

# Teaching Students with Language and Communication Disabilities

S. JAY KUDER



# Teaching Students with Language and Communication Disabilities

FIFTH EDITION

S. Jay Kuder

*Rowan University*



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# Preface

In response to legislation such as the Individuals with Disabilities Education Act and the No Child Left Behind Act, most students with disabilities are now expected to be taught the same curriculum as their peers without disabilities. To be successful in a more challenging curriculum, these students must have the language skills, both spoken and written, that are required.

The purpose of this book is to help teachers and other professionals who work with children identify, understand, and help those with language difficulties so that they can achieve success in school and in life after formal schooling is completed. To achieve these goals, it is essential that all educators, special and regular, understand language—what it is and how to help children experiencing difficulty with it. This book is designed to assist teachers and other education professionals to acquire knowledge about language, language development, language disorders, and evidence-based practices for enhancing language skills that will enable them to become more effective teachers and/or clinicians.

## New to This Edition

The fifth edition of *Teaching Students with Language and Communication Disabilities* includes a number of significant changes. In addition to an update of the research literature, the following are new to this edition:

- The content on language assessment and intervention has been reconceptualized and reframed to better match the Response to Intervention (RTI) model that is becoming more prevalent in the United States.
- Chapter 13 (Language Assessment and Instruction in the Classroom) is now focused on classroom-based language assessment and instruction that are consistent with the first two tiers common to most RTI models.
- Chapter 14 (Intensive Language and Communication Assessment and Instruction) focuses on the more extensive and intensive assessment and instructional methods usually associated with tier 3. Such instruction is usually provided by a special educator and/or a speech-language specialist.
- Throughout the book, there are expanded discussions of emerging technologies, such as the use of mobile apps, that are enabling teachers to provide more individualized instruction to students at a lower cost.

This edition includes a co-author with expertise in second language acquisition—my daughter, Emily Kuder. Emily is a certified teacher of Spanish who has expertise in the



linguistic structures of Spanish, language education, and second language acquisition. She brings a new and welcome perspective to this text.

I hope that faculty and students will find this edition more up-to-date and more grounded in effective practice research while continuing to be readable and practical. My goal, as always, is to present information about language in a form that teachers and other education professionals can use to help children enhance language and literacy skills.

## About the Authors

**Dr. S. Jay Kuder** is a professor in the Department of Interdisciplinary and Inclusive Education at Rowan University in Glassboro, New Jersey. Dr. Kuder's research interests are in the development of effective practices for enhancing the language and literacy skills of children with disabilities. His recent research has focused on the use of technology to enhance communication and social skills in students with autism spectrum disorders. Dr. Kuder holds a master's degree in special education from Temple University and a doctoral degree in applied psycholinguistics from Boston University. He is a member of the American Speech-Language-Hearing Association and the Council for Exceptional Children and is a fellow of the American Association on Intellectual Disabilities.

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# Language and Language Disorders

*In this chapter we will explore the meaning of the terms speech, language, and communication. It is important to understand the meaning of each of these terms since they will be used throughout the text. In addition, they are frequently used—and sometimes misused—to describe the difficulties experienced by some students.*

*Once we are reasonably sure what we are talking about, it is possible to begin to identify children with language disorders. In this chapter we will also discuss the concept of language disorder and consider some criteria for identifying students with language difficulties.*

## Learning Outcomes

After reading this chapter, you should be able to:

1. Differentiate among *speech*, *language*, and *communication* and explain the characteristics of each.
2. Describe the characteristics of language disorders.

## Kevin: A Case Study

Kevin is a 9-year-old student in a regular fourth-grade classroom. Kevin seems bright and usually works hard, but he is a puzzle to his teacher. Sometimes it seems as though he's just not all there. He misunderstands directions—failing to complete all of the assignment or even working on the wrong pages. He is reluctant to answer questions in class. When he does answer, he stops and starts and seems confused. Kevin is a slow, hesitant reader. His teacher, Mrs. Ross, has noticed that his comprehension of text often seems to be ahead of his ability to read the words themselves. He is a poor speller. In his

writing he tends to use short, choppy sentences, and his output is often poorly organized. Although Kevin is good in math, he has difficulty with word problems. In addition to these problems with his schoolwork, Kevin often appears to be lost among his fellow students. He hangs behind the others when they go out to play and often eats by himself at lunch.

Mrs. Ross would like to help Kevin, but she is not sure what is wrong. Is he immature? Should he be referred for special education? Could there be some medical reason for Kevin's problems?

Kevin is typical of students who have problems with language and communication. He may be experiencing difficulty understanding incoming language and producing appropriate spoken responses of his own. He appears to lack some of the subtle communication skills that are critical to social acceptance by his peers. He is at risk for academic as well as social difficulties. If nothing is done, it is likely that Kevin's problems will get worse. As the pace of learning increases in middle and high school, he is likely to fall further behind. But what *should* be done? And just what is Kevin's problem?

In order to understand Kevin and children like him, it is first necessary to understand the nature of language and the related concepts of speech and communication. This may

help in determining what kind of difficulty Kevin is experiencing. It may even help in the development of procedures to help Kevin and children like him to enhance their skills in language and communication.

## Speech, Language, and Communication

### Speech

Speech, language, and communication are all words that are sometimes used in describing the language production and language difficulties of children. It may be that Kevin has a speech problem. He may also have a language problem. Is this just another way of saying the same thing? He may well have some problems communicating with others. How can we describe the problem that Kevin, and other students like him, are having? Does it make any difference what we call his problem, or is this just a tiresome academic debate?

In order to answer these questions, it is necessary to know just what we mean by the terms *speech*, *language*, and *communication*. They are often used loosely, even by some professionals, in describing the difficulties many children face in learning and interacting. But each of these terms has a particular meaning that has implications for understanding and helping students. To understand what *speech*, *language*, and *communication* mean, we have to ask some other questions. Is it possible to have speech without language? Consider the 3-month-old baby as she begins to babble. Listen to the sounds she makes: “bah,” “gah,” “buh.” Are these speech sounds? Linguists (people who study language) say that these *are* speech sounds because they have characteristics that are identical to the same sounds produced by adults. What about people with echolalia? This is a condition prevalent in some children with autism spectrum disorders in which they repeat what they hear. For example, I might say, “What did you have for dinner?” and a person with echolalia might respond, “What did you have for dinner?” Did this person use speech? Of course, the answer is yes.

In each of these examples, it is clear that speech is being used, but most linguists would say that in neither case is true *language* being used. Although Mommy or Daddy may claim to understand what baby is saying, most outsiders would have a hard time interpreting the sounds being uttered. The baby’s speech could hardly be said to be conforming to the rules of adult language. In the case of an individual with echolalia, although the speech output is certainly in the form of language, it is not being used in a meaningful way. It is not an appropriate response within the context of the conversation.

These observations can help us differentiate between speech and language. **Speech** can be defined as the neuromuscular act of producing sounds that are used in language. Not all sounds are speech sounds in a particular language. For example, a person can make clicking sounds with his or her tongue. Although these may actually be speech sounds in some African languages, they are not speech sounds in English. Speech, then, is a physiological act in which the muscles involved in speech production are coordinated by the brain to produce the sounds of language.

### Language

Language is unique to humans. It is, in fact, what makes us human. Do you agree?

While many linguists claim that language is only found in humans, research with many types of animals over the past 50 years has challenged this claim while helping us to clarify our understanding of language itself. This research has found that some animals

### Box 1.1 Do Animals Have Language?

In their book titled *Apes, Language, and the Human Mind*, Savage-Rumbaugh, Shanker, and Taylor (1998) describe the remarkable language (and other accomplishments) of Kanzi, a bonobo (a species of ape from Africa). The authors recount this event:

One day when Kanzi was visiting Austin (a chimpanzee), he wanted some cereal that had been prepared specifically for Austin. He was told, "You can have some cereal if you give Austin your monster mask to play with." Kanzi immediately found his monster mask and handed it to Austin, then pointed to Austin's cereal. When told, "Let's go to the trailer and make a water balloon," Kanzi went to the trailer, got a balloon out of the backpack, and held it under the water faucet. (p. 139)

What does an interaction such as this mean? Did Kanzi really understand what was being said to him? He certainly responded as if he did. But what did he understand? Did he understand the grammar of the complex sentence that he heard? Did he understand the words? Or did he just understand the situation and "figure out" what was expected of him?

These are questions that have long fascinated psychologists and linguists alike. Although early attempts by Winthrop and Luella Kellogg in the 1930s and Keith and Kathy

Hayes in the 1940s to induce language in chimps by raising them just as they would a human infant were largely a failure, the interest in nonhuman primate language did not disappear. Beginning in the 1960s, with research by Beatrice and Allan Gardner of the University of Nevada, interest in the potential language abilities of chimps and other nonhuman primates was revived. Using American Sign Language as the means of communication, the Gardners successfully trained a chimp named Washoe to use over 100 signs. Even more exciting, they claimed that Washoe created new signs by combining signs she had already learned (Gardner & Gardner, 1969).

Many of the claims put forward by the researchers on the language abilities of chimpanzees and apes have been challenged by other scientists. For example, after examining some of the Gardners' earlier research, Dr. Herbert Terrace of Columbia University (Terrace, 1980) concluded that many of the claims for evidence of chimps' language abilities were overblown and that the supposed uses of language were, in fact, merely instances of sophisticated imitation.

The debate on whether language is unique to humans will continue. It is a fascinating debate because it raises questions about what defines language as well as what it means to be human.

appear to have language skills that approach those of humans. Certainly, many species have highly effective communication systems. See Box 1.1 for details on some of the research on language in animals.

Although some animals have demonstrated remarkable abilities to communicate, linguists such as Noam Chomsky and psychologists like Steven Pinker (1994) claim that language is, indeed, unique to humans. Chomsky and his colleagues (Hauser, Chomsky, & Fitch, 2002) claim that the systems of communication of bees and chimps differ qualitatively from human language because they lack the rich expressive and open-ended power of human language. While they acknowledge that humans have much in common with other animals that helps them to develop language in the "broad sense," they also believe that there are aspects of language that are unique to humans. Pinker (1994) argues for the existence of what he calls a language "instinct," a unique feature of humans that is based on the biological development of our brains. Pinker and his colleague Ray Jackendoff (2005) claim that language is a unique adaptation of the human species for the purpose of communication.

While some linguists (for example, Brian MacWhinney, 1999) reject the idea that language is innate and solely the result of biological determinism, there can be little doubt that language is universal in humans. It has been estimated that there are nearly 7,000 languages being spoken today somewhere in the world (Lewis, 2009). Languages are found in all types of societies—urban and rural, industrialized and agricultural—in all regions of the world (search for the Ethnologue website to view a map showing languages of the world).

So, what is language? Before we can arrive at a definition, it is necessary to ask another question. Is it possible to have language without speech? The answer is yes. One example is American Sign Language (ASL). Most linguists agree that American Sign Language is a language (Battison, 2000). It is the primary mode of communication of many people who are deaf. It is a gestural language that has its own unique grammatical structure. But why is it considered a language? What makes it so?

One feature may be obvious: A true language *communicates*. It communicates thoughts, ideas, and meaning. Although communication is a necessary feature of language, it is not sufficient to describe language. Linguists say that in order for a system of communication to be a language, it must be shared by a group of people. They call this feature a *shared code*. That is, although not everyone may know ASL (just as not everyone knows Hungarian), those who know the language being used can communicate with each other. You might ask, “How large does the group need to be?” Now that is another interesting question. There have been occasional reports in the press of twins who share a “secret language.” Researchers who have studied this phenomenon have concluded that, although some twins do indeed develop unique words and sentence structures, most grow out of this stage quickly (Bishop & Bishop, 1998). Even if it lasts just a short time, is this really a language? After all, it is a system of communication that is shared by more than one person. In order to answer this question, we need to know more about what makes a system of communication a language.

A third feature of language is that it consists of *arbitrary symbols*. That is, the symbols have meaning simply because we say they do. There is no reason that a tree might not be called a “smook.” There is nothing green and leafy about the word *tree*. Although a few ASL signs are iconic (they look like the things they represent), most are arbitrary symbols. Therefore, ASL has this feature of language. Another feature of language is that it is *generative*. Given a finite set of words and a finite number of rules, speakers can generate an infinite number of sentences. Although you are an educated person who has read widely, there are certainly sentences in this book that you have never encountered before. This is due to the generative property of language. Finally, language is *creative*. New words are constantly entering the language while existing words drop out of usage or change their meaning. Consider some of the new words that have entered the English language—*byte*, *Teflon*, *laser*. How about words that have acquired additional meanings—*gay*, *cool*, *neat*?

You can see that language is a complex phenomenon and, as such, is difficult to define. Even linguists sometimes have difficulty defining whether a communication system is a language. **Dialects** are variants of a language. They may differ in just one component (think of regional differences for words such as “bag” and “sack” in the United States) or in many components (for example, regional dialects in Italy that can vary so much that speakers from different areas cannot understand each other). At what point does a dialect actually become a separate language? This is a really difficult question and one that linguists continue to struggle with (e.g., Backus, 1999). Although there is no definitive answer to the question of the point at which a dialect can be considered a separate language, asking questions such as this helps us better understand what defines a language.

Because language is such a complex phenomenon and still not completely understood, there is not a single, widely accepted definition. Let's see if we can build our own definition of language. It seems that most of the experts agree that language is **symbolic** and **rule-based**. Our discussion of the use of language suggests that communication through a **shared code** (or, as Hult, Fahey, & Howard [2014] put it, "conventions") is essential. So, putting it all together, we arrive at the following definition that we will use in this book:

**Language** is a rule-governed symbol system for communicating meaning through a shared code of arbitrary symbols.

This definition conveys the idea that language involves communication that is shared by a community. Another important feature of language is that it is both receptive and expressive. That is, it involves both the understanding of language (receptive) and the production of language (expressive). Young children and some children with disabilities may not be able to produce the adult form of words, but if they consistently respond to language input, they can be said to have developed language.

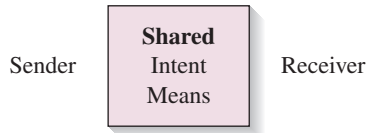
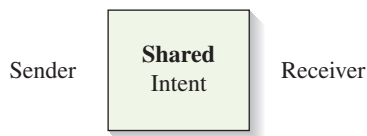
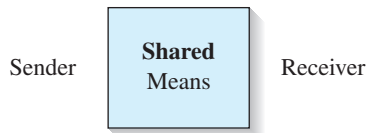
## Communication

Is it possible to communicate without language? If you have ever been in a noisy room, the answer should be obvious. A lot of communication can occur nonlinguistically. A smile, a shift in body position, a gesture, or even the raise of an eyebrow can communicate a great deal. Sometimes these communicative attempts may be misinterpreted, causing problems. But, clearly, it is possible to communicate without spoken language.

Communication is the broadest of the terms that we have attempted to define. **Communication** has been defined by one author as "the process participants use to exchange information and ideas, needs and desires" (Owens, 2015, p. 9). In order for communication to take place, there must be four elements:

1. A sender of the message
2. A receiver of the message
3. A shared intent to communicate
4. A shared means of communication

When all of these elements are present, communication may occur (see Figure 1.1(a)). But when one or more of these elements is missing, there may be a breakdown in communication. Figure 1.1(b) shows what may happen if you meet someone in a foreign country. You may both want to communicate, but unless you share a common language, you may be unable to do so. Although you share the intent to communicate, you lack a shared means of communication. However, if you can get your messages across with gestures and facial expressions, you may be able to communicate with each other after all. Conversely,

**Figure 1.1****Components of Communication****(a) Successful Communication****(b) Shared Means of Communication Lacking****(c) Shared Intent Lacking**

two speakers may share the means to communicate (i.e., a common language) but not share the same communicative intent (see Figure 1.1(c)). For example, if I am teaching a class and suddenly feel hot, I may look at a student in the class who is seated near the window and say, “Gee, it’s hot in here.” If the student’s response is to say, “Yes, it is,” we have failed to communicate. My intent was for the student to open the window. The student’s understanding of my message was that I was simply commenting on the room temperature. For communication to be successful, all of its elements must be in place: a speaker, a listener, a shared intent to communicate, and a shared means of communication.

We have seen that speech and language can be used for communication but are not essential for communication. Communication can take place without either speech or language being used. Similarly, language can be either spoken or nonspoken (e.g., ASL). Speech can be used to express language or for nonlanguage utterances (e.g., babble or echolalia) (see Figure 1.2).

For our purposes it is important to understand the distinctions among speech, language, and communication because these distinctions can help us be more specific about the nature of the problems of a student such as Kevin. It could be that his difficulties are primarily the result of speech problems, such as misarticulation. This could account for some of his reluctance to talk in class and for some of his difficulties in socializing with his peers. But a speech problem alone would not explain Kevin’s difficulties in understanding language or his problems with reading and writing. Kevin clearly has some difficulty communicating with others. This could be caused by misunderstanding the communicative intentions of others or by deficiencies in the language skills that are necessary for communication. It is most likely that Kevin has a language disorder. His difficulty in using and interpreting language for learning and socialization support this conclusion.

**FIGURE 1.2****Speech, Language, and Communication**

*Speech:* The neuromuscular act of producing sounds that are used in language.

*Language:* A rule-governed symbol system for communicating meaning through a shared code of arbitrary symbols. Language:

- Communicates.
- Is a shared code.
- Consists of arbitrary symbols.
- Is generative.
- Is creative.

*Communication:* “The process participants use to exchange information and ideas, needs and desires” (Owens, 2015). In order for communication to take place, there must be a:

- Sender of the message.
- Receiver of the message.
- Shared intent to communicate.
- Shared means of communication.

## Language Disorder

Children with speech and language disorders constitute the second largest category of students with disabilities identified under the Individuals with Disabilities Education Act (IDEA). In the 2011 to 2012 school year, nearly 1.4 million children (about 2.8% of the total school population) in the United States received services for a speech or language disability (U.S. Department of Education, 2015). As large as this number is, it likely underestimates the incidence of speech and language disorders in the school-age population. The IDEA number is based solely on those children who have a primary classification as being speech and language impaired. However, many children with other disabilities (e.g., autism, intellectual disabilities, learning disabilities) have significant speech and/or language disorders. The National Institute on Deafness and Other Communication Disorders (2015) estimates that the prevalence of speech and language disorders is closer to 6 percent of the school-age population. That would mean approximately 3,000,000 children in the United States have a speech or language disorder.

However, there may be far more children with speech and language difficulties who are not receiving services. Current estimates are that about 17 percent of the total U.S. population has some type of communication disorder (Owens, Farinella, & Metz, 2015). Children with language “difficulties” may lag behind their peers in one or more areas of language, but their problems may be less pervasive and less severe than those of children identified as language “disordered.” Even though they may have less serious language challenges, students with language difficulties may be at risk for reading and writing difficulties.

The American Speech-Language-Hearing Association (ASHA) has defined **language disorder** as follows:

A language disorder is impaired comprehension and/or use of spoken, written, and/or other symbol systems. This disorder may involve (1) the form of language (phonology, morphology, syntax), (2) the content of language (semantics), and/or (3) the function of language in communication (pragmatics) in any combination. (ASHA, 1993, p. 40)

Let’s take a look at this definition in more detail. The first major point highlighted by the ASHA definition is that language disorder includes both *comprehension* of language and language *production*. Children who have comprehension (receptive language) difficulties may have a hard time following directions and may appear to be inattentive. Students who have problems with language production (expressive language) may be reluctant to participate in activities that require the use of language. They may use more immature language than do their peers. They might also have difficulty relating personal experiences or retelling stories. Sometimes the productive language problems are more obvious, but difficulties in comprehension can be as much as or more of a problem in the classroom.

The second major point made by the definition is that the disorder can be identified in *either spoken or written* language. Usually we think of a language disorder as referring just to *spoken* language problems. But the definition points out that language is an essential part of writing as well. Sometimes problems in writing are caused by an underlying difficulty in using language.

The third major point is that language disorders can occur in *one or more* aspects of language. We will examine these elements of language in more detail in the next chapter, but the important point is that a language disorder can be pervasive or limited in scope.

It is important to distinguish language *disorders* from language *differences*. Many students come to school speaking a language other than English as their first language or a dialect that differs from standard English. These children must not be labeled “language disordered” merely because they talk differently from their teachers or from some societal standard. However, some children may talk differently and have a language disorder. Later in this book, we will see how experts have devised ways to differentiate children with language differences from those with language disorders.



Language disorders can vary from mild (e.g., problems in using word endings but easily understood by others) to severe (e.g., extreme difficulty in understanding what others say or being understood by others). At times, terms such as *delay* and *deviance* may also be used in relation to language disorders; however, both of these terms are problematic. Most clinicians and researchers prefer not to use the term “deviance” because of the very negative connotations of the term. While children with language disorders may “deviate” from the typical course of development, there is nothing inherently “deviant” about them. The term “delay” suggests that there is nothing seriously “wrong” with the child. Given time, they will catch up. But is this always true? Is there a point where a delay becomes a disorder? If a child is a year behind? Two years? Ten years? In many cases, what looks like a delay at one point in time may be recognized as a plateauing of development later. That is, the child has stopped developing and is now recognized as having a language disorder. Therefore, most practitioners prefer to use the term “language disorders” to describe impairments in language development.

Often children with language and communication disorders experience related problems that may be the result of their language difficulties. They may have difficulty interacting with their peers. They may be shy and reluctant to approach others. Other children may ignore them or, even worse, reject their attempts at friendship. Some children with language and communication disorders have difficulty with cognitive functioning. They may have problems organizing information for recall, may be less attentive than their peers, and may be generally slower to respond. Sometimes children with language and communication difficulties exhibit behavior problems. These problems may be the result of their own frustration with communication, or they may result from the response of others to their difficulties. Some children with language and communication disorders have physical disabilities that either cause or exacerbate their difficulty. For example, children with cleft palate often have difficulty with articulation, and children with mild, fluctuating hearing loss are at risk for a variety of language and communication disorders.

Language disorders are often associated with disabilities such as autism and **intellectual disability**. Children with language disorders may be called “dysphasic,” “dyslexic,” “dysnomic,” “communication handicapped,” “language learning disabled,” and so on. However, language disorders are not limited to children with classifications such as mental retardation and intellectual disability. Many students with mild language difficulties are never classified or are grouped under the general term *learning disabled*. In this book, I have chosen to organize the sections on specific language disorders by category of disability. This was no easy choice, and I recognize its potential for confusion. It might seem that the book is saying that all children with a particular disability (e.g., intellectual disability) have language disorders when, in fact, this may not be the case. Alternatively, it might seem that a child has to be classified with a disability label to have a language disorder. This also is not true. However, special education tends to be organized on the basis of diagnostic categories, and much of the research on language disorders is related to diagnostic categories. So, although these categories may sometimes be misleading, they provide an organizing framework for understanding language disorders.

The key criterion in determining whether a language difficulty is serious enough to require intervention is the impact the problem has on the child and on others. Does the child appear to be concerned about the problem? Is the language difficulty interfering with the child’s ability to learn and/or socialize? Do other children tease or reject the child because of difficulties the child may be experiencing with speech, language, or communication? If the answer to one or more of these questions is yes, the child may require some sort of intervention.

Because children with language and communication disorders are at risk for academic and social failure, it is important that their difficulties be identified as early as possible. In many cases, it may be possible to correct or at least enhance their performance. Children with language and communication disorders may exhibit a wide variety of characteristics. Some of the more frequently occurring characteristics are listed in Figure 1.3. Students who are experiencing one or more of these characteristics for an extended period of time

**FIGURE 1.3****Characteristics of Children with Language and Communication Disorders****Academic Performance**

- Reluctance to contribute to discussions
- Difficulty organizing ideas
- Difficulty recognizing phonemes
- Difficulty producing sounds
- Failure to follow directions
- Difficulty finding the right word for things

**Social Interaction**

- Reluctance to interact with other children
- Exclusion or rejection by other children
- Difficulty carrying on a conversation
- Problems negotiating rules for games

**Cognitive Functioning**

- Difficulty organizing information for recall
- Slow responding
- Inattentiveness

**Behavior**

- High level of frustration
- Frequent arguments
- Fighting with peers
- Withdrawing from interaction

may have underlying difficulties with language and communication. A comprehensive evaluation should include language and communication skills to determine whether they may be contributing to the child's learning and/or behavior difficulties.

Recognizing the problem and determining the need for intervention is a necessary first step in helping children with language and communication difficulties. But it is only a first step. Knowing *what* the child should be able to do and how to help the child get to that point is the goal of the rest of this book.

**Summary**

In the beginning of this chapter, the definitions of speech, language, and communication were presented and the characteristics of each term and the differences between them were described. Communication is the broadest of these concepts, encompassing both verbal and nonverbal interaction. Speech refers to the neuromuscular act of sound production. Language is a complex phenomenon that involves the use of symbols that conform to rules that are used to express meaning. In addition, language disorders were defined as deviations (or differences) from typical development and/or appropriate use of language. It is important to identify language disorders as early as possible because such disorders can cause serious problems in learning and socialization. Moreover, with early identification, it may be possible to help children make significant improvement in their language skills.

# Understanding the Elements of Language

Language has been described as consisting of several elements. In this chapter we will look in depth at the elements of language. We will see how linguists have described each element and the rules that govern its use. Knowing these elements forms the framework for understanding language disorders and for differentiating language disorders from language differences. We will also examine ways to support the development and use of the elements of language by children.

## Learning Outcomes

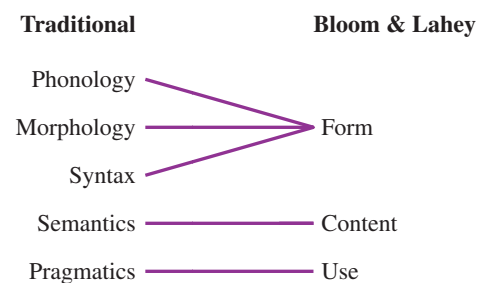
After reading this chapter, you should be able to:

1. Explain what a *phoneme* is and how to recognize it.
2. Define the term *morpheme* and understand how to count morphemes in words.
3. Explain the rules that underlie syntax and recognize their application to sentence building.
4. Describe the challenges in developing rules for semantics.
5. Explain the concept of *pragmatics* and its application in communication.

Human language is extremely complex. In order to simplify and better understand language, linguists have developed various systems for dividing language into its components (or elements). Most linguists identify five major elements: phonology, morphology, syntax, semantics, and pragmatics. Alternatively, Bloom and Lahey (1978) describe language as consisting of three components: form, content, and use. This model recognizes the interrelatedness of language elements. Within the component they call “form,” Bloom and Lahey include the elements of phonology, morphology, and syntax (see Figure 2.1). It is often difficult to separate morphology from phonology (for example, when children are learning that the plural form of *cats* makes an “s” sound but the plural of *dogs* has a “z” sound). Similarly, morphology and syntax are closely related in the emergence of language

**Figure 2.1**

Model of Language Components and Elements



in young children. Nevertheless, in this chapter, we will use the model that includes five language elements because it describes language in its most elemental form. However, as you read the chapter, you should keep in mind the interrelated nature of these elements.

## Phonology

As an exercise to illustrate the interrelatedness of language elements, imagine that your task is to program a computer to understand and use spoken language—in this case, English. This is a formidable task but one that has been pursued for some time and has begun to yield very promising results. What would you include in your program? What would the computer need to know in order to process language?

Since computers work best with the most elemental sort of information, the first step might be to input the sounds of the English language. This would not be a terribly difficult task. Linguists have identified approximately 43 (there are variations due to dialect and regional differences) distinctive sounds in English. These elemental units of language are called *phonemes*. A **phoneme** is the smallest linguistic unit of sound that can signal a difference in meaning. That is, native speakers recognize that because of the change of one sound, the meaning of the word changes.

A complete list of phonemes in both American and British English can be found at the Antimoon website (click on “How to learn English,” then “Pronunciation,” and then click “The sounds of English and their IPA symbols”).

Linguists can determine whether a sound is a phoneme in a particular language by asking native speakers of that language whether the sound, when added to a root word, makes a new word that they recognize. For example, let’s say that we have already established that *bill* is a word in English. Now, if we substitute a *p* sound for the initial *b* sound, will speakers of the language recognize this as a new word? Yes, they recognize the new word as *pill*. Therefore, it appears that *p* is a phoneme in English. Linguists call the two words *pill* and *bill* a **minimal pair** because the two words differ only with respect to one sound. Now, let’s say that we have determined that the word *row* is a word in English. If we substitute a rolled *r* for the flat *r* in *row*, have we made a new word that speakers of English recognize as having a different meaning? No. Although the rolled *r* is a phoneme in Spanish, it is not a phoneme in English.

We can describe all of the sounds in English in terms of the way that those sounds are produced. Vowels are classified in terms of the height and position of the tongue and the shape of the mouth. Consonants are classified in terms of the **place of articulation** (the location of lips and tongue), **manner of articulation** (how the sound is produced), and whether the sound is **voiced** or **unvoiced** (whether the vocal folds vibrate during production of the sound). Now let’s go back to our minimal pair: *pill* and *bill*. How do the two sounds “puh” and “buh” differ? Both sounds are considered **bilabial**, because they are made by putting the lips together. Both sounds are also classified as **stops** because the stream of air is stopped by the lips. But “buh” is voiced—that is, the vocal folds vibrate—whereas “puh” is **voiceless**—it is produced with a puff of air. Try saying both sounds. Can you feel the difference?

As you have probably realized, the number of letters in English (26) does not match the number of phonemes (43, give or take a few). This creates a number of problems. Take the letter “a.” How do you pronounce this letter? Is it pronounced like the “a” sound in the word “may” or like the “a” in the word “can.” Clearly, there are several ways to pronounce the letter that we call “a” in English, depending on the other letters that precede or follow it.

This mismatch between the number of letters in the English alphabet and the number of sounds in the language contributes to the difficulty that some children have in acquiring reading and writing skills. We will have more to say about this dilemma in Chapter 6.

Having programmed our computer with the 40 or so sounds of English, we are ready to go. The first word our computer produces is *tphj*. Oh no! Something seems to be missing. In fact, what is missing are the rules that govern phonology. Remember, our definition of language said that it was a *rule-governed* system. In phonology there are constraints on which sounds can (and cannot) occur together. These are called **phonotactic constraints**. They determine that we can have a word like “team” but are unlikely to ever have a word like “lteam.” There are also rules (or constraints) that tell when and how vowels must be used and how sound combinations are pronounced. Phonotactic constraints can sometimes make it difficult to learn another language, since the sound combinations in those languages may differ from ours.

While many linguists use the word “rules” to describe how language is structured, some are using the word “constraints” (as we did above in discussing which sounds can co-occur in English). The idea of “constraints” comes from **optimality theory**. This model of linguistics emphasizes the role of higher-order cognitive (thinking) processes in governing speech production and recognizes the flexibility in language (Stemberger & Bernhardt, 1999).

**Phonology**, the first of the form elements of language, is the study of the sound system of language. Linguists who are interested in phonology attempt to identify the phonemes of a language and the rules (or constraints) that govern the combination and pronunciation of these phonemes. Knowledge of these rules enables linguists to understand how native speakers of a language know which sound combinations are possible in their language.

## Morphology

So it looks as though we are ready to proceed with our task of developing a computer program to process language. With the rules governing sound, our computer is now producing combinations that look a lot more like English. Some of them may not be words that we recognize (e.g., *blif* and *ulop*), but they are at least *possible* English words. Soon we notice that we are getting some larger words, such as *unpossible* and *deerses*, and we realize that something else is missing. Although these combinations of sounds conform to the rules of phonology, speakers of the language reject these combinations.

The problem is that there must be another set of rules—a set of rules that govern how words are made. In fact, there is such a group of rules. They are called *morphological rules*. **Morphology** is the study of words and how they are formed. Morphological rules determine how sounds can be put together to make words; they govern the structure of words.

Consider the word *base*. Any speaker of English would acknowledge this as a word in English. What about *baseball*? Of course this is a word, too, but it is different. It consists of two words—*base* and *ball*. Moreover, each of these words has a meaning that is related to the compound word. That is, both *bases* and *balls* are used in the game of baseball.

Based on this type of evidence, linguists have concluded that there are elemental building blocks of language called *morphemes*. A **morpheme** is the smallest unit of meaning in a language. To better understand morphemes, let’s go back to the previous example. The word *base* is a morpheme. It cannot be broken into smaller pieces while retaining its original meaning. So what about *baseball*? As discussed previously, this *can* be divided into two parts that retain the meaning of the whole—*base* and *ball*. Therefore each of these words is a morpheme.

Actually, linguists say that there are two basic kinds of morphemes. To illustrate, let's return again to the example. We have already said that *baseball* consists of two morphemes. Each of these is called a *free* morpheme. In other words, each morpheme can stand on its own as a word with meaning. Now let's add a plural *s* to create the word *baseballs*. How many morphemes do we have now? There must be three, since we have already established that *baseball* alone has two morphemes. But what is this new morpheme? What does *s* mean? In this context the *s*, since it is used as a plural, means "more than one." Therefore, there are three morphemes in the word *baseballs*: *base*, *ball*, and *s* (plural). However, the plural *s* is a special kind of morpheme. It cannot stand alone but has meaning only when it is attached to other morphemes. It is called a *bound* morpheme. Prefixes (such as *un* and *pre*) and suffixes (such as *ing* and *able*) are examples of bound morphemes.

If all of this seems a bit complicated, just consider the kind of problems that linguists have with words such as *cranberry*. For years linguists thought that this was one morpheme, since there is no such thing as a *cran*. Then along came *cranapple* juice. This demonstrated that *cran* can be separated from *berry* and still retain its meaning. Therefore, maybe *cranberry* was really two morphemes all along. This is the sort of debate that linguists love to pursue.

For our purposes, the point of this discussion is that there are rules that determine what a word is and how words can be formed. Thus, native speakers of English recognize that the word *unlikely* is fine but *inlikely* does not mean anything, and that even though *boy* is pluralized as *boys*, more than one man is not *mans* but *men*. But how do we account for the fact that sometimes the plural "s" is pronounced like /s/ (as in *cats*) and sometimes like /z/ (as in *dogs*)? These variations in pronunciation are called **allomorphs** and can be explained by understanding how phonological and morphological rules work together. When "s" follows an unvoiced stop sound ("t"), it is pronounced as /s/, but when it follows a vowel or most voiced stops (like "g"), it is sounded as /z/.

Morphology, then, as the study of words and how they are formed, includes the identification of morphemes (the basic *meaningful* units of language) and the rules for constructing words. With our computer programmed to identify and use morphemes, we can eliminate many of the strange letter sound combinations we were getting previously. Unfortunately, now we are getting sentences such as the following: *car the man hit the* and *the sweet is very child*. Clearly, there is still something wrong with our computer program. We need another set of rules. This additional group of rules is called *syntax*.

## Syntax

Look at the following first stanza from Lewis Carroll's "Jabberwocky":

'Twas brillig, and \_\_\_\_\_ slithy toves  
 Did \_\_\_\_\_ and gimble in the \_\_\_\_\_:  
 All mimsy were the borogoves,  
 And the mome raths outgrabe.

Can you guess what goes in each blank? You may not always get the exact word (*the*; *gyre*; *wabe*), but, even though this is a lot of nonsense, you probably guessed accurately about the *type* of word that must go in the blank. You undoubtedly knew that the first word was an article. You probably guessed that the second word was a verb and the third word was a noun. How did you do this? The answer is that you have rules of grammar (syntax) that help you accomplish tasks like this. You may or may not be able to formally state the rules. You may not even be aware that you possess these rules (until you are forced to use them in some ridiculous exercise), but they are there. These are *syntactic* rules. **Syntax** is the study of the rules that govern how words are put together to make phrases and sentences. What do these rules look like?

How would you describe the structure of the following sentences?

1. The dog is running.
2. The girl is reading a book.

For the first sentence, you might say that there is an article (*the*) and a noun (*dog*), an auxiliary verb (*is*), and a main verb (*running*). These are elements of the syntactic rules that linguists call **phrase structure rules**. These rules describe the structure of sentences.

Linguists have devised a shorthand code to describe these rules. For the first sentence, the code would look like the following:

S = NP + VP  
 NP = Art + N  
 VP = Aux + V

This notation says that the sentence consists of two elements—a noun phrase and a verb phrase. The noun phrase, in turn, consists of two elements—an article and a noun. The verb phrase also consists of two other elements—an auxiliary verb and a main verb.

If this were all that we knew about the English language, we could say that these were the rules of English syntax. But then we might find a sentence like the second example. Since this sentence is not completely explained by our original set of phrase structure rules, we must modify the rules somewhat. The second sentence example could be rewritten as:

S = NP + VP  
 NP = Art + N  
 VP = Aux + V + NP  
 NP = Art + N

This sentence introduces a new element into our phrase structure rules—a noun phrase that *follows* a verb phrase. If we were to continue examining sentences and refining our rules, we would end up with the finite (and surprisingly small) set of rules for the English language. Although small in number, these rules can be used to generate an infinite number of sentences, because of the *recursive* feature of phrase structure rules. This feature permits phrases to be joined together without limit. For example, in conjoined sentences (sentences that include a conjunction such as *and* or *but*), two or more noun phrases may be joined, as in the following example: *The boy and the girl sat outside the school*. Other nouns (e.g., *teacher*, *man*, *friend*) could be added to our sentence without limit. Similarly, more than one verb phrase may be embedded in a single sentence as in: *The girl who is here is my niece*.

For many years it was thought that phrase structure rules were all that were needed to describe a language. But there are certain kinds of sentences that are not easily explained by these rules. These include imperative sentences (*Go to bed!*) and questions (*Why are you crying?*). Such sentences bothered linguists for many years because they could not be adequately explained. Finally, Noam Chomsky (1957, 1965) developed a theory to account for these kinds of sentences. Called *transformational grammar*, his theory suggests that there are two levels in all languages—a surface structure and a deep structure. The surface structure is what we actually hear, but the deep structure is the underlying linguistic structure of the utterance. Between the deep structure and the surface structure, according to Chomsky, there is a set of rules (*transformational rules*) that can convert a deep-structure sentence to something else.

For example, take our question sentence, *Why are you crying?* The underlying (deep) structure of this sentence would be *You are crying* (deep-structure sentences are always simple, declarative sentences). In order to get the surface question, a question-transformation rule has to be applied, inverting the subject (*you*) and the auxiliary verb (*are*) and adding the appropriate *wh* word (*why*). This entire operation occurs subconsciously. In the case of the imperative, the deep-structure sentence is actually *You go to bed*. The imperative-transformation rule says that when the first noun is in the second person (*you*), it can be deleted, leaving the surface structure (*Go to bed*).

Transformational rules have served us well for many years; however, they have been found to have some limitations and Chomsky himself has rejected the notions of deep and surface structures. Some problematic sentences can be generated by the theory and its rules. For example, the ambiguity apparent in the sentence *The duck is ready to eat* (Is it the duck that is preparing to eat or is someone about to consume the duck?) cannot be resolved by reference to phrase structure and transformational rules. Additionally, the theory does not adequately explain the universality and learnability of languages (Leonard & Loeb, 1988).

More recent revisions of transformational grammar theory have attempted to describe these universal rules of language. For example, *government and binding theory* (Chomsky, 1981, 1982) attempted to account for the universality of language by describing the rules that relate the language we hear to the underlying mental representations we hold in our minds (Shapiro, 1997). X-bar theory (Pinker, 1994) can be used to explain how it is that in some languages (such as Japanese) the verb comes after the object (Akira sushi ate), whereas in others (such as English) the verb precedes the object (Mike ate chili). X-bar theory proposes “super-rules” to account for these differences; for example, “An X-bar is composed of a head (phrase) X and any number of role players, in either order” (Pinker, 1994, p. 111). In English, the X-bar is head first; that is, the verb precedes the object. Japanese is a “head-last” language. The point is that, according to Chomsky and his colleagues, the rules that underlie all languages can be described.



So we can now program our computer with syntactic rules, including phrase structure and transformational rules. These will help us organize the words of English into coherent sentences that will easily be interpreted by native speakers of the language—sentences such as *Colorless green ideas sleep furiously*. Oh no! It looks like we have another problem.

The sentence *Colorless green ideas sleep furiously* was actually used by Chomsky (1957) to support his theory of the importance of structure in language. As he noted, there is nothing wrong with the syntax of this sentence. All of the words are in the right order. Still, the sentence does not mean anything (at least not in the literal sense). If we are to program our computer to understand and produce both grammatically correct and meaningful sentences, we will have to include yet another set of rules—semantic rules.

## Semantics

Let's look at that sentence again—*Colorless green ideas sleep furiously*—to determine what, exactly, is wrong with this sentence. First of all, something cannot both have color (*green*) and be *colorless*. Additionally, ideas cannot have color, and they cannot sleep. Even if they could sleep, it is not actually possible to sleep furiously. That this sentence makes no sense suggests that there must be rules that govern which words can meaningfully go together. These rules are called *semantic rules*. **Semantics** is the study of how meaning is attached to the words and sentences of language.

The search for these rules has not been easy. There are several theories of semantics, none of which seems to fully describe how words are linked to ideas. For example, the *semantic feature theory* claims that there are certain fundamental features of all words. The word *husband* might consist of the features: + (is) male; + adult; + human; + (is) married. There are also **selection restrictions**. These rules govern which words can appear together. For example, someone would not be described as a *married bachelor* or *my sister the bachelor* or *my 2-year-old the bachelor* because of the component features of the word *bachelor*. You cannot be both married and a bachelor, nor can you be a female or a child and also be a bachelor. Of course, it is possible to talk about child bachelors and married bachelors in a nonliteral sense. Similarly, it is possible to interpret a phrase such as *colorless green ideas*. Surely many of us have had nights when we *slept furiously*. But we have to work to make sense of these expressions. They are not *literally* true; they have truth only in a metaphorical sense. It is this metaphorical feature of semantics that at times is what makes poetry interesting, and even beautiful.

Our fundamental-feature and selection-restriction rules could also be applied to the *colorless green ideas* sentence. Since one feature of green is that it is a color, it cannot be both a color and lack color. Since ideas are not animate, it is not possible for them to sleep. Fundamental-feature and selection-restriction rules help account for the contradiction that speakers find in a sentence, such as *My sister is married to a bachelor*, and for the ambiguity that we found previously in the sentence *The duck is ready to eat*.

The semantic-feature model is only one of many theories of semantics. It helps explain some of the ways in which adult speakers make distinctions between words, but it may not be a good explanation for how children learn word meanings. Additionally, it has limitations in explaining the acquisition of verbs, pronouns, and other word classes other than nouns. Contemporary theories of semantics emphasize the importance of social interaction and cognitive development in shaping word learning (e.g., Tomasello, 2003) and the development of semantic networks in which words are organized on the basis of the strength of the connections between words (Pence & Justice, 2012). We will have more to say about the acquisition of words in Chapter 5.

Now, after including some semantic rules in our computer program, we should be done. Although it may be difficult to describe all of the semantic rules, those that we have do a very good job of delivering meaningful sentences. Every once in a while, we might get a sentence that is difficult to interpret, but that happens in natural language as well.

Now, imagine trying to hold a two-way conversation with your computer. You type in statements or questions, and it types back responses. Suppose you type “Can you use a sentence with the word *dog*?” It types back “Yes.” But that is not what you intended. You had wanted the computer to respond with a sentence using the word *dog*. Is there a problem? You bet there is. And you discover another problem. When you type a sentence such as “How are you today?” the computer might respond with almost anything—“The cat is on the mat,” or “The car is at the shop.” The response does not make any sense. What is wrong?

## Pragmatics

So far, our computer programming task has been relatively simple. We tried something. When it did not work, we changed the program and added another set of rules that got us closer to our goal of simulating human language. The rules could be discovered and were relatively few. Rules for semantics turned out to be a bit more difficult, but still it was possible to include these rules. But now we are faced with a major problem. Our computer seems insensitive to some of the subtle rules that govern conversation. It is misinterpreting the intent of some sentences and not responding to the content of other sentences. In short, we are having difficulty getting our computer to *use* language in conversation, suggesting that there must be yet another element of language. In fact, there is. This element is called **pragmatics**—the use of language for communication, or, as Gleason (2009) put it, “the use of language to express one’s intentions and to get things done in the world” (p. 22).

Pragmatics includes the study of the rules that govern the use of language for social interaction. There are rules that govern the reasons for communicating, as well as rules that determine the choice of codes used in communication. Let’s look more closely at one of these rules.

I recall observing a student teacher in her placement in a classroom with 6- and 7-year-old children with language and communication disabilities. The student teacher was seated at a table at the front of the room, and the children were at their desks. Wanting the children to join her at the table, the student teacher asked, “Can you come to the table?” The children looked at the student teacher, then at each other, but they did not move. Naturally, this wanton disobedience angered the student teacher, so she raised her voice and quite sharply said, “Can you come to the table!” Once again, the only response was some puzzled looks and some foot shuffling. Finally, in exasperation, the student teacher said, “Please come to the table now.” The children immediately got up and went to the table. What happened in this episode? Why were these children so reluctant to come forward?

The answer is that they were probably having difficulty interpreting the communicative intent of the student teacher. Like our computer, they may have interpreted the correct answer to the question, “Can you come to the table?” as “Yes.” But, in fact, this was not

meant to be a question at all, even though it had the form of a question. This is an example of an *indirect speech act*—an utterance for which the syntactic form does not match the communicative intention. In the context in which this sentence was uttered, the intent was clearly that of a command. Unfortunately, the intent may not have been so clear to the children, because indirect speech acts tend to be more difficult to interpret than direct speech acts. Direct speech acts are those in which the communicative intention is reflected in the syntactic form, such as *Can I have some cake?* (question) and *Stop that car!* (imperative). Every utterance, however, is a speech act, and linguists have identified speech acts and the rules that determine whether a conversation is intelligible.

Pragmatics also includes the study of the rules of conversation. You may recall what happened when we tried to engage the computer in conversation. It did not respond appropriately to what we had typed. Our computer violated one of the principles (rules) of conversation identified by Grice (1975)—specifically, the *relation principle*. This principle says that a response must be relevant to the topic. Other principles involve the *quantity* of information provided by the speaker, the *quality* (or truthfulness) of that information, and the *manner* (directness) of the information. When these principles are violated, we know that something is wrong with the conversation. Similarly, there are rules of conversation that govern how one speaks to persons of different levels of social status, that determine how conversations are repaired, and how to maintain the topic of a conversation. But these “rules” can be difficult for children to understand because they are so dependent on the context of the conversation. For example, the conventions for politeness may differ in the home setting as compared to the school (Bryant, 2009).

It would be difficult, if not impossible, to program our computer with such pragmatic rules because these require not only a solid understanding of language but also an understanding of people and their social environment. How do we tell the computer to talk one way to someone wearing a black coat and white collar and another way to someone wearing jeans and a T-shirt? The wonder is that we are able to make these subtle distinctions ourselves and that children are able to develop these skills fairly quickly.

## Summary

This chapter examined the elements of language in detail—considering how form (phonology, morphology, and syntax), content (semantics), and use (pragmatics) relate to language and noting the rules characterizing each in determining the structure and use of language. The rules, considered individually, seem manageable enough, but discussion of the interrelatedness of the elements in language reveals the complexity of the language system. For students who lag in the development in any or all of these language elements, there are methods that can be used to enhance their skills. These methods will be discussed in Chapter 13. The next several chapters will focus on how children acquire the language system and how the system develops as children mature.

# Bases of Language Development

What is it about humans that enables us to learn language? What physical structures are necessary in order for language to be acquired? What role does cognitive development play in acquiring language? What about interaction with others? These are some of the questions that will be addressed in this chapter.

## Learning Outcomes

After reading this chapter, you should be able to:

1. Describe the physical structures and processes that underlie speech.
2. Explain the relationship between *cognition* and *language*.
3. Describe the role that social interaction plays in language acquisition.

## Physical Bases of Language Development

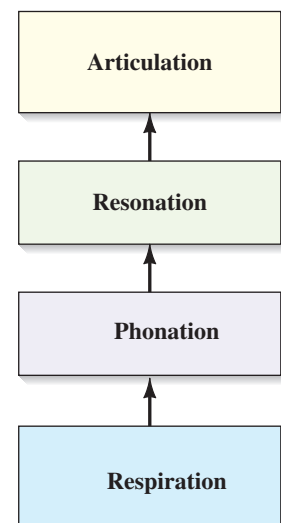
In Chapter 1, the work of Professors Beatrice and Allan Gardner with a chimp called Washoe was described. Although Washoe was able to learn a number of signs for words, the chimp was limited in her ability to develop new words (signs) and use the signs she had acquired in novel ways. Other researchers have tried without success to teach chimpanzees to talk. Why were these animals unable to develop true language skills? The answer lies primarily in the physiological structures that allow humans to learn and develop language. We will look at two types of structures that contribute to language development and use: those of speech production and the regions of the brain that control language.

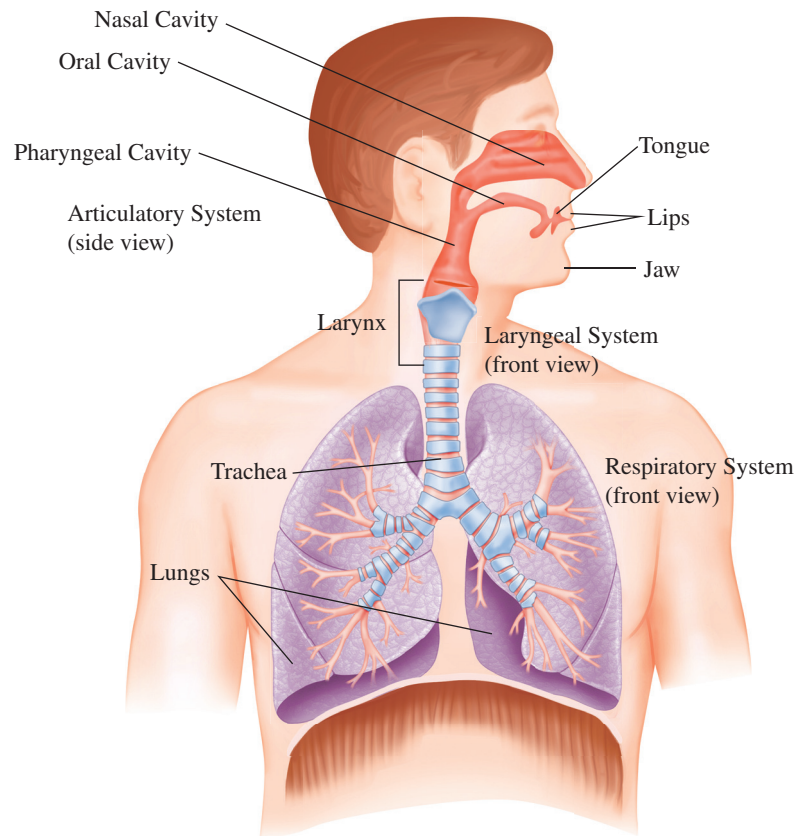
### Speech Production Structures

The speech production system is quite complex, and a thorough discussion of the physiology of speech would go beyond the scope of this book. There are several texts, however, that give a detailed description of the physiology of the speech production system (e.g., Anderson & Shames, 2011; Owens, Farinella, & Metz, 2015). Here, we will briefly look at the structures that contribute to the four processes of speech production—respiration, phonation, resonance, and articulation—and at how these processes and structures together produce speech sounds. Under the control of the brain, they function almost simultaneously in the speech production process (see Figure 3.1).

**Respiration.** How is sound produced? First, we need air, for it is a stream of shaped and guided air that forms sounds. When we breathe normally, about half of the breathing cycle is spent on inhaling air and about half involves exhaling (Hulit, Fahey, & Howard, 2014). However, during speech, something very different happens. Muscles that control respiration—namely, the **diaphragm** (see Figure 3.2)—work to control the airstream so that the exhaling stage lasts close to 85 percent of the breathing cycle—15 seconds or more. Just imagine what speech would be like if we were limited to 2- or 3-second bursts.

**Figure 3.1**  
The Processes of Speech



**Figure 3.2****The Human Vocal Organs**

**Phonation.** In addition to maintaining a longer stream of air, the respiratory muscles allow air to be forced under pressure through structures in the **larynx**. The *vocal folds* contained in the larynx act as a valve that prevents foreign matter from entering the lungs. The vocal folds also obstruct the flow of air from the lungs, thus causing the vibrations necessary for speech. As the airstream is restricted and buffeted, it creates a buzzing sound.

**Resonation.** Moving upward from the larynx, the air resonates in the mouth, the nasal cavities, and/or the pharynx (see Figure 3.2). The tone of the resulting sound is affected by the size and shape of the resonating structures into which the air is expelled. In general, the larger the resonating cavity, the lower is the tone. Try making a vowel sound. This is the sound created by resonated air.

**Articulation.** **Articulation** of sound takes place when the airstream is further impeded by structures such as the lips, tongue, and/or teeth. The production of consonants requires the action of articulation. As we saw in Chapter 2, each phoneme has a unique combination of articulators and resonators that work together to form the sound. Vowel articulation can be described with respect to tongue and lip position. The tongue position varies along two dimensions: front–back and high–low (Kent & Vorperian, 2011). For example, the /ae/ sound (as in *hat*) is described as a low–front sound—that is, the tip of the tongue is placed in a low position at the front of the mouth when that sound is articulated. Try it. Now, say the word *heat*. What happens? You should feel your tongue move toward the roof of your mouth (the /i/ sound is high–front). Vowels are also described by lip position—rounded or unrounded. Similarly, each consonant sound can be described