FIGURE 8.8 Communication among Honeybees. Honeybees use the waggle dance to communicate to other bees the location of a food source: in which direction it lies, how far away it is, and how plentiful it is.

HOW ANIMALS COMMUNICATE. In most nonhuman animals, the two circumstances in which communication most often takes place are—you guessed it—sex and violence. Male songbirds, such as canaries and finches, produce a specific song to attract mates and another song to convey the message "This is my territory; back off" (Kendeigh, 1941). Chimpanzees use a combination of vocalizations and visual displays, such as making facial expressions and slapping the ground, to convey aggression (de Waal, 1989). When it comes to mating rituals, male chimpanzees squat with their knees spread to display their penises as an invitation to mate (admittedly, chimpanzees aren't known for their subtlety).

A fascinating example of nonhuman communication that provides information exchange beyond aggression and mating is the waggle dance of honeybees. Bees use this dance to communicate with their fellow bees about the location of a food source (see **FIGURE 8.8**). (Riley et al., 2005; von Frisch, 1967). The bee's waggle dance is one of the few nonhuman examples of communication about something beyond the here and now.

Vervet monkeys provide another interesting example; they use different alarm calls to signal different predators (Seyfarth & Cheney, 1997). They produce one type of call when they see a leopard, a second when they see a snake, and a third when they see a hawk or another flying predator. These alarm calls are the closest thing to words scientists have observed outside human language, because specific sounds correspond to specific meanings.

TEACHING HUMAN LANGUAGE TO NONHUMAN ANIMALS. Concerted efforts to teach animals human language have been largely unsuccessful. The earliest attempts to teach chimpanzees, one of our nearest living genetic relatives, fell flat. The researchers assumed incorrectly that chimpanzees possess a vocal apparatus similar to ours: Chimpanzees' vocal apparatus doesn't permit anywhere near the range and coordination of sounds we can achieve (Lieberman, Crelin, & Klatt, 1972). Later researchers tried to teach chimpanzees to use either sign language or a lexigram board, which allows them to point to printed visual symbols that stand for specific words (see **FIGURE 8.9**).

Watch in **MyPsychLab** the **Video:** Classic Footage of Chimpanzees and Sign Language

These attempts were more promising, but there were crucial limits. They required many trials with reinforcement to learn the associations between signs or lexigrams and their meanings. Even then, chimpanzees learned only a limited vocabulary. They also never mastered syntactic rules.

Two animal species appear to do a bit better. One is the bonobo, once thought to be a type of chimpanzee but now recognized as a distinct species that's genetically even more closely related to humans. The few studies conducted on bonobos suggest a different learning pathway, which more closely resembles human learning (Savage-Rumbaugh, 1986). Bonobos (1) learn better as young animals than as adults, (2) tend to learn through observation rather than direct reinforcement, and (3) use symbols to comment on or engage in social interactions rather than simply for food treats. Yet bonobos, like their chimpanzee cousins, seem to get stuck when learning syntax.

One species that may be able to use spoken language much as we do is the African gray parrot. An Einstein of a parrot named Alex, who died in 2007 at the age of 31, was renowned for his ability to speak and to solve cognitive tasks. Parrots are, of course, famous (and sometimes infamous) for their ability to mimic sounds. But at least some African gray parrots, including Alex, appear to go beyond mere mimicry. They use language in a more humanlike manner, generating new and meaningful combinations of words and even mastering syntactic rules (Pepperberg, 2006). Yet their learning process is more like that of chimpanzees than bonobos and humans. It's a result of many repetitions rather than observation and interaction with the world.

FIGURE 8.9 A Bonobo Uses Lexigrams to Communicate with Caretakers. This ape has been trained to associate colored shapes with meanings such as "juice," "fruit," and "tickle."

We humans are unique in our ability to use language in such sophisticated ways. Of course, complexity in and of itself doesn't make us better, although it may make us "smarter" in some crucial ways. Squirrels and cockroaches do a pretty decent job of keeping themselves going with whatever communication systems they have to work with. For their purposes, they're every bit as effective in their communication as we are.

Assess Your Knowledge — FACT or FICTION?

1. Nonstandard dialects of English follow syntactic rules that differ from but are just as valid as the rules in standard American English. **True / False**
2. Children's two-word utterances typically violate syntactic rules. **True / False**
3. Children who are deaf learn to sign at an older age than hearing children who are learning to talk. **True / False**
4. Bilingual individuals usually have one dominant language, which they learned earlier in development. **True / False**
5. Few nonhuman animal communication systems involve exchanges of information beyond the here and now. **True / False**

Answers: **1.** T (p. 302); **2.** F (p. 304); **3.** F (p. 307); **4.** T (p. 308); **5.** T (p. 310)

Study and **Review** in **MyPsychLab**

Alex (an African gray parrot) was famous for his impressive language skills.

Communication and the Mind: Connecting Thinking, Language, and Reading

8.10 Identify how our language may influence our thinking.

8.11 Identify the skills required to learn to read.

8.12 Analyze the relationship between reading speed and reading comprehension.

Given how complex language is, we might wonder how it corresponds to the equally complex ways that our thinking works. In this section, we'll explore how our thoughts are translated into spoken words and how our spoken words are translated into print.

Do We Think in Words? The Relation Between Language and Thought

We've all had times when we realized we were conversing with ourselves; we may have even started talking aloud to ourselves. Clearly, we sometimes think in words. What about the rest of the time? One early and since rejected hypothesis, proposed by John B. Watson, the founder of behaviorism (see Chapters 1 and 6), is that thinking is a form of internal speech. For Watson, there's no thinking without language, and all of our thoughts—our memories, decisions, ruminations, and fantasies—are merely verbal descriptions in our minds. Watson believed that thinking is simply subvocal talking, moving the vocal tract as if talking, but below hearing level.

The proposal that all thought is represented verbally implies that children don't think at all until they've mastered language and that the language we speak shapes how we perceive and interact with the world. What does the evidence say?

LINGUISTIC DETERMINISM: WE SPEAK; THEREFORE, WE THINK. The view that we represent all thinking linguistically is called **linguistic determinism**. One of the best-known examples of how language can influence thought is the belief that Inuits (formerly called Eskimos) possess about a thousand words for snow. Linguistic determinists argue that having so many words for snow enables Inuits to perceive incredibly subtle distinctions among types of snow. It's a good story. But there are several reasons to believe this conclusion may not be warranted.

1. Although Inuits make several fine distinctions among types of snow, research shows that a thousand is a substantial exaggeration of these types.
2. English speakers actually use many terms to describe different types of snow, such as *slush*, *powder*, and even *crud*. In fact, we have just about as many terms as do the Inuits.

It's common lore that the Inuit have a thousand words to refer to different types of snow, and as a result, they make finer distinctions among types of snow than do people who speak English. In fact, this claim is a myth: Inuit languages have about the same number of words for snow as does English.

linguistic determinism
view that all thought is represented verbally and that, as a result, our language defines our thinking

3. Even assuming that the Inuits have more terms for snow than we do, we can't infer that the greater number of terms *caused* the Inuit to make finer distinctions. It's just as likely that Inuits and other people who work in snowy conditions, like skiers and hikers, find it helpful to draw fine distinctions among types of snow. If so, language may reflect people's thinking about snow rather than the other way around. The correlation between the number of words and number of distinctions doesn't mean that the words produced distinctions that wouldn't otherwise have been there.

CORRELATION VS. CAUSATION ▶
Can we be sure that A causes B?

"I did not know that I am. I lived in a world that was a no-world. . . . I did not know that I knew aught [anything] or that I lived or acted or desired. I had neither will nor intellect" (Keller, 1910, pp. 113–114).

FIGURE 8.10 Could Helen Keller Think Before She Learned To Communicate? Helen Keller, who lost her hearing and sight at 19 months due to illness, eventually learned to communicate through signs performed against the palm of her hand. After learning to communicate through sign and writing, she described her experience of the world before learning language.

It's challenging to think of ways to test linguistic determinism. One strong test would be to compare the thought processes of people who can use language with those of people who can't to see if their thinking is similar (see **FIGURE 8.10**). Of course, nearly everyone learns language, and those few who don't are typically severely cognitively impaired or have suffered such serious abuse and neglect that they're deeply disturbed emotionally. So we need to turn to other evidence to see whether normal thinking can exist without language.

This evidence gives us reason to doubt linguistic determinism. First, children can perform many complex cognitive tasks long before they can talk about them. A second compelling argument against linguistic determinism comes from neuroimaging studies of problem solving, thinking, remembering, and reading (see **FIGURE 8.11**). These studies show that although language areas often become activated when people engage in certain cognitive tasks such as reading, those areas of the brain aren't especially active during other tasks such as spatial tasks and visual imagery (Gazzaniga, Ivry, & Mangun, 2002). These studies suggest that thought can occur without language.

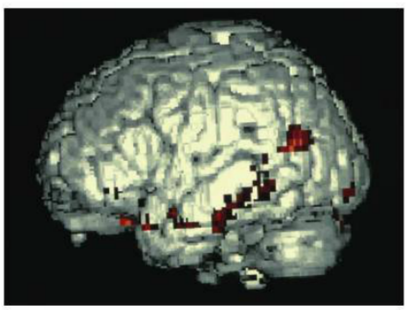

FIGURE 8.11 Brain Activation during Language Tasks. This PET scan shows the areas in the left temporal lobe that become especially active when people are trying to figure out the meanings of words.

LINGUISTIC RELATIVITY: LANGUAGE GIVES THOUGHT A GENTLE NUDGE. Clearly, linguistic determinism—at least in its original form—doesn't have much going for it. Nevertheless, there's some promise for a less radical perspective, called **linguistic relativity**. Proponents of this view maintain that characteristics of language shape our thought processes. This idea is also called the *Sapir-Whorf hypothesis*, named after the two scholars who proposed it (Sapir, 1929; Whorf, 1956). There's evidence both for and against linguistic relativity.

Several studies suggest that language can affect thinking (Majid, 2010; McDonough, Choi, & Mandler, 2003). Two researchers examined the memories of Russians who moved to the United States and achieved fluency in English. These participants recalled events that happened in Russia more accurately when speaking Russian and recalled events that happened in the United States more accurately when speaking English even though they were in the United States when they recalled both sets of events (Marian & Neisser, 2000).

Yet in other cases, language doesn't appear to influence thought. One example is color categorization (Lenneberg, 1967). Different languages contain different numbers of basic color terms. In English, we generally use a set of 11 basic color terms: red, blue, green, yellow, white, black, purple, orange, pink, brown, and gray. Nevertheless, some languages contain fewer basic color terms. A language community may use a single word to refer to all things that are either blue or green. When it becomes important to distinguish blue from green things, speakers may say "blue/green like the sky" versus "blue/green like the leaves." In a small number of non-Westernized cultures such as the Dani of New Guinea, there are no true color terms at all, only "dark" and "bright." Yet even those who have no specific color terms still perceive colors as dividing into roughly the same color categories as English speakers do (Rosch, 1973).

Factoid

Stroke patients who have damage to the left hemisphere of their brain often exhibit pronounced language deficits, but damage to the right temporal and frontal lobes can also disrupt the ability to interpret or use nonliteral speech such as humor and sarcasm.

So does this mean that speakers of all languages end up thinking in precisely the same ways? No, because the evidence suggests that language shapes some, but not all, aspects of perception, memory, and thought. Nevertheless, when researchers identify language-related differences in thought, it's not easy to disentangle the influences of language from culture. Different language communities also have different priorities, emphases, and values that shape how they think about the world. Because nearly all

linguistic relativity
view that characteristics of language shape our thought processes

cross-linguistic comparisons are correlational rather than experimental, language and culture are nearly always confounded. We therefore must be careful when drawing causal conclusions about the impact of language on thinking.

CORRELATION VS. CAUSATION
Can we be sure that A causes B?

The Dani language has only words for "dark" and "bright," not individual colors, but Dani people can distinguish colors just as we do.

Reading: Recognizing the Written Word

Reading, like spoken language, eventually becomes an automatic process, one that doesn't consume our attentional resources, except when we're reading something particularly challenging or engaging. Odds are high you could munch on potato chips while reading this chapter without it affecting your comprehension. In fact, reading becomes so automatic by the time we reach college age that we can't turn it off even when we want to. Usually, this is a good thing because it means we can read street signs while driving even when the person sitting next to us is gabbing away. But the automatic nature of reading can be less than ideal when we glimpse someone's open diary or intimately personal Facebook message on a nearby computer. In these cases, we almost can't help but violate others' privacy, because we can't put the brakes on our brain to stop us from processing what we see.

A compelling demonstration of the automaticity of language—for better or for worse—is the Stroop color-naming task, named after the researcher who invented it, J. Ridley Stroop (1935). This task requires participants to identify the color of ink used to print words. That sounds simple enough. The catch is that the printed words are color names that contradict the ink color (see **FIGURE 8.12**). Most people experience enormous difficulty ignoring the printed words, even though the task doesn't require them to read. The Stroop task shows that reading is automatic and hard to inhibit (MacLeod, 1991). Interestingly, children who are still getting the hang of reading don't experience interference in the Stroop task, so they find it easier than adults (Schadler & Thissen, 1981). Because their reading is effortful, they can turn off their attention to the words and pay attention only to ink color. As children become more practiced readers, they begin to do worse on the Stroop.

Control Condition	Stroop Interference Condition
Rabbit	Red
House	Blue
Blanket	Green
Dance	Yellow
Flower	Purple
Key	Orange
Seven	Black
Dance	Yellow
House	Blue
Key	Orange
Seven	Purple
Flower	Black
Rabbit	Red
Blanket	Green

FIGURE 8.12 The Stroop Effect. The Stroop task demonstrates that reading is automatic. Go down each column and say aloud the color of ink in which each word is printed. Try the control list first—you'll find that it's relatively straightforward task. Then try the Stroop interference list. You'll probably find the task considerably more difficult.

Beginning readers must master two skills to become experts. The first is learning to recognize familiar words when they see them printed on a page. Without this skill, reading can't become automatic. We need to recognize common words without having to sound out each word as if it were the first time we've seen it. The average reader uses **whole word recognition** to read the vast majority of printed words (LaBerge & Samuels, 1974). Still, this obviously can't be the whole story because we need to develop strategies for reading new words, especially when we're just learning to read. For these words, we use a second strategy, called **phonetic decomposition** or *phonics* (National Research Council, 1998). This strategy involves sounding out words by figuring out the correspondences between printed letters and sounds. For words like *livid*, this task is simple because each printed consonant (*l*, *v*, and *d*) corresponds to a single phoneme in English and the vowel (*i*) has the same sound in both instances. Nevertheless, not all sounds in the English language are linked to a unique letter (or even combination of letters) corresponding to them. For example, sounding out the word *pleasure* based on letter-to-phoneme correspondences won't get us far; we'll end up with something way off base, like "plee-ah-sir-eh." In these cases, we need to memorize how the word's spelling translates to the spoken word.

There's been heated debate about whether whole word recognition or phonics is the best strategy for teaching reading. For a long time, educators in the United States believed that teaching children to recognize whole words was the best approach.

whole word recognition
reading strategy that involves identifying common words based on their appearance without having to sound them out

phonetic decomposition
reading strategy that involves sounding out words by drawing correspondences between printed letters and sounds

Although these educators were right that mature readers rely mostly on whole word recognition, they mistook the correlation between reading proficiency and the whole word recognition strategy as causal. They concluded incorrectly that whole word recognition *leads to* better reading. In fact, experiments show that training children to be aware of sound–letter correspondences enhances reading (Bradley & Bryant, 1983; Gibb & Randall, 1988; Lundberg, Frost, & Petersen, 1988) and is a more effective way to get and keep children reading (Rayner et al., 2002).

CORRELATION VS. CAUSATION ▶
Can we be sure that A causes B?

Does Speed-Reading Work?

We can find ads for training programs in speed-reading, also known as photoreading, megaspeed-reading, and alphanetics, in magazines, web ads, and on bulletin boards on campus. Some universities even offer their own sponsored courses to boost students' reading rates. Does it work?

Speed-reading "works" in the sense that it speeds up our reading rate. So what's the catch? Beyond a certain point, our comprehension suffers enormously (Graf, 1973). Reading is subject to a speed–accuracy trade-off: The faster we read, the more we miss. The average college student reads about 200–300 words per minute (Carver, 1990). Controlled studies indicate that reading faster than 400 words per minute results in comprehension rates below 50 percent (Cunningham, Stanovich, & Wilson, 1990).

So why are speed-reading programs so popular? Because they're based on a genuine finding, namely, that reading speed is correlated with comprehension. Nevertheless, this correlation doesn't necessarily imply that if we start reading faster, we'll comprehend more. Proficient readers tend to be both faster at reading and better at comprehending compared with poorer readers, but reading speed doesn't cause comprehension.

CORRELATION VS. CAUSATION ▶
Can we be sure that A causes B?

Speed-reading programs promise to increase our reading rates many times over, to 1,000 or even 2,000 words per minute. There have even been extraordinary claims of people who can read between 15,000 and 30,000 words per minute. Yet the truth turns out to be far less than extraordinary. Speed readers are no better than average readers at finding specific words (Homa, 1983) and understand less than 50 percent of what they read.

EXTRAORDINARY CLAIMS ▶
Is the evidence as strong as the claim?

? We can often spot posters and fliers like this one on college campuses, in coffee shops, and in our spam. Such speed-reading programs claim to increase our reading rate from 2 to 100 times over the average reading rate (which is 200–300 words per minute). **Why should we not trust these claims?** (See answer upside down below.)

Is there any hope of improving our reading speed while not diminishing our comprehension? Fortunately, there *are* tutoring approaches that can increase reading speed, but only within the expected reading range of 200–400 words per minute. Even more important, students who increase their reading speed within this range typically also improve their comprehension, especially on timed reading tasks such as exams. Why? Because they can cover more material in the same amount of time.

Answer: Although our reading rate increases, our comprehension suffers.