Preface

Practitioners and researchers from many disciplines continue to contribute new and exciting information about human language acquisition. It is challenging to keep abreast of the complex array of topics that provides the foundation for human communication and its development from birth through the young adult period. This new edition of *Born to Talk* is suitable for students and practitioners in speech-language pathology, early childhood education, general education, special education, and related disciplines who seek a contemporary and comprehensive view of speech and language development in a reader-friendly manner.

New to This Edition

The eText for this title is an affordable, interactive version of the print text that includes videos and interactive features that provide opportunities for students to get feedback on their answers to the questions posed.

To learn more about the enhanced Pearson eText, go to www.pearsonhighered.com/etextbooks.

- This eText includes three to six video clips in each chapter that allow students and practitioners to watch and hear content that further describes or explains the information in each chapter. Over 90% of the videos were created specifically for this edition.
- Each chapter contains a “Reflect and Apply” interactive eText feature. The feature gives readers access to a video, a thought-provoking question that requires application of content in the video, a hint for thinking about the answer, and detailed feedback.
- Each chapter also contains a “Reflect and Analyze” interactive eText feature that gives readers access to a video, a question that requires the reader to attend to the details of the video, a hint for considering how to answer the question, and feedback.
- A glossary is included in this edition that provides definitions for key terms in the text. These terms appear in boldface when they are first mentioned. In the eText, readers can click on the term to directly access the glossary.

In addition, in this sixth edition of *Born to Talk*, we have

- Reorganized Chapter 4 to highlight the role of the caregiver in early language development. The placement of this information at the forefront of the chapter stresses the importance of establishing joint attention and
joint reference, as well as using interaction strategies for prelinguistic children and children in the early stages of communication.

- Expanded on the development of literacy in Chapters 5 and 6 with the inclusion of original drawings and writing as examples of the growth that transpires from preschool to early elementary school.
- Added a new section on poverty and its relationship to language in Chapter 8, that leads the discussion on the social/cultural aspects of language development. Social/cultural factors appear at the beginning of the chapter in this edition, with regional factors following. This reorganization reflects our social interactionist perspective of language acquisition.
- Added twelve new tables or figures to highlight important content in most chapters making the information easily accessible.
- Provided search terms in Surfing the Web sections at the end of each chapter to encourage readers to expand their knowledge beyond the text to practical and interactive application of the concepts. The search terms provide a vehicle for extended learning opportunities for students in a multimedia context.

About This Text

The primary focus of this book is on *language development*. The sole purpose of Chapter 1 (“A Connection of Brains”) is to pique the reader’s interest in language as a unique human experience and to appreciate how messages are transmitted from one human brain to another. Chapter 2 lays the groundwork for considering the impressive nature and nurture of human communication. We discuss the many perspectives involved in learning language by exploring what human communication is and how we learn it during our early years. In this edition, we also relate the three perspectives—nativist, behaviorist, and social interactionist—to how speech-language pathologists and educators use them in designing appropriate goals and intervention strategies for children with typical and atypical language development. Chapter 3 is an exploration of how the development of cognition and perception is related to language learning. In Chapters 4, 5, and 6 we use a stage model to present the journey each child takes in developing the various components of language. The integration of all language components including literacy using this real-time approach will facilitate an understanding of how one aspect of language affects all other aspects. Chapter 7 explores how language is learned and transmitted from one person to another via speech production. In Chapter 8 we take a close look at the relationship between language acquisition and socioeconomic status and poverty, as well as social dialects. We also explore the wonders and challenges of children learning two languages within a societal framework. Chapter 9 provides a brief overview of developmental and acquired disorders of speech and language. Some readers will be less familiar than others with information pertaining to the anatomy and physiology of speech, language, and hearing. We include this information in the Appendix.
Before we get to our acknowledgments, we want to address the gender strategy we use in this book. As members of a profession that is more than 80% female, we are sensitive to the gender problem in communication. We are also frustrated by the limitations of American English pronouns. For this reason, we alternate the use of feminine and masculine pronouns, with the understanding that these pronouns are intended to be gender-neutral in all contexts. We also generally refer to the child in the singular (versus the plural children) in order to create an image of one child whose speech and language development we study through this book.

There are occasional personal references in this book, indicated by first-person pronouns and by phrases such as my sister, daughter, grandchildren, and father. These references reflect the life experiences of the authors, and each is footnoted for the reader’s information.

Acknowledgments

We are grateful for the invaluable contributions of several people. Pamela Hulit provided computer assistance in creating a number of tables included in the book. Dr. Jill Gilkerson from the LENA Research Foundation provided guidance in the selection of figures from their publications and language samples from their database. Lori Shin from the LENA Research Foundation tailored the graphic art to meet publication specifications. Taylor Weber, a graduate student in speech-language pathology from the University of Northern Colorado (UNC), assisted with the video project and created the glossary. Andy Nagel, the videographer from Mirage Video Pro, and his assistant Ian worked with us in a university and public school setting to produce the videos. We appreciate the special talents of these people, and we are grateful for their efforts on our behalf.

A special thank you is extended to the parents and their children who graciously gave their time and language interactions to the video project, Dr. Madeline Milian for her interview about learning English as a second language and bilingual education, and Carol Haworth for her coordination extraordinaire and expert speech-language pathology services in the school.

Finally, we thank the following people who reviewed the fifth edition of this book: Courtney Karasinski, Grand Valley State University; Lori J. Marra, Duquesne University; Monique T. Mills, The Ohio State University; Jean Silbar, Grand Valley State University; Gabriella Simon-Cerijido, California State University Los Angeles; and Laura J. Strong, Indiana University of Pennsylvania.

To the most important people in our lives, with immeasurable love and gratitude

Pamela, Yvonne, Carmen, Scot, John, Christopher,
Lance, Benjamin, Peyton, Brianna, Bonita, Lane, Cornelia,
Rosemary, Ernest, Daniel, Anna, Molly, Andrew, and Samantha
LEARNING OBJECTIVES

After completion of this chapter, the reader will be able to:

- define communication, language, and speech and the relationship of these terms to each other.
- define and discuss pragmatics, semantics, syntax and morphology, articulation, and suprasegmental aspects of speech production.
- explain how speech and language are separate but related processes.
- recognize and compare the design features of the human communication system.
- explain and demonstrate the elements of the speech chain connecting a speaker’s thoughts to a listener’s understanding of those thoughts.

This first chapter is designed to pique your interest in speech and language as processes within the broader process we call communication. As a future educator, you will be in a unique position to observe and facilitate the growth of children in their journeys to be effective communicators. 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.

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

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*Lloyd Hulit.
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. Each of them has reinforced my appreciation of language as one of humankind’s greatest gifts and most powerful tools.

My family has an eclectus parrot named Toby. When we were trying to teach Toby to talk in his first year, he said, “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 was fascinating about observing Toby was that the process of acquisition was so different from 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 each of us has 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, who is able to communicate, is capable of a form of mental telepathy, because human communication allows one human brain to interact with another human brain in a wondrous and almost magical manner.

Most people give very little thought to the magic of communication through speech and language because it is acquired so naturally and used so effortlessly by humans. 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 talking and listening, to unravel the components of language from sounds to words to elaborate sentence structure that together help us deliver our messages, 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 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 talking, writing, using codes (Morse code, text messaging, semaphore flags, Braille), using 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.

Educators develop a keen sense of the communication strategies of their students. You will notice that some students let you know that they understand or do not understand a particular idea through nodding or shaking the head, smiling or frowning, shrugging shoulders, raising an eyebrow, asking another child for help, or giving that blank stare! These communication signals are quite important as we gauge the speed, amount, and complexity of our 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. 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 family adopted my youngest sister, abandoned by her natural Korean parents, 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 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 or not it is expressed. When we think through an idea or listen to others and understand what they are saying or asking us to do, we call this **receptive language**. When we decide what we want to say and then actually speak it, sign it, or write it, we call it **expressive language**.

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 components and each of these components use rules that allow the members of the language community to understand each other.

Let us look at the most functional component of language—the ability to use language as a social vehicle for establishing and maintaining relationships with others. We call this component **pragmatics**. Consider how we socialize children in our families and in early childhood settings. In Western culture, adults use a combination of obvious instructions, such as “Wait until I finish talking before you speak,” “Say please,” “Ask Joey for that toy nicely,” and subtle cues, such as holding up a hand to signal waiting or withholding the snack, until the child uses a polite request.

Other cultures use varying degrees of verbal and gestural cues as they socialize their children. Pragmatics involves not only using language according to socially established standards but also nonverbal behaviors, such as maintaining an appropriate distance between speakers, establishing and maintaining eye contact, and using body language appropriate to the situation. Most children learn pragmatics through daily routines and we expect that youngsters come to school with well-established social communication patterns. When a child comes to school without age-appropriate pragmatics or if pragmatics skills vary considerably from the cultural expectations of the classroom, it doesn’t take long for teachers and other students to notice.

Another component of language is **semantics**. When we communicate, no matter what medium we choose, the goal is to convey meaning. Each language has rules for using words and for combining them into meaningful arrangements. Consider the following exercise. Write three nouns and then create sentences that convey different ideas. The example words in the following sentences are **flowers**, **vase**, and **morning**.

In the morning, I go to the garden and pick flowers for my vase.
This morning, I knocked over the vase of flowers.
The flowers in my favorite vase were dead in the morning.
The deliveryman arrived this morning with a beautiful vase of flowers.
Do you want to get your friend a vase of flowers this morning?

As you can see, semantics involves the meaning that we wish to convey, even when we are using the same topic words. It involves our use of vocabulary to construct ideas through relationships between words. Children benefit from lots of activities about words. We will explore this idea at length in subsequent chapters.
Ideas can be conveyed rather simply through three to five simple word combinations and even nonverbally, but humans develop rules for putting together words in complex arrangements in order to boost the power and efficiency of their language. We can get a lot done by speaking in an organized and clear manner. We use grammar to connect different types of words and the rule structure for these combinations is called syntax. In the sentences on the previous page, it is necessary to connect the nouns with other parts of speech, so that the meaning occurs. Imagine if we did not have rules for combining words. How would we make sense of messages if we only had nouns, for example? Read the sentences aloud using only the three nouns and you will get the point about the importance of syntax.

The arrangement of words is important for stating our meanings, and each word is considered a morpheme—a unit of meaning. But we also have small units of meaning that we add to words to enhance our messages. For example, the word flowers in the example is not one, but two morphemes. Flower is the name of the object and we use the s at the end to convey that there is more than one. Thus the s is a plural morpheme. We will discuss morphemes in greater detail in Chapters 4 and 5.

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 and 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 all languages share very basic rules, 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 clearly are 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 Toby 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. I vividly recall a 3-year-old boy named Jerry, who arrived for his language therapy session. Jerry had very little verbal language, but he frequently used echolalia. When I said, “Hello, Jerry,” he responded “Hello, Jerry.” Then he pointed at the sign at the top of the door saying, “E-X-I-T. For more information call 1-800-234-6824.”

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, 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

*Kathleen Fahey*
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. In addition to the production of each sound, we use suprasegmental aspects of speech. The syllables in each word are produced with varied degrees of stress. We also use intonation to emphasize certain words over others in order to convey meaning, and we modulate our pitch and phrasing to make speech interesting. Think of someone you know who speaks too fast, speaks in a monotone, or doesn’t have a smooth rhythm. When you consider how many intricate adjustments are made so quickly in the speech mechanism and the suprasegmental aspects that we use to make our speech flow, 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 continue to add vocabulary as long as we live, and most of us are developing our knowledge about how to use language well into adulthood during speaking and writing.

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 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). Recent research provides fascinating information about the communicative abilities of other species (see Table 1.1). But, no matter how much we discover about the abilities of other animals to communicate, we remain convinced that no animal has a communication system as powerful as human speech.

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 “13 design-features” of language. Although many animals share some of these features in their communication systems, Hockett believed that when taken together, his 13 features effectively separate human speech from other forms of animal communication. Since Hockett wrote his essay, new theoretical interpretations of 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, only a few of Hockett’s features are not found in the communication systems of other animals. Interestingly, we 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. Table 1.2 on page 10 shows that eight characteristics are present in humans and other species. Four characteristics are present in human language, but quite rare and limited in nonhumans, and five characteristics are particular to human language.

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
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>Warns other monkeys that snake is nearby/monkeys surround snake</td>
<td>Akmajian, Demers, and Harnish (1984)</td>
</tr>
<tr>
<td></td>
<td>Aerial predator call</td>
<td>Warns other monkeys that eagle is overhead/monkeys seek cover on ground</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Terrestrial predator call</td>
<td>Warns other monkeys that 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 based on amount of risk present in 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>Dogs</td>
<td>Conative signals; play bow</td>
<td>Invites other dogs to play</td>
<td>Hauser, Chomsky, and Fitch (2002)</td>
</tr>
<tr>
<td>Bottlenose dolphins</td>
<td>Distress whistle</td>
<td>Signal for “help!”/dolphins in area arrive and raise distressed animal to the surface</td>
<td></td>
</tr>
<tr>
<td>Birds</td>
<td>Aerial predator call “seet”</td>
<td>Warns other birds that predator is overhead/take cover in bushes and stay still</td>
<td>Gallup, 1982</td>
</tr>
<tr>
<td></td>
<td>Mobbing call “chink”</td>
<td>Warns other birds that stationary predator is nearby/surround (mob) the predator</td>
<td></td>
</tr>
<tr>
<td>Terrestrial song</td>
<td></td>
<td>Warns other male birds to keep away; invites uncommitted females to come to his location</td>
<td></td>
</tr>
<tr>
<td>Chickadees</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>Locates food in future (not evidence of recursion)</td>
<td></td>
</tr>
<tr>
<td>Western scrub jay</td>
<td>Memory for when and how long food is stored</td>
<td>Locates food in future (not evidence of recursion)</td>
<td>Hailman and Ficken (1986)</td>
</tr>
</tbody>
</table>

breaking the vibrating airstream into sounds of speech, which are organized into words and sentences. The listener’s ear receives these sounds. 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,
Table 1.2 ■ Characteristics of Communication in Humans and Other Species

<table>
<thead>
<tr>
<th>Communication Characteristics</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Humans and Other Species</strong></td>
<td></td>
</tr>
<tr>
<td>Vocal-Auditory Channel</td>
<td>Production of sound through mouth that is heard by listener's ear</td>
</tr>
<tr>
<td>Broadcast Transmission and Directional Reception</td>
<td>Vocalizations heard through sound waves</td>
</tr>
<tr>
<td>Rapid Fading</td>
<td>Vocalizations bound by time</td>
</tr>
<tr>
<td>Total Feedback</td>
<td>Producer and receiver recognize the message</td>
</tr>
<tr>
<td>Specialization</td>
<td>Vocalizations designed for communication</td>
</tr>
<tr>
<td>Arbitrariness</td>
<td>No relationship between the sounds and their meanings</td>
</tr>
<tr>
<td>Discreteness</td>
<td>Variations in sounds but limited in number and distinctiveness</td>
</tr>
<tr>
<td>Traditional Transmission</td>
<td>Instinctive and biologically acquired</td>
</tr>
<tr>
<td><strong>Humans but Rare and Limited in Other Species</strong></td>
<td></td>
</tr>
<tr>
<td>Interchangeability</td>
<td>Unlimited exchanges of communication independent of age and gender</td>
</tr>
<tr>
<td>Semanticity and Indexicality</td>
<td>Specific messages that convey variety of meanings using background knowledge, situational contexts, nonvocal information, and dialect</td>
</tr>
<tr>
<td>Productivity</td>
<td>Communication through creative combinations of symbols</td>
</tr>
<tr>
<td>Displacement</td>
<td>Communicating about things remote from time and space</td>
</tr>
<tr>
<td><strong>Humans</strong></td>
<td></td>
</tr>
<tr>
<td>Duality of Patterning</td>
<td>Combining sounds in infinite number of arrangements to produce words and sentences</td>
</tr>
<tr>
<td>Recursion</td>
<td>Creating and using words in complex and embedded arrangements and to store expressions that do not follow standard rules</td>
</tr>
<tr>
<td>Prevarication</td>
<td>Using language to deceive and to invent forms for artistic expression</td>
</tr>
<tr>
<td>Reflexivity</td>
<td>Using language to reflect on and talk about language</td>
</tr>
<tr>
<td>Learnability</td>
<td>Learning language from the environment, cognitive abilities, and social contexts</td>
</tr>
</tbody>
</table>

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 involves broadcast transmission and directional reception, which are 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. For instance, an individual who is deaf may use sign language. The signs can be received only by someone close enough to the sender to see the subtle details of the gestures, 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 by prehistoric people on cave walls.

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 composed 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 a speaker to make constant adjustments so that output is as finely tuned as possible in terms of accurately conveying thoughts. 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 a 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 a listener needs clarification from a speaker in order to correctly interpret a message. As you know from your own communicative experiences, there may be several requests for clarification before a 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 the band instruments she has given to each student. The teacher says, “It’s time to play.” The students know that it is time to play their instruments, not time to break for recess. 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 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 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 vocabulary because the naming of the bits and pieces that make up our environment has been done by different people in different places and 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 certain 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. 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), productivity 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 sculptors use clay. A sculptor can take a mass of clay and make everything from a bowl to 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 never-ending 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 Chapter 2. 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 has 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 it 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. Recall that displacement, the ability to talk about things and events that are remote in time and space, is an aspect of recursion. 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.
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, semioticity, 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...
Figure 1.1 The Speech Chain

interrupted by this kind of failure do we begin to appreciate just how easily and naturally we translate thoughts into language. 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 a child must know to be a...
competent language user, and explore the acquisition process along 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.

SUMMARY

Human communication is a complex phenomenon with unique features as compared to how other species communicate. Speech and language abilities allow us to socialize, get things done, and learn about our world as we send and receive information to others.

Surfing the Web

If you are interested in exploring topics discussed in this chapter in more detail, process one or more of the following relevant terms into a search engine.

- animal communication
- bird communication
- canine communication
- dolphin communication
- feline communication
- Hockett’s design features of language
- primate communication
- speech chain

Review Questions

1. Define communication, language, and speech.
2. How are speech and language separate but related aspects of communication?
3. Define receptive language and expressive language. Give an example of a scenario for each in which a child uses these aspects of language.
4. Why is pragmatics such an important component of communication?
5. Which component of language encompasses the words and their arrangements to convey meanings?
6. How are syntax and morphology related?
7. We use syllable, word, and phrasal stress along with pitch and loudness variations in our speech. What is the name of this component?
8. Which of Hockett’s design features most effectively separate human communication from animal communication and why?
9. Trace the six steps in the speech chain that transform the speaker’s thoughts into the listener’s understanding.