CHAPTER OBJECTIVES

This first chapter is designed to pique your interest in speech and language as processes within the broader process we call communication. We define and describe these processes, and we consider how speech and language interact to produce a form of communication unique to humans. We also consider how a speaker’s thoughts are conveyed to a listener’s brain through a series of communication transformations known collectively as the *speech chain*. Specifically, this chapter is designed to facilitate understanding of the following topics:

- Definitions of communication, language, and speech
- Speech and language as separate but related processes
- Design features of the human communication system
- The speech chain that connects the speaker’s thoughts to the listener’s understanding of those thoughts
The idea for *Born to Talk* was cultivated long before the first word of the original manuscript was written, and it was probably a good thing that there was a period of latency between the concept and the product. During that latency, I observed language development firsthand in my two daughters, Yvonne and Carmen. I learned more about the power and wonder of language in observing them than I have in all the books and all the journal articles I have read over the course of my career because I witnessed their processes of discovery. I watched and listened as they made connections between the world in which they were growing up and the words and language forms that spilled out of them. They are now grown, and they have blessed my wife and me with five grandchildren, giving me five more opportunities to observe speech and language development close up and personal. The births of my grandchildren have spanned the time from the first edition of this book to the fourth. Each of them has reinforced my appreciation of language as one of humankind’s greatest gifts and most powerful tools. As my colleagues and I labored on the fifth edition, there was a new addition to my family—an 8-month-old eclectus parrot named Toby. We are trying to teach Toby to talk. So far he says, “hello” and “step up.” These are certainly not momentous utterances. They fall short of the magic of Abraham Lincoln’s “Four score and seven years ago . . .,” and John F. Kennedy’s “Ask not what your country can do for you . . .” but they are the beginning of speech or, at the very least, the beginning of speech-like behavior. What is fascinating about observing Toby is that the process of acquisition is so different than the process in human children, and it will always be different. His utterances, no matter how many he produces over his lifetime, will always be conditioned responses, and there is no way we will ever know if there is any connection between what is going on inside his parrot brain and what we believe in our human brains he is saying, which leads us to the power of ESP in speech and language.

Have you ever wished you could read someone’s mind, or ever wished or worried that someone could read your mind? Probably all of us at one time or another have at least wondered about mental telepathy, and perhaps some of you reading this page believe you have that gift. We would like to suggest that every person reading this page who is able to speak is capable of a form of mental telepathy, because human speech allows one human brain to communicate with another human brain in a wondrous and almost magical manner.

Most people give very little thought to the magic of speech because it is acquired so naturally and used by humans so effortlessly. The purpose of this book is to explore the miracles of speech and language, to examine the marvelous anatomic structures and physiological processes we humans have adapted for speech, to unravel the layers of language from sounds to words to elaborate sentence structure that together make up speech, to investigate the dialectal differences in our own language, and to consider the problems that occur when speech and language do not develop properly or when something goes wrong after communication skills have been normal for a while. By the time you have turned the final page in your journey through this book, we believe you will be convinced that words such as *magic* and *wondrous* and *miraculous* in reference to speech and language

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are accurately descriptive, but before we go any further, we need to address some basic terminology.

**Separate but Related Processes**

In the preceding paragraphs we used the words *speech* and *language* in a manner implying that they are not the same thing, which is correct. They are separate but related processes in the larger process called communication. To understand any of these processes, you must understand all of them and how they are interconnected.

*Communication* is the sending and receiving of information, ideas, feelings, or messages. To appreciate the breadth of communication, consider just some of the methods by which human beings communicate. We transmit messages of all kinds by speech, the written word, Morse code, semaphore flags, Braille, facial expressions, gestures, art, music, dance, the distances we maintain when we interact, vocal variations, the clothes we wear, hairstyles, our natural and purchased odors, and more. We send hundreds, perhaps thousands, of messages every day. Some of our communications are intended, but many are not. We hope that most of what we send is received according to our intent, but unfortunately this is not always the case. The fact is, we humans cannot stop communicating even when we want to. You may decide to say nothing, but your saying nothing may be saying more than your saying something. Even when you are asleep you may be sending messages. You may talk in your sleep, of course, but even in the silence of unconsciousness, you may communicate restlessness by the way you thrash around in your bed, or you may communicate a basic insecurity by the way you curl into the fetal position, or you may transmit a message of utter tranquility by the relaxed and peaceful expression on your sleeping face. Do you get the point? Communication is so much a part of the human experience that we are constantly sending and receiving messages.

Language is an infinitely more difficult phenomenon to describe, so we will build a definition by first looking at some of the characteristics of language and then trying to piece them together. Most people think of language as "words strung together by grammar," but that captures only a part of language and only what appears on the surface of what we read or hear.

Language is an expression of an ability that is innate in all humans. We are born with the capacity to use language in the same way a spider is born with the ability to weave webs and a bird is born with the ability to make a nest. To use language is instinctive in humans, but the capacity is realized differently in people according to the specific languages to which they are exposed. A child reared in a family of English-speaking adults, who hears only English during the language acquisition period, will speak English. You might be surprised that the logic of that observation escapes some people. My* youngest sister, abandoned by her natural Korean parents, was adopted by the Hulit family when we lived in Korea. When we returned to a small town in rural Ohio 2 years later, some people were amazed that she spoke English without a Korean accent. Children do not know they are

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German, French, Russian, or Japanese when they are born. They speak the language they hear, but the innate capacity for that language is the same, no matter where they are born.

It is important to understand that language and the expression of language are two very different things. Language exists in the mind, and it exists whether it is expressed or not. It is useful to understand language as a system of abstract symbols organized according to basic rules that seem to be common to all the languages known to humankind. In other words, at the deepest, most basic level, all languages share common structural rules.

The fact that we do not all speak the same language suggests that some aspects of language are learned. Languages are different in many ways. They use different words. They have different rules for organizing words into grammatical sentences. English, for example, stresses word order in its grammar system, but other languages, such as Latin, place greater emphasis on word endings than on order to indicate grammatical relationships. That is, all languages have rules for making sentences grammatically correct, but the means by which correctness is achieved vary. We can conclude, therefore, that although the capacity for language is innate and although certain very basic rules are shared by all languages, the specific conventions of any given language are learned. The child who will speak English, for example, must learn the sounds of English as well as its vocabulary and grammar.

Now let us put some of these pieces together into a definition. **Language** is a system of abstract symbols and rule-governed structures, the specific conventions of which are learned. The symbols of language may be sounds that are combined into spoken words, or letters that are combined into written words, or even the elements of sign language that are combined into larger units. It is important to note that whatever the symbols, they are arbitrarily established by the conventional usage of a given people. Furthermore, the symbols or their combinations will change over time because language is a constantly evolving phenomenon. Much more needs to be added to this definition (and will be in the chapters that follow), but this will serve as a starting point.

We can now define speech, a relatively simple task if we understand communication and language. Very simply, **speech** is the oral expression of language. Sometimes people use the terms **language** and **speech** as though they are interchangeable, but they are clearly not. If they were interchangeable, one could not exist without the other because they would be one and the same thing. In fact, speech can and does exist in the absence of language, and language exists in the absence of speech. Consider the parrot or mynah birds that can mimic human speech, often with remarkable clarity. These birds produce speech, but they do not have language. That is, they can produce strings of sounds with the acoustic characteristics of human speech, and human listeners recognize the sequences of sounds as words, but the speech of these birds is devoid of meaning and, therefore, is not the oral expression of language. They have speech but no language. Some human beings, most notably those with severe cognitive challenges, may have the ability to imitate speech perfectly even if they do not fully understand the language underlying the speech. They have speech that reflects language abilities they do not have. Even normal children, between the ages of 18 and 24 months, often produce a form of speech known as **echolalia**,
which is an imitation of words, phrases, or even whole sentences in the absence of an understanding of what they are saying.

Language can also exist independently of speech. Children who are born deaf, for example, may never learn to speak, but their deafness does not preclude their use of language. If these children have no other problems and receive proper stimulation and appropriate educational opportunities, they can develop language abilities just as sophisticated and complete as those of the hearing child who speaks. The child who is deaf and who does not have speech must learn a different way to express language, most likely through signs and gestures. In addition, of course, the child who is deaf can receive and express language through the written word.

We can best understand speech as a highly complex physiological process requiring the coordination of respiration, phonation, resonation, and articulation. Some of the movements involved in producing even the simplest utterances are simultaneous and others are successive, but the synchronization of these movements is critical.

Consider what happens in the production of the single word statistics. The tip of the tongue is lifted from a resting position to an area on the roof of the mouth just behind the upper teeth called the alveolar ridge to produce the s sound. The tongue is pressed against the alveolar ridge hard enough to produce constriction but not so hard as to stop the airflow altogether. As the speaker slowly contracts the muscles of exhalation under precise control, air is forced between the tip of the tongue and the alveolar ridge. Leaving the tongue in the same area, the speaker now presses a little harder to stop the airflow and then quickly releases the contact for the production of the t sound. The tongue drops to a neutral position and the vocal folds in the larynx vibrate to produce the vowel a. The speaker turns off the voice and lifts the tongue to the alveolar ridge for the next t, then vibrates the vocal folds for the vowel i while the tongue stays in a forward but slightly lowered position. The speaker turns voicing off again and moves the tongue to the alveolar ridge yet again to produce the controlled constriction for the next s, followed by increased pressure to stop the airflow and release it for the t. The voice is turned on one more time and the tongue lowered to a neutral position for the i, and then turned off as the tongue arches to the back of the mouth, where it contacts the velum, or fleshy part of the roof of the mouth, for the k. Finally, the tongue tip darts to the alveolar ridge for the production of the final s sound.

All of this occurs in the production of one word! Imagine what occurs in the production of a long sentence produced at an average rate of speed. When you consider how many intricate adjustments are made so quickly in the speech mechanism, it is difficult to imagine that anyone learns to speak at all. But we do learn to speak, and we do it easily and naturally over a very brief period of time.

**Speech and Language Rejoined**

Now that we have established that speech and language are separate, although related, parts of the communication process, we will reconnect them for the remainder of our analysis. For practical purposes, in people with normal communicative abilities, they are not separate. Speech is commonly understood as oral language, and
that understanding will serve our purposes well. It is certainly clear to anyone who has studied the development of communication in children that speech and language develop together, but we should always remember that they do not develop at the same pace. Most of what a child will ever know about language is acquired before entering school, but some speech sounds are not mastered until age 7 or 8. Even within language itself, not all dimensions are acquired according to the same schedule. Rules pertaining to the structure of language are acquired early and most of the basic vocabulary of a language is learned early, but we may continue to add vocabulary as long as we live, and most of us are developing our knowledge about how to use language, a dimension called **pragmatics**, well into adulthood.

From this point on, however, we will consider speech and language as integrated parts of the same process in the same way that pictures and sounds are integrated parts of television. You can certainly have television without pictures: It’s called radio. And you can have television without sound: That’s called network difficulty. But television as we expect it includes not only pictures but also sound. Speech as we expect it in normal human beings combines phonated and articulated noises and the rule-governed structures of language.

### The Unique Characteristics of Human Speech

To appreciate the powers of oral language, we can compare it to the communication systems of other animals. Other animals do communicate, of course, but there is much we do not understand about their systems. Some animals seem to communicate very general messages in simple ways. The beaver, for example, slaps its tail when it senses danger. Dogs bark when they are frightened or excited. Other animals are able to communicate more elaborate messages. Bees dance to tell their fellow bees where the flowers are. Other insects use their antennae to instruct or inform. There is a great deal of interest in the communication systems of dolphins and singing whales because they seem to be much more elaborate than the systems of most other animals (Herman & Forestell, 1985; Janik, 2000; Schusterman, 1986; Tyack, 2000). No matter how much we discover about the abilities of other animals to communicate, however, we remain convinced that no animal has a communication system as powerful as human speech. Recent research provides fascinating information about the communicative abilities of other species (See Table 1.1).

One of the first linguists to take a detailed, analytical look at the characteristics of human speech in comparison to the communication systems of other animals was Charles F. Hockett (1960), who wrote a classic essay entitled “The Origin of Speech,” in which he describes what he calls “thirteen design-features” of language. Although many animals share some of these features in their communication systems, Hockett believed that when his 13 features are taken together, they effectively separate human speech from other forms of animal communication. Since Hockett wrote this essay, new theoretical interpretations about animal communication and research data supporting these interpretations suggest that other species share many of the 13 features Hockett believed differentiated human communication from animal communication. Based on what we now know, there are only a few of Hockett’s features that are not found in the communication systems of other animals. Interestingly, we
**Table 1.1** Animal Communication Signals

<table>
<thead>
<tr>
<th>Animal</th>
<th>Communication Signals and Abilities</th>
<th>Purpose of Signal/Effect of Signal</th>
<th>Researchers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monkeys (vervet)</td>
<td>Snake chatter</td>
<td>Warning other monkeys that a snake is nearby/monkeys surround the snake</td>
<td>Akmajian, Demers, and Harnish (1984)</td>
</tr>
<tr>
<td></td>
<td>Aerial predator call</td>
<td>Warning other monkeys that an eagle is overhead/monkeys seek cover on ground</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terrestrial predator call</td>
<td>Warning other monkeys that a leopard is nearby/monkeys climb trees and go to ends of branches</td>
<td></td>
</tr>
<tr>
<td>Marmots</td>
<td>Alarm signal</td>
<td>Intensity is based on the amount of risk present in the situation</td>
<td></td>
</tr>
<tr>
<td>Bonobos and chimpanzees</td>
<td>Use of symbols</td>
<td>Symbols represent objects or actions; limited combinations of symbols to create new meaning</td>
<td>Corballis (2007)</td>
</tr>
<tr>
<td></td>
<td>Conative signals; play bow</td>
<td>Invites other dogs to play</td>
<td>Hauser, Chomsky, and Fitch (2002)</td>
</tr>
<tr>
<td>Dogs</td>
<td>Distress whistle</td>
<td>Help! Dolphins in area arrive and raise distressed animal to the surface</td>
<td></td>
</tr>
<tr>
<td>Bottle-nosed dolphins</td>
<td>Recognizes self in mirror</td>
<td>(Not evidence of theory of mind)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birds</td>
<td>Aerial predator call “seet”</td>
<td>Warning other birds that a predator is overhead/take cover in bushes and stay still</td>
<td>Akmajian, Demers, and Harnish (1984)</td>
</tr>
<tr>
<td></td>
<td>Mobbing call “chink”</td>
<td>Warning other birds that a stationary predator is nearby/surround (mob) the predator</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terrestrial song</td>
<td>Warning other male birds to keep away; inviting uncommitted females to come to the location</td>
<td></td>
</tr>
<tr>
<td>Chicadees</td>
<td>Four distinct sounds repeated in limited arrangements</td>
<td>(Not evidence of recursion)</td>
<td>Akmajian, Demers, and Harnish (1984)</td>
</tr>
<tr>
<td>Starlings</td>
<td>Count different sounds in sequences and match them for similarities and differences</td>
<td>(Not evidence of recursion)</td>
<td></td>
</tr>
<tr>
<td>Nutcracker</td>
<td>Memory for where it stored food</td>
<td>Locate food in future (not evidence of recursion)</td>
<td>Hailman and Ficken (1986)</td>
</tr>
<tr>
<td>Western scrub jay</td>
<td>Memory for when and how long food is stored</td>
<td>Locate food in future (not evidence of recursion)</td>
<td></td>
</tr>
</tbody>
</table>
have found features beyond those identified by Hockett that can be ascribed to human communication. Nevertheless, “The Origin of Speech” remains an important and interesting part of the literature on human language, because it challenged linguists at the time to think about language and the humans who use it in revolutionary ways. We will examine Hockett’s original 13 design-features as a way of understanding the power of human communication, but we will also attempt to compare and contrast human communication with the communication systems of other species. We will then take a look at some design features that did not make Hockett’s list.

From Mouths to Ears

Hockett’s first design-feature is the vocal-auditory channel. That is, human beings communicate by forcing air through the vocal folds of the larynx and breaking the vibrating air stream into sounds of speech, which are organized into words and sentences. These sounds are received by the listener’s ears. This feature is so obvious that we may need to note that other channels can be used in communication and are used by other animals. Bees, for example, communicate by dancing, and that can be described as the visual channel. In fact, human beings who cannot hear use the visual channel when they produce and receive sign language. Still other animals communicate by touch or by odor. The primary advantage of the vocal-auditory channel for humans is that it leaves our hands free to do other things while we are communicating. We can build or repair, for example, while giving or receiving instructions. Imagine what it would be like for a construction crew building a house if everyone had to put down their tools every time one person needed to communicate with another through the gesture-visual channel. There is no question that vocal-auditory communication is convenient and allows us to be efficient.
in all tasks that involve communication in conjunction with other physical activities. This feature, of course, is not unique to human beings. Many other animals communicate by using the vocal-auditory channel. As indicated in Table 1.1, for example, monkeys and birds use this channel to communicate alarm and dolphins produce whistles to signal distress.

**Sending and Receiving Signals**

The second design-feature is broadcast transmission and directional reception, which is obviously related to the first feature. Two characteristics of speech are involved in this feature. When speech is produced, it radiates in all directions and can be received by any listener who is in range. In addition, a listener with two good ears can compare the loudness and timing of the signals reaching each ear and can determine the direction from which the sound is coming. If communication is visual, reception is much more limited. Sign language used by individuals who are deaf, for example, can be received only by someone who is close enough to the sender to see the details of the gestures, some of which are quite subtle, and the receiver must directly face the sender. When Hockett wrote about this feature, he focused solely on the broadcasting and receiving of speech signals, but we must acknowledge that the general concept of sending and receiving is not unique to human speech, and it is not unique to communication that uses the vocal-auditory channel. Certainly animals that use some form of vocal channel can send their messages to others of their species that have the capacity to receive them, but other animals that use gestural or even odor signals send and receive their messages as well. Starlings, for example, can communicate their location to other starlings. Vervet monkeys can send messages of warning, and ground squirrels can even communicate the degree of danger to other ground squirrels. Red-winged blackbirds signal dominance or aggression. Any form of communication produced by a particular species can be sent to and received by other members of that species.

**Hear Today, Gone Immediately**

Rapid fading means that speech signals are transitory. They do not linger. Humans have developed writing to put language information into a more permanent form, but writing is a relatively new ability for human beings in comparison to speech. We have also developed electronic means for preserving speech, but each time a sample of speech is produced live or on stored media, the signals are broadcast and rapidly fade. We cannot freeze-frame speech and study it in the same way we can read and study the written word or primitive paintings on the cave walls of prehistoric people.

Rapid fading is common to many forms of animal communication—to those that depend on the vocal-auditory channel, of course, but also to those that are gesture-based. The difference between human speech and these forms of communication lies in the structure of the messages. Human speech is comprised of speech sounds arranged in words and sentences. Other animals rely on vocal tones and cadences to form messages that sound “musical” to our ears. Crickets chirp, elks bugle, birds
sing, and coyotes howl. In each case, as in human speech, the signals are transitory. They are produced, they convey their messages, and they fade away.

**If You Can Say It, I Can Say It**

One feature of human speech that we may take for granted is **interchangeability**. This means that any human being can say anything that is said by any other human being. Children can and do imitate the speech of adults. Female humans can produce the same speech forms produced by males. Interchangeability removes communication barriers and is largely responsible for the unlimited exchange of information that characterizes human speech for both sexes and all ages.

Among other animals, this feature is rare. In courtship rituals, for example, the male of many species produces gender-limited communications, and the female produces gender-limited responses. The male frog, for example, emits a call to attract females for the purpose of mating. Female frogs are attracted to male frogs with deep “voices” because they will provide the best DNA for producing viable offspring. Female frogs produce a distinct sound to signal that they are not receptive to specific mating partners, the equivalent of letting those loser boys know that they have no chance. In most varieties of birds, males produce gender-specific songs to let other male birds know that they have staked out particular territories, and they produce songs designed to attract females.

**Did I Say That? Did I Mean That?**

**Total feedback** means that human speakers have the capacity to monitor what they say and how they say it. We hear ourselves, of course, but we also receive information from the musculature of speech about what we feel as the articulators move and contact one another. This feedback component allows the speaker to make constant

![Male frogs use deep voices, and females respond to accept or reject these advances.](image-url)
adjustments so that output is as finely tuned as possible in terms of conveying thoughts accurately. Feedback also provides controls for the mechanics of speech in the sense that speech errors are caught and corrected or even anticipated and avoided. The fact that the feedback system includes information from several sensory sources also protects the speaker from communicative disaster if part of the system fails. Adults who lose hearing, for example, can maintain reasonably good speech by attending more closely to how speech feels. If we lose some of our ability to monitor the motor aspects of speech, we can concentrate more intently on what our speech sounds like.

Although it may not be directly comparable to the kind of feedback we associate with human speech, there is evidence that other species use feedback to monitor their communications as well. At the very least, members of a given species produce and recognize signals that belong to their communication system, and they recognize that other communicative productions do not belong. A bird, for example, knows the difference between bird songs and a wolf’s howl.

**Speech Is for Talking—What Else?**

The feature of *specialization* suggests that speech is specifically designed for communication and serves no other purpose. In the Appendix, you will discover that the physical processes of speech are actually the secondary functions served by the structures involved. That is, human beings have adapted structures that serve more basic biological purposes for speech. Nevertheless, it is true that speech itself is a specialized human function. We speak to communicate and for no other purpose, although we may speak when no one is listening, and sometimes when we speak, we do not communicate successfully.

Consider the tongue, the structure many people most closely associate with speech. The primary biological purpose of the tongue is to aid humans in swallowing. The tongue captures food and/or liquid and moves it back toward the pharynx, where it flows into the esophagus and eventually the stomach. Obviously, this biological function is crucial to our survival as a species, but the tongue is also critical to speech. We touch the tongue to the alveolar ridge to produce sounds like $t$, $d$, $n$, and $l$. We touch the tongue to the velum to produce the sounds $k$ and $g$, and we configure the tongue in a specific manner to produce the sound $r$.

In considering how the design features fit together, we should remember that speech is broadcast, but it is also received. The perception of speech sounds and patterns of speech sounds is also highly specialized in human beings. These perceptual abilities are innate in humans, wired into our brains before we are born. Humans at birth can distinguish sounds from one another, and they show a preference for sounds that are speech-like from the beginning of their lives.

Although it is true that the communication systems of other animals are not as specialized as the human system, it’s fair to note that specialization is not unique to human speech. Those animals that use the vocal-auditory channel use structures that have more basic biological purposes, including the same eating process we observe in humans. The bee uses its wings to produce its communicative dances, but the primary biological purpose of its wings is to fly.
Sending Messages Loud and Clear

One of the remarkable aspects of human communication is the ability to produce very specific messages with words having relatively stable relationships with the people, things, events, actions, and concepts they represent. These relationships allow us to share information effectively and easily, but there are times when the listener needs clarification from the speaker in order to interpret the message correctly. As you know from your own communicative experiences, there may be several requests for clarification before the listener is satisfied that the proper message has been received. In truth, the listener or the speaker sometimes gives up in the process, or the listener may believe that the proper message has been received even when it has not. In other words, communication, no matter how well intended, no matter how carefully crafted, is not perfect. The feature describing the ability to use human speech to convey specific messages is *semanticity*, but more than speech is needed in most cases to ensure the specificity of messages. Perconti (2002) asserts that situational context is also important in establishing meaning in our communicative attempts. He uses the term *indexicality* to describe the rich use of presemantic, semantic, postsemantic, and extrasemantic information in human communication. Presemantics allow communicators to use their past and current experiences to help determine the meanings of words as used in a specific context. Consider, for example, a third-grade teacher who is discussing a rescue story with her class. She asks her students what happened after the characters were rescued from a desert. A boy raises his hand, and when called upon says, “The children yelled, ‘Let’s drink, Daddy.’” This production has at least two meanings, but the teacher affirms the boy’s answer because she knows he meant that Daddy was being asked for water to drink, not that the children were ready to drink Daddy. The interpretation of the utterance depended not just on the words produced, but also on the human ability to use context and knowledge of phrasal stress to help establish meaning. Research indicates that other animals learn to establish meaning by observing the communication practices of other members of their species, and there are even dialectal differences in the communication systems of members of a given species, depending on where they live, but we have no evidence that other animals are able to use presemantic context to establish meaning as humans do.

When most of us think about *meaning*, we think about the most traditional use of the term *semantics*, using specific words in specific grammatical configurations to convey specific messages. Other animals appear to have limited inventories of signals they can use to shape their messages, but their messages lack the indexicality that explicitly specifies sender and receiver, and they do not appear to have the ability to establish different receivers of a given message in different situations. A dog will bow by lowering its front legs to invite another dog to play, for example. That’s a fairly specific message as far as *doggie communication* is concerned, but it falls far short of the specificity inherent in human speech. Some primates have been taught to use signs to refer to specific things and actions in laboratory settings, but they do not appear to use signs to refer to particular objects or actions in the wild. Again, there is evidence of communicative specificity, but not to the extent we observe in human communication.
One of the most powerful aspects of specificity in human communication is the ability to analyze messages to determine the truth, reality, and completeness of the utterances produced in a given situation. This is what is meant by postsemantic information, and this ability appears to be uniquely human. Perconti (2002) uses the example “It is raining” to show how this aspect of human speech works. In this simple sentence, the verb is signals the dimension of time, but there is nothing in the sentence to indicate place. The receiver, using contextual information, must determine the place in order to establish whether or not the statement is true.

Extrasemantic information includes social and psychological factors that can shade or shape meaning. If you are at a party with your best friend and something unpleasant happens to her, you can determine quickly and with a fair degree of accuracy what happened to upset her. How do you assess the situation? You listen to her words, of course, but you also take into account her voice, including stress and intonation. You react to the rhythm of her productions, to rate, pitch fluctuations, and rate variations. Taken together, all this information helps you determine her state of mind. Your assessment of the party crisis may not be completely correct, of course, because you are hearing only one side of the story, but you will have a pretty good sense of how your friend feels. There is evidence that other animals also use context-dependent factors to shape their reactions to messages. If one member of a species communicates danger or alarm, other members will certainly become more alert, and they may flee. If the danger signal occurs in the context of a clearly visible approaching firestorm, the message is enhanced and the fleeing may be considerably more urgent. There is no doubt, however, that human communications are far more sophisticated, far more detailed and specific than those of other animals in terms of using context to interpret the social and psychological factors that help make messages complete and meaning-rich for senders and receivers.

**Because We Say So!**

One of the reasons languages differ so broadly across groups of people on Earth is that the words used to refer to the people, things, events, and concepts in human experiences do not directly reflect their referents. There is an arbitrariness about language. That is, there is nothing inherent in a spoken word to account for its meaning. We call the piece of furniture on which a person may sit a chair, not because it screams out to be called a chair, not because there is a connection between the nature of chairness and the word, but because someone at some time, for reasons of no interest to most people living today, arbitrarily decided to call it a chair. The obvious advantage of arbitrariness is that there is absolutely no limit to how language can describe anything and everything. Languages have different vocabularies because the arbitrary naming of the bits and pieces of the world has been done by different people at different places at different times.

Do other animals demonstrate arbitrariness in their communication systems? We know that other species make sounds or use other communicative signals to warn, to play, and to attract other animals. These signals are arbitrary in the sense that there may be no obvious relationship between the sound or gesture and the message it conveys. We have no evidence that other animals decide which signals they will use...
to convey particular messages. It seems more likely that their innate abilities, their instincts, shape their signals in the most effective manner possible to convey the messages they need to survive.

**The Limits of Speech**

**Discreteness** is a feature that can be applied to human speech in at least two ways. Although the speech mechanism can produce an incredibly wide range of noises, each language is limited to a finite or discrete number of sounds. Furthermore, each sound used in one or more human languages has very specific characteristics so that each sound is discrete. Adult speakers adapt so completely to the specific sounds of a given language that they often have great difficulty breaking out of these patterns to produce sounds found in other languages but foreign to their own. Speakers whose native languages do not contain /l/ or /r/, for example, struggle to produce these sounds when they are learning to speak English, and many of us who speak American English almost choke trying to produce some French vowels. The flexibility we have as infants to produce virtually all sounds known to all languages is quickly lost when we begin to narrow our range to the discrete sounds of our own language.

Although other animals do not appear to have repertoires of signal choices to match the repertoires of sounds, words, and language rules that support human speech, they do demonstrate some variations in their communications. It would be fair to say, therefore, that other animals have sounds and/or gestures that are discrete in number and that have limitations in terms of how they are used or combined to create messages. The frog, for example, has only one croak, but dogs can produce different sounds—bark, whine, growl—to create different messages, and even the bark is not homogeneous. My‡ dogs, for example, produce quite different barking sounds to signal danger than to signal “Let’s play” and yet a different bark to signal that “We need to go outside. We REALLY need to go outside!”

**Back to the Future**

One of the most intriguing features of human speech is displacement. That is, humans can talk about things that are distant in time or space. We can talk about what is going on in places across vast oceans or even across the infinite expanses of space. We can talk about events that occurred hundreds or thousands of years ago, and we can talk about things that have not yet happened.

This amazing ability to talk about things and events that are remote in time and space is an aspect of recursion, a concept we will describe later. Although this feature may not be absolutely unique to human speech, we have no evidence that other animals have communication systems with this feature as fully developed as it is in human speech. We know that bees dance to let other bees know about a food source that is removed in space, but this is a very limited displacement ability. It’s probable that this feature does not exist at all in the communication systems of most animals.

‡Kathleen Fahey
The Creativity of the Mind and Mouth

According to Hockett (1960), productivitiy is one of the most important design-features of human speech. Humans have the amazing ability to be creative in their communication efforts. We can say things that have never been said before, or we can put old messages in brand new language forms. We use words in speech in much the same way the sculptor uses clay. The sculptor can take a mass of clay and make everything from an ashtray to a bowl or a bust. We can use a finite collection of sounds and words to shape an infinite variety of messages, some simple, some profound, some old, some new. No matter what the message is, however, if we obey the rules of our language, the message will be understood by anyone who shares the language we speak. Just imagine that on this very day you may say something that no one has ever said before and perhaps no one will ever say again in exactly the same way. The productivity or creativity of language gives human speakers a communicative power that is not shared by any other species.

It’s well established that other animals have been trained to use symbols, to associate these symbols with words, and to combine them to signal meaningful messages. Most notably, some primates have developed fairly extensive repertoires of visual symbols and words used in reference to objects, people, places, and basic actions. These primates are able to understand simple commands. They can combine symbols to create messages that suggest meaningful sentences. No one is arguing that these accomplishments reflect the kinds of innate language abilities we see in humans, but by using teaching/learning paradigms that incorporate many repetitions of specific symbol–meaning combinations and by systematically rewarding their subjects’ efforts and accomplishments, researchers have facilitated communicative abilities, comparable to human language, in these primates that we could not have imagined 20 years ago. Dolphins, responding to visual commands, have also performed actions that reflect the word order, or syntax, of the commands they are given. As is true of nonhuman primates, dolphins’ learning depends heavily on repetition and reward, and in all cases, we have no evidence that they can use these acquired abilities to create their own language-like combinations, but what they have achieved is remarkable. Most importantly, this work suggests that we have grossly underestimated what other animals can do in the arena of communication—naturally or learned.

Many Wholes from a Few Parts

Part of the creativity that is characteristic of human speech is made possible by another design-feature, duality of patterning. Although a given language is restricted in the number of sounds it uses, these sounds can be combined in an infinite number of ways to produce an infinite variety of words, and the words of a language can be combined into an infinite variety of sentences. Every year of your life you will be witness to the creation of new words that are the product of this duality of patterning. Many of these new words reflect neverending advances in science and technology. Before there were telephones, there was no word telephone, but the sounds making up the word have existed for as long as human language as we know it has existed. It
remained for someone to arrange this particular collection of sounds into this specific word to refer to that object. Just think for a moment about all the words that have been invented as a result of the explosion of computer-related technology. The patterning of sounds into words and words into sentences will end only when humankind ceases to communicate, and that is likely to happen only when humankind ceases to exist.

We have no reason to believe, based on research conducted so far, that duality of patterning, as described by Hockett, exists in the communication systems of other animals. Some trained animals demonstrate patterns in their communicative productions, but those patterns are limited to what their trainers specifically teach and specifically shape.

**Born to Talk**

The final design-feature Hockett describes is **traditional transmission**. Hockett was on the leading edge of a new view of human speech and language, which will be described in more detail in the next chapter. The suggestion in this feature is that speech is instinctive in humans. We have a genetic or biological capacity for language so powerful that few environmental factors can stop the acquisition of speech, although they may affect the rate at which it is acquired and they may affect the quality of the language we use. Although the capacity for language is genetic, the details of a language, including vocabulary and structural rules, are learned.

Other animals do not talk, but whatever communication systems they use are genetically and biologically determined. It’s also important to note that while humans can adapt to biological deficiencies in their natural communication systems by finding alternative methods for sending messages, similar abilities do not exist in other animals. A person who is deaf, for example, will have challenges in using the vocal-auditory channel for speech, but this person can use signs to effectively send and receive language messages. A monkey born blind in the wild that cannot see a predator or a deaf monkey that cannot hear an alarm call will not survive long in its natural environment.

Another reasonable comparison between humans and other animals involves innate ability in concert with exposure. The human child is born with the capacity for spoken language but will not produce speech unless exposed to it. In 3 of 27 orders of songbirds, songs are acquired as a consequence of exposure by parent birds. Just as experience facilitates language competence in human children, experience facilitates fine tuning in the communicative abilities of other animals. As a vervet monkey develops, it tunes its alarm calls. Furthermore, the development of dialects in the vocalizations of some species is the product of innate capacity and exposure to the productions of other members of that species in a particular region.

**Not All Features Are Created Equal**

As shown in Table 1.1, there has been considerable evolution in our thinking about human communication in comparison to animal communication since Hockett wrote his classic essay. The research since 1960, and especially since the 1980s, makes it
clear that the differences are not nearly as stark as Hockett postulated. Hockett tried to identify the features of human speech that provide its communicative efficacy and power, and to determine to what extent those features can be found in the communication systems of other animals. When we look at the net result of the research conducted since Hockett’s essay was published, we can conclude that most of the 13 design-features he found in human speech are also found in the communication systems of animals. The traditional transmission of a system as complex as human language and duality of patterning have not been found in the communication systems of nonhuman species. As indicated earlier, the honeybee dance to indicate the location of a food source is an example of displacement, but this is an exceedingly limited form of displacement. Most importantly, when we look at Hockett’s work, we can conclude that no nonhuman species has a communication system that incorporates all 13 of Hockett’s design-features. We believe that human language, as an extraordinarily complex and powerful communication system, is unique in the animal kingdom even as we concede that other animals are able to communicate much more than Hockett imagined in 1960.

In addition to conceding that other animals communicate more, and more effectively, than we once believed, we need to point out that there are some features Hockett missed.

Who Am I and Why Am I Here?

According to Hauser (2007), recursion involves a human’s ability to use acquired knowledge to create language, to imagine what others may be thinking, to engage in mental time travel to the past and the future, to think about and gain understanding of self, and to relate to a divine being in the development and demonstration of spirituality. Hauser argues that recursion may be the singular characteristic that distinguishes humans from all other creatures. With respect to language specifically, recursion underlies the ability of humans to use words and phrases in complex and embedded arrangements, as well as to store linguistic expressions, such as idioms and other constructions, that do not follow standard syntactic rules. As we have already noted, other primates, notably chimpanzees and bonobos, have been trained to use symbols to represent objects and common actions, but they have very limited abilities to combine symbols to create new meanings. Starlings and chickadees produce and perceive a few distinctive sounds in sequence, but the emphasis is on few. They do not demonstrate anything that remotely resembles human recursion. As would seem reasonable, given its definition, recursion is not limited to language (Jackendoff & Pinker, 2005). It is also evident in visual processing, suggesting that it is a generalized cognitive phenomenon, not just a language phenomenon. We will certainly learn more about recursion as the debate and the subsequent research examining it continue.

All About Context

We considered indexicality (Perconti, 2002) when we examined Hockett’s semanticity feature. Although it’s related to semanticity, it can properly be considered a separate feature. By way of reminder, indexicality refers to the ability of a communicator to use situational context, as well as past experiences, in the production, reception, and
interpretation of messages. Semantics is about meaning. Indexicality is about how we use context to establish meaning beyond what a dictionary might offer.

**Speaking Is an Art Form**

Prevarication is a feature that often, though not always, addresses a darker side of human communication. Prevarication refers to the ability of humans to intentionally deceive others in their communications. This feature might be unique to humans. Other animals engage in deceptive practices for the purpose of survival, but these tactics appear to be the products of instinct, not of specific communicative intention. That is, other animals might lure prey or evade predators through deception, but we have no evidence that other animals *lie*, as humans do, in order to deceive (Anderson, 2004). In fairness, prevarication is not always malicious in human beings. It can also be used to invent creatures, objects, and events for the purpose of storytelling or for other forms of artistic expression. Imagine what J. K. Rowling’s Harry Potter stories would have been like without her ability to prevaricate. Used for good or ill, prevarication adds an important and unique dimension to human language.

**Talking About Talking**

According to Anderson (2004), reflexiveness—called metalinguistic ability by other linguists—refers to the ability of humans to use language to talk about language. Although we admit that reflexiveness is probably a product of language rather than one of its defining characteristics, it is nevertheless a characteristic of human communication not found in nonhuman communication, so we include it as another possible design feature.

**Recipe for Language**

Anderson (2004) also suggests learnability as a possible design feature of human communication. He differentiates learnability and Hockett’s traditional transmission by suggesting that learning should be understood beyond the usual “interaction with the environment” concept. That is, learning occurs when we combine a person’s innate capacity for learning, a learning environment, and some stimulus for learning that comes from the learner himself. Learnability suggests that cognitive structures interact with experience to produce learning. In language development, for example, environmental input, innate cognitive abilities, and the human motivation to pursue social relationships interact to produce language learning. The environmental input will shape the specific learning that occurs. If the environment includes English models, the child will learn English. If the environment includes French models, the child will learn French.

**Summary**

We have considered a range of features that, taken together, help us understand what human communication is, how it compares to the communication systems of other animals, and how it is unique among these systems. We certainly should appreciate
that there are some common denominators when we compare human communication to nonhuman forms of communication, but we cannot help but be impressed by the spectacular differences that separate human communication from other systems in the animal kingdom, especially the differences reflected in features such as productivity, displacement, semanticity, indexicality, duality of patterning, recursion, prevarication, reflexiveness, and learnability that contribute to the powerful creativity that drives human language. As theorists and researchers continue to explore these subjects, we will be reminded that our understanding of human communication, nonhuman communication, and how they compare is far from complete.

**Speech: The Tale of Two Brains**

We are now ready to return to the query that opened this chapter or, more specifically, to a more complete response to that question. All human beings who are able to speak are capable of using a kind of mental telepathy because speech allows two human brains to connect.

This connection is described in another portrait of human speech contained in a book entitled *The Speech Chain* (Denes & Pinson, 1993). A summary of this description will show how the brains of a speaker and a listener connect in a communicative sense.

The speech chain (Figure 1.1) has six steps or links. In the first step, you the speaker sort through your thoughts, decide which of these thoughts to express, and make some decisions about how to express them. Although this process occurs very quickly, within seconds or fractions of a second, it is actually very complex. If, for example, a friend wearing the most atrocious dress you have ever seen asks you, “What do you think of my new dress?” you have some serious decisions to make. Your brain is filled with conflicting thoughts as you consider your response. You know that this article of clothing is an affront to anything resembling good taste. You must also consider that your friend must have liked it because she did, in fact, actually give someone real, government-green money for it. You want to be honest, but you do not want to hurt her feelings. What do you do? What do you say? Well, you sort through all your thoughts. You make a decision about the relative merits of honesty and compassion, and you finally decide what to say. Incidentally, this step is much easier for very young children, who typically spend very little time arranging and editing their thoughts. The 3-year-old is likely to say the first thing that comes to mind, which may be tactless and unintentionally hurtful. One of the aspects of communication acquired most slowly is the ability to make good decisions in the first step of the speech chain.

Regardless of how the decisions are made in the first step or whether they are appropriate decisions, the second step remains the same. You as the speaker put your message into language form by leafing through your mental dictionary to pick out the right words and by selecting the appropriate rules of grammar to create the correct word forms and place them in the right order. This step also occurs so quickly that you cannot monitor yourself doing it unless you cannot think of the right word. Only when the process is interrupted by this kind of failure do we begin to appreciate just how easily and naturally we translate thoughts into language.
Neural impulses are sent to the speech mechanism, triggering speech movements. The message is put into language form. The speaker sorts through his thoughts, decides what he wants to express, and creates a message.

Notice that the first two steps are confined to the brain. We may think of speech as flapping lips and a wagging tongue, but even the simplest utterance begins in the gray matter of the brain.

In the third step, the brain sends instructions, in the form of neural impulses, to the muscles of speech. Keep in mind that these are not just the muscles of the structures in the mouth. The brain must send instructions to the muscles of respiration
and to the muscles of the larynx and pharynx, as well as to the muscles of the face that support speech with nonverbal expressions, and even to the muscles of the arms, hands, fingers, and perhaps even the legs and torso, which provide additional nonverbal support to the speaker’s words. The complexity of this operation is unbelievable and becomes even more amazing when you consider the speed at which all the parts are made operative.

In the fourth step, the movements of the structures of speech interrupt and constrict the flow of vibrating air from the larynx, setting up minute pressure changes in the air surrounding the speaker’s mouth. These patterns of air pressure changes are called sound waves. Sound waves cause air particles to bump into each other, creating compression between some particles and spaces and rarefactions between others. The bumping, compression, and rarefaction of air particles continue until the sound waves reach the listener’s ears.

As the air particles bump into the listener’s eardrums in the fifth step, the listener’s hearing mechanism is activated. As you will discover in more detail in the Appendix, the ear has the capacity to transform the mechanical energy of vibrating air particles into hydraulic energy in the fluids of the inner ear and eventually into neural energy that travels along the acoustic nerve to the brain.

Finally, in the listener’s brain, the neural impulses are analyzed and interpreted so that the listener recognizes the speaker’s message. Consider what has happened in the speech chain. Thoughts have been transformed into language forms, which have been transformed into neural signals, which trigger the structures of speech, which by means of their movements disturb air particles and transform them into sound waves, which bombard the listener’s ears, which transform the sound waves into neural patterns, which are received and decoded by the listener’s brain. Incredibly, the message is not lost or changed. The listener may not always understand what you intended to communicate, but if he is within hearing range and if you speak clearly, he will receive precisely the same pattern you sent.

Speech does indeed give us the power of mental telepathy. It allows brains to connect. Speech is so much a part of the human experience that we truly take it for granted, but it is a wondrous human gift. The next time you engage in a conversation with one or more people, consider the speech chains that connect speakers and listeners. Marvel at the speed involved in the sending and receiving of messages. Notice how quickly speakers become listeners and listeners become speakers in a ballistic communication give-and-take that almost defies understanding. Now consider that human beings know much of what they will ever know about language and have the basic skills involved in speech by the time they are just 4 or 5 years old! How does this happen?

In the remainder of this book, you will take a closer look at many of the elements in the speech chain. You will consider what the child must know to be a competent language user, and explore the acquisition process along all important dimensions of speech and language. You will learn much is still unknown about human language. The experts argue about almost every major topic, but much more is known about speech and language today than was known just 30 years ago. The purpose of this book is to help you understand what is known, to recognize what is not known, and, most important, to appreciate the almost mystical nature of this uniquely human talent.
Chapter 1

Web Sites to Explore

Animal Communication
http://www.birds.cornell.edu/brp/research/animal-communication-research
http://www.dolphincommunicationproject.org

Review Questions

1. Define communication, language, and speech.
2. How are speech and language separate but related aspects of communication?
3. Which of Hockett’s design-features most effectively separate human communication from animal communication and why?
4. Trace the six steps in the speech chain that transform the speaker’s thoughts into the listener’s understanding.

References and Suggested Readings

Corballis, M. C. (2007). The uniqueness of human recursive thinking: The ability to think about thinking may be the critical attribute that distinguishes us from all other species. American Scientist, 95(3), 240–249.


One can only guess when the first nature-versus-nurture argument occurred, but whenever human behaviors are discussed, this argument is sure to arise. It is not surprising, then, that language experts have debated the relative influences of genetics and the environment on speech and language development. Is the child genetically predisposed to talk or taught to talk? This chapter presents the implications of this question and some of the answers experts have suggested. The answers, as you will discover, cover the entire nature-nurture continuum.

This chapter is designed to facilitate comprehension of the evolutionary changes that have occurred over the past four decades in the theories of language acquisition. It considers the contributions made by each major theoretical view along the evolutionary continuum to furthering an understanding about how the various components of language emerge. Specifically, this chapter addresses the following topics:

- The general character of the nature-nurture argument and its potential impact on an understanding of speech and language development
- Linguistic information related to biology and the environment
People probably have argued about how human talents are acquired from the earliest days of our species. Is an artist born or made? Does the musician inherit talent, or is it shaped by hours of rehearsal? Is the great athlete destined to become a physiological virtuoso because of genes, or is athletic skill the product of teaching and practice? Even the casual observer must understand that in most nature-versus-nurture arguments, the truth does not come down on only one side. The master artist must surely be born with the ability to paint or sculpt, but it is only through study, training, and practice that an artist’s skills are developed and refined. The child born with the genetic makeup to become a gifted athlete will realize that potential only when provided the opportunity to learn and perfect the skills of the game she chooses. In other words, most human talents are both born and made.

Even human traits widely considered to be purely genetic can be influenced by the environment. A child might be smaller than his genetically determined size because he is malnourished. A child born with great intellectual capacity might function at a normal or below-normal level because she has not been provided adequate opportunities for learning. Sadly, if the poor diet continues long enough, the small child will remain undersized, and if the educational opportunities are withheld long enough, the intellectually gifted child will lose her gift. Sometimes, of course, environment can affect nature’s outcomes in less dramatic and less permanent ways. A child born brown-eyed can have blue eyes by wearing tinted contact lenses. A short child can wear elevator shoes. The adult with naturally brown hair can have blonde hair by using peroxide. The list of environmental manipulations of natural conditions becomes longer with each generation of humans.

Theories designed to explain how language develops address the nature-versus-nurture debate at various points along the continuum, and you will note that each theoretical view addresses certain aspects of language more directly than others. Some theories, for example, focus primarily on the function of language. Others are more concerned with the structure of language. Others consider the connections between cognition and language, and still others attend to environmental factors as facilitators in the acquisition process.

Until about 1960, most people who studied the development of speech and language in children assumed that oral communication skills are learned. During the first half of the 20th century, much emphasis was placed on parents teaching their children to talk, even though there was concern that parents were not very good teachers. Van Riper, as late as 1964, observed that “children learn to talk. Their parents do the teaching, and it is usually very poor” (p. 92). Many experts during this era believed that children learn to talk not because of their parents but in spite of them.
The nature-versus-nurture argument in speech and language became heated during the 1960s and early 1970s when theorists called nativists or biological nativists suggested that children are genetically predisposed to talk. That is, oral language is instinctive in humans and, like instincts in other animals, speech is a behavior the child produces with minimal environmental involvement. It is a genetically coded behavior and is as natural for the child as walking.

What is sometimes lost in discussions about this debate is that neither side completely discounts the other. Those who believe language is learned (behaviorists) recognize that the child must have the right anatomical equipment and must be ready to acquire language in terms of cognitive, perceptual, and neuromuscular maturation. Their emphasis, however, is on environmental influences. They argue, for example, that a child reared in a stable home with parents who provide good language models has a distinct advantage over one reared in an economically, culturally, and socially impoverished home by parents who provide few and inadequate language models. The nativists accept the fact that environment plays some role in the acquisition of speech and language. That is, the child must be exposed to language models, but the nativists view these models as mere triggers for a natural, biological acquisition process. They argue that the innate drive for the development of language in humans is so powerful that even a poor environment will not prevent the child from talking.

As the debate has continued, the extreme views have moderated, and there is a general understanding that what the child brings to language development genetically is important, but so is the environment into which he is born. Differences among theorists still exist concerning the importance they place on nature or nurture, and given the history of this ongoing debate about all aspects of human development, it is unlikely the experts will ever agree.

Research has added to our understanding of how both human biology and human interaction contribute to language acquisition. Those who enter the debate about how children become expert users of language have a wealth of information to draw on to support their perspectives. We review some findings from this research as a backdrop to our discussion of the theories.

Evidence of Biological and Environmental Influences on Language Learning

In Chapter 1 we considered the varied communication systems of some nonhuman species, where we discovered several different but intricate and interesting ways in which nonhumans interact. Recall that the nature and extent of animal interaction are primarily biologically based for their survival. Some species also seem to engage in social interactions that have a limited but important role in their communication. Consider, for example, the discovery of certain birds that appear to develop local dialects in their calls based on the use of the dialect in their immediate environment. The interaction between the biological system and the environment may account for variations in bird calls from one locality to another. Now we turn our attention to the
nature of human biology as one way to look at how children learn language and interactions within cultures.

**Human Biology**

Psycholinguistic researchers in the 20th and 21st centuries have uncovered compelling evidence about how the human brain is specialized for both the processing and production of language. In the Appendix of this book, we provide a brief account of the major cortical structures involved in language. Figure A.13 shows a schematic drawing of the left hemisphere. Beyond the broad areas of specialization in the temporal lobe, such as Wernicke’s area, Broca’s area, and the primary motor strip in the frontal lobe, neuropsychological and neuroimaging studies have added significantly to our understanding of the complexity and particularities of how animal and human brains respond to nonlinguistic and linguistic information.

For example, a very interesting finding emerged from the study of monkeys as they engage in actions such as grasping, holding, and tearing objects. The neurons that fire during these actions are found in the rostral (front) part of the monkey’s inferior area (area F5). Researchers also discovered that these same neurons fire when the monkey observes the action performed by another. Such neurons are called mirror neurons. Rizzolatti and Arbib (1998, p. 3) propose that mirror neuron activity represents actions that can be used not only for imitating actions, but also “to recognize that another individual is performing an action, to differentiate the observed action from other actions, and to use this information to act appropriately.” They conclude that mirror neurons provide the link between the sender of a message and the receiver of it. Researchers have also discovered that mirror neurons exist in humans, as shown by experiments (Fadiga & Craighero, 2006; Rizzolatti, Fadiga, Gallese, & Fogassi, 1996) where, during observation of various actions, selective increases of motor evoked potentials occur in the muscles that the subjects use to produce the actions. The presence of mirror neurons in humans may explain why we enjoy watching others slide across the ice, run the football down the field, or water or snow ski, or even why we spend several hours each week watching other people cook! In humans the area of the brain that is analogous to F5 in the monkey is Broca’s area. Researchers (Rizzolatti & Arbib, 1998) contend that the mechanism for recognizing the actions of others was the neural underpinning for the development of speech. In addition, Rizzolatti and Arbib (1998, p. 7) state that “our suggestion, by contrast [to Universal Grammar], is that natural selection yielded a set of generic structures for matching action observation and execution. These structures, coupled with appropriate learning mechanisms, proved great enough to support cultural evolution of human languages in all their richness. We hold that human language (as well as some dyadic forms of primate communication) evolved for a basic mechanism that was not originally related to communication: the capacity to recognize actions.” These exciting findings offer strong support for the nature end of the argument regarding language acquisition.

The human brain also has a dynamic ability to change constantly as individuals learn, an ability also known as plasticity. This ability is called the self-organizing neural network. Consider, for example, research showing that the brain organizes
the way it responds to words in relation to how the words function within the language. Thus, nouns, verbs, and other categories show different patterns of neural activity during listening tasks (Li, 2003; MacWhinney, 2001; Miikkulainen, 1993, 1997; Ritter & Kohonen, 1989). Our ability to categorize words, as you can imagine, allows us to select and use words from our memories with great speed and accuracy.

This ability to learn, store, and retrieve words is critical to normal language development. An example of the workings of the self-organizing neural network can be found during the vocabulary spurt that children experience between 18 and 20 months. A child who had the ability to name items in her environment suddenly finds herself having some confusion in naming these known objects, people, and events. This brief period has been called the naming deficit. It is thought to occur for one of two reasons. It occurs either because the densely packed representation stored in memory during rapid vocabulary growth also produces competition in word selection (Gershkoff-Stowe & Smith, 1997) or because the words are undergoing reorganization, causing confusion about words that have strong semantic relationships (Bowerman, 1978, 1982). The result of either or both of these processes is short-term difficulty with word recall. Consider this scenario. A child might be very excited to discuss playing with the dump truck in the sandbox with his day-care aide. In his excitement, he might repeatedly call it a tractor even though he knows all about dump trucks.

An additional research finding regarding the brain’s neural response to language input is known as the age of acquisition effect. Words that are learned early show faster retrieval during naming and reading tasks than words learned later (Ellis & Morrison, 1998). This phenomenon is explained in terms of plasticity in learning. As new learning occurs, the neural network needs to retain its plasticity and its stability in word representations so that word learning increases efficiently across time.

The self-organizing neural network has been used in discussions about language learning as an interconnected system where learning in one language domain, such as the sound system, cannot help but affect other language domains. These interconnections also may explain why there is such variability and widespread difficulties across the language system among children who have language problems (Zera & Lucian, 2001).

There is a substantial body of literature that verifies genetic influences on language development and the occurrence of language disorders. Paul (2007) provides a review of family aggregation studies, pedigree studies, twin studies of typically developing children, and twin studies of children with language disorders. The summary statements relative to findings from many studies (see Figure 2.1) offer strong support for the genetic transmission of language capability.

Biologically speaking, humans not only have the neural mechanisms that support language learning and use, these abilities are also genetically transmitted to their offspring. But of course, genetic makeup is only one of the ingredients in successful language development. The most compelling evidence about how our environment influences language learning comes from cross-linguistic studies. We will explore the contributions of both the amount and the nature of interactions children receive.
Interactional Environment

The most current view of language learning is a combined approach in which biology (neural substrates and genetics) and participation in the native linguistic environment work in tandem for language growth. Evidence supporting interactionist viewpoints shows that children learn the language structure (grammar) in piecemeal fashion across many years, with a co-occurring accumulation of vocabulary. This gradual growth in language occurs through meaningful interactions between the developing child and those who communicate with her in everyday interactions. Further, we know that there are wide variations in the rate of language acquisition among children, even though they follow a predictable path. It is also clear that there are several ways in which particular aspects of language can be impaired. What accounts for this variability?

There is no clear answer to this question, except that children develop at differing rates in correspondence with many factors, including the amount of exposure and opportunities to engage in interactions with others. We know that adults do not intentionally teach language to children, but they do provide various degrees of language input. This input can be well formed, responsive to their child’s communicative attempts, well adapted to their child’s current focus of attention and understanding, and rich in contingent reformulations that model correct forms (Paul, 2007). All of these components interact to promote language growth. On the other hand, some adults may provide little language to their children. Unfortunately, the lack of well-formed, responsive, and interactive language places children

• The mean incidence of a positive family history for speech and language problems across studies is 46% in families of children with specific language impairment and 18% in controls (Stromswold, 1998).
• An autosomal dominant inheritance pattern was found for children with specific grammatical language impairments (Van der Lely & Stollwerck, 1996).
• Gene mapping studies show that genetic region SPCH1, chromosome 7q31, is linked to severe motor dyspraxia, expressive grammar delay, written language problems, and intellectual deficits. (Fisher, Vergha-Khadem, Watkins, Monaco, & Pembray, 1998).
• The human gene subregion CFTR within SPCH1 in the frontal lobe has been linked to specific language impairment causing problems with expressive language delay, severe articulatory disturbance (verbal dyspraxia), and moderate cognitive impairment (Fisher et al., 1998).
• Twin studies of typical children show that rapid receptive vocabulary acquisition at 14 months and expressive acquisition vocabulary at 20 months are influenced by genetics due to fast mapping of phonological forms to objects and the vocabulary spurt (Kay-Raining Bird Chapman, 1998).
• Twin studies of children with language disorders reveal a strong role for genetic influence in the variation of language ability between normally developing and language-impaired twins (Bishop, North, & Donlan, 1995; Lewis & Thompson, 1992; Tomblin & Buckwalter, 1998).

FIGURE 2.1 Genetic Influence on Language Development and Disorders
at a disadvantage for language growth and development. A fascinating study published by Hart and Risley (1995) showed a remarkable connection between the amount of talking between parents and their children in the first 3 years and the child’s academic success at 9 years of age. Notably, the more talking that occurs during infancy, the more likely the child will do well in school later in life. We will describe this study and the major findings of similar studies in Chapter 4.

Cross-linguistic studies comparing one or more aspects of language provide us with very rich information on the ways in which language learning is influenced by the particular input received from those in communication with the learner. Let us consider some evidence from researchers who study the emergence of language in children learning different languages.

English grammar is constructed by combining word classes (e.g., nouns, verbs, adjectives) with inflectional and derivational morphemes (see Figure 4.2), such as those that mark tense, pluralization, possession, and prefixes and suffixes in rule-governed combinations to produce sentences. For example, a 2-year-old child might say, “Mommy, I’m thirsty. Can I have some more milk?” Other languages have been compared to English in relation to the degree of their use of morphemes to mark changes in meaning. Examples of highly inflected languages are Italian, Turkish, and Finnish. These languages use a variety of morphemes at the end of words. Less inflected languages include Russian and Serbo-Croatian. Historically, researchers and theorists thought that inflections were more difficult for children and thus were learned after the basic word order structure of the language was in place. This idea was shown to be erroneous through comparative research. Indeed, the nature of the input is the key to the learning. For example, Bates and Marchman (1988) examined research studies to argue against a universal idea (first linguistic universal) that word order constitutes early grammar and is followed by the gradual emergence of inflections. Studies show that, early on, English children use primarily content words to produce telegraphic speech in which words are initially uninflected, and then they learn to use inflection gradually across the first 5 or 6 years. For example, a child might develop these two utterances in the following way:

- Mommy go night-night.  
- Mommy me go night-night.  
- Mommy I go night-night.  
- Mommy I am going night-night.  
- Mom, I am going to bed.

- Cookie?  
- Cookie please?  
- Me cookie please.  
- Please, have a cookie?  
- Please, can I have a cookie?

However, Turkish children do not follow a pattern in which inflections are learned in this gradual way. They use inflections on single-word and multiword combinations and master basic case morphology by 24 months. Children who are acquiring Hindi and Polish develop similarly to Turkish children. Yet, Russian and Serbo-Croatian children have a protracted development of morphemes into their 6th or 7th year. Finnish children produce a wide variety of word orders even before they have mastered inflections. These studies led Bates and Marchman to conclude that the native language influences the route that children take in their acquisition of grammar. They propose at least three routes to the acquisition of grammatical morphology that occur in relation to the native language: (1) productive use of inflection from the beginning;
(2) rigidly ordered telegrams without grammatical morphology; and (3) uninflected word combinations that occur in a range of different orders. They further explain that the variations in the acquisition of morphology are directly related to the saliency (perceptual relevance) of the inflections of the language the children are learning. In other words, children focus on the perceptually relevant aspects of their language. Thus, word order in English is salient, and it has a regular set of word-order principles but relatively little grammatical morphology. Turkish has a very regular, clear, and semantically transparent inflectional system, whereas Russian and Serbo-Croatian have very irregular and arbitrary inflectional systems. Bates and Marchman (1988, p. 23) refute the first linguistic universal by saying that “Children are biased to pick up clear and regular structures before they learn arbitrary and/or irregular forms. This bias toward clear and regular forms may reflect the application of language-specific predispositions—but may also reflect the applications of general perceptual/cognitive strategies to the domain of language learning.”

A second linguistic universal derived from studies of English is the observation that children omit verbs from their first multiword combinations. In English, verbs are morphologically more complex than nouns because of the array of possible endings that can be added, and they express complex semantic relationships that are acquired late in development. Thus, English-speaking children initially avoid verbs by combining associated nouns (e.g., daddy cookie). However, cross-linguistic studies show that this pattern of verb omission does not occur in all languages (MacWhinney & Bates, 1978). In Hungarian, subject nouns and objects carry inflections; therefore, they are needed to convey meaning. The verbs also carry inflections that are redundant with the object inflections; thus, the object can be omitted. In Italian, verb inflections carry information that is necessary for sentence meaning. Italians (even adults) sometimes omit the subjects of sentences and vary the word order because it is the verb that provides information (person and number) about the subject.

The three patterns found in these studies reveal a bias toward verb omission, a bias toward object omission, and a bias toward subject omission, depending on the language being used. Thus the application of the second universal rule is not supported. Bates and Marchman (1988, p. 25) concluded that “Children are sensitive to the informativeness of elements in their language and/or to the statistical distribution of those elements in adult speech. This predisposition may be attributable to a species-specific preparation for language domain.” These two examples of how word order and verb complexity vary across languages serve to remind us that the nature of the input, that is, what language the child is exposed to, is a very powerful influence on how he learns language.

Hearing the regularities of the grammar of the language is certainly important, but grammar ultimately functions to help us convey meaning. Thus, how particular children gain meaning through word order across languages has also provided us with information about what cues are important in language learning (the semantics first hypothesis). In an experimental study of semantics and word order with 3-year-old children, researchers found that the presentation of three different declarative word order structures resulted in differing outcomes from English- and Italian-speaking children. Sentences were acted out by children using animate nouns (living things), toy animals, and inanimate nouns (nonliving things) through the use of
common objects and verbs in the NVN (noun–verb–noun), NNV (noun–noun–verb), and VNN (verb–noun–noun) combinations. The researchers discovered that English-speaking children used word order as the first cue for sentence interpretation by 2 years of age but Italian-speaking children of this age used animacy. Thus, Bates and Marchman (1988, p. 26) concluded that “Children begin at a very early age to identify and utilize those clues to sentence meaning that are most informative for their language. This predisposition leads to word order in English, and to lexical semantics in Italian.” Put another way, Paul (2007, p. 7) stated that “the specific language and conceptual understanding of events interact to give weight and cue value to particular aspects of meaning and form.”

In addition to evidence regarding word order and meaning, Devescovi et al. (2005) studied the relationship between grammar and lexical development in English and Italian children. They found not only that vocabulary development is a valid and strong predictor of grammatical development, because they are linked, represented, and accessed together (the lexicalist theory), but also that the pace and complexity of the development of each vary with the complexity of the native linguistic input. For children learning English, as grammatical complexity increased, so did vocabulary. After they learned the first 400 words, grammatical learning accelerated. For children learning Italian, vocabulary and grammatical learning occurred consistently across time. The results suggest that grammar is learned earlier in highly inflected languages, which supports the work of other cross-linguistic researchers.

One of the most dramatic examples of language variation was documented by the linguist Daniel Everett, who lived for over 6 years with the Pirahã, a group of people of Brazil, who speak their language using severely constrained grammar. A striking aspect of Pirahã is the restriction of communication to the immediate experience of those engaged in conversation. This lack of perfect and future tenses, which had been thought of as a core aspect of grammar in a universal grammar framework, has caused linguists to revise the notion of universal grammar. The characteristics of this language also suggest that some of the features discussed in Chapter 1 (interchangeability, displacement, and productivity) may be culturally constrained. That is, culture appears to have a very important role in shaping how we think and communicate.

Pirahã is the only language known without number, numerals, or a concept of counting. It also lacks terms for quantification such as “all,” “each,” “every,” “most,” and “some.” It is the only language known without color terms. It is the only language known without embedding (putting one phrase inside another of the same type of lower level, e.g., noun phrases in noun phrases, sentences into sentences, etc.). It has the simplest pronoun inventory known, and evidence suggests that its entire pronominal inventory may have been borrowed. It has no perfect tense. It has perhaps the simplest kinship system ever documented. It has no creation myths—it's texts are almost always descriptions of immediate experience or interpretations of experience; it has some stories about the past, but only of one or two generations back. Pirahã in general express no individual or collective memory of more than two generations past. They do not draw, except for extremely crude stick figures representing the spirit world that they (claim to) have directly experienced.
In addition, the following facts provide additional overt evidence for ways in which culture can be causally implicated in the linguistic structure of the language: The phonemic inventory of Pirahã women is the smallest in the world, with only seven consonants and three vowels, while the men’s inventory is tied with Rotokas and Hawaiian for the next-smallest inventory, with only eight consonants and three vowels (Everett, 1979). The Pirahã people communicate almost as much by singing, whistling, and humming as they do using consonants and vowels (Everett, 1985, 2004). Pirahã prosody is very rich, with a well-documented five-way weight distinction between syllable types (Everett, 1979, 1988; Everett and Everett, 1984).

A final fascinating feature of Pirahã culture, which I will argue to follow from the above, is that Pirahã continue to be monolingual in Pirahã after more than 200 years of regular contact with Brazilians and other non-Pirahã. What we will see as the discussion progresses is that Portuguese grammar and communication violate the Pirahã constraint on grammar and living, a profound cultural value, leading to an explanation for this persistent monolingualism. (Everett, 2005, p. 622)

Many variations in linguistic input have been documented in the literature to show that environment affects language acquisition. In later chapters, we will discuss variables such as the nature and amount of prelinguistic input, parent–child interaction, and sociolinguistic factors that contribute to language learning.

Now that we have reviewed some evidence about the influence of biology and environment on language acquisition, we will explore theories that arise from these points of view. These theoretical perspectives include behaviorism, nativism, and interactionism.

A Review: The Major Theories of Language Acquisition

Behaviorist Interpretation: The Role of Nurturing—The Extreme View of the Environment’s Contribution to Language Development

The proponents of the behaviorist perspective focus on observable behaviors to explain language development. They look for patterns of language that children demonstrate, such as the way English-speaking children combine two nouns (daddy cookie). Based on both observation and measurement, they then draw conclusions about the relationships between the environment and the regularities in children’s language. These relationships allow predictions of the continuing course of language development across all children within the particular culture under observation (Bohannon & Warren-Leubecker, 1989). Behaviorists do not emphasize mental activities, such as attention and memory, because these activities cannot be observed directly in language learning, although they do acknowledge their existence and their important connection to language development.

Using Watson (1924) and Skinner (1957) as examples, Bohannon and Warren-Leubecker (1989, p. 173) make the point that behaviorists believe language is learned because they do not believe language is unique among human behaviors. Watson (1924) categorizes language in its earliest stages as a behavior no more complicated...
than a habit used to influence or control the behaviors of others. Behaviorists argue that language is something humans *do*, not something they *have*, and it should be understood, therefore, in the same context of learning as other behaviors humans do, such as brushing their teeth or tying their shoes. They contend that language is learned according to the same principles used in training animals and that, like trained animal behaviors, language behaviors are learned by imitation, reinforcement, and successive approximations toward adult language behaviors. Recall from Chapter 1 the limitations found in training an animal to learn symbolic communication to appreciate the learning that is required for human language to emerge and develop.

One of the more controversial aspects of the behaviorist view is that children are passive during the process of learning language (Bryen, 1982). That is, children begin life with their “language tanks” on empty. They become language users as their tanks are filled by the experiences provided by the language models in their environments. This is not to say that children are totally inactive, of course. They are active in the sense that they imitate language forms, but they do not initiate these behaviors on their own, and the shape of their emerging language is determined not by self-discovery or creative experimentation but by the selective reinforcements received from their speech and language models.

This leads us to the key assumption underlying behaviorist views of language development. Although behaviorists have differing opinions about exactly how the process of learning occurs, they all agree that environment is the critical and most important factor in the acquisition formula. While nativists stress the similarities that occur in the language development of children, behaviorists stress the differences that are explained by the widely varying environments of children during the language acquisition period. The behaviorists focus on the external forces that shape the child’s verbal behaviors into language. They see the child simply as a reactor to these forces (Bryen, 1982).

**Speech and Language as Operant Behaviors**

The theorist most closely associated with the behaviorist interpretation of speech and language development is B. F. Skinner. It is not surprising that Skinner (1957) viewed speech as learned behavior, because he viewed virtually all behaviors as learned according to operant conditioning principles. To understand Skinner’s explanation of speech and language development, therefore, one must understand the basic principles of operant conditioning.

An **operant** is any behavior whose frequency can be affected by the responses that follow it. If a target behavior’s frequency of occurrence increases as a consequence of the response that follows it, **reinforcement** has occurred. If the frequency decreases, the target behavior has been **punished**. Very often people try to understand operant punishment in terms of aversiveness or unpleasantness, but these judgments may interfere with an understanding of the principle involved. If a target behavior’s frequency of occurrence decreases as a consequence of the response that follows it, punishment has occurred whether or not the organism being conditioned perceives the response as unpleasant or aversive. In other words, reinforcement and punishment are defined on the basis of their effects.
Consider the following example of these concepts. Sara, age 3, says “Daddy, give me the book, please.” Daddy says, “Here you go, Sara. I like how you asked me for the book.” Sara’s request (the operant) is likely to occur again in the same polite manner because her dad’s comment (response) was so positive. He not only gave her the book, but also used the opportunity to praise her (reinforcement). Now here is an example of how punishment decreased a behavior. Frank is a 5-year-old who loves to go to the park. He asks his parents repeatedly to take him (operant), to the point where they need to decrease his requests to maintain their sanity! They decide to tell Frank that he can go to the park only once each day after school and once on Saturday and Sunday morning (response). If he asks for more trips to the park, he will not be able to go at all the next day (punishment). As indicated earlier, punishment (a decrease in behavior) does not have to be negative. We might take the suggestions of a friend to decrease our rate of talking (operant), and when we do (response), we find that those around us like to talk to us more (punishment)!

In operant conditioning, the events that follow target behaviors are critical to learning, but the events preceding the target behaviors are also important, because they can come to control whether or not these target behaviors will be produced. During the learning period, a parent may, consciously or not, give the child a certain look as he is receiving a gift, a look that reminds the child that he should say “thank you.” We call this look a **discriminative stimulus**. Now notice the sequence. The child receives the gift. The parent gives him the look. The child says “thank you,” and the parent praises him for his gratitude. Over time, the look or discriminative stimulus comes to control the frequency with which the child says “thank you.”

There are other preceding events. The **delta stimulus** is a signal indicating that reinforcement will not follow a particular response, and an **aversive stimulus** warns that there will be an unpleasant consequence for a particular behavior. It is very important to remember, however, that these preceding events have only as much power to control behaviors as provided by the strength and consistency of the events that follow targeted behaviors. A parent might try to use an aversive stimulus by threatening time out if the child produces a certain behavior, but if that behavior is never followed by time out, the preceding event will have no power to control. This is why parents are counseled not to make empty threats. Behavior in children and all other organisms can be managed by operant principles only if preceding events are connected to following events, at least part of the time. In other words, behavior management is effective only if efforts to manage are consistent and if the manager follows through on the promises or threats inherent in the preceding events.

Sometimes the behavior we want must be **shaped** in small steps that gradually approximate the target behavior. When the child is learning to say **water**, she might begin by saying **wawa**. The adult accepts this production as a step toward the target behavior and reinforces it, perhaps by giving the child a drink when she says **wawa**. As the child gets older and expectations for her speech rise, she might be reinforced for saying **wada** but she is no longer reinforced for saying **wawa**. The next approximation might be **wata** and finally **water**. In each step of the shaping process, what is reinforced is closer to the target. Productions that are not advanced or are perceived as regressions are ignored.

Many behaviors, including speech behaviors, occur in sequences. These sequences are learned through a procedure known as **chaining**. A child sees his mother getting
ready to go out and thinks she looks pretty. He says, “You sure look pretty, Mommy.” The mother, flattered, responds, “Well, thank you! That was a nice thing to say.” The child says, “You’re welcome.” Seeing his mother looking pretty is the discriminative stimulus for the child’s initial comment, which is followed by the mother’s response and the child’s response to her response, each reinforcing the preceding utterance.

It is not too difficult to understand how Skinner and others have applied these basic principles to speech and language development. In general, the child acquires language as a result of selective reinforcements provided by his caregivers. The caregivers provide models. The child imitates the models. Imitations most closely resembling the models are reinforced by the caregivers when they give the child what he wants, when they respond with another comment, or when they give the child adoring attention. Over time, the child will cease to use productions that have not been reinforced and will continue to use those that have been reinforced. Stringing words together into sentences occurs as the result of chaining. Imitation, important throughout the learning process, undergoes a change as the child moves from single words to sentences. Staats (1971) suggests that this new version of imitation is introduced by the child’s parents as their expectations for her speech increase. The child produces a single-word utterance. One of the parents, believing she can produce a longer utterance, expands this single word into a sentence and withholds reinforcement until the child imitates the expanded form.

Remember that behaviorists stress the idea that language is a doing or performing phenomenon more than a knowing phenomenon. Skinner (1957), for example, argues that verbal behaviors serve one of five specific functions defined according to what they do: echoic, tact, mand, intraverbal, and autoclitic. Perhaps the simplest of these behaviors is echoic, the imitation of a model in the presence of a nonverbal stimulus to which the word refers. For example, as a parent hands the child a dessert, she says, “Cookie.” The child takes the treat and imitates the model, “Cookie.” Eventually the child will associate the word with the object and will use the word to refer to or request a cookie, but in the beginning his production is simple, meaningless imitation.

After the child has established an association between an object and its corresponding word, an echoic becomes a tact. A tact is a verbal behavior used to name or label something, typically in response to things or events the speaker is discussing.

The next term sounds and looks something like the word demand, and that is not a coincidence. A mand is a verbal behavior used to request, command, or make a demand, and it identifies its own reinforcer. An utterance like “me want drink” indicates a request. If the request is granted, the drink becomes the reinforcement for the utterance.

An intraverbal is a production that often seems to have no direct connection to the utterance that precipitated it. A mother might say, “Daddy went to work,” and the child might reply, “Go outside and play now?” Although there might seem to be no direct link between these two utterances, the child might be conditioned to go outside to play only after her father goes to work. In this context, the child’s response makes sense. Intraverbals are used in the free association characteristic of conversation. In conversation, what one person says may not dictate the response received. In some cases, a person responds even when there is no request for a response. The free-associated and nonrequested responses in conversation and social gesture talk are intraverbals.
Autoclitic responses can be understood in two important ways. First, these responses influence and are influenced by the speaker’s behaviors. Second, autoclitic responses account for the linking of words into sentences. Using operant terminology, each word serves as a discriminative stimulus for the following word. Another way to understand the linking of words into autoclitic responses is to consider how the child is combining isolated ideas. The child, for example, might be watching her brother, Billy, playing baseball, and she wants to comment on this observation. She knows the names for *Billy* and *ball*, and she knows that striking the ball with a bat is called *hitting*. She links the three ideas together to create the utterance “Billy hitting the ball.” This is an autoclitic response.

As language structures become more complex, it is more difficult to explain them on the basis of learning alone. In reference to autoclitics, for example, Fey (1986) says there is the implication that only strings of words that have been specifically reinforced can be produced. We know, however, that all speakers, including young children, produce strings of words that have never been produced or heard before. In other words, operant principles cannot adequately account for the creativity that is a dominant characteristic of language. Additionally, operant principles alone fail to account for the acquisition of meaning in novel utterances.

### Classical Conditioning

Staats (1971) believes we must include classical conditioning principles to explain language acquisition, especially the meaning component. In classical conditioning, an originally neutral stimulus is paired with an unconditioned stimulus that elicits an unconditioned response. In the famous Pavlovian experiment, the dog hears a bell
just before seeing food, which elicits the unconditioned response, salivation. After a number of trials, the bell alone, now a conditioned stimulus, will elicit salivation, now a conditioned response. That is, the dog has learned or been conditioned to salivate upon hearing the bell. Staats argues that a word is, in the beginning, a neutral stimulus that acquires meaning only as responses are classically conditioned to it. The word *sit* develops meaning as it comes to represent the physical act associated with it through the process of conditioning. At first, when the child hears his parent say, “Sit!” there is no reaction, but if the word is paired with the physical act of being placed on a chair, the word alone, after enough trials, will elicit the act of sitting and will be understood to represent the act.

**Review and Reflection on the Behaviorist Perspective**

The behaviorists stress the importance of environment. The child is viewed as an empty vessel to be filled by the experiences provided by the important people in his life. The child is typically viewed as having no knowledge about the rules of language. His parents and other speakers are credited for “teaching” language by providing models that the child imitates. By selective reinforcement, the parents shape the child’s utterances into adult forms. (See Table 2.1.)

Obviously, the behaviorist perspective of language acquisition has not gone unchallenged. James (1990) provides an excellent and succinct summary of some of the problems and criticisms. The role of imitation has been questioned, for example. As noted earlier, children produce sentences they have never heard before. This may mean that they produce sentences that are more creative and elaborate than their models, but it also means that they produce utterances that are simply not produced by adults because such utterances are infantile. The child will typically say things such as “Daddy goed work” and “That mine milk,” productions that are clearly not imitations of sentences produced by parents. Perhaps more importantly, the frequency of imitation decreases dramatically after the second birthday, but there is still a lot of language to be acquired beyond age 2. Some children, even from the beginning, imitate very little. If imitation is as important as the behaviorists argue, we would expect to see imitations more consistent with the models provided, and we certainly would expect to see imitation play a major role in acquisition throughout the learning period. James also notes that because parents are more likely to correct children for the content of their utterances than for the grammatical accuracy of their sentences, syntactic development cannot be explained solely on the basis of selective parental reinforcement.

Whatever the problems with the behaviorist perspective, there seems little doubt that learning explains some aspects of language acquisition. We know that language changes over the course of a person’s lifetime, well beyond the age range identified by the nativists as the critical acquisition period. These changes are best explained by general learning principles. An innate capacity for language, for example, cannot account for how humans learn the nuances of language, such as when to use *who* and when to use *whom*, and environmental influences seem to be very important in changing a person from an adequate user of language into an exceptional user of language.
### Table 2.1 Tracing the Evolution of Language Acquisition Theories

<table>
<thead>
<tr>
<th>Theory</th>
<th>Primary Architect</th>
<th>Essential Idea</th>
<th>Primary Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behaviorist</td>
<td>Skinner (1957)</td>
<td>Language is learned by selective reinforcement</td>
<td>General</td>
</tr>
<tr>
<td>Nativist</td>
<td>Chomsky (1957)</td>
<td>Language is processed by universal and innate rules governing deep and surface structure</td>
<td>Syntax</td>
</tr>
<tr>
<td>Interactionist/ case grammar</td>
<td>Filmore (1968)</td>
<td>A level beneath deep structure includes universal semantic concepts that determine relationships between nouns and verbs</td>
<td>Semantics</td>
</tr>
<tr>
<td>Interactionist/ cognitive</td>
<td>Piaget (1963)</td>
<td>Language and thought develop as parallel processes</td>
<td>Thought</td>
</tr>
<tr>
<td>Interactionist/ information processing</td>
<td>Bates and MacWhinney (1987)</td>
<td>Function, not abstract grammar generates language structure</td>
<td>Structure by function</td>
</tr>
<tr>
<td>Interactionist/ social</td>
<td>Bruner (1983)</td>
<td>Language develops through social interaction and construction</td>
<td>Structure by use</td>
</tr>
<tr>
<td>Interactionist/ speech act</td>
<td>Searle (1969)</td>
<td>Language develops through its use in interactions</td>
<td>Pragmatics</td>
</tr>
</tbody>
</table>

### Nativist Interpretation: The Role of Biology—The Extreme View of Nature’s Contribution to Language Development

If the behaviorist view represents the extreme nurture end of the nature–nurture continuum, the nativist perspective is the extreme nature end of the same continuum. As the name of this view suggests, nativists stress the idea that language is innate or biologically based. They argue that human beings are born with a species-specific capacity for language, a capacity that is realized with minimal assistance from the environment. Whereas behaviorists seem solely concerned with performance, nativists stress competence or knowledge that leads to performance.

The theorist most closely associated with the nativist view is Noam Chomsky, a linguist. Chomsky (1968) expresses one of the basic assumptions of nativism in this declaration: “Anyone concerned with the study of human nature and capabilities must somehow come to grips with the fact that all humans acquire language” (p. 59). The idea that language is universal among humans and unique to humans is the foundation of the nativistic interpretation of language acquisition. These theorists point out that unless there are severe physical or mental limitations, human beings will acquire language, and that the innate drive to acquire language is so powerful that many humans talk in spite of what may seem to be insurmountable limitations. They also argue that only human beings are capable of acquiring and using language as we know and understand it.
The earliest attempts to teach chimpanzees to speak failed, but when Gardner and Gardner (1969, 1971, 1975) began their research with Washoe, a 10-month-old female chimpanzee, they tried a different language avenue. They taught Washoe how to use American Sign Language, the manual communication system used by people who are deaf. Washoe eventually learned more than 100 signs and, according to the Gardners, spontaneously produced combinations of signs to express basic requests such as “Listen dog” and “Give me food.” The fact that Washoe brought her hands to a resting position only after a series of signs was produced was interpreted to mean that she intended to combine these signs. There is no question that what Washoe accomplished was beyond what linguistics would have imagined possible, but even those most excited about attempts to teach apes to use language have recognized some important limitations. There is no evidence, for example, that Washoe learned any rules of grammar as reflected by consistent or meaningful word order. Some have suggested that this failure to acquire grammatical rules may be a function of American Sign Language, which is not bound by the strict word order rules used in spoken and written language. On the other hand, it may simply be that chimpanzees do not have the ability to learn syntax, a conclusion that seems to be supported by the findings of another researcher, Terrace (1980), who specifically analyzed his chimpanzee’s signed utterances to determine whether there were any word order consistencies. He found none.

Efforts also have been made to teach language to pygmy chimpanzees (Savage-Rumbaugh, MacDonald, Sevcik, Hopkins, & Rubert, 1986). Pygmy chimpanzees are reportedly more intelligent and social than those used in earlier experiments, and the preliminary evidence suggests that they have a greater capacity for language-based communication skills. According to their trainers, these chimpanzees have acquired symbols simply by observing their human trainers, and they have used these symbols spontaneously in apparent attempts to communicate with humans. There is also evidence that they can combine these symbols to create more complex utterances, and they seem to understand some spoken words.

One of the most remarkable primates studied by Georgia State University researchers is Kanzi, a bonobo or pygmy chimpanzee, born in October 1980. Kanzi is the Swahili word for treasure, an appropriate name for an animal that has been a treasure trove of discovery for those who care for him and study him. Kanzi is the first primate, other than human children, to acquire language not by direct teaching, but by being reared in a language-rich environment. As is true of human children, all his interactions with his caregivers, from the time he was born, have been framed in language. It is significant to note that Kanzi understands not just words, but even word order. When given the instructions “Put jelly in the milk” and “Put milk in the jelly,” Kanzi carries out the instructions appropriately, an accomplishment dependent on understanding word order (Rumbaugh & Beran, 2003; Savage-Rumbaugh, Shanker, & Taylor, 1998). As impressive as Kanzi’s abilities are, it must be acknowledged that chimpanzees, including the pygmy variety, so far have not shown the ability to acquire adult-like syntax, but we must not overlook the fact that these primates seem capable of acquiring and using the kind of language expected of very young human children (Greenfield & Savage-Rumbaugh, 1984; Savage-Rumbaugh, 1990; Savage-Rumbaugh et al., 1986).
All the research conducted with apes must be understood in the context of the criticisms raised about the general methods used. Skeptics have noted that whatever “language” is learned is the result of extraordinary efforts to teach on the part of human trainers—the kind of constant and powerful teaching that is not necessary for humans to acquire language. Critics also suggest that the successes noted are more the result of imitation and prompting than of any natural capacity for language (Terrace, Pettito, Saunder, & Bever, 1979).

Based on all the data now available, we have no reason to believe that nonhumans are capable of acquiring and using language, at least not a language directly and completely comparable to human language. Even if we accept that apes and other animals can acquire symbols and combine them, and that they can understand some spoken words, we have no evidence that they can acquire the rules for combining words into grammatical structures, engage in conversation, or use language creatively. If we believe that language goes beyond vocabulary to include structure, the layering of meanings, the transformations of word forms to indicate things such as plurality, possession, and tense changes, the use of language as a pragmatic tool, and the creativity that allows even young children to formulate utterances never produced or heard before, we must conclude that Lenneberg (1964) was more right than wrong—at least so far.

Another basic assumption of the nativist perspective is that because language is acquired so quickly and so early in the child’s life, learning alone cannot adequately account for acquisition. Nativists argue that caregivers do not provide language models that are designed to teach progressive understanding of language forms. In fact, the nativist would question whether caregivers teach language at all. Children are exposed to language forms of enormous complexity, variety, and inconsistency, and they are never given specific feedback about whether their utterances are correct or incorrect (Pinker, 1984, 1987; Wexler & Culicover, 1980). If language is learned, the nativist argues, we would expect the teacher to provide models that allow children to develop progressively more sophisticated hypotheses about the rules and forms they are learning, and we would certainly expect the teacher to indicate clearly when a child’s productions are right or wrong.

One of the most compelling arguments for the nativist perspective is that language is essentially the same experience for all human beings no matter what language they speak, where they live, or how they interact with their language models. As listeners and speakers of languages, we may be most impressed by their differences, but when languages are studied carefully, we discover many commonalities. All languages, for example, have rules for organizing words into grammatical sentence forms. They do not all use the same rules, of course. Some languages, such as English, stress word order in conveying meaning through grammatical sentences. Italian, on the other hand, allows more freedom in word order because the inflections on verbs carry much of the information for meaning.

Nativists stress the common ground, however. That is, all languages have rules to indicate the structural relationships among words in sentences. All languages distinguish between subjects and predicates and allow the embedding of one sentence structure in another to create an elaborated sentence representing both original structures. All languages have rules to indicate changes in tense and plurality, and draw
sets of speech sounds from a common pool of sounds, and the list goes on. These commonalities or linguistic universals are evidence, say the nativists, that language is an ability humans possess, not by virtue of specific learning or teaching, but by virtue of their humanness.

All of these assumptions led to the creation of a concept that underlies the nativist’s understanding of language development: the language acquisition device, or LAD (Chomsky, 1965; Lenneberg, 1967). The LAD is an innate language reservoir filled with information about the rules of language structure. Nativists contend that it should be understood as a real part of the brain, that part specifically designed to process language. The LAD takes the syntactic information provided by the child’s models and generates the grammar of that child’s native language. Because no child is predetermined to speak any specific language, the LAD is driven by knowledge common to all languages. As you might imagine, the existence and certainly the nature of the LAD have been widely debated (Bohannon & Warren-Leubecker, 1989).

As you may have sensed in this discussion, nativists believe that the structure of language is somehow independent of its use. In fact, they view structure as being independent of meaning and almost every other aspect of the total language package. The rules for structuring sentences determine, for any given language, that some forms are grammatical and allowable and others are not. There is a finite, or specifically limited, number of rules for a given language. These rules allow the speaker to create an infinite number of grammatically acceptable sentences. The rules should be understood not in a prescriptive sense but in a descriptive sense. In other words, these rules do not tell the speaker what she should do but what she does do. They are rules that describe the regularities of a language. Once the speaker knows what these rules are, she can create an unlimited number of grammatical sentences, including the possibility of sentences that have never been produced by any other human. Language acquisition, therefore, is a matter of discovering and applying the rules or regularities of one’s native language.

**Transformational Generative Grammar**

Chomsky (1957) devised transformational generative grammar to account for the production of an unlimited number of grammatically acceptable sentences. This grammar suggests that language is processed at two levels, and two kinds of rules describe what is occurring at each level. Phrase structure rules describe the underlying relationships of words and phrases, the level of structure referred to as deep. These rules are universal and operate in all languages. Transformations are rules that describe the rearrangement of deep structures as they are moved to the next level of structure, referred to as surface. These rules are not universal. Each language has its own set of transformations, although the basic principles that operate in transformations are much the same in all languages. A complete description of transformational generative grammar is beyond the scope of this book, but the reader should understand how the grammar works to appreciate Chomsky’s point of view about language.
If we take a simple sentence such as “The little boy hit the white ball,” we can identify three basic phrase structure rules that operate to create this kind of sentence:

1. **Sentence** = **Noun Phrase** + **Verb Phrase**. Our sample sentence consists of the noun phrase (The little boy) and the verb phrase (hit the white ball).
2. **Verb Phrase** = **Verb** + **Noun Phrase**. The verb phrase in our sentence consists of the verb (hit) and the noun phrase (the white ball).
3. **Noun Phrase** = **Modifier(s)** + **Noun**. There are two noun phrases in our sentence. In the first noun phrase, there are two modifiers (The and little) and the noun (boy). The second noun phrase also has two modifiers (the and white) and the noun (ball).

Keep in mind that Chomsky was devising a grammar to account for the production of an infinite number of grammatical sentences with a finite number of rules. By using just these three rules, it is possible to create an unlimited number of sentences. The example here is an English sentence, but these same rules can be used to describe the deep structure of similar sentences in any language.

Think of deep structures as the origins of a sentence in the brain before it is spoken or written. Phrase structure rules describe the relationships of the most basic elements of sentences while they are thoughts, before they become spoken or written sentences. To move these deep structures to the surface, we need transformations (rules that determine how words are shaped and organized to make sentences grammatical). Each language has its own set of transformations.

In English, for example, we can understand the creation of a grammatically correct question by understanding what happens as we move from the deep structure of a particular sentence to the surface. Let’s assume that you want to know whether Marco is going to the library. At the deep structure level, the origin of the question is something like this:

“Marco is going to the library.”—Question?

The rule in English for transforming this deep structure into a grammatically correct interrogative form is fairly simple. You rearrange the words, reversing Marco and is to create the surface structure “Is Marco going to the library?” The rule for rearranging the words to create a question is a transformation. If you are thinking:

“Marco is going to the library.”—No!

you can use a negative transformation to express that idea on the surface. In this case, you insert the word not between is and going to create the grammatically acceptable sentence “Marco is not going to the library.” The transformation describes what you do on the surface to express what you have thought at the deep level.

It is also important to understand that every sentence has a deep structure and a surface structure. Notice, for example, that “The boy hit the ball” and “The ball was hit by the boy” mean the same thing. That is, they have the same deep structure. They differ only on the surface. The transformation used to change the first sentence into the second is called the **passive transformation**. Notice the reordering of words necessary to transform the active sentence into the passive sentence. Once you understand the rule, you can transform any active sentence into its correct passive
version. Try it on sentences such as “The beautiful woman rode the aging horse” or “The vicious cat chased the frightened dog under the porch.” If several people try the same transformation, assuming basic competence in English, the resulting sentences will be the same:

The aging horse was ridden by the beautiful woman.
The frightened dog was chased under the porch by the vicious cat.

How did you do? You have just demonstrated something many nativists believe supports their view. That is, you know what you know about language even if you do not know what you know. Think about that for a few seconds. The point is, you might not have known what the term passive transformation means, and if asked how to make a sentence passive, you might not have been able to explain it; but by changing active sentences that you have never seen before into passive versions, you have demonstrated your knowledge of not only the deep structures of these sentences but the rules for surface structure as well. The nativists would argue that if language were purely learned, you would have a more conscious understanding of what you are doing when you create sentences at the deep level and as you move them to the surface. Instead, they contend, your LAD provides you with innate knowledge of deep structures and the ability to easily acquire the rules for surface structures for your native language, an acquisition that comes by exposure to models, not direct teaching.

Chomsky significantly expanded and extended his theoretical views regarding the acquisition of grammar to emphasize the limited hypotheses about language structure that the learner can formulate. These revisions include the government binding theory and several subtheories that explain constraints, principles, and rules involved in language acquisition.

Review and Reflection on the Nativist Perspective

Nativists are clearly at the nature end of the nature–nurture continuum. They believe human beings are born with a capacity for language—that given exposure to language, the human child will talk, even if environmental conditions are not favorable. Nativists contend that the universality of language among all human beings, the striking commonalities in how language is acquired, and the schedule by which it is acquired, regardless of cultural or other environmental variations, are evidence of the innateness of language. They believe children are born with a Language Acquisition Device (LAD), a neurophysiological entity filled with language knowledge. The LAD provides children with the knowledge they need to understand any language at the deep structure level and provides them with the ability to acquire easily and quickly the surface structure rules specific to the language they will speak.

James (1990) notes that it is difficult either to confirm or refute the nativist perspective, although several of its basic assumptions have been challenged. The assumption that language is unique to humans has been challenged, however inconclusively, by attempts to teach apes and other animals to use language. The assumption that language acquisition is essentially complete by the time the child is 4 or 5 appears to be overstated. There is evidence that significant language acquisition occurs well beyond 5 years and that some complex language forms are not mastered.
until adolescence. For example, Nippold (1998) discussed the emergence and specific use of adverbial conjuncts (e.g., moreover, nevertheless) and other connectives (e.g., because, during), abstract or rare words, slang, idioms (“The girl threw him off the track”), analogies (feather is to bird as wheel is to ), and metaphors (“Life is like a bowl of cherries”) well into the high school years and beyond. The argument that language must be innate because parents and others provide models that are too complex and ambiguous for progressive learning also appears to be incorrect. Although it is true that adults talk to other adults in language that is often confused, incomplete, and grammatically ambiguous, evidence indicates that adults use a different kind of language with children. That is, adults tend to provide input to children that is relatively short, simple, and grammatically correct, but their input also adds a degree of complexity beyond the child’s current level in order to facilitate continued language learning. Do not forget, however, based on the evidence gathered so far, that we have not ruled out the nativists’ basic contention, which is that human beings are born with an innate capacity for language. What remains in the debate is to determine the relative importance of this innate capacity in comparison to the influence of environmental factors.

**Interactionist Interpretations**

The interactionist viewpoints of how language acquisition occurs in children span 30 years and offer varying degrees of support for the roles that biology and nature play in the acquisition process. We will present two views that fall into this general interactionist category.

**Semantic Cognitive View**

During what is known as the semantic revolution, theorists shifted their focus from the structure of language conveyed by grammar to the meaning that children convey through grammar as they learn about their world. Language is viewed in interactionist theories to be intrinsically related to the development of thought and our ability to use language in the construction of meaning. Those who take the semantics view argue that for a language to be truly generative, it must generate meaning as well as structure, and that meaning in language is expressed not only in words but also through the syntactic relationships among words. If we are to understand the acquisition of language, we must account for the expression of meaning.

**Case Grammar Theory**

One of the earliest and most often cited generative semantics theories was developed by Fillmore (1968). Fillmore’s case grammar is designed to explain the importance and influence of semantics on the form of language. Fillmore suggested that there is a deeper level of deep structure than that proposed by Chomsky. Beneath deep structure is a level composed of universal concepts that determine how nouns and verbs are related to one another. These are semantic concepts, not syntactic relations, and they are independent of surface structure. Even though these semantic concepts are universal, they are not necessarily innate. According
to generative semantics theorists, these concepts are either genetic or environmental phenomena (Chafe, 1970).

Fillmore suggests that sentences have two components: modality and proposition. **Modality** is concerned with sentence characteristics such as verb tense or the expression of negation or interrogation. The second component, proposition, is more critical to the semantic theory. **Proposition** is concerned with the relationship between nouns and verbs in sentences. The relationship between the noun and verb in a given sentence determines the meaning underlying that sentence. Each proposition represents a type of sentence that includes a verb in combination with a case or a set of nouns. In the context of this view of language, certain categories of verbs require certain cases. **Case** refers to a specific semantic role or function that can be filled by a particular type of noun phrase.

Fillmore identifies seven universal cases. An **agentive** case noun phrase is the initiator of an action and, as you would expect, is usually animate. A **dative** case is a person, animal, or other animate being that is affected by the action or by the state of being ascribed by the verb. An **experiencer** is a person, animal, or other animate being that experiences an action or a mental or emotional state. A **factitive** is an object or a being that is the product of an action or state ascribed by a verb. An **instrumental** is an inanimate object that is not the instigator of an action but the means by which the action occurs. A **locative** is the place or location where the action or state ascribed by the verb occurs. An **objective**, considered the most neutral of the cases, is a noun phrase whose role in the action or state ascribed by the verb is determined by the specific meaning of the verb. A summary of these cases with sample sentences is displayed in Table 2.2.

<table>
<thead>
<tr>
<th>Case</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agentive</td>
<td>The initiator of an action</td>
<td>Tom hid the present.</td>
</tr>
<tr>
<td>Dative</td>
<td>A being affected by the action or state of being ascribed by the verb</td>
<td>Sally gave <em>him</em> a generous tip.</td>
</tr>
<tr>
<td>Experiencer</td>
<td>A being who experiences an action or a mental or emotional state</td>
<td>Jerry enjoyed the concert.</td>
</tr>
<tr>
<td>Factitive</td>
<td>An object or being that is the product of an action or state ascribed by the verb</td>
<td>They built the <em>house</em>.</td>
</tr>
<tr>
<td>Instrumental</td>
<td>An inanimate object that is the means by which an action occurs</td>
<td>She made the fire with <em>charcoal</em>.</td>
</tr>
<tr>
<td>Locative</td>
<td>The place where the action or state ascribed by the verb occurs</td>
<td>He went camping in the <em>forest</em>.</td>
</tr>
<tr>
<td>Objective</td>
<td>A noun phrase whose role in the action or state ascribed by the verb is determined by the specific meaning of the verb</td>
<td>Dad kicked <em>the ball</em> to me.</td>
</tr>
</tbody>
</table>

Note that there are not exclusive sets of nouns for each case. A given noun may be used in any case if it meets the definition and requirements of that case. The word boy is agentive in the sentence “The boy broke the window.” It is dative in the sentence “The woman gave a generous tip to the boy.” It is experiencer in the sentence “The boy dreamed about owning his car,” and it is objective in the sentence “The homecoming queen kissed the embarrassed little boy.” In each case, the verb determines the case of the noun phrase, which means that structure can be explained on the basis of the semantic functions of nouns as determined by verbs. In short, structure is a product of semantic relations.

Chomsky and Fillmore share an important viewpoint relative to language production. Each believes that language production is a generative process and that any theory of language acquisition must account for how language is generated. The essential difference between Chomsky and Fillmore should be clear, however. Chomsky devised a theory to account for the generation of structure. Fillmore devised a theory to account for the generation of semantic relationships, which underlie and provide a foundation for structure.

Chomsky’s ideas about transformational generative grammar led many linguists during the late 1960s to analyze children’s emerging language from a syntactic point of view. Lois Bloom joined this movement. She discovered that syntactic analysis provided valuable information about the early utterances of children, but she also concluded that it did not provide adequate information about the meaning system underlying early language production. Based on her experiences in analyzing the meanings of early utterances using contextual information, Bloom (1970) asserted that transformational generative grammar is more useful in explaining children’s language if the analysis includes semantic information that can be used to help analysts draw conclusions about underlying structure. This shift from syntactic analysis to semantic analysis was the beginning of what has been called the semantic revolution, a point of view about children’s language that suggests that we should study the structure of early language within the context of the speaker’s intended message. This context must necessarily take into account linguistic and nonlinguistic information because the communications of children are not words, only events. This kind of analysis is described as a richer form of analysis than the transformational generative analysis precisely because it goes beyond the speaker’s words to take into account environmental and other nonverbal factors that contribute to the total message.

Other linguists, including Schlesinger (1971) and Brown (1973), reached essentially the same conclusions as Bloom about the importance of semantics in the analysis of early language. Schlesinger went a step further when he concluded that the grammar of early language is semantic, not syntactic, and that early productions are best understood in terms of the semantic relationships expressed in these productions rather than in terms of abstract syntactic categories such as subject, verb, and object.

**Piaget’s Cognitive Theory**

At about the same time that the semantic revolution was underway, there was renewed interest in Piaget’s cognitive theory and its relationship to language acquisition. Theorists considered specific connections between Piaget’s stages of cognitive development and stages of speech and language development, with special emphasis
on Piaget’s sensorimotor period. This stage of cognitive development extends from birth through 2 years, the period of time that, not coincidentally, is critical for early speech and language development. In other words, it is easy to understand why linguists would be intrigued by possible, and highly plausible, connections between cognitive development and language acquisition. We will discuss this theory in depth in Chapter 3.

It should be noted that all theorists accept that a relationship exists between cognitive development and language development. What separates cognitive theorists from others is their belief that language does not hold an absolutely unique position in overall development. They believe that language itself is not innate, even though the cognitive precursors for language are innate. They also believe that language is not learned as behaviorists suggest it is learned. Language emerges, in the cognitive view, not because children are specifically genetically predisposed to produce language and not because language is shaped by learning principles. Language emerges as a product of cognitive organization and development. Language is one of several abilities the child develops for the purpose of conceptual representation and manipulation. All of these abilities emerge as a consequence of cognitive maturation. They emerge when there is an imbalance between the child’s existing cognitive structures and new information he is receiving from his environment. These theorists agree that the child’s cognitive abilities differ from the adult’s in terms of how much information is processed and how effectively it is processed. But no matter where a person is in cognitive development, he adds new information to existing cognitive categories or, if the new information does not fit, he extends, combines, or creates new categories. The process of language acquisition, according to this view, is not separate from but related to cognitive development; it is one part of, and fully integrated into, cognitive development.

Cognitive theorists have noted a number of correlations between language use and other cognitive behaviors, correlations that may help us understand how language is acquired. There certainly seems to be a relationship, for example, between the child’s understanding that words represent people, places, things, and ideas and the cognitive behavior known as symbolic play. There seems to be a connection between understanding that language can be used to get things done and the cognitive behaviors involved in solving problems with tools. Imitation is an important behavior in overall cognitive development, and imitation is clearly an important behavior in speech and language acquisition.

**Information Processing Theory/Competition Model**

To appreciate the information processing theory, one must first understand how it relates to other theoretical perspectives and how these other perspectives relate to one another. To review briefly where we have been so far, the reader should understand that the behaviorist view stresses language function. Linguistic views, best represented by Chomsky’s transformational generative grammar, emphasizes language structure. The cognitivist view stresses logical structure. Into this context, we bring the information processing theory. This theory shares with the behaviorist perspective a greater emphasis on how language is learned than on the abstract rule
system that presumably underlies language, but it goes a step further by making a concerted effort to relate structure and function.

The information processing view is represented well in the competition model developed by Bates and MacWhinney (1987). The basic assertion of this theoretical view is that function, not abstract grammar, generates language structure. This view suggests that a human being processes information in much the same way a computer does. That is, a human being has an information processing system that gathers information from the environment and puts that information into symbolic codes, codes that include but are not limited to words and numbers. This internal information processing system interprets these symbolic codes, holds them in memory, and allows for the retrieval of stored information. Language acquisition occurs when a child experiences and gathers language evidence in the productions of her speech and language models and uses that evidence to make fundamental changes within her personal information processing system. The system is constantly adjusted to make its functions consistent with the language evidence the child is gathering.

According to this view, children are not born with an internally wired system for language. Rather, they are born with a potential for all kinds of connections between symbols and the things and ideas symbols can represent. Based on their experiences, some connections are firmly established because they are repeated over and over again. Other possible connections eventually fade away because children do not experience the evidence to activate them. Children internalize language and the connections between language symbols and the things and ideas they represent because there is a constant inpouring of language evidence.

The information processing theory suggests that the processing patterns responsible for the acquisition of language are parallel rather than serial. Parallel patterns occur at many levels at the same time. By contrast, serial patterns, which are suggested by Chomsky’s linguistic view, occur in a kind of vertical sequence. That is, deep structures are generated and are then transformed in a highly predictable sequence into surface structures. Information processing theory suggests that the order in which language forms are acquired is determined by what these forms accomplish. Those language forms that show up most often in a child’s language models and that tend to serve the same purpose are acquired first. If, for example, a child’s earliest language evidence is filled with examples of structures that make requests, language structures that fill the requesting function will emerge early.

Those who take the information processing view try to explain what occurs in children’s minds when they acquire language. They suggest, as already mentioned, that the child processes language information at a number of levels at the same time, a form of processing known as parallel distributed processing (PDP). The competition model of Bates and MacWhinney (1987) is an example of a PDP system. A basic premise of this model is that children are not born with an innate understanding of language but with a powerful PDP device that has the capacity to process many different forms of information, including language information. In the earliest stages of language development, the PDP device does not differentiate among words, phonological patterns, and language forms in terms of their ability to represent communicative functions or meanings. This situation changes, however, as children’s experiences with language increase and become more differentiated. Words,
phonological patterns, and language forms that are experienced repeatedly activate and strengthen connections in the PDP device. Other connections weaken. As the name of the model suggests, the patterns or connections that are most consistent with the language evidence the child is gathering win the competition. They are retained within the child’s communication system. Patterns that do not match the evidence lose the competition and are discarded.

So, is the information processing view (and therefore the competition model) a nature or a nurture view of language acquisition? You have probably already surmised, correctly so, that this view includes elements of both extremes. Bates, Bretherton, and Snyder (1988) suggest that children are innately predisposed to acquire language, just as they are innately predisposed to acquire other behaviors. In this sense, they believe that there is a biological, or innate, basis for language acquisition, though they do not believe that it necessarily accounts for language universals. In terms of nurture, they assert that each child uses biologically based abilities to learn language creatively. They point out, for example, that there are significant individual variations in language acquisition among children within the same culture as well as across cultures. Within the context of the competition model, these differences are the result of varying experiences resulting in differentiated connections within the PDP system.

Social Interactionist View

The evolution in theoretical interpretations relative to language acquisition eventually led theorists to explore a middle ground. This is what usually happens in nature-versus-nurture arguments, so the emergence of a compromise view was probably inevitable, although it has emerged later than some might have expected. This middle-ground view is known as social interactionism.

According to the social interactionist interpretation of speech and language development, both biological and environmental factors are important in the acquisition process, although not necessarily equally. Some interactionist theorists are closer to the nature end of the continuum in that they understand language development as a product of general cognitive development (Bates & MacWhinney, 1982). Others place more emphasis on the contributions of the environment, but all agree that the interaction of biological abilities with environmental influences accounts for language acquisition, and they note the importance of children’s interaction with their parents or other caregivers. This basic assumption about the importance of both biology and environment has led to other basic interactionist assumptions about language development.

For example, these theories assume that language acquisition is a product of children’s early social interactions with the important people in their life. In fact, Jerome Bruner (1983) proposed that a language acquisition support structure (LASS) is necessary for children to learn language as a result of interactions with others. Proponents of this viewpoint believe that children communicate and interact socially with other people before they are able to produce language forms. They believe that language develops as a natural consequence of these interactions. That is, children’s attempts to communicate and socialize prompt their parents and other caregivers to provide the language appropriate for these exchanges. Lev Vygotsky (1962) describes the zone
Language development is facilitated by social interaction.

of proximal development (ZPD) as the opportunities that family and others have to provide the help children need to make steady progress in their development. As children develop language, their communicative and social skills increase, allowing more mature and sophisticated interactions. These more mature interactions prompt more complex language forms from the parents, and the cycle continues until children's language system and corresponding social skills reach adult levels.

James (1990) provides an excellent example of this progression. She suggests that a 9-month-old child requests a cookie by reaching for it and vocalizing with an utterance such as “Uh, uh, uh” while making eye contact with her mother. The mother, recognizing the communicative intent, might provide a language form as she gives the child a cookie: “Do you want a cookie? Say, ‘Cookie . . . cookie.’ ” By the time the child is 2 years old, she might make the same request by saying, “Mommy, want cookie,” an utterance met with a cookie and an expanded language form modeled by the mother: “Say, ‘Mommy, I want a cookie.’ ” By the time the child is 4, she will have learned, on the basis of her social and communication experiences, to ask for the cookie by hinting. She might say, “You know, Mommy, I haven’t had a cookie for a long time.” Notice what happens in this progression. The child is able to make a request from the beginning, before she has any language, and she certainly is able to interact with other people before she can speak. As she acquires language, however, her communicative and interactive abilities improve, and she is able to make her request known in more socially appropriate, more adultlike ways.

James’s (1990) example illustrates another emphasis in the interactionist perspective. Unlike the nativists, who stress structure independent of communicative function or intent, interactionists focus on language use known as pragmatics. The intent to communicate leads the child to interact with people who can respond to his intent.
The intent shapes his initial attempts to communicate, no matter how crude or unsophisticated these attempts may be. The recognition of the child’s intent and associated communicative attempt prompts the caregiver not only to meet the intent but to provide an appropriate language model to support the intent. It may be that the model is given only to provide the child an opportunity to confirm or deny the intent, but the model is provided nonetheless. Over time, even though a given intent remains constant, the child acquires more sophisticated language forms by which he can make the intent more immediately and clearly known to his caregivers.

Interactionists, like behaviorists, emphasize the importance of parents or caregivers in the language acquisition process. Behaviorists, however, view children as passive recipients of language shaped by selective reinforcement. Interactionists believe children are active participants in language acquisition by virtue of their bidirectional involvement with their parents. That is, children initiate communicative and social efforts, perhaps as often as they receive them.

In comparison to the nativists, the interactionists concede that children come to the language acquisition process with innate cognitive and linguistic abilities, but they do not believe these innate abilities are of greatest importance in language development. Children’s interactions, socially and communicatively, with the important people in their environments are the most important factors in the acquisition of language.

Interactionists do not ignore structure or grammar in their understanding of language development. In fact, like the nativists, they try to discover common forms of structure in a variety of languages and cultures (DePaulo & Bonvillian, 1978). They believe, however, that these forms are fairly simple imitations of models to which children are exposed in social interactions (Moerk, 1975, 1983). It can be concluded, therefore, that although interactionists look for and try to explain structure, they are not as focused on structure as nativists. Because their emphasis, as already noted, is on the function of language within social interactive contexts, they are concerned with how structure contributes to the use of language in getting things done.

Whereas nativists see structure or grammar as almost an end unto itself, interactionists view structure as a means to the end of accomplishing intent. This has led them to study language structure within the child–parent or child–caregiver interaction. In the beginning, these studies focused on the language forms of the caregiver (James, 1990), but more recent studies have examined the child’s role and responses in these exchanges.

James (1990) notes that studies of caregivers’ speech have revealed that the language forms adults use with young children are very different from the forms they use with other adults or even older children. According to James’s review of the relevant research, when caregivers talk to young children, they do the following:

1. Use short, simple sentences.
2. Talk about objects that the child is attending to or actions being engaged in.
3. Repeat their own utterances.
4. Repeat the child’s utterances.
5. Use a slightly higher pitch and an exaggerated intonation pattern.
6. Introduce significant pauses between utterances.
7. Use a lot of questions and commands. (p. 179)
This style of speech has been given several names, but perhaps the most popular and descriptive is motherese. It should be noted, of course, that this general style is used by all adults when they talk to young children, although there may be some gender differences. Ratner (1988) has found, for example, that although mothers and fathers use the same vocabulary in talking with young children, fathers are more likely than mothers to include the less commonly used words in that vocabulary.

Although no empirical data confirm the efficacy of any of the elements of motherese in facilitating language development, interactionists believe that motherese is ideally designed to help children acquire language. It can be argued that repetition, for example, provides multiple models and, depending on the nature of the communicative exchange, several opportunities for the child to practice a particular language form. The use of short, simple sentences seems to provide the child with models he can reasonably expect to imitate. The use of pauses may help him recognize where utterances begin and end. The use of emphatic prosodic patterns might direct the child to those words or structures that are most important. Talking about what is present and readily observable helps keep the communicative process concrete, which in turn probably helps hold the child’s attention. The use of questions and commands seems to have the effect of keeping the child active in the communicative process.

On the basis of some research (Barnes, Gutfreund, Satterly, & Wells, 1983; Cross, 1978), one facet of motherese that seems to be related to language acquisition is the use of a technique known as expansion. Expansion occurs when the adult repeats what a child has said but adds additional words and/or structure (see Figure 2.2).

Imagine a toddler walking through a zoo with her mother. She is seeing animals she has never seen before, and she is very curious about these new and different creatures. Imagine the rate, pitch, and intonational patterns of the child’s speech as well as the mother’s speech. In the following exchange, notice some of the typical characteristics of motherese: a topic selected by the child’s attention; short, simple sentences; repetition of key elements of the child’s utterances; the use of questions to prompt additional responses; and expansion of the child’s utterances into more complete, adultlike productions.

Child (pointing to a monkey): Mommy, what’s that?
Mother: That’s a monkey. Can you say monkey?
Child: Monkey!
Mother: Yes, monkey. What’s the monkey doing?
Child: Him eating.
Mother: What’s he eating?
Child: Him eating banana.
Mother: Do you eat bananas?
Child: I like bananas!
Mother: The monkey likes bananas, too. . . . What’s he doing now?
Child: Him swinging by his tail.
Mother: Can you swing by your tail?
Child: No, I don’t gots a tail.
Mother: No, you don’t have a tail like the monkey.

FIGURE 2.2 Motherese in Action
For example, the child might point to a passing vehicle and say, “Truck!” The parent might respond with “That’s a fire truck.” Parents and other caregivers frequently use expansions when they talk to young children, and they seem to do it naturally, without instruction. Because expansions are more frequently used by the caregivers of linguistically advanced children, and because the use of this technique seems to be associated with an increase in the mean length of children’s utterances, it is reasonable to conclude that expansion probably facilitates language development. It is important, however, not to take the conclusion too far. There is, as yet, no evidence suggesting that this technique is essential for normal language development.

Remember that the interactionist view emphasizes the importance of the interaction between the child and her caregiver(s). What is known about the nature of this interaction, especially as it might be related to communication and language development? First, many adults treat the child as a communicator from the time she is born and begins to cry. That is, when the infant cries, her caregivers try to figure out why. They want to know what she is communicating. Her caregivers also try to understand what the infant’s cooing and babbling sounds mean and even what her facial grimaces and body movements mean. Even though the infant’s vocalizations, grimaces, and body movements may be random and accidental, her caregivers assume that they have meaning and respond as though they are intentional communications. This is a bidirectional communicative exchange in which the child is treated as an active participant.

As the child grows older, the interactions become a little more elaborate. Many parents, for example, read aloud to their children long before the children are producing language. Why do parents read to speechless children? They may assume that their children are receiving something of linguistic value in the exercise even if they cannot express anything in language form. They may assume that the interaction itself is valuable because it is establishing a bond that will facilitate more meaningful learning when their children are old enough to talk. Parents and other caregivers also play speech-related social games, such as peekaboo, with children. This kind of routine is highly structured, allows the child to participate by predicting what is going to happen (Bruner, 1978), and is a simple but comfortable communication activity. It is, after all, a game. It is nonthreatening and fun, but it provides children with an opportunity to experience all aspects of oral and nonverbal communication, and it gives them a chance to experiment with some of the components of language they are acquiring.

When a young child interacts with a caregiver, his nonverbal communications contribute to the fun and pleasure of the activity, but his nonverbal signals may also be helpful to the caregiver. When the adult uses a language form that the child cannot understand because it contains unfamiliar words or because it is too long or syntactically complex, the child will very likely send some kind of signal, perhaps verbal, but more often nonverbal, to indicate that he is confused and needs help. He might simply look puzzled, or he might shrug his shoulders. When the adult receives this kind of signal, he offers another utterance, which he adjusts toward what he believes is necessary to facilitate the child’s understanding. In this way, the verbal and nonverbal interaction allows the adult to simplify and reformulate language forms in ways that certainly facilitate improved communication and may facilitate language development.
Once again, be careful not to read too much into what is happening in these interactions. If, as has been suggested, adults adjust their language to facilitate child–adult communication, it is probably not because adults are making conscious efforts to “teach” their children how to talk. Keep in mind that when adults talk to other adults and an obvious failure to communicate occurs, the listener lets the speaker know that the message has not been received, and the speaker tries again by creating a new version of the original message that is more carefully crafted in terms of vocabulary and/or structure. When adults talk to children, they make exactly the same kinds of adjustments, and, interestingly, when children talk to adults, they sometimes have to adjust in ways that help the adults understand. Are these adjustments essential in helping children acquire language? As tempting as it may be to let common sense answer yes, there is no data to draw that conclusion.

**Speech Act Theory: A Focus on Pragmatics**

The semantic revolution that was a reaction to Chomsky’s narrow emphasis on structure eventually led to a focus on **pragmatics**, the study of the functions served by communication. Researchers became concerned with how the context of language influences meaning and how language serves different functions for speakers under varying circumstances. The pragmatics revolution of the 1980s and 1990s had its origins many years earlier in work completed by Austin (1962) and Searle (1969). Austin’s primary assertion was that when speakers produce utterances, they are doing more than saying words organized by conventional language rules. They are also using these words to get things done. Searle, a student of Austin’s, suggested that every speech act consists of three separate acts: (1) the locutionary act, (2) the illocutionary act, and (3) the perlocutionary act.

The **locutionary act** is the most obvious part of the utterance because it is the part that strikes our ears. It is the expression of the words. If you say to a friend, “You’ve lost some weight,” the locutionary act is limited to the utterance itself. It is the sentence the speaker speaks and the hearer hears. The locutionary act, because it is a sentence, consists of a subject, or referring expression, and a predicate, or predicating expression. Beyond the words, however, consider the possible reasons for your making this observation, and you will get some sense that there may be more to your utterance than meets the listener’s ears.

The **illocutionary act**, or **illocutionary force** (Searle, 1976), is concerned with the motive or purpose underlying an utterance. When someone says, “I know what you said, but I want to know what you meant,” she is asking the speaker to identify his illocutionary act. Using the earlier example above, if you say to a friend, “You’ve lost some weight,” you could be telling him that he looks good, but you could also be saying that he looks sickly. Your motive might be even more contrived. You might believe that your friend should be losing a lot of weight, and you hope that saying that you have noticed some weight loss will motivate him to lose more. Consider the purpose that might be served by what Searle (1975) calls an indirect speech act. If a woman says, “It’s a little drafty in here,” it is not likely that she is simply making an observation about the wind currents and the temperature level in the room. It is more likely that her comment is an indirect way of saying, “Close the window!”
Chapter 2

The **perlocutionary act** takes the listener into account. It is concerned with the effect the locutionary act might have on the listener, an effect that may or may not be consistent with the speaker’s communicative intention. If you intend to compliment your friend by saying, “You’ve lost some weight,” but your friend knows that he has, in fact, gained a few pounds, he might be offended by the comment, believing you are being sarcastic. Communication works best, of course, when the listener’s reactions match the speaker’s intentions in terms of communicative content (locutionary act) and purpose (illocutionary act). When this happens, the speaker and listener agree that they are “on the same page,” communicatively speaking. When they are not on the same page, communication can be very frustrating. The speaker may be frustrated because he knows what he is trying to say, but no matter how he tries to say it, the listener does not seem to get it. The listener may be frustrated by a sense of communicative paranoia that may or not be justified. The disconnection between speaker and listener, relative to communicative purpose, is not pleasant for either party, and it causes the process of communication to break down.

**Emergentist Perspective: A New View**

Where does the evolution in theories of language acquisition stand in the 21st century? It would be inaccurate to say that the experts have reached a consensus about how children acquire language, but it would also be erroneous to conclude that we have not made progress in our considerations. Some are still convinced that language is a uniquely human and innate ability that only needs an environmental trigger to emerge, almost magically, according to a biologically predetermined schedule. Some still believe that language is almost entirely the product of environmental influences and that human children do not “develop” language as much as they “receive” language from their caregivers by virtue of their selective reinforcement and shaping of their initially random language-like behaviors. There seems to be growing support, however, for the middle ground in this nature-versus-nurture argument. As suggested in the opening of this chapter, this kind of compromise was almost inevitable. The interactionist perspective, therefore, is likely to have an increasingly greater voice in how theorists describe language acquisition and in formulating the questions researchers will attempt to answer about human language and its development.

Chapters 3 to 5, tracing the development of language from the preparation stage through late childhood, are written primarily from the interactionist point of view, with references to other explanations where appropriate. For people who are just beginning to explore language and its development in children, it is particularly important to take the broadest possible view. Humans are complex beings who do not live in vacuums and certainly do not grow up in vacuums. To a large extent children are shaped by their environment, especially by parents and other significant caregivers. At the same time, do not lose sight of the enormous power of genetic talent. Who does not marvel at world-class musicians and athletes? These people have worked hard to develop their considerable skills, but without the right genetic stuff a woman cannot high-jump 7 feet, no matter how much she practices, and without the appropriate genetic gift, a pianist will never do justice to great music, no matter how
many hours he spends at the keyboard. Language, like many other human abilities, is acquired by as a genetic gift shaped by environmental forces. Which is the greater factor, heredity or environment? Let’s not go there!

Web Sites to Explore

Theories of Language Development
http://languagedevelopment.tripod.com/id15.html
http://www.literacytrust.org.uk/talktoyourbaby/theories.html

Review Questions

1. How did the discovery of mirror neurons in primates and humans change the way we consider human language learning?
2. What advantages do brain plasticity and a self-organizing neural network have for children learning language?
3. What special talents do you have? From which member(s) of your family did you get a particular talent? From whom did you inherit your strong verbal abilities?
4. Consider your own environment during your first 3 years of life. What language(s) were you exposed to, and how much do you think your caregivers talked with you? What are some clues you can use to discover this?
5. What is the general nature-versus-nurture argument, and how does it apply to language development?
6. Summarize the behaviorist interpretation of speech and language development.
7. What do behaviorists mean when they describe language as a doing or performing phenomenon as opposed to a knowing phenomenon?
8. How can classical conditioning principles be used to explain the acquisition of meaning in language?
9. What have we learned about language development from experimental attempts to teach chimpanzees to use language?
10. What is the language acquisition device (LAD), and what is its role in language development, according to the nativist interpretation?
11. In transformational generative grammar, what is the difference between surface structure and deep structure?
12. Identify the four levels of representation at which universal grammar operates, and briefly explain what each level contributes to language production.
13. In the context of Fillmore’s case grammar, what is meant by modality and proposition?
14. Briefly define and provide an example for each of Fillmore’s seven universal cases.
15. What is the essence of the cognitive interpretation of language development?
16. What is meant by parallel distributed processing (PDP), and how does a model based on PDP, such as the competition model, explain language acquisition?
17. Compare and contrast the LAD and the PDP.
18. What are the three parts of the speech act, according to Searle, and what does each part contribute to the whole speech act?
19. How does the social interactionist interpretation fill the gap between the nativist interpretation at one end of the nature-versus-nurture continuum and the behaviorist interpretation at the other end of the continuum?

20. Based on your understanding of the twists and turns in the evolution of theories regarding language development over the past 50 years, what kinds of theoretical interpretations do you think language experts will be considering 50 years from now?

References and Suggested Readings


Language Acquisition: A Theoretical Journey


Moerk, E. (1989). The LAD was a lady and the tasks were ill-defined. Developmental Review, 9, 21–57.


Chapter 2


What is the role of intellectual development in language development? This is one of the most interesting and challenging questions to be addressed in a study of human communication development. Because language is a means by which people express what they are thinking, the relationship between cognition and language is certainly connected, but the precise relationship has been the subject of debate throughout the ages.

This chapter focuses on varying views of the relationship between cognition and language. We will explore some theoretical positions on this topic, considering how different accounts explain early intellectual development, with special attention to the implications relative to child language development. We will also consider the perceptual basis that underlies early cognitive and language development, as well as the mental processes that contribute to thinking, knowing, and using language. This chapter is designed to facilitate understanding of the following topics:

- Multiple ways of thinking and knowing, as reflected in Howard Gardner’s theory of multiple intelligences
Chapter 2 examined a number of theories of language development that can be arranged along a continuum representing the possible influences of nurture and nature on the language acquisition process. The basic question that has driven the developers of these theories can be framed as follows: “Is language genetically or environmentally determined?” The answer, as you discovered, is not to be found at either extreme, but the question provides an appropriate segue into this chapter.

Are you ready for another question about language for which there is no answer or, more accurately, no easy answer? Well, ready or not, here it is.

How do language and cognition relate to one another? Unfortunately, we don’t remember ourselves as infants and toddlers. In fact, this lack of consciousness about our early years tells us quite a bit about our limitations during that time regarding both language and cognition. How did we think about things then, and how is our thinking different now? What was the driving force that enabled us to learn language, and how did language development assist us in our thinking? The important point of these questions is that for many thought processes, it is not possible to separate thinking and language. As you read the words on this page, you are processing language to interpret your thoughts, and as you consider what we mean, you are manipulating your thoughts in some kind of language form. You might not use complete and grammatical sentences in your inner language, but they are in language form.

At the same time, human beings can and do think in ways that do not involve language. When Beethoven wrote his music, he thought in terms of music. When artists paint, they think in colors, forms, and visual messages. Football coaches design plays by thinking about arrangements of Xs and Os, and mathematicians think in numbers and formulas. Although we are able to use words to describe our emotions, images, sounds, and smells, words often fail to do them justice. A contemporary theorist, Howard Gardner, recognized our ability to know about and interact with our world and proposed that humans have several types of intelligence. Gardner’s theory of multiple intelligences (1983) has significantly influenced educational practices by recognizing that children learn differently and through many avenues.
The seven types of intelligence that he initially described have expanded to eight, and two additional types are sometimes included (spiritual-existential and moral) as Gardner, other researchers, and educators continue to explore ways of thinking and knowing. Table 3.1 is a summary of each of the eight intelligences. You can obtain full descriptions and explore your own strengths in ways of knowing on a variety of Web sites provided at the end of this chapter. As you review the descriptions, consider the numerous ways in which children must interact with their environment. Such variability in how children approach learning provides a compelling explanation of the great diversity across people.

As the eight types of intelligence show, language is only one of many ways that humans interact with the world, yet it is a very important aspect of thinking and knowing. In particular, language is necessary in our interactions with others, a critical aspect of learning and being a social member of our communities.

To facilitate an understanding of the critical relationship between cognition and language, we will examine some theories of cognitive development. We will consider research evidence that supports each view, scholarly ponderings that these theories have generated, and what each theory suggests about the role of language and cognition in development.

**Piaget’s Theory of Cognitive Development**

Jean Piaget is well known in the United States as a child psychologist, but his field of study was genetic epistemology, the study of how knowledge is acquired. Thus, his work led him into both education and psychology. Piaget’s original passion was
Cognitive Development: Building a Foundation for Language

biology, a passion born and cultivated at a young age. By the time he was 10 years old, he had already published an article describing a partly albino sparrow. This intellectually gifted boy earned his bachelor’s degree at age 18 and his doctorate at 21, by which time he had already published 25 professional papers. Piaget’s early studies of mullusks caused him to believe that development was not just the product of biological maturation guided by genetics but was also affected by environmental factors. During his professional career, this conclusion led him to understand that cognitive development is also the result of both nature and nurture components.

The Elements and Processes of Cognitive Organization

It is important to remember what Piaget learned from his work as a biologist. He came to understand that many actions of living creatures are adaptations to their environments and that these actions help creatures organize their environments (Wadsworth, 1971). He applied this understanding in explaining children’s cognitive development by assuming that cognitive acts organize children’s environments and are the result of children’s adaptations to their environments. How does adaptation occur, according to this theory? We will use an example of George and his computer to introduce and explain several concepts involved in this process. Table 3.2 provides an overview of these concepts.

George is a businessman who uses his computer to create, organize, store, and retrieve his business reports, letters, appointments, budget, addresses, and so forth. In order to put his information in a certain place where he can find it, he must use a schema (a category) or computer file for each category. Thus, when George needs to process new information, such as adding to his budget, he must open the budget file, enter the new information, and save that file. He will not be successful in his work on the budget if he cannot find his file or if he opens another file, such as his letter file. In much the same way, we use our schema to process, identify, store, and retrieve information in our brains. When we encounter new information, we must locate and use our existing schemata to be able to relate effectively to the new information at hand. This process of using existing schemata to include new information is called assimilation.

<table>
<thead>
<tr>
<th>Concept</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Schema</td>
<td>A cognitive structure that helps children process, identify, organize, and store information</td>
</tr>
<tr>
<td>Assimilation</td>
<td>A cognitive process whereby a new stimulus is fitted into an existing schema</td>
</tr>
<tr>
<td>Accommodation</td>
<td>A cognitive process whereby new schemata are created for information that does not fit existing schemata</td>
</tr>
<tr>
<td>Equilibrium</td>
<td>A cognitive process to maintain a balance between existing schemata (assimilation) and the creation of new schemata (accommodation)</td>
</tr>
</tbody>
</table>
What happens when some new information does not fit an existing schema? George is a prolific letter writer, so after a few years of producing and saving letters, his letter file becomes very large. Because he writes many different kinds of letters, his file becomes unmanageable and disorganized, with family letters, letters to friends, business correspondence, and love letters to his wife, Betty. Finally, George creates new files according to new schemata. When people develop new schemata to allow for the organization of information that does not fit existing schemata, we call this process accommodation. Thus, we change our organizational strategy as we learn new things that do not fit easily into our current cognitive structures.

It should be noted here that some schemata, even for the most intelligent adults, are never completely accurate. An adult, for example, who has little interest in football might have a schema for a football player that is incomplete. He may not understand the specialized responsibilities of the various players on offense and defense or the difference between a nose guard and a linebacker. The point is, we are all ignorant in our own ways, and our ignorance is reflected in how our schemata are shaped and cataloged through our experiences.

We are now ready to consider the final basic concept, equilibrium. Think of this concept as a balance between assimilation and accommodation. If a person assimilates all new stimuli he experiences, he will have relatively few schemata—and these schemata will be so broadly defined that he will be unable to recognize the commonalities among the things he is trying to categorize. George will have so many different types of letters that he will not be very efficient in finding and using specific types when needed. But if George accommodates all new stimuli, he will have a similar problem. There will be so many different categories on file that he will have difficulty recognizing their similarities. Thus, George needs a filing system that strikes a balance, being neither too broad nor too narrow.

How does this cognitive organization through schemata relate to how children learn language? Each time a child encounters a new stimulus, she either assimilates or accommodates, but she places the information somewhere. She might assimilate a new stimulus for a short time before she accommodates by creating a new schema more appropriate for that stimulus, but she does not leave her cognitive organization in disarray. It does not matter that her schemata are right or wrong in comparison with adult schemata. The child places stimuli according to her understanding of the world at any given moment in her intellectual development. In other words, she always finds her equilibrium.

Humans continually use assimilation and accommodation to accept new stimuli, reshape existing schemata, and create new schemata throughout their lives. It is fascinating to consider the ways in which we organize information and continue to reorganize it as needed.

**The Stage Concept of Cognitive Development**

Throughout our discussion of language acquisition, we will encounter stages and substages of development. It is important to remember that these stages are not like stair steps, in which moving from a lower step to the next higher step means leaving the lower step behind. In language development, what is acquired in one stage is
carried over and integrated into the next stage. The same is true in cognitive development. Piaget’s stages of intellectual development are not discrete. Each stage builds on the preceding stage so that development is a continuing process of qualitative changes in a person’s schemata. As children grow intellectually, they do not discard schemata. They accommodate by reshaping a schema and by creating new schemata, but schemata are not disposable any more than stages of development are passed through and forgotten. Intellectual growth is a cumulative, integrative, expanding process. As the child comes to understand that not all four-legged animals are dogs, she does not throw away her dog schema. She accommodates this schema to make it more dog-like, and she acquires new schemata to allow for other four-legged animals. She might for a time put horses, cows, donkeys, and zebras in her horse schema, but she eventually sorts out all the four-legged animals into adult-like schemata.

Piaget compares the progression through the stages of cognitive development to the building of a pyramid, which may be a helpful way to understand the progression from one stage to the next and the interdependence of the stages. Just as the structure of a pyramid is layered, each stage of cognitive development lays the foundation for the following stage, but what is acquired in each stage is not forgotten. The child’s schemata are corrected and refined, and he continually adds schemata. Cognitive development should be understood as an improving and adding process, like remodeling and adding on to an existing house as opposed to destroying it and building a new one.

Piaget (1963) described four stages of intellectual development from birth through late adolescence, briefly summarized here:

1. **Sensorimotor intelligence** (birth to 2 years). Most of the child’s behaviors during the sensorimotor intelligence stage are reflexive and motor. That is, he interacts with his environment in physical and mostly unlearned ways, especially early in the stage. He does not manipulate ideas in a conceptual sense, although cognitive development occurs in this stage and it occurs rapidly. The child at 2 is a very different creature intellectually from the child in infancy.

2. **Preoperational thought** (2 to 7 years). The most rapid period of language development occurs during the stage of preoperational thought. The child begins to think conceptually, is able to categorize things in his environment, and can solve physical problems.

3. **Concrete operations** (7 to 11 years). The child develops the ability to think logically in dealing with concrete or physical problems. He is able to place stimuli into categories based on order and levels.

4. **Formal operations** (11 to 15 years). Cognitive abilities become fully developed. The child is able to think abstractly, to solve problems mentally, and to develop and test mental hypotheses. He reasons and thinks logically.

Remember, these stages are not independent. They are cumulative and integrated into one another. The ages attached to these stages are not absolute. They simply represent the ages when most normal children are experiencing the cognitive developments indicated. One child might show signs of preoperational thought at 14 months, but another child 10 or 11 years old might still be demonstrating characteristics of preoperational thought, and both children could be normal. There is a great
deal of variability among children in terms of when and how quickly they pass through each stage, but, as Piaget insists, each child must pass through the stages in the order listed, and a child will not skip a stage.

With this overview of cognitive development in mind, we will now direct our collective attention to the first stage, sensorimotor intelligence. During this stage, according to Piaget, the child develops those intellectual abilities that lay the foundation for symbolic behaviors such as dreaming, drawing, and language. Within the larger context of symbolic behaviors, therefore, this stage of cognitive development prepares the child for the challenges and expressive opportunities inherent in speech and language development.

**The Principle of Distancing in Sensorimotor Development**

The primary focus of this chapter is on the intellectual and perceptual prerequisites experts assume are necessary for the development of early language. Note, however, that as important as these factors are to language development, the acquisition of language is an extraordinarily complex process that depends on factors other than cognition and perception. This complexity being established, we will consider how perception works with cognition in helping establish a foundation for language. To understand this relationship, we must go back one step further to sensory input.

A person receives stimuli through the senses: touch, taste, smell, hearing, and vision. **Perception** refers to the processes by which the person selects, organizes, integrates, and interprets sensory stimuli. It should be obvious, therefore, that the child must be able to receive and perceptually process sensory stimuli to put this information into manipulable thought forms. Later in this chapter, we consider some of the child’s earliest perceptual abilities, which appear to be related to his first attempts to communicate.

Before we can continue our explanation of the sensorimotor stage of cognitive development, however, we must identify and describe **distancing**, a basic perceptual principle affecting those cognitive changes that apparently precede and lay the foundation for language acquisition.

The infant relates to her environment in a very physical way. She grasps things with her hands and puts things into her mouth. In fact, parents often believe that everything goes into the infant’s mouth. The infant is trying to understand her world primarily through touch, taste, and smell.

Now consider how you relate to the world, especially to new stimuli. The first time you saw a laptop or iPod, you did not put these new things into your mouth. You looked at the laptop. You looked at and listened to the iPod. You used senses that placed you at a greater distance from these new stimuli than if you had explored them by touch, taste, or smell. One can reasonably assume that you would eventually touch these items, but, unless you are very strange, you probably would not taste or smell an iPod during your first encounter. One thing that happens during perceptual development, therefore, is that the child relates to stimuli from a greater and greater distance. Moerk (1977) believes that the child’s long-range visual and/or auditory images of new stimuli are the forerunners of representational meaning. That is, she first relates to an object by putting it into her mouth—immediate and
maximal contact. As she develops, she creates a kind of mental picture of the object based on what she sees. The visual image represents the real thing, and the child recognizes the real thing based on that image.

Consider what happens as distancing progresses. A toy truck represents a real truck. A block of wood might be used by the child to represent a toy truck, which represents a real truck. The child will then recognize a truck in a picture. Eventually, the word *truck* represents the real thing. In each progression, the distance between the child and contact with the actual object becomes greater. Language represents the ultimate perceptual distance, and consider the advantages gained in the use of language. Linguistic symbols allow the child to mentally manipulate objects more quickly and easily than the objects themselves can be physically manipulated, and the mental manipulation of symbols representing things, people, places, and ideas is unfettered by time or space. Distancing moves the child’s experiences with her environment from her hands and mouth to her brain. This is a short trip when measured in feet and inches, but when understood in the context of cognitive development, it is a journey spanning an intellectual universe.

**Concepts and Behaviors Central to Early Cognitive Development**

As we progress through the six substages of the sensorimotor phase of cognitive development, we will encounter three concepts (object permanence, causality, and means–ends) and three behaviors (imitation, play, and communication) that account for increasingly advanced intellectual functioning as they change. Consider these concepts and behaviors the principal players in the unfolding sensorimotor drama. Although the roles of these six characters in our cognitive drama change from scene to scene or substage to substage, these concepts and behaviors are the forces that together, in an interactive manner, shape the child’s intellectual growth during this rapidly evolving first stage of cognitive development. And now, before the curtain goes up, let’s meet the players.

A common bond shared by all six players in our drama is **representation**, the idea that a stimulus can stand for or represent something else. A stop sign itself does not prevent you from driving a car through an intersection, but the sign represents the law, which says that a person must stop before proceeding. The whistle of an approaching train will not destroy your car, but the distinctive sound of the whistle causes you to approach the railroad crossing cautiously because you know the whistle represents the train, which can destroy your car and you if you put yourself in its path. All day, every day, we are bombarded by stimuli representing ideas, people, things, and directions. An important and basic part of cognitive development is the evolutionary understanding of the concept of representation. Without this understanding, language is not possible because words are symbols that direct our thoughts to the things for which they stand.

The first player in our drama is a concept clearly related to representation, **object permanence**. It would not be accurate to say that the infant is unaware of objects, because even the youngest child will grasp or suck the things in his environment with which he has direct contact. When an object is removed, however, the infant pays no attention to its removal and does not look for it. When an object is out of sight, it is
The child’s first contacts with his world are physical and sensory. Literally out of mind. As cognitive development proceeds, the child understands that objects exist even when they are not being touched, tasted, smelled, seen, or heard. Only when the child understands that things are permanent can he represent them cognitively, perhaps first in mental pictures, but eventually in words. (See Table 3.3 for definitions of these concepts and behaviors.)

The next member of our cast is causality. In the beginning, the child has no concept of cause and effect. As she develops intellectually, she realizes that certain events cause other events, and she understands that she can produce behaviors that have predictable effects. According to Bates, Benigni, Bretherton, Camaioni, and Volterra (1979), the development of causality is a significant factor in the child’s social and communicative maturation. Communication is a process driven by intentions. We do things or say things to produce desired and predictable results. An early understanding of causality might be reflected in the child’s pushing a spoonful of

<table>
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<th>Concepts</th>
<th>Behaviors</th>
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<td>Object permanence—knowing that objects exist in time and space even if you can’t see or act on them</td>
<td>Imitation—duplication of models you hear and see</td>
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<tr>
<td>Causality—the understanding that events can cause other events</td>
<td>Play—child-directed activities that provide the child with opportunities for learning</td>
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<tr>
<td>Means–ends—a conceptual extension of causality; the understanding that there are ways (means) to attain a goal (end)</td>
<td>Communication—conceptual development contributes to the ever-increasing development of a child’s language ability</td>
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The child’s first contacts with his world are physical and sensory.
strained carrots out of her mouth with her tongue. As she develops language, she might simply say “No!” She uses a word to represent her intention to cause the carrots to not be delivered to her stomach.

**Means–ends** can be understood as a concept that extends causality. As this concept develops, the child learns to use the cause–effect concept to solve problems. The young infant’s first behaviors are random and unintentional. Perhaps she sees a cookie she would like to consume. She reaches out to grab it, but it is beyond her reach. Her mother sees the child reaching, figures out what she wants, and gives her the cookie. Although the child got what she wanted, she stretched out her arms not to communicate intent but to reach the cookie. As she becomes more cognitively sophisticated, she is able to establish goals and to figure out means by which to accomplish these goals or ends. She will eventually reach for an object she knows is beyond her reach because she is intentionally signaling by this gesture that she wants the targeted object. In terms of language development, means–ends is important because language is used to get things done. It becomes a means by which many ends are accomplished. The child must learn not only that language is a means–ends phenomenon but also that adjustments in language must be made depending on who the listener is and what kind of relationship the child has with the listener. If she wants a cookie from her younger brother, she might simply demand it. If she wants a cookie from her mother, she will likely ask for it—and say “Please!” In both cases, the end is thoughtfully targeted, and the means is carefully created to maximize the possibility of success.

The fourth principal player is **imitation**. Anyone who observes young children will quickly and comfortably conclude that imitation is an important factor in cognitive development and in language development. Most of what children learn, and much of what adults learn, appears to be the result of attending to models and trying to duplicate them.

The research data concerning the acquisition of communication skills support the conclusion that imitation is an important developmental factor (Moore & Meltzoff, 1978; Rees, 1975; Snyder, 1978). Recall our discussion of mirror neurons in Chapter 2 that may be the neurological mechanism underlying the ability of humans to imitate actions, pantomime through gestures, use conventional gestures to use signs, and produce speech. It is assumed that imitation facilitates children’s ability to internalize models of the behaviors of others, which they can then duplicate. Early imitations are crude, imprecise, and always immediate, but over the course of development, imitated behaviors become more accurate and sophisticated, and they occur in a delayed manner. **Delayed or deferred imitation** is important because it allows children to produce a desired behavior even when the model is not present. Without deferred imitation, language would not progress beyond the kind of parroted productions accomplished by talking birds. Even before children can imitate language forms, they imitate movements and gestures. Imitations of behaviors associated with objects seem to suggest some understanding of the objects themselves. For example, if the child, with or without a real comb in his hands, imitates a combing motion, we might reasonably assume that he knows something about the function of the comb. Bates and Snyder (1987) suggest that imitation is a primitive kind of labeling. That is, the child labels a comb by imitating, immediately or on a deferred basis, the action of combing. In the sensorimotor drama, imitation is a major player, as you will see.
Our next player is play itself. Many adults think of playing as a frivolous activity, but play is viewed by professionals concerned with child development as fairly serious business. Play is certainly a fun and entertaining activity, but it also provides children with many opportunities to learn about the things and people in their world, as well as concepts ranging from colors, numbers, and simple prepositions, such as in and on, to more complex things such as sharing and social interactions. As children grow older, language and other forms of communication become increasingly prominent and important components in play activities. Experts in cognitive and language development are especially interested in symbolic play, an activity in which one object represents another object. How many times, for example, have you watched children play for hours in a big box, pretending it was a house or a fort? A child might use a block as a truck. My* youngest daughter, when she was about 2 years old, used rubber bands as bracelets and often had 10 or 12 on her wrist at one time. All of these are examples of symbolic play. This kind of play has a rather obvious connection to language. In symbolic play, the child might use a stick to represent a nail-driving tool. In language, he can use the word hammer to refer to the same object. Both are representational activities. It is probably not a coincidence, then, that Bates, Bretherton, Snyder, Shore, and Volterra (1980) found that children who are able and willing to use objects to represent other objects progress more quickly in language development than children who are more rigid in their use of objects.

Sixth, communication is the leading character in our version of the sensorimotor drama, because speech and language are the focus of this book. The development of the concepts we have identified is reflected in the child’s increasingly sophisticated communication system, and few would argue with the conclusion that imitation and play are important in helping children acquire greater conceptual understandings and more advanced communicative skills by which to express their understandings. It is also reasonable to assume that, at some point, children use their communication abilities, especially language, to facilitate advances in their cognitive development. As we proceed through the substages of sensorimotor development, we will track changes in communication as well as changes in the other concepts and behaviors we have identified. For the sake of convenience and to allow for direct comparison of the substages, we discuss the players in the same order in each substage; however, keep in mind that the order signifies nothing about the importance of these players. The interactions among the players are more important than the individual players themselves. The further into cognitive development we proceed, the more inextricably connected the players become.

The cast is set. The curtain is rising. Let the play begin.

The Sensorimotor Period (Birth to 2 Years)

Scene 1—Substage 1 (Birth to 1 Month)

At birth and through the first three substages of the sensorimotor period, the infant is egocentric, which means that he sees and understands the world only as an extension of himself. Since he does not understand that he is only one thing among many other

*Lloyd Hulit.
things in the environment, he does not have the concept that others can make things happen; thus, he is not able to relate to causality or means–ends. The substage 1 infant is not capable of imitation, but he does produce behaviors that seem to be imitative. McCormick (1990) describes “vocal contagion” as the phenomenon in which, when one newborn begins to cry, other newborns in the same room are likely to cry too. Piaget believed that vocal contagion is not imitation, but rather the activation of an already established response to an external stimulus. Of course, at this early stage, the newborn infant does not play and the little communication that occurs is caregiver responsiveness to his cries and sounds of pleasure and contentment. Refer to Table 3.4 for a summary of the key attributes of sensorimotor substage 1 development across the six behaviors.

As dramas go, this has not been the most exciting opening scene one might imagine. What do we have here? We have a living organism with enormous cognitive and communicative potential, but he is just sitting on the stage crying, grasping, and sucking. He pays little attention to the audience and is constantly falling asleep. This drama builds in excitement, however, so hang in there. It gets better.

**Scene 2—Substage 2 (1 to 4 Months)**

During this substage, the child begins to show some awareness of objects, but the awareness is sensory rather than conceptual. She reacts to objects visually and auditorily, and, more significant, she is able to coordinate her visual and auditory contacts with objects. That is, when she hears a noise, she searches for the source with her eyes, and if the sound source moves within her field of vision, she follows its movement. Piaget (1954) reported that one of his daughters during this substage not only located objects visually but was also able to look away from an object and then locate it again. Whether a child reacts to this visual and auditory hide-and-seek activity with disappointment and expectation as Piaget suggested, it is reasonable to conclude that the child is developing an interest in objects and is using her senses to make and maintain contact with them.

Even though there is sensory interest in objects during this substage, the child still does not demonstrate an understanding that objects are separate from her. She makes few, if any, meaningful differentiations among objects and does not differentiate objects from herself, even when the objects move in and out of her sensory fields. In other words, she is still strongly egocentric. As was true in the first substage, there are no parts; therefore, there is no possibility for a demonstration of causality or means–ends behaviors.

Even though we see sensorimotor behaviors in this substage that we did not see earlier, such as visually locating and following a moving object or grasping and looking at an object, we should not conclude that these behaviors reflect intentionality. These are still essentially reflexive behaviors even though they can be modified by other people who cause objects to move or make noise. Piaget (1952) contended that “Even when the child grasps an object in order to look at it, one cannot infer that there is a conscious purpose” (p. 143). In this example, it might be tempting to think of looking as the end and the grasping as the means, but because grasping is a reflexive behavior, we cannot conclude that the sequence of behaviors
<table>
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<tr>
<th>Substage (and Months)</th>
<th>Object Permanence</th>
<th>Causality</th>
<th>Means–Ends</th>
<th>Imitation</th>
<th>Play</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (0 to 1)</td>
<td>Out of sight, out of mind</td>
<td>No concept of causality</td>
<td>No understanding of means–ends</td>
<td>None</td>
<td>None</td>
<td>No communicative intent</td>
</tr>
<tr>
<td>2 (1 to 4)</td>
<td>Uses senses to make and maintain contact with objects</td>
<td>No concept of causality</td>
<td>No understanding of means–ends</td>
<td>Preimitation; repeats her own behavior that has been imitated by someone else</td>
<td>Produces behaviors preliminary to play, including grasping and looking at objects</td>
<td>Cries, coos, and laughs</td>
</tr>
<tr>
<td>3 (4 to 8)</td>
<td>Watches object move and anticipates its future position; reaches for partially hidden object</td>
<td>Does not understand cause–effect, behaves as though she is the cause of all actions</td>
<td>Produces goal-oriented behaviors but only after activity has begun</td>
<td>Imitates only behaviors she has spontaneously produced at an earlier time</td>
<td>Still very sensory but begins to interact with other people</td>
<td>Babbles</td>
</tr>
<tr>
<td>4 (8 to 12)</td>
<td>Looks for an object if he sees it being hidden</td>
<td>Externalizes causality, knows other people and objects can cause activities</td>
<td>Evidence of planning and the production of intentional behaviors</td>
<td>Imitates behaviors he has not spontaneously produced</td>
<td>Uses developing concepts in his play activities</td>
<td>Links gestures and vocalizations to convey fairly specific messages</td>
</tr>
<tr>
<td>5 (12 to 18)</td>
<td>Follows sequential displacements to find hidden object</td>
<td>Sees other people and objects as agents for causality in new situations</td>
<td>Uses experimentation to solve problems</td>
<td>Uninhibited imitation to facilitate her own understanding</td>
<td>Play reflects cognitive growth; he figures out how to make toys work</td>
<td>Produces first meaningful words; communication is intentional but still heavily nonverbal</td>
</tr>
<tr>
<td>6 (18 to 24)</td>
<td>Fully developed concept of object permanence; can now accommodate invisible displacements</td>
<td>Causality enhanced by ability to represent objects and cause–effect relationships in his mind</td>
<td>Can mentally represent a goal and his plan for achieving the goal</td>
<td>Deferred imitation; imitates a behavior he has represented mentally and stored in his memory</td>
<td>Progresses from autosymbolic to symbolic play</td>
<td>Imitates and spontaneously produces multiple word utterances</td>
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from grasping to looking is intentional. It just happens, and the looking is part of the reflexive sequence.

We see the beginning of imitation in this substage, although it is a specialized kind of imitation. The child produces a behavior that someone, perhaps a parent, imitates. The child then repeats the behavior. What we have then is the child imitating a behavior that she produced, but only after someone else imitated her. Got it? These behaviors might be gestural but are usually vocal. In a common example, the child says, “Goo-goo.” The parent mimics the child, saying, “Goo-goo.” The child, terribly excited by this insightful communicative exchange, repeats her original production, “Goo-goo.” Piaget called this behavior “pre-imitation,” suggesting it is behavior that sets the stage for true imitation. McCormick (1990) calls the same behavior “mutual imitation,” which describes the nature of the exchange.

It would be a real stretch to call anything the child does in the second substage play, but she is engaging in sensorimotor behaviors that are preliminary to play. She is not only grasping objects but also holding them for brief periods of time and looking at them, and she is showing some interest in the sensory characteristics of objects. Even the primitive imitative responses we see in this substage are preparing the child for play activities seen in later substages. Early play activities involve very basic motor and sensory behaviors, and they often involve imitation, so the child is getting ready for play.

During the early weeks of this substage, most of the child’s communications are still in the form of reflexive cries, but as the substage progresses, the child cries less frequently and develops distinctly different types of cries. According to D’Odorico (1984), at about 4 months the child produces three differentiated cries to signal discomfort, to call, and to request. Noncrying vocalizations signaling pleasure develop during this substage. The child begins to coo, especially when interacting with someone else. These productions are described as vowel-like to indicate that there are no consonant approximations and to suggest that the sounds produced are not true vowels. They are random, undifferentiated productions of sounds with vowel characteristics. Toward the end of this substage, at about 4 months, the child is also laughing (Stark, 1979), a delightful development for child and parents. The child may not be receptive to political humor or satire at this point, but she does laugh. It is, in fact, often difficult to figure out what makes a 4-month-old child laugh, but if gentle pokes in the belly accompanied by funny faces and silly vocal noises make her laugh, parents will enjoy it! They have made communicative contact with their child about subjects other than hunger and soiled diapers. Refer back to Table 3.4 as a summary of key attainments in sensorimotor substage 2.

**Scene 3—Substage 3 (4 to 8 Months)**

The period between 4 and 8 months is an active time in the infant’s life. This is the time when sitting and crawling are attained, and the infant is highly aware of his surroundings. Infants love to explore objects during this time, but they are bound by the here and now and by objects that are in full or partial view. Thus, the child will follow a moving object, such as a dog running in the yard. He will watch his cookie fall to the floor, and he will reach for an object sticking out from under a blanket. However,
at this stage, an object out of sight is literally out of mind. The child will not search for objects that are outside of his visual realm. Flavell (1977, p. 43) calls this lack of object permanence the “essential limitation” of substage 3.

A wonderful attainment during substage 3 is causality. Children delight in repeating actions that capture their interest or cause pleasure. For example, a child might bang her spoon on her high chair tray simply because it feels good and she likes the noise. At this stage, the child lacks an understanding of the effects of her behavior. The idea that food is being flung far and wide is of no concern at all! It is also true that the child doesn’t recognize that others can cause sounds too. Her dad might ring a bell, which could be a very enjoyable game; thus, she pushes his face to cause the bell to ring again. She does not understand that her dad’s hand is the cause of the bell ringing. The child believes it is her actions that cause the bell to ring because she is, of course, the mistress of the universe.

The sophistication of means–ends in this stage matches the child’s understanding of causality, as we would reasonably expect. In the first two substages, we saw no evidence of intentionality. In the third substage, there is a limited but important progression in means–ends development. The child might pick up a new rattle, for example. In the course of examining the rattle, she shakes it and it makes a noise she finds interesting. She continues to shake the rattle. This can certainly be construed as intentional or goal-oriented behavior, but the goals in this substage are established only after the activity has begun (Wadsworth, 1971). Behavior based on a complete understanding of means–ends is initiated in an intentional manner after a goal has been identified and a strategy for reaching that goal has been developed. At this point, the child is engaging in intentional behaviors but is not yet a planner.

McCormick (1990) refers to substage 3 imitation as “systematic imitation.” The most significant progressions are that the child imitates a wider range of behaviors,
and she will imitate the behaviors of others. Most imitations are of sounds and physical actions, but the child will not imitate an action she herself has not performed spontaneously at an earlier time. She will imitate only complete sequences of behaviors, not isolated parts of a sequence. The child must be able to see herself perform the activity she is imitating, and if it involves sound, she must be able to hear herself. If we put these limitations together, they mean that the child will imitate making and releasing a fist if she has previously done this on her own. If, in releasing her fist, the child spontaneously spreads her fingers, she will spread her fingers when she imitates the fist-making/fist-releasing sequence, but she will not imitate only the spreading of her fingers. She will imitate fist making/fist releasing if she can watch herself, but she will not imitate this sequence of behaviors while holding her hand behind her back.

In the third substage, we see the child engaging in activities that more closely resemble play. The child is interacting with other people. Even though his imitations are limited to his repertoire of behaviors, he does respond to models of physical and vocal activity. He is finding toys more interesting and repeats actions on toys that may or may not be appropriate. That is, he might shake a rattle, but he might also bang it on the floor or on Mom’s forehead. He is still very much a sensory creature. He grasps toys, ears, nostrils, and dogs’ paws, and he still tries to put all objects, including the coffee table leg, into his mouth. The child is deriving pleasure from his play activities, and they provide him opportunities for developing concepts and elaborating behaviors important for later cognitive and communicative development.

Few dramatic changes in communication occur in this substage. The child continues to produce vowel-like utterances, but we do notice the emergence of consonant-like sounds. Keep in mind that the -like qualification affixed to vowel and consonant means that these productions are random and not meaningful, but they are sounds that have characteristics of true sounds. Toward the end of this substage, at about 6 to 8 months, the child begins to produce productions referred to as babbling. These are combinations of vowel- and consonant-like sounds, resulting in utterances such as “gagaga” or “mamama.” As you might imagine, parents often interpret these babbled productions as words, but until a production is used in a consistent, intentional, and meaningful manner, it cannot be considered a word. It will be a few months before the child produces true words, but she is laying the groundwork at this point by establishing control over the components of her speech mechanism (Sachs, 1989, p. 45). It would certainly be a mistake to assume that the child in substage 3 is not communicating. She is using her vocalizations and gestures to communicate many things, from “I’m not a very happy person right now because my diapers are wet—again” to “I would like very much to have that cookie in your hand, and if you don’t mind, I am going to grab it while distracting you with my devastating smile.”

Scene 4—Substage 4 (8 to 12 Months)

As the child moves into the last few months of his first year, he seems more curious about his world. Part of what adults might perceive as curiosity is the further development of the object permanence concept. In the first two substages, if an object was
out of sight, it was out of mind. In the third substage, the child would reach for an object if it was partially hidden but would not physically search for it if it was completely out of sight. In the fourth substage, the child shows evidence that he remembers objects. If a playful adult hides his favorite pacifier under a pillow, he will lift the pillow to find it. In addition to understanding that objects are permanent, the child demonstrates an understanding that the shape and size of objects are constant. (We will explore shape as an important attribute in learning words later in this chapter.) If a familiar object, such as his bottle, is given to him upside down, he knows that the business end has a nipple on it, and he will turn the bottle around. In other words, he knows the shape has not changed even when his perspective of the bottle is different. He will also recognize his bottle when viewed from a distance, even though the bottle appears smaller from 30 feet away than from 6 inches. The object concept is not yet fully developed, however. For example, the child will look for an object that has disappeared, but often only if he sees it disappear. Piaget (1954) observed that his daughter, Jacqueline, in the fourth substage, would search for hidden objects where they usually disappeared, not necessarily where she saw them disappear. The object concept is fairly complete by the end of this substage, but some gaps still exist, and we will not see a thorough understanding of object permanence until the sixth substage.

We encounter a child who is far less egocentric than in earlier substages. This shift from an egocentric view of the world is most noticeable in the child’s more sophisticated understanding of causality. In the third substage, the child had a limited understanding of causality but behaved as though she was the cause of all actions. She now externalizes causality. That is, she understands that other people and other objects can cause activities. Using the same example of bell ringing we employed in the preceding substage, we can create a very different scenario. Earlier, the child believed she was responsible for causing the bell to ring even though she did not touch the bell. Now when the child watches Dad pick up the bell and ring it, she will push Dad’s hand toward the bell to indicate that she wants him to ring it again. She understands that Dad caused the action.

In the third substage, the child showed evidence of a very elementary understanding of means–ends. She used goal-oriented behavior, but the goals were set only after behavior was in progress. In the fourth substage, the child plans behavior. She devises a means or strategy before initiating a behavior, and there is a clear connection between the strategy and the goal. Wadsworth (1971, p. 48) suggests that this behavior is one of “the first clear acts of intelligence” we observe in the developing child. Many of the child’s behaviors are now intentional, and they reflect thoughtful planning. In an earlier example related to object permanence, the child searched for her pacifier under a pillow. This same example demonstrates her more sophisticated means–ends understanding. The problem is a missing pacifier. The end is to find the pacifier. The means is to move the pillow. Eureka! There is the pacifier!

Imitation undergoes some interesting and significant changes in the fourth substage. The child now imitates behaviors he has not produced himself, although he is likely to imitate only actions or vocalizations similar to those he has produced on his own (McCormick, 1990). It is not necessary in this substage that he be able to see or hear himself while he is imitating. For example, if while holding the child on her lap,
the mother sticks out her tongue, he might imitate this behavior even though he cannot see his own protruding tongue. Owens (2001, p. 141) suggests that this kind of imitation requires some short-term motor memory, which has obvious relevance to the speech skills he will acquire in the near future.

It should be apparent by this point in our drama that play provides children with opportunities to use their developing concepts in activities that are pleasurable. More important, perhaps, it is through play that children discover new aspects of these concepts and demonstrate these new understandings to those who observe them. While playing with her toys, the child in the fourth substage will look for toys that are not in sight.

In the early months of the fourth substage, the child is still babbling. By the end of the substage, she may actually produce her first meaningful words. Whether or not there are true words during this time, it is evident that the child is communicating, vocally and gesturally, in an intentional manner. Even without speech, children in the latter months of this substage link gestures and vocalizations to convey fairly specific messages. Bates, Camaioni, and Volterra (1975) studied a girl in this substage who, on one occasion at least, vocalized “ha” to her mother while looking in the direction of the kitchen. When her mother carried her into the kitchen, the girl pointed at the sink, prompting her mother to give her a drink of water. The child did not use words, but she certainly communicated.

**Scene 5—Substage 5 (12 to 18 Months)**

The child is now capable of following sequential displacements. If Mom hides his pacifier under the pillow, he will look under the pillow. If Mom then hides it under his blanket, he will look under the blanket, and if Mom puts it in her shirt pocket, he will search for his pacifier in her pocket, undoubtedly ripping the shirt in the process. Why, then, is the concept not complete? Although the child can handle sequential displacements if he can see them, he cannot handle a displacement he cannot see. If, for example, Mom hides his pacifier under the pillow and while she has her hand under the pillow she slips the pacifier between the sofa cushions, the child will look for the pacifier under, over, and around the pillow but will not search between the sofa cushions. The object permanence concept becomes complete in the sixth and final substage when the child is finally able to move an object from its place in the restricted physical world to the mind, where it is represented abstractly and is free of all time and space limitations.

The change in causality in substage 5 is subtle but important. In the substage 4, the child was aware that people and things other than herself can be agents of cause, but she demonstrated this understanding only in relation to people, things, and actions with which she was familiar. In this substage, the child’s understanding of causality becomes more sophisticated in that she sees other people and objects as agents for causality in new situations. If, for example, the child is given a new toy unlike anything she has seen before, she might examine it carefully and, deciding that she does not know what to do with it, push it into an adult’s hand. She is seeking the adult’s assistance as an agent of causality. In essence, the child is saying, “Show me what this thing does!” In another example, we have a child who, when playing with
his mother’s lipstick, got the sticky red goo all over his fingers. He now approaches a fire hydrant painted the same bright red as the lipstick. He touches the hydrant and examines his fingers, expecting to see them colored red. In this example, the child is able to transfer his understanding of causality from one situation to another, and in the process learns that red does not always icky fingers make. In both examples, we see evidence that the child’s understanding of external causality has increased.

Means–ends in the fifth substage can be characterized as more creative or experimental in comparison to the fourth substage. The child is becoming a problem solver, and in the process of learning to solve problems, she experiments with objects and actions. The child, for example, has a toy workbench. She uses a play hammer to drive a large wooden peg through an opening in the bench. Banging the hammer is the means by which to reach the end, defined as making the peg move. She now picks up a banana. It weighs about the same as the hammer, and it has a convenient “handle,” so the child hits the peg with the banana. The banana breaks, and the peg does not move. This means did not accomplish the desired end because, as the child learned through trial and error, the banana is too soft. As her experimentation proceeds, she will learn that things other than the hammer can be used, like Dad’s shoe or Mom’s skillet, to drive the peg through the bench because, like the hammer, they are hard. As you might imagine, this experimentation business can be interesting and dangerous. Parents are well advised to observe their children carefully as they identify their goals and map their strategies for attaining them. A peanut butter sandwich might be approximately the same size as a DVD, but when pushed into the loading device of the DVD, the peanut butter sandwich has a markedly different effect than the disc. Yech!

My, look at the intricate detail in this thing.
The same willingness, perhaps eagerness, to experiment observed in means–ends experiences is observed in imitation. The child is an excellent and uninhibited imitator in this substage. The accuracy of his imitations is limited only by his motor abilities (Owens, 2001), but he will try almost anything. According to McCormick (1990), this child imitates to better understand his world and the things in it. He will imitate animal noises, for example, and will attempt to imitate even complex speech productions. When my† own children were in this substage, they modeled words such as encyclopedia, electroencephalographic, and diadochokinesis, which they gladly tried to imitate. Their productions of these words were not accurate, but they produced excellent imitations of words and actions that were within their motoric capabilities.

The child's play in this substage clearly reflects his cognitive advances. He thoroughly examines his toys and quickly figures out the operative pieces. If the toy is relatively simple to operate, he figures out how to make it work through trial and error. If there is a string, he pulls it. If there is a lever, he pushes it. If there is a dial, he turns it. If he cannot figure out what to do with the toy, as mentioned in the causality discussion, he hands it to someone else for consultation and demonstration. The child also combines toys in a functional manner. He might, for example, use his toy hammer to make a ball roll across the floor.

It is during this substage that we typically children producing their first meaningful words. These words are monosyllabic (e.g., go, no) or duplicated disyllabic forms (e.g., mama, wawa). There is no question that communication during this substage is intentional. For example, the child might say “bye-bye” to indicate that she wants to leave or wants someone else to leave. Toward the end of this substage, it is not uncommon for the child to say “nite-nite,” while shaking her head from side to side, to suggest that she has no intention of going to bed now, under any circumstances, not until Monday Night Football is over or until the popcorn is all gone, whichever occurs first. Communication continues to be heavily dependent on nonverbal messages conveyed by the voice, face, and gestures, but there is very little of importance, as defined by the child’s own needs and desires, that she cannot communicate.

As scene 5 closes, we leave the last of the truly sensorimotor substages. The child is now ready for an important transition. Through the first five substages, he has evolved from a creature tied completely to his physical world by his senses and his oral and manual manipulation of objects to a creature who has gradually distanced himself from direct contact with objects. In the fifth substage, we have seen a child who understands that he is only one of many people in the world. He understands that other people and other things are agents of cause. He is a curious creature who tests and expands his understanding of causality and means–ends by exploration and experimentation. He freely and happily interacts with other people by imitating their vocalizations and their actions, including behaviors totally unfamiliar to him, and he communicates with other people. He sends and receives messages nonverbally and, for the first time, verbally. This has been an exciting scene in our drama, the transitional scene that sets the stage for the final scene, substage 6, during which we will see the completion of the concepts and the elaboration of the behaviors we have been following in the first five scenes.

*Lloyd Hulit.
Scene 6—Substage 6 (18 to 24 Months)

The common denominator underlying all the significant changes in the sixth substage is representation. That is, the child’s understanding of her world moves from the sensorimotor level to a level in which she is able to represent objects internally and to manipulate these internal representations of reality to solve problems. She is becoming, in a word, a cognitive thinker instead of a touchy-feely experiencer.

The child now has a fully developed concept of object permanence. Not only can she follow sequential displacements, but she can accommodate invisible displacements. If Mom moves the pacifier out of sight under the pillow and then slides the pacifier between the sofa cushions, the child will first look under the pillow but, not finding it, will continue to look in and around the area where it disappeared until she finds it. She now has a mental image of the pacifier that is entirely free of her senses and her physical contacts with it. She knows that the pacifier and all objects are permanent, do not disappear just because they are out of sight, and do not change in size or shape just because they are viewed from different angles or distances. When the object is out of sight, it is now firmly in mind. It is, in reference to the common denominator of this substage, represented in her mind.

The child’s understanding of causality is also enhanced by this ability to represent objects and cause–effect relationships in her mind. A child in the early substages, for example, might simply react with frustration when trying to remove a play telephone from her toy box, the receiver of which is tangled on another toy at the bottom of the box. She cannot see what has tangled the receiver, and she does not have the ability to conceptualize the cause–effect relationship that is preventing the removal of the telephone. After tugging a few times, she might give up or cry, but she will not try to solve the problem by identifying and eliminating the cause. If we move this same child forward to substage 6, we see a much different performance when the same problem occurs. After tugging on the phone a time or two, she reaches into the toy box to discover what is catching the receiver. She eliminates the tangle and removes the telephone. She was able to solve this problem because, even without seeing what was catching the receiver, she was able to mentally represent a physical obstacle of some kind. She understood the principle of cause and effect that was operating, and she applied this intellectual understanding to the solution of a physical problem.

Means–ends, in its fully developed form, is about intentionality. The child can now represent the goal mentally, map out plans for reaching that goal in his mind’s eye, and put the plan into action. In earlier substages, the child might get a cookie out of the unreachable cookie jar by pointing and grunting until someone gets the cookie for him. By the end of the sensorimotor stage, the child might push a chair to the counter, climb onto the counter, and stand on tiptoes to reach the cookie jar on the shelf his mother thought was safely beyond reach. This kind of creative planning is just part of what is waiting for parents during the stage of child development often called the terrible 2s.

Imitation undergoes significant changes as we proceed through the six substages. In the early substages, the child imitates only those actions and vocalizations she produces spontaneously. In the fourth substage, she imitates behaviors that are similar to those she produces; in the fifth substage, she imitates new behaviors.
Executing an imperfect and perhaps dangerous plan of action.

In the sixth substage, the child produces what are called “deferred imitations” (McCormick, 1990). This means that the child can imitate a behavior modeled for her earlier, an action or vocalization that she has represented mentally and stored in her memory. Now when someone asks the child what sound the cow makes, she retrieves the model from her own mental catalog of animal noises and imitates that model by saying, “Moo!” When someone leaves the house, she does not need to have someone prompt a wave by demonstration and exhortation. She remembers the action and produces it spontaneously, a deferred imitation of a model she has stored in her memory.

In addition to seeing the child apply his more complete conceptual understandings in play, we observe some fundamental changes in the nature of the child’s play in the sixth substage (Westby, 1980). Early in this substage, the child might pretend to drink out of a cup or glass or pretend to sleep, but all of his pretending behaviors are autosymbolic. That is, he limits pretending to his own actions. About midway through the final substage, he extends pretending to other objects during symbolic play, but the objects must be realistic. The child will pretend he is feeding a doll with a real or toy spoon, for example, but will not pretend that a Popsicle stick is a spoon. By the end of the sixth substage, the child will engage in play activities that represent real-life experiences. He might play house, but the toys used must still be realistic in terms of function and, to some extent, even in terms of size.

In the earliest stages of make-believe play, the child’s pretending is limited to real, or at least realistic-looking, objects. At 18 months, for example, he will pretend to eat with forks and spoons—either actual forks and spoons or toy forks and spoons—but he will not pretend that a roofing plank from a set of Lincoln Logs is a fork. He is quite literal and rigid in what he uses and in the actions he performs. These initial steps in pretend play advance to pretend actions that represent what the
child observes people, including himself, execute in real-life situations. Thus, as he moves beyond his second birthday, he might use Lincoln Log roof planking as a fork, or he might put a bowl on his head, pretending it is a baseball cap (Tomasello, Striano, & Rochat, 1999). By the time the child is 3 and well beyond sensorimotor substage 6, there need be no connection, even a visual similarity, between the object he uses in play and the object it represents (O’Reilly, 1995). He might, for example, use the bowl or the roofing plank as a car or truck.

All the changes we have identified in the sixth substage of the sensorimotor period have direct implications for what is happening to the child as a communicator as she completes this phase of her cognitive development and prepares to move forward. Until the child has some understanding that objects are permanent, she cannot represent them in words. Only when the child understands that all people and many objects can be agents of cause will she be ready to use communication as an agent for causality. If intentionality is the key to means–ends, it is clearly the key that opens the door of communication, both verbal and nonverbal. As the sensorimotor stage unfolds, the child learns that gestures can be used to make needs and desires known, and she eventually learns that words can be even more effective because they allow greater specificity.

Language has been described as a tool for many years, and in the context of means–ends, that is an apt description. As the sensorimotor stage comes to a close, the child is using words and combinations of words to get things done. Imitation, especially deferred imitation, is critical to the development of communication. The child learns gestures by imitation and, as mentioned earlier, will use a gesture to label an object (Bates & Snyder, 1987).

Imitation also plays a role in the acquisition of speech. By the end of the fourth substage, the typical child is producing her first meaningful words that, although they may be only approximations of adult utterances, are evidence of internalized models. In the fifth substage, the child is imitating adult utterances unlike anything she has produced on her own, and by the end of the sixth substage, she is imitating and spontaneously producing multiple word utterances. The essential contribution of imitation is that it helps the child develop the ability to represent behaviors internally, and eventually to produce these behaviors even when the models are not present. This is the essence of language, a system of communication based, in part, on a huge inventory of internalized models. As the child’s play progresses from a solitary, physically limited activity to a more interactive and representational activity, language plays a more important role. We have to go beyond the sensorimotor stage to observe speech as a primary play activity, but in the latter months of this first stage of cognitive development, we see communication becoming an increasingly important part of play.

As the curtain slowly falls on the sensorimotor drama, remember that this is but the beginning of the cognitive development story. Piaget’s theory has three more stages, which might be viewed as sequels to the sensorimotor drama. Unlike sequels to bad movies, which typically only compound the badness of the original, however, the cognitive sequels are improved dramas, because each stage is based on and incorporates the preceding stage. We are pausing after the sensorimotor phase, not to indicate intellectual closure but to indicate that the stage has now been set for the
Cognitive Development: Building a Foundation for Language

part of the child development story that is the primary focus of this book—speech and language acquisition. We will provide closure to our discussion of Piaget’s theory of cognitive development, however, by reviewing reservations about some of his views precipitated by research data gathered in recent years.

Recent Research: A Critical Review of Piaget’s Sensorimotor Stage

Because the Piagetian view of cognitive development was so widely accepted and so heavily influenced the understanding of many aspects of early child development (with direct and indirect connections to cognitive development), researchers have tried to verify Piaget’s observations about what happens during the sensorimotor stage and when. The results of this research suggest that children exhibit some cognitive abilities at much earlier ages than Piaget indicated. Note, however, that reservations about what Piaget proposed should not be construed as criticisms of the man. Today’s researchers understand that Piaget did not have access to modern research methodologies that would have allowed him to conduct the kinds of carefully designed and rigorously implemented studies the human behavioral research community demands today. Piaget suggested, for example, that the infant shows evidence that he is exploring his world and making preliminary efforts to control aspects of his environment when he is about 4 to 8 months old. Using basic operant conditioning principles, researchers have demonstrated that the child is displaying this level of cognitive awareness immediately after birth. This conclusion is drawn from evidence that the neonate will enthusiastically suck on a nipple in order to produce a wide range of sounds and sights he finds interesting. This experiment demonstrates that the newborn child is aware of these auditory and visual stimuli and that he is able to exercise rudimentary control to make them happen. Similar research strategies, based on operant conditioning principles, have been used to reveal what the sensorimotor-stage child knows about object permanence and mental representation and when he knows it.

Regarding object permanence, Baillargeon, Graber, DeVos, and Black (1990) concluded from their experiments that the child understands object permanence even if she is not yet capable of implementing the means–ends strategies necessary for locating an object when it is moved out of sight. It is one thing, after all, to know that an object still exists even when it is no longer visible, and it is quite another to push aside, lift up, or reach behind whatever is hiding the object. The child might know object permanence, therefore, even if she is not yet demonstrating that knowledge in her searching or locating behaviors.

According to Piaget’s cognitive theory, the child cannot represent experience until he is about 18 months old. Meltzoff (1988b) demonstrated, however, that deferred imitation occurs in children as young as 9 months old. He also found that the child at 9 months can retain several actions in memory at the same time. By the time he is 14 months old, he can hold in memory as many as six modeled actions over the course of a week. Thus, Piaget’s predictions relative to deferred imitation are much too conservative.

We also do not see evidence of mental representation, including deferred imitation and categorization in Piaget’s theory until the end of the sensorimotor period.
However, it is more plausible to conclude that sensorimotor schemata and symbolic schemata develop simultaneously. This view would certainly be consistent with research findings relative to categorization, which develops incrementally from 3 months to 18 months. Children as young as 9 to 12 months look longer at pictures of things within a category than at pictures of objects foreign to that category, and they can categorize things, such as birds, food, and stuffed animals (Oakes, Madole, & Cohen, 1991; Roberts, 1988; Sherman, 1985). Eighteen-month-olds are able to categorize objects into two classes (Gopnik & Meltzoff, 1987). Thus, given a mixture of blocks and dolls, they can easily sort them.

What Does Current Research Suggest About the Sensorimotor Stage?

The findings of current research on the cognitive abilities of young children make it impossible to escape the conclusion that many essential and basic cognitive abilities, at least in preliminary form, are exhibited by children considerably earlier than Piaget predicted. To some, this might seem grounds enough to dismiss Piaget’s theory, but we should react cautiously to the apparent contradictions between what Piaget proposed theoretically and what researchers have found in actual behavior. Berk (1994) notes, for example, that “when these (cognitive) capacities first appear, they may not be secure enough to make a large difference in the baby’s understanding of the world or to serve as the foundation for new knowledge” (p. 231). It is also important to affirm, as Berk and others have, that the general developmental time line established by Piaget’s sensorimotor stage holds in terms of when many basic cognitive abilities fully emerge even if Piaget did not accurately predict the earliest manifestations of these abilities.

The most significant differences between what Piaget proposed and what researchers have found center on the emergence of specific cognitive abilities, such as object permanence, and on how early cognitive development takes place. That is, some cognitive abilities do emerge earlier than Piaget asserted. These include the abilities we have highlighted in this discussion, object permanence and mental representation. Table 3.5 compares these cognitive attainments across researchers. A more important gap between the theory and current research focuses on how this development occurs. Piaget believed that in this first stage of cognitive development, the acquisition of all knowledge is facilitated by the child’s sensorimotor experiences. Even those who have serious reservations about Piaget’s theory concede that some of the child’s knowledge in these early months of life is established by motor and sensory contact with her environment. These same people suggest, however, that some of the child’s cognitive abilities, including understanding of object permanence and the ability to imitate, may be genetically determined, and that other abilities may be products of innate perceptual processing of auditory and visual information. That is, some of the knowledge the child demonstrates during the first year, and even during the first half year, comes through watching and listening, not through direct physical contact with the things in her world.

Some critics believe that recent research findings suggest that cognitive development does not progress in the fairly rigid, step-by-step manner implied by Piaget’s stages. According to Piaget’s theory, a range of cognitive abilities develop together
within each substage of the sensorimotor period, and they undergo comparable changes within each succeeding stage. The research evidence suggests that the specific cognitive abilities of a given child might be at different levels of maturity at the same time, and that when there is a change in one ability, there will not necessarily be a directly correlated change in another. Cognitive development, these critics argue, is variable because it depends on biological maturation interacting with environmental experiences. The most extreme of these critics believe we should completely dismiss the notion of stages in our understanding of cognitive development. They believe that the bases of cognitive abilities are constant at all ages and that, over time, each child gradually figures out how to apply each ability to the completion of thought-related tasks (Gelman & Baillargeon, 1983). Others take a more moderate view. They believe that Piaget’s stage concept, with appropriate modifications, remains viable. Flavell (1985), for example, has difficulty accepting the idea that cognition and its development is as widely variable as some have suggested. He believes that the varying cognitive abilities all theorists and researchers recognize in developing children must somehow be tied together in a coherent manner. These connections among cognitive abilities, in combination with maturational changes, suggest to Flavell that there must be some stage foundation to cognitive development.

So, where does this leave us? There is little doubt, even among the most ardent critics of Piaget’s theory, that Piaget has appropriately identified the cognitive abilities the child acquires, and there is consensus that Piaget’s general time frame for the maturity of cognitive abilities is, for the most part, on target. It is clear that some of Piaget’s estimates about when certain cognitive abilities first appear were not correct. Children show the first signs of certain cognitive abilities much earlier than Piaget predicted. It also seems fair to conclude, based on recent research evidence, that early

### Table 3.5 Cognitive Abilities in the Sensorimotor Stages

<table>
<thead>
<tr>
<th>Cognitive Abilities</th>
<th>Piaget</th>
<th>Other Researchers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory awareness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exploration and control of environment</td>
<td>4 to 8 months</td>
<td>At birth</td>
</tr>
<tr>
<td>Object permanence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Object that is out of sight is out of mind</td>
<td>4 to 8 months</td>
<td>3½ months*</td>
</tr>
<tr>
<td>Search last place object was hidden</td>
<td>8 to 12 months</td>
<td>8 months</td>
</tr>
<tr>
<td>Search for object hidden in several places</td>
<td>8 to 12 months</td>
<td>12 months</td>
</tr>
<tr>
<td>Mental representation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deferred imitation</td>
<td>18 months</td>
<td>9 months†</td>
</tr>
<tr>
<td>Retain several modeled actions in memory over time</td>
<td>18 months</td>
<td>14 months</td>
</tr>
<tr>
<td>Categorization</td>
<td>24 months</td>
<td>3 to 18 months†</td>
</tr>
<tr>
<td>Physical characteristics of mobiles</td>
<td></td>
<td>3 months</td>
</tr>
<tr>
<td>Pictures of objects</td>
<td></td>
<td>9 to 12 months</td>
</tr>
<tr>
<td>Objects into two classes</td>
<td></td>
<td>18 months</td>
</tr>
</tbody>
</table>

†Gopnik and Meltzoff (1987); Meltzoff (1988a).
knowledge is not the product of sensorimotor experience only, that some cognitive abilities may be genetically predetermined, and that others may be influenced at least as much by innate perceptual abilities and experiences as by direct environmental contact. On the issue of stages, legitimate debate persists. It would not be unreasonable to assume, however, that when the dust from this particular battle settles, we will have concluded that some semblance of a stage model is still useful in understanding cognitive development, even though any future stage model will almost certainly accommodate wide individual variations.

The Sensorimotor Stage and Language: A Summary

In closing this section on Piaget’s theory of cognitive development, it will be useful to return to our primary focus, language. Even though, as we noted earlier, Piaget did not specifically theorize about language development, he and others who have endorsed his theory have related aspects of cognitive development, as Piaget has described it, to language. Table 3.6 contains a brief summary of key aspects of cognitive development that are related, or appear to be related, to language development. In processing this information, keep in mind that relationship does not necessarily mean cause–effect. In fact, most of the research data do not suggest that the connections between cognitive and language factors are more than correlational relationships. Nevertheless, it is intriguing to think about what these relationships might mean relative to both cognitive and language functions.

Vygotsky’s Theory of Cognitive Development: A Sociocultural Perspective

The issue stated at the beginning of this chapter has significant relevance in relation to Vygotsky’s theory of cognitive development: the relationship between cognition and language. Hold that issue in mind as this section unfolds, and try to determine how Lev Vygotsky would answer it.

Like Piaget, Vygotsky believed that the child is an active agent in her quest for knowledge. Beyond this general agreement, however, emerges a striking difference in the views of the two men. Whereas Piaget believed that the child operates independently to construct knowledge through her actions on the environment, especially during the early stages of cognitive development, Vygotsky was convinced that the child’s cognitive development is heavily influenced by her environment and by her culture from the very beginning of knowledge acquisition. In fact, Vygotsky believed that the developing child interacts with her environment in order to develop cognitive abilities that will allow her to adapt to her culture. In other words, during the course of intellectual development, there is a synergistic relationship between what the child brings to the cognitive table in terms of innate abilities and self-directed exploration and what her environment and culture bring to the table.

Vygotsky’s own boyhood experiences related to learning shaped his views of cognitive development. As a youngster, he did not attend a formal school. He was taught at home by a tutor who believed that education involves more than simply
### Table 3.6 Sensorimotor and Language Events: A Summary

<table>
<thead>
<tr>
<th>Sensorimotor Concept/Behavior</th>
<th>Language Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Object permanence</strong></td>
<td>1. Object permanence appears to be related to early semantic functions, including nonexistence, disappearance, and recurrence.</td>
</tr>
<tr>
<td></td>
<td>2. Brown (1973) suggests that the understanding of object permanence reflected in substage 4 may be adequate for the acquisition of the child’s first productive words.</td>
</tr>
<tr>
<td><strong>Causality</strong></td>
<td>1. An understanding of causality is a cognitive prerequisite for communication (Bates &amp; Snyder, 1987; Greenwald &amp; Leonard, 1979; Snyder, 1978).</td>
</tr>
<tr>
<td></td>
<td>2. There appears to be a significant relationship between causality and the child’s ability to understand verbs and semantic relations (Miller, Chapman, Branston, &amp; Reichle, 1980).</td>
</tr>
<tr>
<td><strong>Means–ends</strong></td>
<td>1. An understanding of means–ends is critical to language development.</td>
</tr>
<tr>
<td></td>
<td>2. There is a significant correlation between an understanding of means–ends and language development during the early portion of substage 4 (Bates et al., 1975, 1979; Bates, Benigni, Bretherton, Camaioni, &amp; Volterra, 1977). This cognitive ability is particularly important to the development of communicative intentionality.</td>
</tr>
<tr>
<td></td>
<td>3. The understanding of means–ends reflected in substage 6 appears to be significantly related to the emergence of two-word utterances (Zachary, 1978).</td>
</tr>
<tr>
<td><strong>Imitation</strong></td>
<td>1. Imitation is significantly correlated with gestural development at 9 to 10 months.</td>
</tr>
<tr>
<td></td>
<td>2. Deferred imitation is significantly correlated with naming and with recognitory gestures (i.e., gestures that represent the functions or uses of objects, Bates &amp; Snyder, 1987).</td>
</tr>
<tr>
<td></td>
<td>3. When the child produces deferred imitation, we can assume that she has a true understanding of symbolic function because in deferred imitation, the referent for the imitation need not be present.</td>
</tr>
<tr>
<td><strong>Play</strong></td>
<td>1. There is a significant correlation between object play and language at 10 to 13 months (Bates et al., 1979; James, 1980).</td>
</tr>
<tr>
<td></td>
<td>2. Children who show a propensity for using a variety of schemes for objects in their early play experiences tend to progress more dramatically in language development than children who are more limited in their use of object schemes (Bates et al., 1975; Greenwald &amp; Leonard, 1979; Sugarman, 1978).</td>
</tr>
<tr>
<td></td>
<td>3. A child will produce meaningful words as symbols for people, things, and events before he has demonstrated complete competence in symbolic play.</td>
</tr>
</tbody>
</table>
filling an empty intellectual vessel. The tutor challenged the young Russian boy to be
fully engaged in the process of learning, to answer and pose questions, to process an-
wers, to think about how one piece of knowledge is integrated with established
knowledge, to consider how one question leads to another. His was a truly interac-
tive learning experience, and he came away from this personal experience believing
that knowledge acquisition and intellectual development must necessarily proceed
in this interactive manner.

Piaget and Vygotsky communicated with each other between 1924 and 1929, but
communication was challenging due to Stalin’s dictatorial rule. Despite the political
climate of their era, these theorists shared ideas through their published works and
each had an influence on the other’s thinking about human development (Pass,
2007). For instance, Vygotsky modified his stages of development from three to four
after studying Piaget, and Piaget recognized that social and historical contexts might
impact a child’s learning.

One might well ask why there is so much interest in Vygotsky’s views about cog-
nitive development today. After all, this man’s views about cognition were published
more than 70 years ago. According to Wertsch and Tulviste (1992), the present inter-
est in Vygotsky’s theory can be traced to his belief that the child is not an independ-
ently operating agent, that the child’s cognitive development is the product of an
interaction between the child’s innate abilities and his social experiences. It is note-
worthy that Vygotsky’s view of intellectual development is generally consonant with
the dominant view of language development today, the social interactionist view.
The marriage between a sociocultural view of cognition and a social interactionist
view of language is a natural and eminently logical phenomenon.

Even though some people might be tempted to park Vygotsky at the nurture end
of the nature–nurture continuum, that would be an oversimplification of his views
about development. Vygotsky begins, in fact, with a nature base. He believes that
human children are born with fundamental cognitive and perceptual abilities, in-
cluding capacities for memory and attending, abilities that human beings share with
other animals. During the first 2 years of the human child’s life, these abilities de-
velop and mature according to a mostly biological calendar and as a result of the
child’s primitive contacts with his environment. The nature of cognitive develop-
ment changes radically, however, as soon as the child can mentally represent the en-
vironmental phenomena he is experiencing. This mental representation includes, as
a primary component, language.

At this point, armed with naturally developing cognitive and perceptual abilities
and with emerging language skills, the child is able to engage in the social dialogues
that are so inextricably connected to cultural activities. The groundwork is now laid
for the component of Vygotsky’s theory of cognitive development most closely asso-
ciated with his name, private speech. When the young child begins to talk to herself,
she crosses an important threshold in her cognitive development. From this point
forward, and as a direct result of the power of language, the child’s mental abilities
will be shaped into the higher-order cognitive processes of an intelligence that
clearly separates human beings from animals with lesser cognitive capacities. That is,
the child uses language to direct her actions and to learn how to get things done
(Wertsch & Tulviste, 1992).
Before we take a closer look at private speech and other critical elements of Vygotsky’s theory, there is another basic difference between Piaget and Vygotsky that must be stressed. Piaget, as we have noted at a number of junctures in this chapter, believed that cognitive development proceeds in a predictable stage-by-stage manner. Vygotsky’s view was that cognitive development does not proceed through exactly the same progressive sequence for all children. He argued that while each child experiences progressive changes in the way she thinks and behaves as a cognitive creature, the progression is continuous rather than stage by stage. More important, each child’s cognitive development is shaped by the influences of the important adults and peers in the social environment and by the experiences unique to her culture.

Although Vygotsky and Piaget would agree that there are systematic changes in cognitive development, Vygotsky would argue that these systematic changes vary widely across cultures because the nature of social interactions between children and the important people in their lives varies widely by culture. The tasks around which learning occurs differ from culture to culture. In some cultures, for example, girls are expected to perform domestic tasks at a young age. In other cultures, boys are expected to learn how to hunt and fish. In our culture, children are free of these kinds of responsibilities and are encouraged to play and “have fun.” It is not difficult to imagine significant differences in the kinds of interactions that will occur between adults and children in each of these cultural situations. If little girls are expected to perform domestic tasks at an early age, they will be taught these skills by their primary caregivers and other significant adults. These lessons will involve communicative exchanges unique to the tasks being taught. Learning the skills inherent in the tasks will involve unique problem-solving challenges. Little boys who must learn how to hunt, fish, and forage will have radically different interactions with their caregivers than little boys whose caregivers teach them how to play baseball and fly kites. Children who live in cultures that place a premium on written language will face different cognitive challenges and will experience different social and communicative interactions with their significant others than children who live in cultures that depend mostly or solely on spoken language.

Vygotsky’s point is that cognitive development does not occur in isolation but is a function of a person’s social and cultural environment. That there are cross-cultural differences in the nature of social/communicative exchanges between young children and adults has been demonstrated by research that lends support to Vygotsky’s argument (Bakeman, Adamson, Konner, & Barr, 1990; Childs & Greenfield, 1982; Draper & Cashdan, 1988; Saxe, 1988). We will now turn our attention to some of the critical elements in Vygotsky’s theory, beginning with private speech.

**Private Speech**

Anyone who has watched young children play has heard private speech. A preschool child who is trying to construct a building out of blocks might say to himself, “This piece is too big. It sticks out. I need a smaller one.” A child with a fistful of crayons and a coloring book might mutter to herself, “What color should the house be? I think I’ll make it purple. No, that’s not right. Houses aren’t purple. It should be
white. Where’s the white crayon?” Yet another child, trying to put plastic pieces of varying geometric shapes into a box with holes corresponding to these shapes, might be heard to say to herself, “This one is round, so it won’t fit here, but it will fit here. Whoops, it didn’t fit because it’s too big. I need to find the small round one. There it is!”

What is all this self-talking about? The answer to that question depends on the expert to whom it is addressed. Piaget referred to this self-directed talk as egocentric speech, which he believed is nonsocial and relatively purposeless. It is speech produced by the individual child for the individual child who cannot mentally represent the viewpoints of other people. Based on what we have already established about Vygotsky’s theory, you would expect a very different response from his perspective, and your expectation would be realized. Vygotsky (1986) believed that when children speak to themselves, they are guiding themselves through their actions. Especially early in their lives, children use self-directed speech, or private speech, literally to help themselves think through problems and tasks, to help themselves choose actions that are most appropriate to doing whatever it is they are trying to do. Private speech is a first step toward more elaborate cognitive skills. It helps the child learn how to pay attention, how to memorize and recall bits of information from memory, how to formulate and execute plans in solving problems, and, in a very real sense, how to think, ponder, or muse. As the child gets older, the nature of self-directed talking changes. In the beginning, the child talks out loud. As she gets older, she might whisper or mutter under her breath. Eventually, her private speech will be truly private. It will be silent and internalized. In short, it will become exactly the kind of private speech you use every day to think through your problems, to choose plans of actions for solving your problems, to reflect on the meaning of life and the futility of the Chicago Cubs.

The weight of the research evidence relative to self-directed talking comes down heavily on the side of Vygotsky. For that reason, most people who refer to self-directed talking today refer to it as private speech and no longer as egocentric speech. The most telling evidence supporting Vygotsky’s view about private speech shows that children are more likely to talk to themselves when they are engaged in difficult tasks, when they are struggling with tasks and making mistakes, or when they are unsure about what they should do next (Berk, 1992). The research also confirms that Vygotsky was correct about the changes that occur to private speech as children mature. That is, it becomes less overt and more private until it becomes essentially speech in thought form (Berk & Landau, 1993; Frauenglass & Diaz, 1985). From a cognitive development point of view, Vygotsky’s most crucial assertion is that private speech provides a foundation for higher-order cognitive functions. When the child engages in make-believe play, for example, private speech is a critical element of that activity. The coexistence of these two activities suggests that private speech helps the child place the control of action within the constraints of thought (Krafft & Berk, 1998). Research indicates that children who are uninhibited self-talkers when they are confronted with challenging tasks are more attentive, more fully engaged, and more likely to complete tasks successfully than children who are more reticent self-talkers (Behrend, Rosengren, & Perlmutter, 1992; Bivens & Berk, 1990). There is also evidence that preschool children who participate in elaborate sociodramatic
play, an activity that depends heavily on private speech, make more rapid progress in learning to follow classroom rules than children who are less inclined to participate in this kind of activity (Elias & Berk, 2002).

**Social Keys to Cognitive Development**

Keep in mind that Vygotsky believed that the establishment of higher-order cognitive functions begins in children's social interactions with the important people in their environment, interactions that reflect the culture of which they are members. This means that, from Vygotsky's point of view, we cannot talk about cognitive development without taking these social interactions into account. Children learn how to do things, and they learn how to process their thoughts in ways that appropriately reflect the culture in which they live, by interacting with adults who already know how things should be done and how to think in ways that are culturally acceptable. The child might be able to handle some tasks with which she is confronted without any direct intervention or assistance. That is, she will figure some things out, just as Piaget suggested, by independent discovery. There are many other tasks, however, that the child cannot manage on her own. She needs help from people who have greater knowledge, experience, and skill than she possesses. These tasks fall into what is called the **zone of proximal development**. Within this zone are those tasks with which the child needs help, and the help typically comes in the form of language. As a child and an adult work together to learn a skill or solve a task problem, they talk to one another. The child retains language from these exchanges that she incorporates into her private speech. At some later time, she will use this private speech, now enhanced by the language she has garnered from these dialogues, to solve problems on her own.

If he had lived longer and continued to revise and elaborate his theory, Vygotsky would have probably tried to identify the features of adult–child dialogues that would most effectively facilitate the development of the child’s cognitive abilities. In the absence of direction from Vygotsky himself on this subject, researchers have identified at least two attributes of these dialogues they believe are crucial in transferring the adult’s cognitive competence to the child’s cognitive development. The first of these attributes is **intersubjectivity**. An interaction is characterized by intersubjectivity if two people working together on a common task with different levels of understanding about how the task can or should be accomplished manage to merge what they know into a shared understanding as the task is completed. In this kind of interaction, each partner accommodates the viewpoint and competence of the other partner. This kind of dialogue demonstrates mutual respect and a shared determination to solve a problem for which the partners feel a united ownership. In an interaction shared by an adult and a child, the adult will convey what she knows to the child in a manner that fits what the child already knows and that does not exceed the child’s ability to understand. You will recognize that this is exactly what occurs in any good teaching–learning situation even when the teacher and learner are both adults. That is, the teacher conveys her knowledge to the student by drawing on what the student already knows, by taking into account the student’s abilities to understand, and by challenging the student to expand his
own knowledge. In an interaction characterized by intersubjectivity, therefore, the child is challenged by the adult's dialogue and demonstrations to extend his understanding so that he develops a more mature, adultlike strategy for completing the targeted task (Rogoff, 1990).

The second attribute that characterizes facilitating dialogues is **scaffolding** (Bruner, 1983; Wood, 1989). To understand this feature of dialogues, we should first consider the literal meaning of the word *scaffold* and consider how scaffolds are used in real life. According to http://www.Dictionary.com, a *scaffold* is “a temporary platform, either supported from below or suspended from above, on which workers sit or stand when performing tasks at heights above the ground.” We have all seen painters and window washers on scaffolds.

How does scaffolding relate to cognitive development and to the dialogues and interactions that facilitate cognitive development? Just as a real-life scaffold is adjusted to the height necessary for the completion of a task such as washing windows, adults can provide scaffolds for the child when she is trying to reach new heights of cognitive competence. If the child has little idea about how to accomplish a targeted task, adults will set the scaffold low in the sense that they provide direct instruction. At this level, adults might try to segment the task into smaller tasks, building on what the child does know and can do, and then helping her master the next level, and then the next, until she can complete the whole task. When we teach children to write, for example, we do not expect the child to move from no writing skill to adult mastery in one step. We begin by asking the child to draw vertical lines, horizontal lines, and circles, skills she already has or that she can easily master. We scaffold the skills upward from the easiest and most basic drawing skills to increasingly elaborate writing skills until the child is actually producing written letters. As the child’s cognitive competence increases, her need for direct support decreases. The adult who is a skillful scaffolder will gradually withdraw cognitive supports as the child gradually demonstrates less need for them, but the same sensitive scaffolder will be prepared to introduce the supports again if the child’s independent efforts are producing more frustration and failure than success. The general rule in effective scaffolding, therefore, is to adjust support so that it meets the changing cognitive needs of the child.

Does effective scaffolding make a difference? There is research evidence indicating that it does. In studies focusing on the possible benefits of this strategy, some mothers used scaffolding more effectively than others in the process of teaching their children how to solve a particularly difficult puzzle. The children of the more effective scaffolders used more private speech and were more successful in independently solving a similar puzzle than the children of mothers who were less skillful in the use of scaffolding (Behrend et al., 1992; Berk & Spuhl, 1995).

During his tragically brief life, Vygotsky gave us much to think about relative to cognition, cognitive development, and the synergistic relationship between cognition and language (see Figure 3.1). Researchers continue to test the principles and concepts of his theory, and, so far at least, his views that cognitive development occurs within the larger context of social and cultural experiences, and that language directs cognition as much as cognition directs language, are holding up well to empirical scrutiny.
• Children are active participants in their quest for knowledge.
• Cognitive development is heavily influenced by the environment and culture.
• Language is a key player in cognitive development.
• Children use private speech to guide themselves through their actions.
• Children are born with basic cognitive and perceptual abilities.
• Children’s cognitive abilities during the first 2 years of life develop and mature according to a biological calendar.
• At about 2 years, cognition and language influence each other.
• Children’s ability to represent their environment mentally, including their use of language, facilitates cognitive development.
• Cognitive development does not proceed through exactly the same sequence for all children.

FIGURE 3.1 Key Features of Vygotsky’s Theory

Dynamic Systems Theory

As we continue to explore ways that children develop knowledge and thinking abilities, researchers and practitioners recognize the interactions that occur between learners and their environment. Consider a young child just beginning to talk in single words. What is the driving force behind this amazing accomplishment? The Dynamic Systems Theory provides us with a look into the complexity of each learning situation. Let’s look at Ricardo, a 12-month-old child who is beginning to say his first words. Ricardo is an active and curious child, who has three older siblings: 10-year-old Angela, 7-year-old Juan, and 3-year-old Maria. They are delighted with their young brother, and the household is filled with verbal chatter and play. The parents are bilingual in Spanish and English, and the children speak both Spanish and English, in the home and at school. Thus, Ricardo is hearing and learning both language forms. As we can imagine, Ricardo’s learning is influenced by the totality of his experiences and his own very typical physical and cognitive growth. His parents, three siblings, two languages, and interactions throughout each day create unique opportunities for his specific growth in knowledge and his organization and use of his knowledge for future learning. Samuelson and Horst (2008, p. 210) view the Dynamic Systems perspective of development:

as the emergent product of the real-time interaction of many components—the child’s physical and cognitive abilities, the specifics of the task, the state of the system in the just-previous past, and the child’s individual developmental history of perceiving and acting (Smith & Thelen, 2003; Thelen & Smith, 1994). By the Dynamic Systems perspective, each individual moment of knowing reflects the context-specific integration of these components and sets the stage for the next interaction between the child and the context. Over time, stable patterns of behavior emerge as many individual interactions are laid down over the course of a child’s developmental history. Likewise, variability and change emerge as the system is pushed into new forms of organization by the specifics of individual contexts, abilities, and experiences. Thus, the dynamic systems view accounts for both stability and variability in performance, grounds current behavior in the
longer-term activity of the system, and is fundamentally developmental (see also Samuelson & Smith, 2000b).

What evidence do we have that a Dynamic Systems Theory explains cognitive growth? One example of development that illustrates this perspective is known as the shape bias. The rate at which youngsters acquire names of things has intrigued theorists and researchers in developmental psychology for several decades. Numerous studies have verified that young children generalize novel names to new instances that match in shape. This ability to generalize based on shape helps children learn new words (Samuelson & Bloom, 2008). Generalization is very important to learning in that it allows us to apply what we know to new information, thus increasing our ability to learn rapidly.

The shape bias has been observed in children as young as 15 months old following 9 weeks of training (Smith, Jones, Landau, Gershkoff-Stowe, & Samuelson, 2002), and 2- and 3-year-old children appear to use shape consistently as a feature to attend to word learning (Booth, Waxman, & Huang, 2005; Diesendruck & Bloom, 2003). Samuelson and Horst (2008) describe the Attentional Learning Account (ALA), which is based on the Dynamic Systems Theory. These authors emphasize that knowledge emerges from the interaction of cognitive, physical, historical, and task-specific interactions and that such interactions build upon each other over the child’s developmental history.

Briefly, the ALA proposes that as children learn their early vocabulary, they learn a system of statistical regularities among linguistic devices, the properties of objects, and perceptual category organization. These learned associations then mechanistically shift attention to the relevant properties of objects in future word learning situations, enabling children to make generalizations from the categories they know to novel categories. As a consequence, children learn new words rapidly. By this account, children’s attention to shape results from the particular statistical structure of the linguistic context they have previously been exposed to. Thus, the ALA predicts individual, cross-cultural, and task-based differences in performance that are closely tied to the specifics of an individual’s history, the particular language being learned, and the specifics of the task—predictions supported in a growing body of work. (Samuelson & Horst, 2008, p. 210)

Proponents of this second theoretical argument regarding how the shape bias occurs (Booth & Waxman, 2008; Markson, Diesendruct, & Bloom, 2008) are more tolerant of a diverse set of mechanisms and of their levels of influence. Statistical regularities indeed occur, but this view “acknowledges a rich and diverse array of processes in both perception and cognition that can have fine-grained influences on how children acquire and use labels” (Samuelson & Horst, 2008, p. 217). The researchers will likely debate the actual mechanisms and processes that underlie the shape bias. What is important for us is the realization and understanding that multiple aspects of cognition are operating to influence learning in children.

We have considered three theories regarding cognition and the relationship of cognition to language. It should be evident that we still have much to learn about human thought and language in developing children, but we should also have an appreciation for the many perspectives that provide us with plausible examples and explanations as to what is likely taking place within the first 2 years of development.
The Perceptual Groundwork for Communication

Before we proceed to a detailed description of speech and language development in the next three chapters, we must address more fully the perceptual preparation for communication, a topic briefly introduced when we discussed the principle of distancing earlier in this chapter. Perception, you may remember, refers to the processes by which a person selects, organizes, integrates, and interprets the sensory stimuli he receives. Because children must somehow make sense of the sensory information they receive related to communication in general and speech specifically before they can create their own communicative output, we should know something about what they receive and what catches their attention during the preparation period. What follows then is a brief summary of what we believe are children’s earliest perceptual abilities as they pertain to communication.

The Relationship Between Cognition and Perception

It should be fairly obvious that perception cannot be completely separated from cognition. To understand, think, solve problems, and engage in all other activities associated with cognition, we must be able to sort through the stimuli our senses are receiving, recognize important stimuli, ignore unimportant ones, and then categorize, integrate, and interpret the stimuli we have selected. The further into perception we proceed, the closer to cognition we get, until the line between them becomes effectively blurred to the point of virtual elimination.

Stern (1977) makes a useful distinction between perceptual stimulation and cognitive stimulation. As a result of perceptual or sensory stimulation, a child recognizes that stimuli are present and reacts to the major characteristics of the stimuli. If they are auditory stimuli, for example, he reacts to the loudness and pitch changes of the sounds he is receiving. If they are visual, he reacts to things such as size and shape. This level of perception develops early. As the child develops intellectually, he shows evidence of cognitive stimulation, which means he not only recognizes stimuli by their sensory characteristics but also understands what they mean and how they compare to other stimuli he has received. He understands, for example, the difference between the ringing of the doorbell and the ringing of the telephone. When the doorbell rings, he runs to the door because he knows someone will be there. When the telephone rings, he picks it up because he knows someone will answer. He combines his ability to make discriminations among similar and dissimilar bits of sensory information with his ability to make mental judgments about what this information means. This complex marriage of perception and cognition continues throughout the child’s development years and beyond. In fact, as long as a person can receive new information, process it, and think about it, the marriage thrives.

Visual and Tactile Perception

You might wonder what visual perception has to do with language and especially with speech. Actually, what the child sees can be very important in the language acquisition process. Sachs (1989) contends that visual and tactile stimuli “play a
great role in establishing the bond between adult and child” (p. 38). This in no way minimizes the importance of auditory stimulation, but it does suggest that what the child sees helps to direct and fix her attention. Presumably, once the speaker has gained the child’s attention by whatever visual or tactile stimuli are required, the child will gain more from the auditory stimuli produced by the speaker. Even though we have no proof that this connection of sensory modalities is necessary for speech development, it is probably more than coincidental that infants are interested in the kinds of visual stimuli that are characteristic of early child–adult interactions.

Vision is the first sensory system the child controls (Tiegerman, 1989). Within hours after birth, the infant can follow movement visually (Greenman, 1963) and is able to focus on a target 7.5 inches removed, the distance at which vision achieves its optimal focus (Owens, 2001). This is potentially significant because when the child is being fed, his mother’s eyes are almost exactly 8 inches away, and his mother watches him almost constantly during feeding (Stern, 1977), while he returns the visual favor. It is tempting to conclude, as some observers have, that the child is genetically preprogrammed for this visual coupling, which, it is further assumed, leads to bonding between the child and mother.

By the time the child is 3 months old, she can control eye movements sufficiently to determine the visual information she chooses to receive. She looks at things and people she finds interesting, and she turns away when she is no longer interested. The infant prefers objects of contrasting colors, and she likes things that move (Haith, 1976). She is attracted to objects with designs of varying angles and curves, and visually complex objects that reflect light variably (Fantz, 1964; Freedman, 1964; Haaf & Bell, 1967). What makes this fascinating is that the infant shows strong interest in the human face, an object that meets all these criteria for preference and interest. The face can consist of many colors when you include all the parts: hair, eyes, eyebrows, lashes, lips, and cheeks. The face is capable of almost infinite movement and has many angles and curves that reflect and shade light. Again, it is tempting to conclude that the child is born with visual interests that perfectly match the facial characteristics of her primary object of attention and affection, the caregiver.

Much attention has been paid by researchers and theorists to the child’s interest in the human face in general, the caregiver’s face in particular, and to the eye contact or gaze between child and caregiver. There has been much speculation about what all this might suggest about bonding in the child–caregiver relationship. Certainly no one questions the newborn’s preoccupation with looking at his caregiver’s face. So fixed is he on looking at the caregiver’s face in the first few weeks of his life that it is difficult to direct his visual attention anywhere else. By the time he is just 2 weeks old, he may be able to distinguish, on the basis of face and voice, his caregiver from other people (Bower, 1977). When he is 3 weeks old, he will respond to his caregiver’s face and other human faces by smiling (Trevarthen, 1979). By the time he is 3 months old, the infant and his caregiver exchange gazes in a manner that suggests adultlike conversational turn taking (Jaffe, Stern, & Perry, 1973). At the very least, this is intriguing stuff. At most, contingent on more research that would allow for more confident conclusions, it might suggest that the child is genetically tuned to
certain visual stimuli that are important in capturing his attention and in helping to
establish a communicative relationship with his caregiver, a relationship many social
interactionist theorists believe is important, if not vital, to normal communication
development.

Information is gained about objects through many different avenues. But it is
not known precisely how children make discoveries about the properties of objects,
especially when they have not fully developed reflective understanding about how
access to information can assist in knowledge gains. Robinson, Haigh, and Pendle
(2008) reviewed literature across 20 years that shows that young children below age
7 or 8 do not realize that input can be ambiguous; that several interpretations of in-
formation are possible; and that different interpretations can be made by different
people. For instance, young children not only make inaccurate assumptions about
partially hidden objects, but they also have incomplete knowledge of how different
modalities (seeing and feeling) are used to gain information, and they are poor at re-
porting the source of knowledge gained. It isn’t until children reach 7 or 8 years of
age that they have these realizations. The authors speculate that young children
may be able to gather and use information from both seeing and feeling, but they do
not have the reflective understanding to be able to describe how they know until
age 7 or 8.

They tested this hypothesis experimentally with 48 children between the ages of
3 years, 5 months and 4 years, 4 months who attended nursery school classes. Using
a partial access identity task, children in the first group stated that two toys looked
(or felt) the same or felt (or looked) different. When presented with one toy and
asked, “Which one is it?” the child either named it just by seeing it or named it after
touching it. Thus, this task was used to determine whether children had sufficient in-
formation to identify the target. Children who were in the source reporting group
saw both items and then were handed one. Each child was asked, “Which one is it?”
and was also asked a source question, such as “How did you know it was the hard
one?” For wrongly answered questions, children were given the correct answer.
When children answered correctly, they were told, “That’s right, you know it was the
hard one because you felt it.” Children in these groups were better at identifying the
toys on the basis of necessary and sufficient information than they were at reporting
the information source. In this task, children had to recognize whether seeing or feel-
ing led to the knowledge of the target’s identity.

In the second and third experiments, the researchers explored similar tasks that
included a no-access identity task, whereby children in different age groups had to
predict what knowledge they would gain by seeing or feeling. Children in all age
groups were able to recognize when they had been given sufficient information
and when they had not. But children did not do as well when they had to predict
which modality would provide them with the relevant information to identify the
target. The authors surmise, however, that young children may not require correc-
tive feedback from others as they attempt to learn about objects. If they err, they
likely self-correct by seeking additional information from other modalities. Thus,
even 3- to 4-year-old children have a working understanding of the link between
information access and knowledge state that allows them to discover the proper-
ties of objects.
Auditory and Visual Perception

Just as children seem to have a special interest in the visual characteristics of the human face, they seem to be especially attracted to the human voice and speech. It is important to establish, however, that there are characteristics of sounds in general that appeal to infants, characteristics found in human speech. This could mean that children are interested in these characteristics because they are born with speech perceptual abilities and find these sound characteristics interesting whether they occur in speech or nonspeech sounds.

It would seem important to first assess the very young infant’s ability to determine the direction from which a sound is coming. An early study by Wertheimer (1961) indicated that a child just after birth moved his eyes in the direction of clicking sounds, but later studies have not confirmed this finding. A more reasonable suggestion of the localization of sound in young infants is turning the head, a behavior studied by Muir and Field (1979). Using head turning as a criterion for localizing sound, they found that infants ranging in age from 2 to 7 days turned in the direction of a rattling noise about three-fourths of the time. This consistency allows us to conclude that newborns can determine at least the general direction of sound sources.

From the time the child is born, perhaps even while he is still in the uterus, he can make many kinds of auditory discriminations. Some newborn children, for example, can discriminate between a pure tone at 400 Hz and another at 1000 Hz (Bridger, 1961), and there is evidence that they seem to make their best discriminations among frequencies characteristic of human speech (Eisenberg, 1976).

Newborns can make gross discriminations about the loudness levels of sounds. When they listen to white noise (a mixture of a wide range of frequencies) that is varied in loudness, there are noticeable changes in heart rate and in the startle reflex (Bench, 1969). Similar changes in behavior occur when children hear pure tones varied by loudness (Bartoshuk, 1964).

Although it is important to remember that we are dealing with only the broadest judgments of differences, some evidence suggests that infants respond differentially to sounds of varying durations (Clifton, Graham, & Hatton, 1968; Ling, 1972). In reference to the Ling study, Reich (1986) cautions that it “does not demonstrate that the infant can detect these differences, only that it reacts more to signals of longer duration” (p. 15). At the least, this research indicates that infants are aware of when sounds begin and end and how long they are sustained, and it is probable that infants are able to make some discriminations concerning durations.

An Early Interest in the Human Voice and Speech

One of the most exciting general findings of the research related to the early perceptual abilities of children is that infants show a greater interest in human speech than in other noises (Eisenberg, 1976; Jensen, Williams, & Bzoch, 1975). There is evidence that a child may prefer the acoustic characteristics of a speech passage his mother recited while she was pregnant over the acoustic characteristics of something she did not read (DeCasper & Spence, 1986), and there is evidence that a child as young as 3 days recognizes his mother’s voice and discriminates it from the voices of other mothers (DeCasper & Fifer, 1980). All of this can be interpreted to mean that, just as
children are born with basic biological abilities to produce speech and language, they are born with biological perceptual abilities to receive and interpret speech and language. Whether or not a conclusion as sweeping as this is warranted, we can conclude that a newborn infant is able to distinguish between speech and nonspeech sounds, that he seems to prefer speech, that he recognizes his mother’s voice very early, and that he seems to be aware of differences between sounds to which he was exposed while in the uterus and sounds to which he was not exposed. These are significant perceptual abilities.

As impressive as the infant’s general speech discrimination is, it is perhaps even more impressive that as early as 1 month, a child can discriminate among speech sounds. One of the methods used to assess this ability in infants is known as nonnutritive sucking or high-amplitude sucking and was developed at Brown University (Eimas, Siqueland, Jusczyk, & Vigorito, 1971). In this procedure, the infant sucks on a specially designed pacifier connected to a sound generator. When she sucks on the pacifier with enough vigor, she hears a predetermined sound. Because the only thing that changes in this exercise is the sound produced by the sucking, it is reasonable to assume that, if the infant does not recognize the difference between the first sound and the second, there will be no change in the rate of sucking, but this is not what happens. When Eimas et al. (1971) presented “ba,” the 1-month-old infant sucked vigorously and quickly, but after a few minutes lost interest and decreased the rate of sucking. When a new sound, “pa,” was introduced, the infant increased the rate of sucking. A number of studies reviewed by Aslin, Pisoni, and Jusczyk (1983) have shown the same reaction with a variety of speech sounds.

Because this ability is demonstrated at such a young age, it appears to be an innate ability rather than environmental. In an attempt to answer this particular nature–nurture question, Trehub (1976) tested the ability of Canadian infants and English-speaking adults to discriminate between two Czech sounds. Although the infants discriminated between the Czech sounds as well as between English sounds such as p and b, the adults had great difficulty with the Czech sounds. Trehub concluded that children are born with the ability to discriminate among sounds found in all languages. As speakers become more immersed in their own languages, they lose some of this discriminative ability.

Taking the question to the next logical level, Werker and Tees (1984) tried to determine how quickly the infant loses this open-ended ability to discriminate speech sounds. They presented non-English sounds to English-speaking children ranging in age from 6 to 12 months. Infants between 6 and 8 months had little difficulty making the necessary discriminations. Those between 8 and 10 months had more difficulty, and those between 10 and 12 months had the most difficulty. It appears then that the ability to discriminate a wide range of sounds representing many languages declines early in the child’s life. Werker and Tees suggest that it is probably not coincidental that children’s discrimination abilities become more narrow as they are acquiring their own sound system and language. Environment does play a role in shaping discrimination abilities, therefore, but rather than expanding these abilities, children’s environmental experiences make their discriminations more selective, more consistent with the speech sounds native to their language.
During the toddler years, remarkable advances occur in vocabulary knowledge. An 8-month-old child will gain 200 times her number of comprehended words at 16 months and another 10 times in her number of words at 24 months. The period between 16 and 19 months is especially critical for word learning. A child needs only to be exposed to a new word once for learning to occur. It appears that speech perception in toddlers requires the participation of several neural systems in addition to the language systems within the temporal and parietal lobes (Redclay, Haist, & Courchesne, 2008). When the initial language spurt is over, these other systems may no longer be necessary to the same degree during passive listening, as children have a base of semantic knowledge with which to process familiar words and to incorporate newly learned words.

We must also consider the relationship between speech perception and visual perception in developing children because speech perception is not just an auditory phenomenon. In fact, children and adults use both auditory and visual information to determine speech sounds. You probably experience better understanding of someone else when you are able to see his face during speaking. The developmental influence of visual cues (lip and facial movements) helps listeners to compensate for degraded acoustic information (poor quality of information due to background noise, for example) or the tendency for listeners to fail to perceive a mismatch between what is seen and what is heard, known as the McGurk effect (McGurk & McDonald, 1976). There is a developmental increase in how visual information affects the ability to perceive speech in the auditory and visual modes. Children ages 3 to 5 years and 7 to 8 years have less visual influence on their perception than do adults. One explanation for the increase in the use of visual information over time is that as children make advances in their speech articulation, they develop a better internal representation of visible speech. In other words, they know what speech sounds like and also what it looks like. Thus, as children make fewer speech production errors, they are also better at using visual cues to determine speech sounds spoken by others.

Sekiyama and Burnham (2008) investigated how experience with the native language impacts children’s ability to use auditory-visual speech processing. Their developmental cross-linguistic study compared children (6-, 8-, and 11-year olds) and adults from Japanese and Australian English language backgrounds. Each participant was shown stimuli from two talkers in his/her native language and two talkers in his/her nonnative language. The children participated in a three-alternative forced-choice task, and their reaction times were also recorded to compare responses in matching visual-only stimuli, auditory-visual stimuli, and auditory-only stimuli and to examine the nature of developmental and interlanguage differences.

In the first experiment (Sekiyama & Burnham, 2008), adult Japanese and English speakers were compared in their ability to perceive the videotaped and digitized syllables ba, da, and ga uttered by two English speakers and two Japanese speakers under three conditions: auditory-only, visual-only, and audiovisual. The conditions were counterbalanced, randomized, and delivered under highly controlled conditions. The researchers found that the visual influence for English speakers was greater than for Japanese speakers. Both groups showed greater visual influence for nonnative stimuli, and both groups performed similarly in the
auditory-only condition. English speakers performed better in speech-reading (visual cues) on nonnative than native stimuli than did Japanese speakers. Thus, there was a weaker visual influence on auditory-visual speech perception in Japanese-speaking adults than English-speaking adults. The researchers also timed the responses of their participants. The comparison of reaction times across groups revealed that Japanese speakers were faster in the auditory-only condition. The English speakers were faster in the visual-only trials. The authors speculate that the differences between Japanese and English response frequency data may be the result of a different time course in their auditory, visual, and auditory-visual speech processing. The Japanese speakers may use auditory information first because it is faster for them, whereas the English speakers may use visual information first because it is faster for them.

The second experiment involved three age groups of children (6, 8, and 11 years old) who were Japanese speakers and English speakers. The same experiment described above revealed that 6-year-olds showed relatively weak visual influence; however, this influence increased for English but not Japanese speakers at 8 years of age and older. The growth was related to increased speed in auditory and visual processing for English speakers. Japanese speakers showed stronger auditory processing at 6 years compared to English speakers, and this auditory superiority increased across time.

The results of these two studies show that language experience impacts auditory-visual speech perception. The integration of bimodal integration (visual and auditory) increased for English speakers by 8 years of age. For Japanese 6-year-olds, strengths in auditory accuracy may be due to the smaller number of vowels and the lack of some consonant contrasts, resulting in a “less crowded phoneme space” compared to English. Thus, the more dense English auditory information may result in greater processing time and more susceptibility to visual information at early ages. Specifically, more varied and complex syllable structures, more vowels, more consonant contrasts, syllable-initial consonant clusters, and distinct visual consonant contrasts may together result in English speakers seeking extra sources of information to assist in speech perception. Japanese speakers, on the other hand, may not need to integrate visual information to the same extent because their phonological environment does not demand it.

Executive Functions

Executive functions refer to a set of control processes in the human brain that allow us to maintain attention, inhibit irrelevant associations, and use working memory. These processes develop slowly during maturation (Cutting & Denckla, 2003), and they correspond to functions involved in motor control, cognitive control, and social-emotional control. Interrelationships between executive function, language, and academic skills are complex and not well understood, but associations have been made between executive functions and social competence, moral conduct, school readiness, and theory of mind. We will explore attention and memory in the following sections as they relate to learning language, as well as show that bilingual experience and theory of mind are related to executive functioning.
Attention and Memory

Attention and memory are highly interactive processes for learning; thus, one cannot be discussed fully without the other. We might presume that in order to learn something, a child needs to be able to focus his attention on it and then store the relevant details while inhibiting other stimuli not directly related to the learning at hand. Thus, attention and memory co-occur in any learning situation. Given this relationship, we provide some information about these processes in order to illustrate how they contribute to learning.

**Controlled attention**, defined by Swanson and Saez (2003), includes the capacity to maintain and hold relevant information, especially when there are internal or external distractions or interferences in the environment. Imagine yourself in a crowded airport waiting for your flight. You may become deeply involved in your science fiction novel, despite crying babies, announcements of other flights, people talking to each other and on cell phones, and the cacophony of sounds of people on the move. Wolf and Bell (2007) add that working memory allows for the voluntary, focused, and exclusive processing and maintenance of task-relevant information. Thus, you should be able to read and comprehend the information on one page in your novel and use it to understand subsequent paragraphs. Working memory allows us to encode, process, and retrieve information to which we have been exposed, and it is related to performance across academic and cognitive areas.

A well-supported theory of working memory views it as consisting of an executive control system that interacts with, coordinates, controls, and regulates two storage systems. The phonological loop temporarily stores verbal information that individuals use during the process of subvocal articulation. This storage area allows you to rehearse a message in your mind before you store it or speak it. The other storage system is a visual-spatial sketch pad that assists individuals in generating and manipulating mental images (Baddeley, 1986, 1996; Baddeley & Logie, 1999; Swanson & Saez, 2003). You might use this storage space to picture yourself expertly skiing, dancing, or delivering the speech you have prepared for your class assignment.

Working memory develops as children mature, along with all aspects of cognitive control during the early childhood years. Research (Wolfe & Bell, 2007) indicates that young children between the ages of 3½ and 7 years develop these self-regulatory skills, with working memory positively associated with verbal fluency for complex spoken language in 3- and 4-year-old children, and phonological short-term memory associated with receptive vocabulary knowledge in 4-year-olds. Further, as children use their knowledge to practice and learn, phonological abilities and vocabulary have a reciprocal influence, whereby increases in both occur.

As you can imagine, difficulties in controlled attention and working memory result in poor performance when attention must be divided. Children who have attention and memory problems demonstrate weak monitoring of information and difficulty in suppressing irrelevant information. They also show weak storage and processing when verbal and visual–spatial tasks occur together. It is difficult to imagine learning anything without the ability to control attention and use working memory to process, store, and retrieve information. To extend our airport example, consider how frustrating and futile it would be to read the novel when you cannot tune out other people or when you can’t recall what you’ve just read even if you can tune them out.
Executive Functioning and Bilingual Acquisition

As reported by Wolfe and Bell (2007), language is highly associated with attention and working memory. But what influence does knowing two languages have on executive functioning? Do children who are bilingual have some advantages in executive functioning compared to monolingual children? Carlson and Meltzoff (2008) set out to discover the relationship between bilingual experience and executive functioning in young children. They relied heavily on Bialystok’s comprehensive literature review (2001) to establish that inhibitory control over attentional resources develops more rapidly in children who are bilingual; thus, these children are more advanced in their ability to focus attention in the presence of competing information.

You may believe that bilingual individuals use their native language when interacting with one group of people, such as family members, and then switch to their second language when in the presence of another group, such as schoolmates. Guttentag, Haith, Goodman, and Hauch (1984) dispelled the notion that bilingual individuals switch from one language to the other specific to the communication situations they encounter. They found that both languages remain active during language processing, thus requiring the language user to hold the relevant language in mind while inhibiting the nonrelevant language. Daily practice with inhibitory control might thus be more developed in bilingual children. This assumption was put to the test in the Carlson and Meltzoff study.

They used two types of tasks that tap different cognitive functions (conflict tasks and delay tasks) to test three groups of kindergarten children: monolinguals (English), bilinguals (Spanish–English), and children in an immersion language program. The native bilingual children showed an advantage on conflict tasks requiring inhibitory control as compared to the other groups. The groups did not differ on delay tasks that require suppression of motor responses or delayed gratification that requires little use of working memory. This finding supports Bialystok’s theory (2001) regarding the dual direction of influences between language and executive functioning. The authors propose “that early exposure to more than one language may foster the inhibition and working memory skills necessary for cognitive flexibility in a variety of problem-solving situations. The behavioral and brain evidence thus far supports the notion that language switching might be a subset of more generalized executive and behavior-selection processes rather than an isolated linguistic process” (p. 293). The authors reflect on the cognitive advantage that bilingual children have regarding implications for education. Given that bilingual children (Spanish–English) in the United States “are not equally matched with monolingual peers on verbal ability and SES, bilingual children may be able to compensate or achieve the same ends by an alternative route, namely, in our view, honing of the cognitive operations involved in language switching” (p. 293)

Executive Functioning and Theory of Mind

Executive functioning and language development have also been associated with the development of theory of mind. Theory of mind is an understanding of mental states that develops over time to assist us in considering other people’s thoughts, feelings, and knowledge. There is some evidence that bilingual speakers
have advanced theory of mind in comparison to monolingual preschoolers (Goetz, 2003). Miller (2006) tracks some precursors of theory of mind as it relates to communication development. She includes joint attention, appreciation of intentionality, recognition that people have different perspectives, use of mental state words, and pretend play in her discussion of the first 5 years of development. Even as early as 9 months of age, infants begin to establish that adults focus their attention on specific aspects of objects or events. Between the ages of 1 and 5 years, several areas of understanding emerge that allow children to engage effectively in conversations and play. Language development is interwoven with the development of theory of mind. We are able to talk about internal states such as thinking, knowing, and feeling. Language is the way these ideas are represented and shared with others.

*I’m Ready! Let’s Talk!*

There is much we still do not know about the child’s preparation for language, but it should be obvious that the child does not just sit in his crib waiting for that thrilling moment when he begins to speak. From the time the child is born, even before he is born, he is receiving sensory information about his world. From the moment of his birth, he processes all of these data in attempts to understand the nature of objects, people, and sounds. From the earliest moments of his life, he can make distinctions among things he sees and things he hears, and many of these distinctions seem to be relevant to his future social and communicative development. Over the first 2 years of his life, he progresses from an almost completely reflexive and sensory creature to a person who is able to think and solve problems. He progresses from an intellectual view of the world that is strictly reality based and hands-on to a view that allows for mental representation of all that is real and even some that is not. When the child is able to capture the world in his brain and in his thought processes, when he is able to transform things, people, places, events, and actions into abstract, representational forms, he is ready for language. Readiness does not come in one magic moment, of course, and language does not spill out of the child in a complete package. Language, like the cognitive and perceptual abilities on which it is based, emerges in a progressive manner, in steps and stages that are as interlocking and integrated as are the stages of cognitive development. Even in this chapter, which has focused on the preparation for speech and language, we have seen substantial evidence of communicative ability and output. In the next three chapters we will look more closely at speech and language development, a progression that amounts to an explosion in the preschool years but slows down and becomes more evolutionary in nature as the child moves toward adolescence.

As we close this chapter and look ahead to a detailed examination of language development, we should emphasize that although cognitive development and language development are inextricably connected, and although there are clearly cause–effect relationships between cognition and language use, they do not develop in a simplistic parallel manner. The child is clearly a thinker before she is a speaker. She conceptualizes before she can produce the words that represent the concepts she understands. She can link thoughts before she can produce grammatically complete utterances that express those cognitive linkages. The lag between cognitive development and the emergence of correlative language forms was identified quite accurately in
an October 2004 installment of the syndicated comic strip, *Hi and Lois*, written by Greg and Brian Walker and drawn by Chance Browne. In the first panel of this installment, Lois and a friend are watching Lois’s little girl, Trixie, interact with another little girl. Trixie is watching in silence as the other little girl coos and gestures. Lois’s friend says, “Cute! She’s trying to talk to Trixie.” Lois says, “I wonder why Trixie’s not responding.” In the second panel, the cooing little girl continues her efforts while we read Trixie’s thoughts: “I refuse to engage in meaningless babble until my verbal skills catch up to my cognitive abilities.” Trixie would get some arguments from language people about the idea that babbling is *meaningless*, but she is right on target about the delay between thinking and talking. In the chapters that follow, we will take a close look at the developmental process by which the gap between cognition and language is closed, a process that results in such a thorough integration of cognition and language that in mature communication, the line that separates what we think and what we say is nearly nonexistent.

**Web Sites to Explore**

**Howard Gardner’s Multiple Intelligences**
- www.howardgardner.com
- http://surfaquarium.com/MI

**Piaget’s Theory of Cognitive Development**
- http://learningandteaching.info/learning/piaget.htm
- http://psychology.about.com/od/piagetstheory/a/keyconcepts.htm

**Vygotsky’s Social Development Theory**
- http://www.simplypsychology.pwp.blueyonder.co.uk/vygotsky.html

**Dynamic Systems Theory**
- http://philosophy.uwaterloo.ca/MindDict/dynamicsystems.html

**Review Questions**

1. Explore at least one Web site from the list provided that describes and explains the eight intelligences offered by Gardner. Take a self-quiz to discover your most prominent forms of intelligence. Write a paragraph about your top three intelligences as they apply specifically to yourself. What did you find out about your strengths? How did you develop these strengths?

2. What does common sense suggest about the relationship between language and thought?

3. Define and provide examples of the following concepts included in Piaget’s theory of cognitive development: schema, assimilation, accommodation, and equilibrium.

4. Identify and briefly describe each of Piaget’s four stages of intellectual
development from birth through adolescence.

5. What is the principle of distancing? What does this principle contribute to our understanding of cognitive and language development?

6. Define each of the following key concepts and behaviors as the primary players in the sensorimotor stage of cognitive development: object permanence, causality, means–ends, imitation, play, and communication.

7. Six substages comprise Piaget’s sensorimotor stage of intellectual development. Identify what you believe are the most important developmental changes in each substage, and justify your selections.

8. What does recent research suggest about Piaget’s predictions regarding the emergence of object permanence and mental representations? Why is there such a disparity between Piaget’s predictions and empirical evidence?

9. What does the evidence suggesting that mental representation occurs earlier than Piaget predicted suggest about the explanation of early cognitive abilities solely within the context of sensorimotor experiences?

10. Why do some critics of Piaget’s theory believe that the stage concept of cognitive development is no longer viable? Why do others believe that the stage concept, in some form, still has value in understanding how intellectual development occurs?

11. How did Vygotsky’s own life experiences shape his views about cognitive development?

12. Why is Vygotsky’s theory referred to as a sociocultural theory of cognitive development?

13. Differentiate Vygotsky’s private speech from Piaget’s egocentric speech. Why is private speech the preferred label for self-directed talk today?

14. What is meant by the zone of proximal development?

15. Identify and describe the two attributes of adult–child dialogues that presumably facilitate cognitive development.

16. How are cognition and perception related to one another?

17. How is visual perception related to speech and language development?

18. What auditory perceptual abilities does the newborn child have that seem to be related to early communication development?

19. Summarize what is known about the infant’s interest in the human voice and speech.

20. What are two important executive functions that allow children to efficiently and effectively learn information via their environment?

References and Suggested Readings


James, S. (1980). *Normal language acquisition*. Austin, TX: PRO-ED.


