p/ in English.

alphabetic abbreviation A word composed of the initials of several words and pronounced letter-by-letter, e.g., *MRI* from *m*agnetic *r*esonance *i*maging. See **acronym**.

alphabetic writing A writing system in which each symbol typically represents one sound segment.

alveolar A sound produced by raising the tongue to the **alveolar ridge**, e.g., [s], [t], [n].

alveolar ridge The part of the hard palate directly behind the upper front teeth.

ambiguous, ambiguity The terms used to describe a word, phrase, or sentence with multiple meanings.

American Sign Language (ASL) The sign language used by the deaf community in the United States. See **sign languages**.

analogic change A language change in which a rule spreads to previously unaffected forms, e.g., the plural of *cow* changed from the earlier *kine* to *cows* by the generalization of the plural formation rule or by **analogy** to regular plural forms. Also called **internal borrowing**.

analogy The use of one form as an exemplar by which other forms can be similarly constructed, e.g., based on *bow/bows*, *sow/sows*, English speakers began to say *cows* instead of the older *kine*. Analogy also leads speakers to say **brang* as a past tense of *bring* based on *sing/sang/sung*, *ring/rang/rung*, and so on.

analytic Describes a sentence that is true by virtue of its meaning alone, irrespective of context, e.g., *Kings are male*. See **contradiction**.

analytic language A language in which most words contain a single morpheme, and there is little if any word morphology, e.g., there are no plural affixes on nouns or agreement affixes on verbs. Also called an isolating language. Vietnamese is an example of an analytic language.

anomalous Semantically ill-formed, e.g., *Colorless green ideas sleep furiously*.

anomaly A violation of semantic rules resulting in expressions that seem nonsensical, e.g., *The verb crumpled the milk*.

anomia A form of **aphasia** in which patients have word-finding difficulties.

antecedent A noun phrase with which a pronoun is **coreferential**, e.g., *the man who is eating* is the antecedent of the pronoun *himself* in the sentence *The man who is eating bit himself*.

anterior A phonetic feature of consonants whose place of articulation is in front of the palato-alveolar area, including **labials**, **interdentals**, and **alveolars**.

antonymic pair Two words that are pronounced the same (i.e., are homonyms) but spelled differently and whose meanings are opposite, e.g., *raise* and *raze*. See **autoantonym**.

antonyms Words that are opposite with respect to one of their semantic properties, e.g., *tall/short* are both alike in that they describe height, but opposite in regard to the extent of the height. See **gradable pair**, **complementary pair**, **relational opposites**.

aphasia Language loss or disorder following brain damage.

approximants Sounds in which the articulators have a near frictional closeness, but no actual friction occurs, e.g., [w], [j], [r], and [l] in English, where the first three are central approximants, and [l] is a lateral approximant.

arbitrary Describes the property of language, including sign language, whereby there is no natural or intrinsic relationship between the way a word is pronounced (or signed) and its meaning.

arc Part of the graphical depiction of a transition network represented as an arrow, often labeled, connecting two nodes. See **node**, **transition network**.

argot The specialized words used by a particular group, such as pilots or linguists, e.g., *morphophonemics* in linguistics.

arguments The various NPs that occur with a verb, e.g., *Jack* and *Jill* are arguments of *loves* in *Jack loves Jill*.

argument structure The various NPs that occur with particular verbs, called its arguments, e.g., **intransitive verbs** take a subject NP only; **transitive verbs** take both a subject and direct object NP.

article (Art) One of several subclasses of determiners, e.g., *the*, *a*.

articulatory phonetics The study of how the vocal tract produces speech sounds; the physiological characteristics of speech sounds.

aspirated Describes a voiceless stop produced with a puff of air that results when the vocal cords remain open for a brief period after the release of the stop, e.g., the [p^h] in *pit*. See **unaspirated**.

assimilation rules/assimilation A phonological process that changes feature values of segments to make them more similar, e.g., a vowel becomes [+nasal] when followed by [+nasal] consonant. Also called **feature-spreading rules**.

asterisk The symbol * used to indicate ungrammatical or anomalous examples, e.g., **cried the baby*, **sincerity dances*. Also used in historical and comparative linguistics to represent a reconstructed form.

auditory phonetics The study of the perception of speech sounds.

autoantonym A word that has two opposite meanings, e.g., *cleave*, "to split apart" or "to cling together." See **antonymic pair**.

automatic machine translation The use of computers to translate from one language to another. See **source language**, **target language**.

Aux A syntactic category containing **auxiliary verbs** and abstract tense morphemes that functions as the **head** of a **sentence** (**S**). It is also called **INFL**.

auxiliary verb Verbal elements, traditionally called "helping verbs," that co-occur with, and qualify, the **main verb** in a verb phrase with regard to such properties as tense, e.g., *have*, *be*, *will*.

babbling Speech sounds produced in the first few months after birth that gradually come to include only sounds that occur in the language of the household. Deaf children babble with hand gestures.

baby talk A certain **style** of speech that many adults use when speaking to children that includes among other things exaggerated intonation. See **motherese**, **child-directed speech** (**CDS**).

back-formation Creation of a new word by removing an affix from an old word, e.g., *donate* from *donation*; or by removing what is mistakenly considered an affix, e.g., *edit* from *editor*.

backtracking The process of undoing an analysis—usually a top-down analysis—when sensory data indicates it has gone awry, and beginning again at a point where the analysis is consistent with the data, e.g., in the syntactic analysis of *The little orange car sped*, analyzing *orange* as a noun, and later reanalyzing it as an adjective. See **top-down processing**.

base Any **root** or **stem** to which an affix is attached.

bidialectal Persons who know one or more **dialects** and speak the one most appropriate to the sociolinguistic context, often mixing the several dialects. See **codeswitching**.

bilabial A sound articulated by bringing both lips together.

bilingualism The ability to speak two (or more) languages with native or near native proficiency, either by an individual speaker (**individual bilingualism**) or within a society (**societal bilingualism**).

bilingual language acquisition The (more or less) simultaneous acquisition of two or more languages before the age of three years such that each language is acquired with native competency.

bilingual maintenance (BM) Education programs that aim to maintain competence in both languages for the entire educational experience.

birdcall One or more short notes that convey messages associated with the immediate environment, such as danger, feeding, nesting, and flocking.

bird song A complex pattern of notes used to mark territory and to attract mates.

blend A word composed of the parts of more than one word, e.g., *smog* from *smoke* + *fog*.

blocked A derivation that is prevented by a prior application of morphological rules, e.g., when *Commun* + *ist* entered the language, words such as *Commun* + *ite* (as in *Trotsky* + *ite*) or *Commun* + *ian* (as in *grammar* + *ian*) were not needed and were not formed.

borrowing The incorporating of a loan word from one language into another, e.g., English borrowed *buoy* from Dutch. See **loan word**.

bottom-up processing Data-driven analysis of linguistic input that begins with the small units like phones and proceeds stepwise to increasingly larger units like words and phrases until the entire input is processed, often ending in a complete sentence and semantic interpretation. See **top-down processing**.

bound morpheme A **morpheme** that must be attached to other morphemes, e.g., *-ly*, *-ed*, *non-*. Bound morphemes are **prefixes**, **suffixes**, **infixes**, **circumfixes**, and some **roots** such as *cran* in *cranberry*. See **free morpheme**.

bound pronoun A pronoun (or more generally, a **pro-form**) whose antecedent is explicitly mentioned in the discourse. See **unbound**, **free pronoun**.

broadening A semantic change in which the meaning of a word changes over time to become more encompassing, e.g., *dog* once meant a particular breed of *dog*.

Broca, Paul A French neurologist of the nineteenth century who identified a particular area of the left side of the brain as a language center.

Broca's aphasia See **agrammatism**.

Broca's area A front part of the left hemisphere of the brain, damage to which causes **agrammatism** or **Broca's aphasia**. Also called Broca's region.

calligraphy The art of writing or drawing Chinese characters.

case A characteristic of nouns and pronouns, and in some languages articles and adjectives, determined by the function in the sentence, and generally indicated by the morphological form of the word, e.g., *I* is in the nominative case of the first-person singular pronoun in English and functions as a subject; *me* is in the accusative case and functions as an object.

case endings Suffixes on the noun based on its grammatical function, such as *'s* of the English genitive case indicating possession, e.g., Robert*'s* sheepdog.

case morphology The process of **inflectional morphemes** combining with nouns to indicate the grammatical relation of the noun in its sentence, e.g., in Russian, the inflectional suffix *-a* added to a noun indicates that the noun is an object.

case theory The study of thematic roles or grammatical case in languages of the world.

cause/causative The thematic role of the noun phrase whose referent is a natural force that is responsible for a change, e.g., *the wind* in *The wind damaged the roof*.

cerebral hemispheres The left and right halves of the brain, joined by the **corpus callosum**.

characters (Chinese) The units of Chinese writing, each of which represents a morpheme or word. See **ideogram**, **ideograph**, **logograms**.

Chicano English (ChE) A **dialect** of English spoken by some bilingual Mexican Americans in the western and southwestern United States.

child-directed speech (CDS) The special intonationally exaggerated speech that some adults sometimes use to speak with small children, sometimes called **baby talk**. See **motherese**.

circumfix A **bound morpheme**, parts of which occur in a word both before and after the root, e.g., *ge—t* in German ***geliebt***, "loved," from the root *lieb*.

classifier A **grammatical morpheme** that marks the semantic class of a noun, e.g., in Swahili, nouns that refer to human artifacts such as beds and chairs are prefixed with the classifiers *ki* if singular and *vi* if plural; *kiti*, "chair" and *viti*, "chairs."

click A speech sound produced by sucking air into the mouth and forcing it between articulators to produce a sharp sound, e.g., the sound often spelled *tsk*.

clipping The deletion of some part of a longer word to give a shorter word with the same meaning, e.g., *phone* from *telephone*. See **abbreviation**.

closed class A category, generally a **functional category**, that rarely has new words added to it, e.g., prepositions, conjunctions. See **open class**.

coarticulation The transfer of **phonetic features** to adjoining segments to make them more alike, e.g., vowels become [+nasal] when followed by consonants that are [+nasal].

cocktail party effect An informal term that describes the ability to filter out background noise and focus on a particular sound source or on a particular person's speech.

coda One or more phonological segments that follow the **nucleus** of a syllable, e.g., the /st/ in /prist/ *priest*.

codeswitching The movement back and forth between two languages or dialects within the same sentence or discourse.

cognates Words in related languages that developed from the same ancestral root, such as English *man* and German *Mann*.

coinage The construction and/or invention of new words that then become part of the lexicon, e.g., *podcast*.

collocation analysis Textual analysis that reveals the extent to which the presence of one word influences the occurrence of nearby words.

comparative linguistics The branch of historical linguistics that explores language change by comparing related languages.

comparative method The technique linguists use to deduce forms in an ancestral language by examining corresponding forms in several of its descendant languages.

comparative reconstruction The deducing of forms in an ancestral language of genetically related languages by application of the **comparative method**.

competence, linguistic The knowledge of a language represented by the mental grammar that accounts for speakers' linguistic ability and creativity. For the most part, linguistic competence is unconscious knowledge.

complement The constituent(s) in a phrase other than the head that complete(s) the meaning of the phrase and which is **C-selected** by the verb. In the verb phrase *found a puppy*, the noun phrase *a puppy* is a complement of the verb *found*.

complementary distribution The situation in which phones never occur in the same phonetic environment, e.g., [p] and [p^h] in English. See **allophone**.

complementary pair Two **antonyms** related in such a way that the negation of one is the meaning of the other, e.g., *alive* means *not dead*. See **gradable pair**, **relational opposites**.

complementizer (C) A syntactic category, also functional category, of words, including *that*, *if*, *whether*, that introduce an **embedded sentence**, e.g., *his belief that sheepdogs* *can swim*, or, *I wonder if sheepdogs can swim*. The complementizer has the effect of turning a sentence into a complement.

compositional semantics A theory of meaning that calculates the truth value or meaning of larger units by the application of semantic rules to the truth value or meaning of smaller units.

compound A word composed of two or more words, which may be written as a single word or as words separated by spaces or hyphens, e.g., *dogcatcher*, *dog biscuit*, *dog-tired*.

computational forensic linguistics A sub-area of **forensic linguistics** that concerns itself with computer applications in matters involving language, the law, and the judicial system.

computational lexicography The building of electronic dictionaries suitable for use by computational linguists.

computational linguistics A subfield of linguistics and computer science that is concerned with the computer processing of human language.

computational morphology The programming of computers to analyze the structure of words.

computational phonetics and phonology The programming of computers to analyze the speech signal into phones and phonemes.

computational pragmatics The programming of computers to take context and situation into account when determining the meaning of expressions.

computational semantics The programming of computers to determine the meaning of words, phrases, sentences, and discourse.

computational syntax The programming of computers to analyze the structure of sentences. See **parse**, **bottom-up processing**, **top-down processing**.

concatenative (speech) synthesis The computer production of speech based on assembling prerecorded human pronunciations of basic units such as phones, syllables, morphemes, words, phrases, or sentences.

concordance An alphabetical index of the words in a text that gives the frequency of each word, its location in the text, and its surrounding context.

conditioned sound change Historical phonological change that occurs in specific phonetic contexts, e.g., the voicing of /f/ to [v] when it occurs between vowels.

connectionism Modeling grammars through the use of networks consisting of simple neuron-like units connected in complex ways so that different connections vary in strength, and can be strengthened or weakened through exposure to linguistic data. For example, in phonology there would be stronger connections among /p/, /t/, and /k/ (the voiceless stops and a natural class) than among /p/, /n/, and /i/. In morphology there would be stronger connections between *play/played* and *dance/danced* than between *play* and *danced*. Semantically, there would be stronger connections between *melody* and *music* than between *melody* and *sheepdog*. Syntactically, there would be stronger connections between *John loves Mary* and *Mary is loved by John* than between *John loves Mary* and *Mary knows John*.

connotative meaning/connotation The evocative or affective meaning associated with a word. Two words or expressions may have the same **denotative meaning** but different connotations, e.g., *president* and *commander-in-chief*.

consonant A speech sound produced with some constriction of the air stream. See **vowel**.

consonantal The phonetic feature that distinguishes the class of obstruents, liquids, and nasals, which are [+consonantal], from other sounds (vowels and glides), which are [−consonantal].

consonantal alphabet The symbols of a **consonantal writing** system.

consonantal writing A writing system of symbols that represent only **consonants**; vowels are inferred from context, e.g., Arabic.

constituent A syntactic unit in a **phrase structure tree**, e.g., *the girl* is a noun phrase constituent in the sentence *the boy loves the girl*.

constituent structure The hierarchically arranged syntactic units such as noun phrase and verb phrase that underlie every sentence.

constituent structure tree See **phrase structure tree**.

content words The nouns, verbs, adjectives, and adverbs that constitute the major part of the vocabulary. See **open class**.

context The discourse preceding an utterance together with the real-world knowledge of speakers and listeners. See **linguistic context**, **situational context**.

continuant A speech sound in which the air stream flows continually through the mouth; all speech sounds except stops and affricates.

contour tones In tone language, tones in which the **pitch** glides from one level to another, e.g., from low to high as in a rising tone.

contradiction Describes a sentence that is false by virtue of its meaning alone, irrespective of context, e.g., *Kings are female*. See **analytic**, **tautology**.

contradictory Mutual negative entailment: the truth of one sentence necessarily implies the falseness of another sentence, and vice versa, e.g., *The door is open* and *The door is closed* are contradictory sentences. See **entailment**.

contralateral Refers to neural signals that travel between one side of the body (left/right) and the opposite **cerebral hemisphere** (right/left).

contrast Different sounds contrast when their presence alone distinguishes between otherwise identical forms, e.g., [f] and [v] in *fine* and *vine*, but not [p] and [p^h] in [spik] and [sp^{h}ik] (two variant ways of saying *speak*). See **minimal pair**.

contrasting tones In tone languages, different tones that make different words, e.g., in Nupe, *bá* with a high tone and *bà* with a low tone mean "be sour" and "count," respectively.

contrastive stress Additional stress placed on a word to highlight it or to clarify the referent of a pronoun, e.g., in *Joe hired Bill and he hired Sam*, with contrastive stress on *he*, it is usually understood that Bill rather than Joe hired Sam.

convention, conventional The agreed-on, although generally arbitrary, relationship between the form and meaning of words.

cooperative principle A broad principle within whose scope fall the various **maxims of conversation**. It states that in order to communicate effectively, speakers should agree to be informative and relevant.

coordinate structure A syntactic structure in which two or more constituents of the same syntactic category are joined by a conjunction such as *and* and *or*, e.g., *bread and butter*, *the big dog or the small cat*, *huffing and puffing*.

coreference The relation between two noun phrases that refer to the same entity.

coreferential Describes noun phrases (including pronouns) that refer to the same entity.

coronals The class of consonants articulated by raising the tip or blade of the tongue, including **alveolars** and **palatals**, e.g., [t], [ʃ].

corpus A collection of language data gathered from spoken or written sources used for linguistic research and analysis.

corpus callosum The nerve fibers connecting the right and left **cerebral hemispheres**.

cortex The approximately ten billion neurons that form the outside surface of the brain; also referred to as gray matter.

count nouns Nouns that can be enumerated, e.g., *one potato*, *two potatoes*. See **mass nouns**.

cover symbol A symbol that represents a class of sounds, e.g., C for consonants, V for vowels.

creativity of language, creative aspect of linguistic knowledge Speakers' ability to combine the finite number of linguistic units of their language to produce and understand an infinite range of novel sentences.

creole A language that begins as a **pidgin** and eventually becomes the native language of a speech community.

creolization The linguistic *expansion* in the lexicon and grammar, and an increase in the contexts of use, of an existing **pidgin**. See **pidginization**.

critical-age hypothesis The theory that states that there is a window of time between early childhood and puberty for learning a first language, and beyond which first language acquisition is almost always incomplete.

critical period The time between early childhood and puberty during which a child can acquire a native language easily, swiftly, and without external intervention. After this period, the acquisition of the grammar is difficult and, for some individuals, never fully achieved.

C-selection The classifying of verbs and other lexical items in terms of the syntactic category of the complements that they accept (*C* stands for categorial), sometimes called **subcategorization**, e.g., the verb *find* C-selects, or is subcategorized for, a noun phrase complement.

cuneiform A form of writing in which the characters are produced using a wedge-shaped stylus, and most notably utilized by ancient civilizations of the Middle East such as the Sumerians.

data mining Complex methods of retrieving and using information from immense and varied sources of data through the use of advanced statistical tools.

declarative (sentence) A sentence that asserts that a particular situation exists. See **interrogative**.

declension A list of the inflections or **cases** of nouns, pronouns, adjectives, and determiners in categories such as grammatical relationship, number, and gender.

deep structure See **d-structure**.

definite Describes a noun phrase that refers to a particular object known to the speaker and listener.

deictic/deixis Refers to words or expressions whose reference relies on context and the orientation of the speaker in space and time, e.g., *I*, *yesterday*, *there*, *this cat*.

demonstrative articles, demonstratives Words such as *this*, *that*, *those*, and *these* that function syntactically as articles but are semantically **deictic** because context is needed to determine the referent of the noun phrase in which they occur.

denotative meaning The referential meaning of a word or expression. See **connotative meaning**.

dental A place-of-articulation term for consonants articulated with the tongue against, or nearly against, the front teeth. See **interdental**.

derivation The steps in the application of rules to an underlying form that results in a surface representation, e.g., in deriving a syntactic s-structure from a d-structure, or in deriving a phonetic form from a phonemic form.

derivational affix See **derivational morpheme**.

derivational morpheme A **morpheme** added to a stem or root to form a new stem or word, possibly, but not necessarily, resulting in a change in syntactic category, e.g., *-er* added to a verb like *kick* to give the noun *kicker*.

derived structure Any structure resulting from the application of transformational rules.

derived word The form that results from the addition of a **derivational morpheme**, e.g., *firmly* from *firm* + *ly*.

descriptive grammar A linguist's description or model of the mental grammar, including the units, structures, and rules. An explicit statement of what speakers know about their language. See **prescriptive grammar**, **teaching grammar**.
determiner (Det) The syntactic category, also functional category, of words and expressions, which when combined with a noun form a noun phrase. Includes the articles *the* and *a*, **demonstratives** such as *this* and *that*, quantifiers such as *each* and *every*, etc.
diacritics Additional markings on written symbols to specify various phonetic properties such as **length**, **tone**, **stress**, **nasalization**; extra marks on a written character that change its usual value, e.g., the tilde ~ drawn over the letter *ñ* in Spanish to represent a palatalized nasal rather than an alveolar nasal.
dialect A variety of a language whose grammar differs in systematic ways from other varieties. Differences may be lexical, phonological, syntactic, and semantic. See **regional dialect**, **social dialect**, **prestige dialect**.
dialect area A geographic area defined by the predominant use of a particular language variety, or a particular characteristic of a language variety, e.g., an area where *bucket* is used rather than *pail*. See **dialect**, **dialect atlas**, **isogloss**.
dialect atlas A book of **dialect maps** showing the areas where specific dialectal characteristics occur in the speech of the region.
dialect continuum A geographic range of slightly varying **dialects** occurring between two distinctly different dialects spoken in different regions of a language area.
dialect leveling Movement toward greater uniformity or decrease in variations among dialects.
dialect map A map showing the areas where specific dialectal characteristics occur in the speech of the region.
dichotic listening Experimental methods for brain research in which subjects hear different auditory signals in the left and right ears.
digraph Two letters used to represent a single sound, e.g., *gh* represents [f] in *enough*.
diphthong A sequence of two vowels run together as a single phonological unit, e.g., [aɪ, aʊ, ɔɪ] as in *bite*, *bout*, *boy*. See **monophthong**.
direct object The grammatical relation of a noun phrase when it appears immediately below the verb phrase (VP) and next to the verb in deep structure; the noun phrase complement of a transitive verb, e.g., *the puppy* in *the boy found the puppy*.
discontinuous morpheme A **morpheme** with multiple parts that occur in more than one place in a word or sentence, e.g., *ge* and *t* in German ***geliebt***, "loved." See **circumfix**.
discourse A linguistic unit that comprises more than one sentence.
discourse analysis The study of broad speech units comprising multiple sentences.
discreteness A fundamental property of human language in which larger linguistic units are perceived to be composed of smaller linguistic units, e.g., *cat* is perceived as the phonemes /k/, /æ/, /t/; *the cat* is perceived as *the* and *cat*.
dissimilation rules **Phonological rules** that change feature values of segments to make them less similar, e.g., a fricative dissimilation rule: /θ/ is pronounced [t] following another fricative. In English dialects with this rule, *sixth* /sɪks + θ/ is pronounced [sɪkst].
distinctive Describes linguistic elements that contrast, e.g., [f] and [v] are distinctive segments. Voice is a distinctive phonetic feature of consonants.
distinctive features Phonetic properties of phonemes that account for their ability to contrast meanings of words, e.g., *voice*, *tense*. Also called **phonemic features**.
ditransitive verb A verb that appears to take two noun-phrase objects, e.g., *give* in *he gave Sally his cat*. Ditransitive verb phrases often have an alternative form with a prepositional phrase in place of the first noun phrase, as in *he gave his cat to Sally*.
dominate In a **phrase structure tree**, when a continuous downward path can be traced from a node labeled A to a node labeled B, then A dominates B.

downdrift The gradual lowering of the absolute **pitch** of tones during an utterance in a tone language. During downdrift, tones retain their *relative* values to one another.

d-structure Any **phrase structure tree** generated by the phrase structure rules of a transformational grammar; the basic syntactic structures of the grammar. Also called **deep structure**. See **transformational rule**.

Dual Language Immersion An education program that enrolls English-speaking children and minority-language students in roughly equal numbers, with the intention of making all students bilingual.

dyslexia A cover term for the various types of reading impairment.

ear witnessing The use of human listeners to identify an unknown speaker of an utterance, as opposed to **speaker identification**, which uses computers to achieve that end.

Early Middle English Vowel Shortening A sound change that shortened vowels such as the first *i* in *criminal*. As a result, *criminal* was unaffected by the **Great Vowel Shift**, leading to word pairs such as *crime/criminal*.

ease of articulation The tendency of speakers to adjust their pronunciation to make it easier, or more efficient, to move the articulators. Phonetic and phonological rules are often the result of ease of articulation, e.g., the rule of English that nasalizes vowels when they precede a nasal consonant.

Ebonics An alternative term, first used in 1997, for the various dialects of **African American English**.

embedded sentence A sentence that occurs within a sentence in a **phrase structure tree**, e.g., *You know that **sheepdogs cannot read**.*

emoticon A string of text characters that, when viewed sideways, forms a face or figure expressing a particular emotion, e.g., [8<\ to express "dismay." Frequently used in e-mail.

entail One sentence entails another if the truth of the first necessarily implies the truth of the second, e.g., *The sun melted the ice* entails *The ice melted* because if the first is true, the second must be true.

entailment The relationship between two sentences, where the truth of one necessitates the truth of the other, e.g., *Corday assassinated Marat* and *Marat is dead*; if the first is true, the second must be true.

epenthesis The insertion of one or more **phones** in a word, e.g., the insertion of [ə] in *children* to produce [tʃɪlə̲drə̃n] instead of [tʃɪldrə̃n].

eponym A word taken from a proper name, such as *Hertz* for "unit of frequency."

etymology The history of words; the study of the history of words.

euphemism A word or phrase that replaces a **taboo** word or is used to avoid reference to certain acts or subjects, e.g., *powder room* for *toilet*.

euphemism treadmill The process whereby a euphemism takes on the taboo characteristics of the word it replaced, thereby requiring another euphemism, e.g., *cripple—handicapped—disabled—challenged*.

event/eventive A type of sentence that describes activities such as *John kissed Mary*, as opposed to describing states such as *John knows Mary*. See **state/stative**.

event-related brain potentials (ERP) The electrical signals emitted from different areas of the brain in response to different kinds of stimuli.

experiencer The thematic role of the noun phrase whose referent perceives something, e.g., *Helen* in *Helen heard Robert playing the piano*.

extension The referential part of the meaning of an expression; the referent of a noun phrase. See **reference**, **referent**.

feature-changing rules **Phonological rules** that change feature values of segments, either to make them more similar (see **assimilation rules**) or less similar (see **dissimilation rules**).

feature matrix A representation of phonological segments in which the columns represent segments and the rows represent features, each cell being marked with a + or − to designate the presence or absence of the feature for that segment.

feature-spreading rules See **assimilation rules**.

finger spelling In **signing**, hand gestures that represent letters of the alphabet used to spell words for which there is no sign.

flap A speech sound in which the tongue touches the alveolar ridge and withdraws. It is often an allophone of /t/ and /d/ in words such as *writer* and *rider*. Also called **tap**.

folk etymology The process whereby the history of a word is derived from nonscientific speculation or false analogy with another word, e.g., *hooker* for "prostitute" is falsely believed to be derived from the name of the U.S. Civil War general Joseph Hooker.

forensic linguistics A subfield of linguistics that applies to language as used in legal and judicial matters.

form The phonological or gestural representation of a morpheme or word.

formant In the frequency analysis of speech, a band of frequencies of higher intensity than surrounding frequencies, which appears as a dark line on a **spectrogram**. Individual vowels display different formant patterns.

formant (speech) synthesis The computer production of sound based on the blending of electronic-based acoustic components; no prerecorded human sounds are used.

fossilization A characteristic of second-language learning in which the learner reaches a plateau and seems unable to acquire some property of the L2 grammar.

free morpheme A single **morpheme** that constitutes a word, e.g., *dog*.

free pronoun A pronoun that refers to some object not explicitly mentioned in the sentence, e.g., *it* in *Everyone saw it*. Also called **unbound**. See **bound pronoun**.

free variation Alternative pronunciations of a word in which one sound is substituted for another without changing the word's meaning, e.g., pronunciation of *bottle* as [batəl] or [baʔəl].

fricative A consonant sound produced with so narrow a constriction in the vocal tract as to create sound through friction, e.g., [s], [f].

front vowels Vowel sounds in which the tongue is positioned forward in the mouth, e.g., [i], [æ].

function word A word that does not always have a clear lexical meaning but has a grammatical function; function words include conjunctions, **prepositions**, **articles**, auxiliaries, **complementizers**, and pronouns. See **closed class**.

functional category One of the categories of function words, including **determiner**, **Aux**, **complementizer**, and **preposition**. These categories are not lexical or phrasal categories. See **lexical category**, **phrasal category**.

fundamental difference hypothesis Second language acquisition (L2) differs fundamentally from first language acquisition (L1).

fundamental frequency In speech, the rate at which the vocal cords vibrate, symbolized as F_0, called F-zero, perceived by the listener as **pitch**.

fusional languages Synthetic languages in which several meanings are packed into what appears to be a single affix, such as *-amos* in Spanish *hablamos* meaning "first person, plural, present tense."

gapping The syntactic process of deletion in which subsequent occurrences of a verb are omitted in similar contexts, e.g., *Bill washed the grapes and Mary, the cherries*.

garden path sentences Sentences that appear at first blush to be ungrammatical, but with further syntactic processing turn out to be grammatical, e.g., *The horse raced past the barn fell*.

geminate A sequence of two identical sounds; a long vowel or long consonant denoted either by writing the phonetic symbol twice as in [biiru], [sakki] or by use of a colon-like symbol [biːru], [sakːi].

generate To specify precisely, concisely, and in all particulars, e.g., syntactic rules generate the different kinds of sentence structures of a language.

generative grammar A grammar that accounts for linguistic knowledge by means of rules that generate all and only the grammatical sentences of the language.

generic term A word that applies to a whole class, such as *wombat* in *the wombat lives across the seas, among the far Antipodes*. A word that is ordinarily masculine, when used to refer to both sexes, e.g., *mankind* meaning "the human race"; the masculine pronoun when used as a neutral form, as in *Everyone should do* his *duty*.

genetically related Describes two or more languages that developed from a common, earlier language, e.g., French, Italian, and Spanish, which all developed from Latin.

glide A speech sound produced with little or no obstruction of the air stream that is always preceded or followed by a vowel, e.g., [w] in *we*, [j] in *you*.

gloss A word in one language given to express the meaning of a word in another language, e.g., "house" is the English gloss for the French word *maison*.

glottal/glottal stop A speech sound produced with constriction at the **glottis**; when the air is stopped completely at the glottis by tightly closed vocal cords, a glottal stop is produced.

glottis The vocal cords themselves and/or the opening between the vocal cords.

goal The thematic role of the noun phrase toward whose referent the action of the verb is directed, e.g., *the theater* in *The kids went to the theater.*

gradable pair Two **antonyms** related in such a way that more of one is less of the other, e.g., *warm* and *cool*; more warm is less cool, and vice versa. See **complementary pair**, **relational opposites**.

grammar The mental representation of a speaker's linguistic competence; what a speaker knows about a language, including its phonology, morphology, syntax, semantics, and lexicon. A linguistic description of a speaker's mental grammar.

grammar translation A method of second-language learning in which the student memorizes words and syntactic rules and translates them between the native language and target language.

grammatical, grammaticality Describes a well-formed sequence of words, one conforming to rules of **syntax**.

grammatical case See **case**.

grammatical categories Traditionally called "parts of speech"; also called **syntactic categories**; expressions of the same grammatical category can generally substitute for one another without loss of grammaticality, e.g., **noun phrase**, **verb phrase**, **adjective**, **auxiliary verb**.

grammatical morpheme A **function word** or **bound morpheme** required by the syntactic rules, e.g., *to* and *s* in *he wants* **to** *go*. See **inflectional morpheme**.

grammatical relation Any of several structural positions that a noun phrase may assume in a sentence. See **subject**, **direct object**.

graphemes The symbols of an **alphabetic writing** system; the letters of an alphabet.

Great Vowel Shift A sound change that took place in English some time between 1400 and 1600 C.E. in which seven long vowel phonemes were changed.

Grimm's Law The description of a phonological change in the sound system of an early ancestor of the Germanic languages formulated by Jakob Grimm.

Hangul An alphabet based on the phonemic principle for writing the Korean language designed in the fifteenth century.

head (of a compound) The rightmost word, e.g., *house* in *doghouse*. It generally indicates the category and general meaning of the compound.

head (of a phrase) The central word of a phrase whose lexical category defines the type of phrase, e.g., the noun *man* is the head of the noun phrase *the man who came to* *dinner*; the verb *wrote* is the head of the verb phrase *wrote a letter to his mother*; the adjective *red* is the head of the adjective phrase *very bright red*.

hemiplegic An individual (child or adult) with acquired unilateral lesions of the brain who retains both hemispheres (one normal and one diseased).

hemispherectomy The surgical removal of a hemisphere of the brain.

heteronyms Different words spelled the same (i.e., **homographs**) but pronounced differently, e.g., *bass*, meaning either "low tone" [bes] or "a kind of fish" [bæs].

hierarchical structure The groupings and subgroupings of the parts of a sentence into syntactic categories, e.g., *the bird sang* [[[the] [bird]] [sang]]; the groupings and subgroupings of morphemes in a word, e.g., *unlockable* [[un] [[lock][able]]]. Hierarchical structure is generally depicted in a **tree diagram**.

hieroglyphics A writing system used by the Egyptians around 4000 B.C.E. that began as a **pictographic writing** system and evolved over time into a **logographic writing** and **syllabic writing** system.

hiragana A Japanese **syllabary** used to write native words of the language, most often together with ideographic characters. See **kanji**.

historical and comparative linguistics The branch of linguistics that deals with how languages change, what kinds of changes occur, and why they occur.

historical linguistics See **historical and comparative linguistics**.

holophrastic The stage of child language acquisition in which one word conveys a complex message similar to that of a phrase or sentence.

homographs Words spelled identically, and possibly pronounced the same, e.g., *bear* meaning "to tolerate," and *bear* the animal; or *lead* the metal and *lead*, what leaders do.

homonyms/homophones Words pronounced, and possibly spelled, the same, e.g., *to*, *too*, *two*; or *bat* the animal, *bat* the stick, and *bat* meaning "to flutter" as in "bat the eyelashes."

homorganic consonants Two sounds produced at the same place of articulation, e.g., [m] and [p]; [t], [d], [n]. See **assimilation rules**.

homorganic nasal rule A phonological assimilation rule that changes the place of articulation feature of a nasal consonant to agree with that of a following consonant, e.g., /n/ becomes [m] when preceding /p/ as in *impossible*.

hypercorrection Deviations from the "norm" thought by speakers to be "more correct," such as saying *between he and she* instead of *between him and her*.

hyponyms Words whose meanings are specific instances of a more general word, e.g., *red*, *white*, and *blue* are hyponyms of the word *color*; *triangle* is a hyponym of *polygon*.

iambic Stress on the second syllable of a two-syllable word, e.g., *giráffe*.

iconic, iconicity A nonarbitrary relationship between form and meaning in which the form bears a resemblance to its meaning, e.g., the male and female symbols on (some) restroom doors.

ideogram, ideograph A character of a word-writing system, often highly stylized, that represents a concept, or the pronunciation of the word representing that concept.

idiolect An individual's way of speaking, reflecting that person's grammar.

idiom/idiomatic phrase An expression whose meaning does not conform to the **principle of compositionality**, that is, may be unrelated to the meaning of its parts, e.g., *kick the bucket* meaning "to die."

ill-formed Describes an ungrammatical or anomalous sequence of words.

illocutionary force The intended effect of a speech act, such as a warning, a promise, a threat, and a bet, e.g., the illocutionary force of *I resign!* is the act of resignation.

imitation A proposed mechanism of child language acquisition, according to which children learn their language by imitating adult speech.

immediately dominate If a node labeled A is directly above a node labeled B in a phrase structure tree, then A immediately dominates B.

implicature An inference based not only on an utterance, but also on assumptions about what the speaker is trying to achieve, e.g., *Are you using the ketchup?* to mean "Please pass the ketchup" while dining in a café.

impoverished data Refers to the incomplete, noisy, and unstructured utterances that children hear, including slips of the tongue, false starts, and ungrammatical and incomplete sentences, together with a lack of concrete evidence about abstract grammatical rules and structure.

individual bilingualism The ability of an individual speaker to speak two (or more) languages with native or near native proficiency. See **bilingualism**, **societal bilingualism**.

Indo-European The descriptive name given to the ancestor language of many modern language families, including Germanic, Slavic, and Romance. Also called **Proto-Indo-European**.

infinitive An uninflected form of a verb, e.g., (to) *swim*.

infinitive sentence An **embedded sentence** that does not have a tense and therefore is a "to" form, e.g., *sheepdogs to be fast readers* in the sentence *He believes sheepdogs to be fast readers*.

infix A **bound morpheme** that is inserted in the middle of another morpheme, e.g., Tagalog *sulat* "writing" but ***s**um**ulat*** "to write" after insertion of the infix *um*.

INFL Abbreviates "inflection," a term sometimes used in place of **Aux**; the head of a **sentence** (S).

inflectional affix See **inflectional morpheme**.

inflectional morpheme A bound **grammatical morpheme** that is affixed to a word according to rules of syntax, e.g., third-person singular verbal suffix *-s*.

information retrieval The process of using a computer to search a database for items on a particular topic. See **data mining**.

innateness hypothesis The theory that the human species is genetically equipped with a **Universal Grammar**, which provides the basic design for all human languages.

instrument The thematic role of the noun phrase whose referent is the means by which an action is performed, e.g., *a paper clip* in *Houdini picked the lock with a paper clip*.

intension The inherent, nonreferential part of the meaning of an expression, also called **sense**. See **sense**, **extension**.

intensity The magnitude of an **acoustic signal**, which is perceived as loudness.

interdental A sound produced by inserting the tip of the tongue between the upper and lower teeth, e.g., the initial sounds of *thought* and *those*.

interlanguage grammars The intermediate grammars that second-language learners create on their way to acquiring the (more or less) complete grammar of the target language.

internal borrowing See **analogic change**.

International Phonetic Alphabet (IPA) The **phonetic alphabet** designed by the International Phonetic Association to be used to represent the sounds found in all human languages.

International Phonetic Association (IPA) The organization founded in 1888 to further phonetic research and to develop the International Phonetic Alphabet.

interrogative (sentence) A sentence that questions whether a particular situation exists. See **declarative**.

intonation The **pitch** contour of a phrase or sentence.

intransitive verb A verb that must not have (does not **C-select** for) a direct object complement, e.g., *sleep*, *rise*.

IP Inflection Phrase. A term sometimes used in place of **sentence** (**S**). A phrasal category whose head is **Aux**.

ipsilateral Refers to neural signals that travel between one side of the body (left/right) and the same cerebral hemisphere (left/right). See **contralateral**.

isogloss A geographic boundary that separates areas with **dialect** differences, e.g., a line on a map on one side of which most people say *faucet* and on the other side of which most people say *spigot*.

isolating language A language in which most words contain a single morpheme, and there is little if any word morphology, e.g., no plural affixes on nouns or agreement affixes on verbs. Also called an analytic language, e.g., Vietnamese.

jargon Special words peculiar to the members of a profession or group, e.g., *glottis* for phoneticians. See **argot**. Also, the nonsense words sometimes used by Wernicke's aphasics.

jargon aphasia Form of aphasia in which phonemes are substituted, resulting in nonsense words; often produced by people who have severe **Wernicke's aphasia**.

kana The characters of either of the two Japanese syllabaries, **katakana** and **hiragana**.

kanji The Japanese term for the Chinese characters used in Japanese writing.

katakana A Japanese **syllabary** generally used for writing loan words and to achieve the effect of italics.

L2 acquisition See **second language acquisition**.

labial A sound articulated at the lips, e.g., [b], [f].

labiodental A sound produced by touching the bottom lip to the upper teeth, e.g., [v].

labio-velar A sound articulated by simultaneously raising the back of the tongue toward the velum and rounding the lips. The [w] of English is a labio-velar glide.

language contact The situation in which speakers of different languages regularly interact with one another, and especially where there are many bilingual or multilingual speakers.

language isolate A natural language with no demonstrable genealogical relationship with other living languages.

larynx The structure of muscles and cartilage in the throat that contains the vocal cords and **glottis**; often called the "voice box."

late closure principle A psycholinguistic principle of language comprehension that states: Attach incoming material to the phrase that was most recently processed, e.g., *he said that he slept yesterday* associates *yesterday* with *he slept* rather than with *he said*.

lateral A sound produced with air flowing past one or both sides of the tongue, e.g., [l].

lateralization, lateralized Terms used to refer to cognitive functions localized to one or the other hemisphere of the brain.

lax vowel A vowel produced with relatively less tension in the vocal cords and little tendency to diphthongize, e.g., [ʊ] in *put*, [pʊt]. Most lax vowels do not occur at the ends of syllables, that is, [bʊ] is not a possible English word. See **tense**.

length A prosodic feature referring to the duration of a segment. Two sounds may contrast in length, e.g., in Japanese the first vowel is [+long] in /biːru/ "beer" but [−long], therefore short, in /biru/ "building."

level tones Relatively stable (nongliding) **pitch** on syllables of tone languages. Also called **register tones**.

lexical access The process of searching the mental **lexicon** for a phonological string to determine if it is an actual word.

lexical ambiguity Multiple meanings of sentences due to words that have multiple meanings, e.g., *He blew up the pictures of his ex-girlfriend*.

lexical category A general term for the word-level syntactic categories of noun, verb, adjective, and adverb. These are the categories of content words like *man*, *run*, *large*, and *rapidly*, as opposed to functional category words such as *the* and *and*. See **functional category**, **phrasal category**, **open class**.

lexical decision Task of subjects in psycholinguistic experiments who on presentation of a spoken or printed stimulus must decide whether it is a word or not.

lexical gap Possible but nonoccurring words; forms that obey the **phonotactic constraints** of a language yet have no meaning, e.g., *blick* in English.

lexical paraphrases Sentences that have the same meaning due to synonyms, e.g., *She lost her purse* and *She lost her handbag*.

lexical semantics The subfield of semantics concerned with the meanings of words and the meaning relationships among words.

lexicographer One who edits or works on a dictionary.

lexicography The editing or making of a dictionary.

lexicon The component of the grammar containing speakers' knowledge about morphemes and words; a speaker's mental dictionary.

lexifier language The dominant language of a **pidgin** (and **creole**) that provides the basis for the majority of the lexical items in the language.

lingua franca A language common to speakers of diverse languages that can be used for communication and commerce, e.g., English is the lingua franca of international airline pilots.

linguistic competence See **competence, linguistic**.

linguistic context The discourse that precedes a phrase or sentence that helps clarify meaning.

linguistic determinism The strongest form of the **Sapir-Whorf hypothesis**, which holds that the language we speak establishes how we perceive and think about the world.

linguistic performance See **performance, linguistic**.

linguistic relativism A weaker form of the **Sapir-Whorf hypothesis**, which holds that different languages encode different categories, and that speakers of different languages therefore think about the world in different ways. For example, speakers of languages that have fewer color words will be less sensitive to gradations of color.

linguistic sign Sounds or gestures, typically morphemes in spoken languages and signs in sign languages, that have a form bound to a meaning in a single unit, e.g., *dog* is a linguistic sign whose form is its pronunciation [dag] and whose meaning is *Canis familiaris* (or however we define "dog").

linguistic theory A theory of the principles that characterize all human languages. See **Universal Grammar**.

liquids A class of consonants including /l/ and /r/ and their variants that share vowel-like acoustic properties and may function as syllabic nuclei.

loan translations Compound words or expressions whose parts are translated literally into the borrowing language, e.g., *marriage of convenience* from French *mariage de convenance*.

loan word Word in one language whose origins are in another language, e.g., in Japanese, *besiboru*, "baseball," is a loan word from English. See **borrowing**.

localization The hypothesis that different areas of the brain are responsible for distinct cognitive systems. See **lateralization**.

location The thematic role of the noun phrase whose referent is the place where the action of the verb occurs, e.g., *Oslo* in *It snows in Oslo*.

logograms The symbols of a **word-writing** or **logographic writing** system.

logographic writing See **word writing**.

machine translation See **automatic machine translation**.

magnetic resonance imaging (MRI) A technique to investigate the molecular structures in human organs including the brain, which may be used to identify sites of brain lesions.

main verb The verb that functions as the head in the highest verb phrase of a sentence, e.g., *save* in *They save money to travel*. See **head of a phrase**.

manner of articulation The way the air stream is obstructed as it travels through the vocal tract. **Stop**, **nasal**, **affricate**, and **fricative** are some manners of articulation. See **place of articulation**.

marked In a gradable pair of antonyms, the word that is *not* used in questions of degree, e.g., *low* is the marked member of the pair *high/low* because we ordinarily ask *How high is the mountain?* not **How low is the mountain?*; in a masculine/feminine pair, the word that contains a derivational morpheme, usually the feminine word, e.g., *princess* is marked, whereas *prince* is unmarked. See **unmarked**.

mass nouns Nouns that cannot ordinarily be enumerated, e.g., *milk*, *water*; **two milks* is ungrammatical except when interpreted to mean "two kinds of milk," "two containers of milk," and so on. See **count nouns**.

maxim of manner A conversational convention that a speaker's discourse should be brief and orderly, and should avoid ambiguity and obscurity.

maxim of quality A conversational convention that a speaker should not lie or make unsupported claims.

maxim of quantity A conversational convention that a speaker's contribution to the discourse should be as informative as is required, neither more nor less.

maxim of relevance A conversational convention that a speaker's contribution to a discourse should always have a bearing on, and a connection with, the matter under discussion.

maxims of conversation Conversational conventions such as the **maxim of quantity** that people appear to obey to give coherence and sincerity to discourse.

mean length of utterances (MLU) The average number of words or morphemes in a child's utterance. It is a more accurate measure of the acquisition stage of language than chronological age.

meaning The conceptual or semantic aspect of a sign or utterance that permits us to comprehend the message being conveyed. Expressions in language generally have both form—pronunciation or gesture—and meaning. See **extension**, **intension**, **sense**, **reference**.

mental grammar The internalized grammar that a descriptive grammar attempts to model. See **linguistic competence**.

metalinguistic awareness A speaker's conscious awareness *about* language and the use of language, as opposed to linguistic *knowledge*, which is largely unconscious. This book is very much about metalinguistic awareness.

metaphor Nonliteral, suggestive meaning in which an expression that designates one thing is used implicitly to mean something else, e.g., *The night has a thousand eyes*, to mean "One may be unknowingly observed at night."

metathesis The phonological process that reorders segments, often by transposing two sequential sounds, e.g., the pronunciation of *ask* /æsk/ in some English dialects as [æks].

metonym, metonymy A word substituted for another word or expression with which it is closely associated, e.g., *gridiron* to refer to the game of American football.

mimetic Similar to imitating, acting out, or miming.

minimal attachment principle The principle that in comprehending language, listeners create the simplest structure consistent with the grammar, e.g., *the horse raced past the barn* is interpreted as a complete sentence rather than a noun phrase containing a relative clause, as if it were *the horse* (that was) *raced past the barn*.

minimal pair (or set) Two (or more) words that are identical except for one phoneme that occurs in the same position in each word, e.g., *pain* /pen/, *bane* /ben/, *main* /men/.

modal An **auxiliary verb** other than *be*, *have*, and *do*, such as *can*, *could*, *will*, *would*, and *must*.

modularity (modular) The organization of the brain and mind into distinct, independent, and autonomous parts that interact with each other.

monogenetic theory of language origin The belief that all languages originated from a single language. See **Nostratic**.

monomorphemic word A word that consists of one morpheme.

monophthong Simple vowel, e.g., [ɛ] in [bɛd]. See **diphthong**.

monosyllabic Having one syllable, e.g., *boy*, *through*.

morpheme Smallest unit of linguistic meaning or function, e.g., *sheepdogs* contains three morphemes, *sheep*, *dog*, and the function morpheme for plural, *s*.

morphological parser A process, often a computer program, that uses rules of word formation to decompose words into their component morphemes.

morphological rules Rules for combining morphemes to form stems and words.

morphology The study of the structure of words; the component of the grammar that includes the rules of word formation.

morphophonemic orthography A writing system, such as that for English, in which morphological knowledge is needed to read correctly, e.g., in *please/pleasant* the *ea* represents [i]/[ɛ].

morphophonemic rules Rules that specify the pronunciation of morphemes; a morpheme may have more than one pronunciation determined by such rules, e.g., the plural morpheme /z/ in English is regularly pronounced [s], [z], or [əz].

motherese See **child-directed speech (CDS)**.

naming task An experimental technique that measures the response time between seeing a printed word and saying that word aloud.

narrowing A semantic change in which the meaning of a word changes in time to become less encompassing, e.g., *deer* once meant "animal."

nasal (nasalized) sound Speech sound produced with an open nasal passage (lowered velum), permitting air to pass through the nose as well as the mouth, e.g., /m/. See **oral sound**.

nasal cavity The passageways between the throat and the nose through which air passes during speech if the velum is open (lowered). See **oral cavity**.

natural class A class of sounds characterized by a phonetic property or feature that pertains to all members of the set, e.g., the class of stops. A natural class may be defined with a smaller feature set than that of any individual member of the class.

negative polarity item (NPI) An expression that is grammatical in the presence of negation, but ungrammatical in simple affirmative sentences, e.g., *any* in *James does not have any money* but **James has any money*.

Neo-Grammarians A group of nineteenth-century linguists who claimed that sound shifts (i.e., changes in phonological systems) took place without exceptions.

Neo-Grammarian hypothesis The claim that sound shifts (i.e., changes in phonological systems) take place without exceptions.

neurolinguistics The branch of linguistics concerned with the brain mechanisms that underlie the acquisition and use of human language; the study of the neurobiology of language.

neutralization Phonological processes or rules that obliterate the contrast between two phonemes in certain environments, e.g., in some dialects of English /t/ and /d/ are both pronounced as voiced flaps between vowels, as in *writer* and *rider*, thus neutralizing the voicing distinction so that the two words sound alike.

node A labeled branch point in a phrase structure tree; part of the graphical depiction of a transition network represented as a circle, pairs of which are connected by arcs. See **arc**, **phrase structure tree**, **transition network**.

noncontinuant A sound in which air is blocked momentarily in the oral cavity as it passes through the vocal tract. See **stops**, **affricate**.

nondistinctive features Phonetic features of phones that are predictable by rule, e.g., aspiration in English.

nonphonemic features See **nondistinctive features**.

nonredundant A phonetic feature that is distinctive, e.g., stop, voice, but not aspiration in English.

nonsense word A permissible phonological form without meaning, e.g., *slithy*.

Nostratic A hypothetical language that is postulated as the first human language.

noun (N) The syntactic category, also lexical category, of words that can function as the head of a noun phrase, such as *book*, *Jean*, *sincerity*. In many languages nouns have grammatical alternations for number, case, and gender and occur with determiners.

noun phrase (NP) The syntactic category, also phrasal category, of expressions containing some form of a noun or pronoun as its head, and which functions as the subject or as various objects in a sentence.

nucleus That part of a syllable that has the greatest acoustic energy; the vowel portion of a syllable, e.g., /i/ in /mit/ *meet*.

obstruents The class of sounds consisting of nonnasal stops, fricatives, and affricates. See **sonorants**.

onomatopoeia/onomatopoeic Refers to words whose pronunciations suggest their meaning, e.g., *meow*, *buzz*.

onset One or more phonemes that precede the syllable **nucleus**, e.g., /pr/ in /prist/ *priest*.

open class The class of lexical content words; a category of words that commonly adds new words, e.g., nouns, verbs.

Optimality Theory The hypothesis that a universal set of ranked phonological constraints exists, where the higher the constraint is ranked, the more influence it exerts on the language, e.g., in English, one constraint is the following: *Obstruent sequences may not differ with respect to their voice feature at the end of a word*.

oral cavity The mouth area through which air passes during the production of speech. See **nasal cavity**.

oral sound A non-nasal speech sound produced by raising the velum to close the nasal passage so that air can escape only through the mouth. See **nasal sound**.

orthography The written form of a language; spelling.

overextension The broadening of a word's meaning in language acquisition to encompass a more general meaning, e.g., using *dog* for any four-legged animals including cats or horses.

overgeneralization Children's treatment of irregular verbs and nouns as if they were regular, e.g., *bringed*, *goed*, *foots*, *mouses*, for *brought*, *went*, *feet*, *mice*. This shows that the child has acquired the regular rules but has not yet learned that there are exceptions.

palatal A sound produced by raising the front part of the tongue to the palate.

palate The bony section of the roof of the mouth behind the **alveolar ridge**.

paradigm A set of forms derived from a single root morpheme, e.g., *give*, *gives*, *given*, *gave*, *giving*; or *woman*, *women*, *woman's*, *women's*.

paradox A sentence to which it is impossible to ascribe a truth value, e.g., *this sentence is false*.

parallel processing The ability of a computer to carry out several tasks simultaneously as a result of the presence of multiple central processors.

parameters The small set of alternatives for a particular phenomenon made available by Universal Grammar. For example, Universal Grammar specifies that a phrase must have a head and possibly complements; a parameter states whether the complement(s) precedes or follows the head.

paraphrases Sentences with the same truth conditions; sentences with the same meaning, except possibly for minor differences in emphasis, e.g., *He ran up a big bill* and *He ran a big bill up*. See **synonymy**.

parse The act of determining the grammaticality of sequences of words according to rules of syntax, and assigning a linguistic structure to the grammatical ones.

parser A computer program that determines the grammaticality of sequences of words according to whatever rules of syntax are stored in the computer's memory, and assigns a linguistic structure to the grammatical ones.

participle The form of a verb that occurs after the auxiliary verbs *be* and *have*, e.g., *kissing* in *John is kissing Mary* is a present participle; *kissed* in *John has kissed many girls* is a past participle; *kissed* in *Mary was kissed by John* is a passive participle.

passive sentence A sentence in which the verbal complex contains a form of *to be* followed by a verb in its participle form, e.g., *The girl was kissed by the boy*; *The robbers must not have been seen*. In a passive sentence, the direct object of a transitive verb in d-structure functions as the subject in s-structure. See **active sentence**.

performance, linguistic The *use* of linguistic competence in the production and comprehension of language; behavior as distinguished from linguistic knowledge, e.g., linguistic competence permits one-million-word sentences, but linguistic performance prevents this from happening.

performative sentence A sentence containing a performative verb used to accomplish some act. Performative sentences are affirmative and declarative, and are in first-person, present tense, e.g., *I now pronounce you husband and wife*, when spoken by a justice of the peace in the appropriate situation, is an act of marrying.

performative verb A verb, certain usages of which result in a **speech act**, e.g., *resign* when the sentence *I resign!* is interpreted as an act of resignation.

person deixis The use of terms to refer to persons whose reference relies entirely on context, e.g., pronouns such as *I*, *he*, *you* and expressions such as *this child*. See **deictic**, **time deixis**, **place deixis**, **demonstrative articles**.

petroglyph A drawing on rock made by prehistoric people.

pharynx The tube or cavity in the vocal tract above the glottis through which the air passes during speech production.

phone A phonetic realization of a **phoneme**.

phoneme A contrastive phonological **segment** whose phonetic realizations are predictable by rule.

phonemic features Phonetic properties of phonemes that account for their ability to contrast meanings of words, e.g., *voice*, *tense*. Also called **distinctive features**.

phonemic principle The principle that underlies alphabetic writing systems in which one symbol typically represents one phoneme.

phonemic representation The phonological representation of words and sentences prior to the application of phonological rules.

phonetic alphabet Alphabetic symbols used to represent the phonetic segments of speech in which there is a one-to-one relationship between each symbol and each speech sound.

phonetic features Phonetic properties of segments (e.g., voice, nasal, alveolar) that distinguish one segment from another.

phonetic representation The representation of words and sentences after the application of phonological rules; symbolic transcription of the pronunciation of words and sentences.

phonetic similarity Refers to sounds that share most phonetic features.

phonetics The study of linguistic speech sounds, how they are produced (**articulatory phonetics**), how they are perceived (**auditory** or perceptual **phonetics**), and their physical aspects (**acoustic phonetics**).

phonetic transcription The "spelling" of a word in terms of the individual phones it contains, using a **phonetic alphabet**, as opposed to ordinary **orthography**, e.g., [fə̃nɛɾɪk] for *phonetic*.
phonographic symbol A symbol in a writing system that stands for the sounds of a word.
phonological rules Rules that apply to phonemic representations to derive phonetic representations or pronunciation.
phonology The sound system of a language; the component of a grammar that includes the inventory of sounds (phonetic and phonemic units) and rules for their combination and pronunciation; the study of the sound systems of all languages.
phonotactics/phonotactic constraints Rules stating permissible strings of phonemes; within a syllable, e.g., a word-initial nasal consonant may be followed only by a vowel (in English). See **possible word**, **nonsense word**, **accidental gap**.
phrasal category The class of syntactic categories that occur on the left side of phrase structure rules, and are therefore composed of other categories, possibly including other phrasal categories, e.g., noun phrase (NP). See **lexical category**, **functional category**.
phrasal semantics See **sentential semantics**.
phrase structure rules Principles of grammar that specify the constituency of syntactic categories and of phrase structure trees, e.g., VP → V NP.
phrase structure tree A tree diagram with syntactic categories at each node that reveals both the linear and hierarchical structure of phrases and sentences.
phrenology A pseudoscience of examining bumps on the skull to determine personality traits and intellectual ability. Its contribution to neurolinguistics is that its methods were highly suggestive of the modular theory of brain structure.
pictogram A symbol in a writing system that resembles the object represented in a direct way; a nonarbitrary form of writing.
pictographic writing A method of writing that utilizes **pictograms**, or literal representations of the word.
pidgin A simple but rule-governed language developed for communication among speakers of mutually unintelligible languages, often based on one of those languages called the **lexifier language**. See **substrate languages**.
pidginization The process of the creation of a pidgin that involves a simplification of the grammars of the impinging languages and a reduction of the number of domains in which the language is used. See **creolization**, **pidgin**.
Pinyin An alphabetic writing system for Mandarin Chinese using a Western-style alphabet to represent individual sounds.
pitch The **fundamental frequency** of sound perceived by the listener.
pitch contour The intonation of a sentence.
place deixis The use of terms to refer to places whose reference relies entirely on context, e.g., *here*, *there*, *behind*, *next door*. See **deictic**, **time deixis**, **person deixis**, **demonstrative articles**.
place of articulation The part of the vocal tract at which constriction occurs during the production of consonants. See **manner of articulation**.
plosives Oral, or non-nasal, stop consonants, so called because the air that is stopped explodes with the release of the closure.
polyglot A person who speaks several languages.
polymorphemic word A word that consists of more than one **morpheme**.
polysemous/polysemy Describes a single word with several closely related but slightly different meanings, e.g., *face*, meaning "face of a person," "face of a clock," "face of a building."
polysynthetic language Languages with extraordinarily rich morphologies in which a single word may carry the semantic content of an entire sentence.

positron emission tomography (PET) Method to detect changes in brain activities and relate these changes to localized brain damage and cognitive tasks.

possessor The thematic role of the noun phrase to whose referent something belongs, e.g., *the dog* in *The dog's tail wagged furiously*.

possible word A string of sounds that obeys the **phonotactic constraints** of the language but has no meaning, e.g., *gimble*. Also called a **nonsense word**.

poverty of the stimulus See **impoverished data**.

pragmatics The study of how context and situation affect meaning.

predictable feature A nondistinctive, noncontrastive, redundant phonetic feature, e.g., aspiration in English voiceless stops, or nasalization in English vowels.

prefix An **affix** that is attached to the beginning of a morpheme or stem, e.g., *in-* in *inoperable*.

preposition (P) The syntactic category, also functional category, that heads a prepositional phrase, e.g., *at*, *in*, *on*, *up*.

prepositional object The grammatical relation of the noun phrase that occurs immediately below a **prepositional phrase** (**PP**) in d-structure.

prepositional phrase (PP) The syntactic category, also phrasal category, consisting of a prepositional head and a noun phrase complement, e.g., *with a key*, *into the battle*, *over the top*.

prescriptive grammar Rules of grammar brought about by grammarians' attempts to legislate what speakers' grammatical rules should be, rather than what they are. See **descriptive grammar**, **teaching grammar**.

prestige dialect The dialect usually spoken by people in positions of power, and the one deemed correct by prescriptive grammarians, e.g., RP (*r*eceived *p*ronunciation) (British) English, the dialect spoken by the English royal family.

presupposition Implicit assumptions about the world required to make an utterance meaningful or relevant, e.g., "some tea has already been taken" is a presupposition of *Take some more tea!*

primes The basic formal units of sign languages that correspond to phonological elements of spoken language.

priming An experimental procedure that measures the response time between hearing a word and grasping the meaning of that word, as a function of whether the participant has heard a related word previously. See **semantic priming**.

principle of compositionality A principle of semantic interpretation that states that the meaning of a word, phrase, or sentence depends both on the meaning of its components (morphemes, words, phrases) and how they are combined structurally.

productive Refers to **morphological rules** that can be used freely and apply to all forms to create new words, e.g., the addition to an adjective of *-ish* meaning "having somewhat of the quality," such as *newish*, *tallish*, *incredible-ish*.

pro-form A word that replaces another word or expression found elsewhere in discourse, or understood from the situational context. Pronouns are the best known pro-forms, but words like *did* may function as "pro-verb phrases" as in *John washed three sheepdogs and Mary did too*.

proper name A word or words that refer to a person, place, or other entity with a unique reference known to the speaker and listener. Usually capitalized in writing, e.g., Nina Hyams, New York, Atlantic Ocean.

prosodic bootstrapping The learning of word or phrase segmentation by infants inferred from the stress pattern of a language.

prosodic feature The duration (**length**), **pitch**, or loudness of speech sounds.

Proto-Germanic The name given by linguists to the language that was an ancestor of English, German, and other Germanic languages.

Proto-Indo-European (PIE) See **Indo-European**.

protolanguage The earliest identifiable language from which genetically related languages developed.
psycholinguistics The branch of linguistics concerned with **linguistic performance**, language acquisition, and speech production and comprehension.
rebus principle In writing, the use of a **pictogram** for its phonetic value, e.g., using a picture of a bee to represent the verb *be* or the sound [b].
recast The repetition with "corrections" of a child's utterance by an adult. E.g., the child says *I holded the rabbit*, and the adult corrects by saying *You mean you held the rabbit*.
recursive rule A **phrase structure rule** that repeats its own category on its right side, e.g., VP → VP PP, hence permitting phrase structures of potentially unlimited length, corresponding to that aspect of speakers' **linguistic competence**.
reduced vowel A vowel that is unstressed and generally pronounced as schwa [ə] in English.
redundant Describes a nondistinctive, nonphonemic feature that is predictable from other feature values of the segment, e.g., [+voice] is redundant for any [+nasal] phoneme in English because all nasals are voiced.
reduplication A morphological process that repeats or copies all or part of a word to produce a new word, e.g., *wishy-washy*, *teensy-weensy*, *hurly-burly*. Also used in some languages as an inflectional process, e.g., Samoan *manao*/*mananao*, "he wishes/they wish."
reference That part of the meaning of a noun phrase that associates it with some entity. That part of the meaning of a declarative sentence that associates it with a **truth value**, either true or false. Also called **extension**. See **referent**, **sense**.
reference resolution In **computational pragmatics**, the computer algorithms that determine when two expressions have the same referent, e.g., identifying the referents of pronouns.
referent The entity designated by an expression, e.g., the referent of *John* in *John knows Sue* is the actual person named John; the referent of *Raleigh is the capital of California* is the truth value *false*. Also called **extension**.
reflexive pronoun A pronoun ending with *-self* that generally requires a noun-phrase antecedent within the same S, e.g., *myself*, *herself*, *ourselves*, *itself*.
regional dialect A dialect spoken in a specific geographic area that may arise from, and is reinforced by, that area's integrity. For example, a Boston dialect is maintained because large numbers of Bostonians and their descendants remain in the Boston area. See **social dialect**.
register A stylistic variant of a language appropriate to a particular social setting. Also called **style**.
register tones In tone languages, level tones; high, mid, or low tones.
regular sound correspondence The occurrence of different sounds in the same position of the same word in different languages or dialects, with this parallel holding for a significant number of words, e.g., [aɪ] in non-Southern American English corresponds to [aː] in Southern American English. Also found between newer and older forms of the same language.
relational opposites A pair of **antonyms** in which one describes a relationship between two objects and the other describes the same relationship when the two objects are reversed, e.g., *parent/child*, *teacher/pupil*; John is the parent of Susie describes the same relationship as Susie is the child of John. See **gradable pair**, **complementary pair**.
retroflex sound A sound produced by curling the tip of the tongue back behind the alveolar ridge, e.g., the pronunciation of /r/ by many speakers of English.
rime The **nucleus** + **coda** of a syllable, e.g., the /en/ of /ren/ *rain*.

root The **morpheme** that remains when all affixes are stripped from a complex word, e.g., *system* from *un* + *system* + *atic* + *ally*.

rounded vowel A vowel sound produced with pursed lips, e.g., [o].

rules of syntax Principles of grammar that account for the grammaticality of sentences, their hierarchical structure, their word order, whether there is structural ambiguity, etc. See **phrase structure rules**, **transformational rules**.

SAE See **Standard American English**.

Sapir-Whorf hypothesis The proposition that the structure of a language influences how its speakers perceive the world around them. It is often presented in its weak form, **linguistic relativism**, and its strong form, **linguistic determinism**.

savant An individual who shows special abilities in one cognitive area while being deficient in others. Linguistic savants have extraordinary language abilities but are deficient in general intelligence.

second language acquisition The acquisition of another language or languages after first language acquisition is under way or completed. Also called **L2 acquisition**.

segment (1) An individual sound that occurs in a language; (2) the act of dividing utterances into sounds, morphemes, words, and phrases.

semantic bootstrapping The learning of word categories inferred from the word's meaning, e.g., a word whose meaning is a person, place or thing would be considered a noun.

semantic features Conceptual elements by which a person understands the meanings of words and sentences, e.g., "female" is a semantic feature of the nouns *girl* and *filly*; "cause" is a semantic feature of the verbs *darken* and *kill*.

semantic network A network of **arcs** and **nodes** used to represent semantic information about sentences.

semantic priming The effect of being able to recognize a word (e.g., *doctor*) more rapidly after exposure to a semantically similar word (e.g., *nurse*) than after exposure to a semantically more distant word. The word *nurse* primes the word *doctor*.

semantic properties See **semantic features**.

semantic representation A symbolic system suitable for the characterization of the meaning of natural language utterances in a computer, e.g., logic-based expressions or **semantic networks**.

semantic rules Principles for determining the meaning of larger units like sentences from the meaning of smaller units like noun phrases and verb phrases.

semantics The study of the linguistic meaning of morphemes, words, phrases, and sentences.

sense The inherent part of an expression's meaning that, together with context, determines its referent. Also called **intension**. For example, knowing the sense or intension of a noun phrase such as *the president of the United States in the year 2010* allows one to determine that Barack Obama is the referent. See **intension**, **reference**.

sentence (S) A syntactic category of expressions consisting minimally of a **noun phrase** (**NP**) followed by a **verb phrase** (**VP**) in **d-structure**. Also called a **TP** (**tense phrase**). The head of S is the category **Aux**.

sentential semantics The subfield of semantics concerned with the meaning of syntactic units larger than the word.

Separate Systems Hypothesis A proposal that a bilingual child builds a distinct lexicon and grammar for each language being acquired.

sequential bilingualism Refers to the acquisition of a second language by someone (adult or child) who has already acquired a first language.

shadowing task An experiment in which subjects are asked to repeat what they hear as rapidly as possible as it is being spoken. During the task, subjects often unconsciously correct "errors" in the input.

sibilants The class of sounds that includes alveolar and palatal **fricatives** and **affricates**, characterized acoustically by an abundance of high frequencies perceived as "hissing," e.g., [s], [tʃ].
sign A single gesture (possibly with complex meaning) in the sign languages used by the deaf.
sign languages The languages used by deaf people in which linguistic units such as morphemes and words as well as grammatical relations are formed by manual and other body movements.
simultaneous bilingualism Refers to the (more or less) simultaneous acquisition of two languages beginning in infancy (or before the age of three years).
sisters In a phrase structure tree, two categories that are directly under the same node, e.g., V and the direct object NP are sisters inside the verb phrase.
situational context Knowledge of who is speaking, who is listening, what objects are being discussed, and general facts about the world we live in, used to aid in the interpretation of meaning.
slang Words and phrases used in casual speech, often invented and spread by close-knit social or age groups, and fast-changing.
slip of the tongue An involuntary deviation of an intended utterance. See **spoonerism**. Also called **speech error**.
social dialect A dialect spoken by members of a group delineated by socioeconomic class, racial background, place of origin, or gender, and perpetuated by the integrity of the social class. See **regional dialect**.
societal bilingualism The mutual abilities of a community to speak two (or more) languages with native or near native proficiency. See **bilingualism**, **individual bilingualism**.
sociolinguistic variable A linguistic phenomenon such as double negation whose occurrence varies according to the social context of the speaker.
sonorants The class of sounds that includes **vowels**, **glides**, **liquids**, and **nasals**; nonobstruents. See **obstruents**.
sound change See **sound shift**.
sound shift Historical phonological change. Also called **sound change**.
sound symbolism The notion that certain sound combinations occur in semantically similar words, e.g., *gl* in *gleam*, *glisten*, *glitter*, which all relate to vision.
sound writing A term sometimes used to mean a writing system in which one sound is represented by one letter. Sound-writing systems do not employ the phonemic principle and are similar to phonetic transcriptions.
source The thematic role of the noun phrase whose referent is the place from which an action originates, e.g., *Mars* in *Mr. Wells just arrived from Mars*.
source language In automatic machine translation, the language being translated. See **target language**, **automatic machine translation**.
speaker identification The use of computers to assist in matching a voice recording by an unknown person to a known person.
specific language impairment (SLI) Difficulty in acquiring language faced by certain children with no other cognitive deficits.
specifier The category of the left sister of X' in **x-bar theory**, e.g., a **determiner** in an NP or an **adverb** in a VP. It is a modifier of the head and is often optional.
spectrogram A visual representation of speech decomposed into component frequencies, with time on the horizontal axis, frequency on the vertical axis, and intensity portrayed on a gray scale—the darker, the more intense. Also called **voiceprint**.
speech act The action or intent that a speaker accomplishes when using language in context, the meaning of which is inferred by hearers, e.g., *There is a bear behind you*

may be intended as a warning in certain contexts, or may in other contexts merely be a statement of fact. See **illocutionary force**.

speech error An inadvertent deviation from an intended utterance that often results in ungrammaticality, nonsense words, anomaly, etc. See **slip of the tongue**, **spoonerism**.

speech recognition In computer processing, the ability to analyze speech sounds into phones, phonemes, morphemes, and words; the transcription of speech.

speech synthesis An electronic process that produces speech either from acoustically simulated sounds or from prerecorded units. See **formant synthesis**, **concatenative synthesis**.

speech understanding Computer processing for interpreting speech, one part of which is **speech recognition**.

spelling pronunciation Pronouncing a word as it is spelled, irrespective of its actual pronunciation by native speakers, e.g., pronouncing *Wednesday* as "wed-ness-day."

spelling reform The attempt by governments or academic institutions to change the spelling of words to more accurately reflect their current pronunciation.

spell-out rules Rules that convert abstract inflectional morphemes such as tense, agreement, and possessive into affixes.

split brain The result of an operation for epilepsy in which the **corpus callosum** is severed, thus separating the brain into its two hemispheres; split-brain patients are studied to determine the role of each hemisphere in cognitive and language processing.

spoonerism A **speech error** in which phonemic segments are reversed or exchanged, e.g., *you have hissed my mystery lecture* for the intended *you have missed my history lecture*; named after the Reverend William Archibald Spooner, a nineteenth-century Oxford don.

S-selection The classifying of verbs and other lexical items in terms of the semantic category of the head and complements that they accept, e.g., the verb *assassinate* S-selects for a human subject and a prestigious, human NP complement.

s-structure The structure that results from applying transformational rules to a **d-structure**. It is syntactically closest to actual utterances. Also called **surface structure**. See **transformational rule**.

standard The **dialect** (regional or social) considered to be the norm.

Standard American English (SAE) An idealized dialect of English that some prescriptive grammarians consider the proper form of English.

state/stative A type of sentence that describes states of being such as *Mary likes oysters*, as opposed to describing events such as *Mary ate oysters*. See **event/eventive**.

stem The base to which an affix is attached to create a more complex form that may be another stem or a word. See **root**, **affix**.

stemming In **computational morphology**, the analysis of words into their component morphemes by the recursive stripping off of affixes.

stops [−continuant] sounds in which the airflow is briefly but completely stopped in the oral cavity, e.g., [p,n,g].

stress, stressed syllable A syllable with relatively greater length, loudness, and/or higher pitch than other syllables in a word, and therefore perceived as prominent. Also called **accent**.

stress-timed language A language in which at least one syllable of a word receives primary stress. English is such a language.

structural ambiguity The phenomenon in which the same sequence of words has two or more meanings that is accounted for by different phrase structure analyses, e.g., *He saw a boy with a telescope*.

structure dependent (1) A principle of Universal Grammar that states that the application of **transformational rules** is determined by phrase structure properties, as opposed to structureless sequences of words or specific sentences; (2) the way children construct rules using their knowledge of syntactic structure irrespective of the specific words in the structure or their meaning.

style A situation dialect, e.g., formal speech, casual speech; also called **register**.

subcategorization See **C-selection**.

subject The grammatical relation of a noun phrase to a S(entence) when it appears immediately below that S in a phrase structure tree, e.g., *the zebra* in *The zebra has stripes*.

subject-verb agreement The addition of an **inflectional morpheme** to the main verb depending on a property of the noun phrase subject, such as number or gender. In English, it is the addition of *s* to a verb when the subject is third-person singular present tense, e.g., *A greyhound run*s *fast* versus *Greyhounds run fast*.

substrate languages The language(s) of the indigenous people in a language contact situation that contributes to the lexicon and grammar of a pidgin or creole but in a less obvious way than the **superstrate language**.

suffix An **affix** that is attached to the end of a morpheme or stem, e.g., *-er* in *Lew is taller than Bill*.

summarization The computer scanning of a text and condensation to its most salient points.

superstrate language The language that provides most of the lexical items of a pidgin or creole, typically the language of the socially or economically dominant group. Also called **lexifier language**. See **substrate languages**.

suppletive forms A term used to refer to **inflected morphemes** in which the regular rules do not apply, e.g., *went* as the past tense of *go*.

suprasegmentals **Prosodic features**, e.g., length, tone.

surface structure See **s-structure**.

syllabary The symbols of a syllabic writing system.

syllabic A phonetic feature of those sounds that may constitute the nucleus of syllables; all vowels are syllabic, and liquids and nasals may be syllabic in such words as *towel*, *button*, *bottom*.

syllabic writing A writing system in which each syllable in the language is represented by its own symbol, e.g., **hiragana** in Japanese.

syllable A phonological unit composed of an **onset**, **nucleus**, and **coda**, e.g., *elevator* has four syllables: *el e va tor*; *man* has one syllable.

syllable-timed language A language in which the syllables have approximately the same loudness, length, and pitch, as opposed to a **stress-timed language**. French, for example, is such a language.

synonyms Words with the same or nearly the same meaning, e.g., *pail* and *bucket*.

synonymy (synonymous) Having the same meaning in all contexts. More technically, in the semantic component of the grammar, two sentences are synonymous if they **entail** each other, e.g., *the cat ate the rat*; *the rat was eaten by the cat*. See **paraphrases**.

syntactic bootstrapping The learning of word meaning inferred from syntax, e.g., when a child hears *John glouted Mary a clibe* he realizes that *glout* is a verb and likely means the transferring of something from one person to another.

syntactic category/class See **grammatical categories**.

syntax The rules of sentence formation; the component of the mental grammar that represents speakers' knowledge of the structure of phrases and sentences.

synthetic language Languages in which words often contain multiple morphemes, e.g., English and Indo-European languages in general.

T (tense) A term sometimes used in place of **Aux**. The syntactic category that is the head of **TP (tense phrase)** or **sentence (S)**.

taboo Words or activities that are considered inappropriate for "polite society," e.g., *cunt*, *prick*, *fuck* for vagina, penis, and sexual intercourse, respectively.

tap A speech sound in which the tongue quickly touches the alveolar ridge, as in some British pronunciations of /r/. Also called **flap**.

target language In automatic machine translation, the language into which the source language is translated. See **source language**, **automatic machine translation**.

tautology A sentence that is true in all situations; a sentence true from the meaning of its words alone, e.g., *Kings are not female*. Also called **analytic**.

teaching grammar A set of language rules written to help speakers learn a foreign language or a different dialect of their language. See **descriptive grammar**, **prescriptive grammar**.

telegraphic speech Utterances of children that may omit **grammatical morphemes** and/or **function words**, e.g., *He go out* instead of *He is going out*.

telegraphic stage The period of child language acquisition that follows the two-word stage and consists primarily of **telegraphic speech**.

tense A **phonetic feature** that distinguishes similar pairs of vowels. Vowels that are [+tense] are somewhat longer in duration and higher in tongue position and pitch than the corresponding [−tense] (lax) vowel, e.g., in English [i] is a high front tense vowel whereas [ɪ] is a high front lax vowel. See **lax vowel**. Also a term sometimes used in place of **Aux**, and usually abbreviated T, it is the syntactic category that is the head of **TP** (**tense phrase**) or **sentence** (**S**).

text-to-speech A computer program that converts written text into the basic units of a speech synthesizer, such as phones for **formant synthesizers**, or diphones, disyllables, etc. for **concatenative synthesizers**.

thematic role The semantic relationship between the verb and the noun phrases of a sentence, such as **agent**, **theme**, **location**, **instrument**, **goal**, **source**.

theme The thematic role of the noun phrase whose referent undergoes the action of the verb, e.g., *Martha* in *George hugged Martha*.

theta assignment The ascribing of thematic roles to the syntactic elements in a sentence.

time deixis The use of terms to refer to time whose reference relies entirely on context, e.g., *now*, *then*, *tomorrow*, *next month*. See **deictic**, **deixis**, **demonstrative articles**, **person deixis**, **place deixis**.

tip of the tongue (TOT) phenomenon The difficulty encountered from time to time in retrieving a particular word or expression from the mental lexicon. Anomic aphasics suffer from an extreme form of this problem. See **anomia**.

tone The contrastive **pitch** of syllables in **tone languages**. Two words may be identical except for such differences in pitch, e.g., in Thai *naa* [naː] with falling pitch means "face," but with a rising pitch means "thick." See **register tones**, **contour tones**.

tone language A language in which the **tone** or **pitch** on a syllable is phonemic, so that words with identical segments but different tones are different words, e.g., Mandarin Chinese, Thai.

top-down processing Expectation-driven analysis of linguistic input that begins with the assumption that a large syntactic unit such as a sentence is present, and then analyzes it into successively smaller constituents (e.g., phrases, words, morphemes), which are ultimately compared with the sensory or acoustic data to validate the analysis. If the analysis is not validated, the procedure backs up to the previously validated point and then resumes. See **bottom-up processing**, **backtracking**.

topicalization A transformation that moves a syntactic element to the front of a sentence, e.g., deriving *Greyhounds I love very much* from *I love greyhounds very much*.

TP (tense phrase) A term sometimes used in place of **sentence** (**S**). A phrasal category whose head is **Aux**.

transcription, phonemic The phonemic representation of speech sounds using phonetic symbols, ignoring phonetic details that are predictable by rule, usually given between slashes, e.g., /pæn/, /spæn/ for *pan*, *span* as opposed to the phonetic representation [pʰæ̃n], [spæ̃n].

transcription, phonetic The representation of speech sounds using phonetic symbols between square brackets. They may reflect nondistinctive predictable features such as aspiration and nasality, e.g., [pʰat] for *pot* or [mæ̃n] for *man*.

transfer of grammatical rules The application of rules from one's first language to a second language that one is attempting to acquire. The "accent" that second-language learners have is a result of the transfer of first language phonetic and phonological rules.

transformational rule, transformation A syntactic rule that applies to an underlying phrase structure tree of a sentence (either **d-structure** or an intermediate structure already affected by a transformation) and derives a new structure by moving or inserting elements, e.g., the transformational rules of *wh* movement and *do* insertion relate the deep structure sentence *John saw who* to the surface structure *Who(m) did John see*.

transformationally induced ambiguity This occurs when different **d-structures** are mapped into the same **s-structure** by one or more transformations, e.g., the ambiguous *George loves Laura more than Dick* may be transformationally derived from the d-structures *George loves Laura more than Dick* <u>*loves Laura*</u>, or *George loves Laura more than* <u>*George loves*</u> *Dick*, with the underlined words being deleted under identity by a transformation in either case.

transition network A graphical representation that uses nodes connected by labeled arcs to depict syntactic and semantic relationships. See **node**, **arc**.

transitional bilingual education (TBE) Educational programs in which students receive instruction in both English and their native language, for example Spanish, and the native language support is gradually phased out over two or three years.

transitive verb A verb that C-selects an obligatory noun-phrase complement, e.g., *find*.

tree diagram A graphical representation of the linear and hierarchical structure of a phrase or sentence. A **phrase structure tree**.

trill A speech sound in which part of the tongue vibrates against part of the roof of the mouth, e.g., the /r/ in Spanish *perro* ("dog") is articulated by vibrating the tongue tip behind the alveolar ridge; the /r/ in French *rouge* ("red") may be articulated by vibrations at the uvula.

trochaic Stress on the first syllable of a two-syllable word, e.g., *páper*.

truth conditions The circumstances that must be known to determine whether a sentence is true, and therefore part of the meaning, or **sense**, of declarative sentences.

truth-conditional semantics A theory of meaning that takes the semantic knowledge of knowing when sentences are true and false as basic.

truth value TRUE or FALSE; used to describe the truth of declarative sentences in context; the **reference** of a declarative sentence in **truth-conditional semantics**.

unaspirated Phonetically voiceless stops in which the vocal cords begin vibrating immediately upon release of the closure, e.g., [p] in *spot*. See **aspirated**.

unbound A pronoun or pro-form whose reference is determined from context rather than linguistic discourse. See **free pronoun**, **bound pronoun**.

unconditioned sound change Historical phonological change that occurs in all phonetic contexts, e.g., the **Great Vowel Shift** of English in which long vowels were modified wherever they occurred in a word.

underextension The narrowing of a word's meaning in language acquisition to a more restrictive meaning, e.g., using *dog* for only the family pet and not for other dogs.

ungrammatical Describes structures that fail to conform to the rules of grammar.

uniformity of theta assignment A principle of Universal Grammar that states that the various thematic roles are always structurally in the same place in deep structure, e.g., the thematic role of *theme* is always a direct object.

uninterpretable Describes an utterance whose meaning cannot be determined because of **nonsense words**, e.g., *All mimsy were the borogoves*.

Unitary System Hypothesis A proposal that a bilingual child initially constructs only one lexicon and one grammar for both (or all) languages being acquired.

Universal Grammar (UG) The innate principles and properties that pertain to the grammars of all human languages.

unmarked The term used to refer to that member of a gradable pair of antonyms used in questions of degree, e.g., *high* is the unmarked member of high/low; in a masculine/feminine pair, the word that does not contain a derivational morpheme, usually the masculine word, e.g., *prince* is unmarked, whereas *princess* is marked. See **marked**.

uvula The fleshy appendage hanging down from the end of the **velum** (soft palate).

uvular A sound produced by raising the back of the tongue to the **uvula**.

velar A sound produced by raising the back of the tongue to the soft palate, or **velum**.

velum The soft palate; the part of the roof of the mouth behind the hard palate.

verb (V) The syntactic category, also lexical category, of words that can be the head of a verb phrase. Verbs denote actions, sensations, and states, e.g., *climb*, *hear*, *understand*.

verb phrase (VP) The syntactic category of expressions that contains a verb as its head along with its complements such as noun phrases and prepositional phrases, e.g., *gave the book to the child*.

verbal particle A word identical in form to a preposition which, when paired with a verb, has a particular meaning. A particle, as opposed to a preposition, is characterized syntactically by its ability to occur next to the verb, or transposed to the right, e.g., *out*, in *spit out* as in *He spit out his words*, or *He spit his words out*. Compare with *He ran out the door* versus **he ran the door out*, where *out* is a preposition.

Verner's Law The description of a conditioned phonological change in the sound system of certain Indo-European languages wherein voiceless fricatives were changed when the preceding vowel was unstressed. It was formulated by Karl Verner as an explanation to some of the exceptions to **Grimm's Law**.

vocal tract The oral and nasal cavities, together with the vocal cords, glottis, and pharynx, all of which may be involved in the production of speech sounds.

vocalic A phonetic feature that distinguishes vowels and liquids, which are [+vocalic], from other sounds (obstruents, glides, nasals), which are [−vocalic]. The feature is little used in contemporary linguistic literature.

voiced sound A speech sound produced with vibrating vocal cords.

voiceless sound A speech sound produced with open, nonvibrating vocal cords.

voiceprint A common term for a **spectrogram**.

vowel A sound produced without significant constriction of the air flowing through the **oral cavity**.

well-formed Describes a grammatical sequence of words, one conforming to rules of syntax. See **grammatical**, **ill-formed**.

Wernicke, Carl Neurologist who showed that damage to specific parts of the left cerebral hemisphere causes specific types of language disorders.

Wernicke's aphasia The type of aphasia resulting from damage to **Wernicke's area**.

Wernicke's area The back (posterior) part of the left brain that if damaged causes a specific type of aphasia. Also called Wernicke's region.

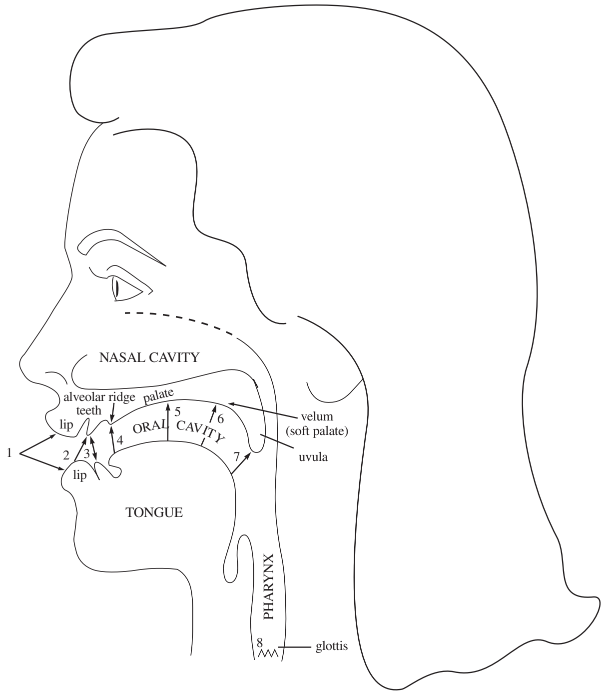
***wh* questions** Interrogative sentences beginning with one or more of the words *who*(*m*), *what*, *where*, *when*, and *how*, and their equivalents in languages that do not have *wh* words, such as *quién* in Spanish: *Who(m) do you like?* ¿A quién le gusta?

word writing A system of writing in which each character represents a word or morpheme of the language, e.g., Chinese. See **ideograph**, **logographic writing**.

X-bar theory A universal schema specifying that the internal organization of all phrasal categories (i.e., NP, PP, VP, TP(=S), AdjP, AdvP) can be broken down into three levels, e.g., NP, N', and N.

yes-no question An interrogative sentence that inquires as to whether a certain situation is true or not, e.g., *Is the boy asleep?*

The Vocal Tract. Places of articulation: 1. bilabial; 2. labiodental; 3. interdental; 4. alveolar; 5. (alveo)palatal; 6. velar; 7. uvular; 8. glottal



Some Phonetic Symbols for American English Consonants

	Bilabial	Labiodental	Interdental	Alveolar	Palatal	Velar	Glottal
Stop (oral)							
voiceless	p			t		k	ʔ
voiced	b			d		g	
Nasal (voiced)	m			n		ŋ	
Fricative							
voiceless		f	θ	s	ʃ		h
voiced		v	ð	z	ʒ		
Affricate							
voiceless					tʃ		
voiced					dʒ		
Glide							
voiceless	ʍ					ʍ	
voiced	w				j	w	
Liquid (voiced)							
(central)				r			
(lateral)				l			