

The Development of Language

Ninth Edition



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Preface

This is the ninth edition of *The Development of Language*, which we have written for anyone with an interest in how children acquire language from infancy through the later school years. The field has changed substantially since our last edition, and we are very pleased to present new perspectives and new findings that have emerged over the past several years. This edition also includes some new topics that we think are interesting and important for a broader understanding of the basic features of language development from both historical and cross-cultural perspectives.

Our goal in writing this book is to provide an authoritative, interesting text that includes concepts and research findings that are both important and useful. The ninth edition places a substantial emphasis on language development in children who are learning languages other than, or in addition to, English, as well as on children with risk factors for language delay or disorder. Additionally, the chapters address cultural influences that lead to group and individual variation in children's language. The book focuses on language acquisition from the early months, even before children begin to speak, through mastery of adult language skills.

»» New to This Edition

Readers who are familiar with previous editions of this text will notice immediately that we have replaced the chapter on aging with a totally new and comprehensive chapter called Bilingual Language Development. This is in response to many requests from instructors, and it is a reflection of the growing importance of this topic. We are happy to welcome our new co-authors of Chapter 11, L. Quentin Dixon of Texas A&M University and Jing Zhao of Sun Yat-sen University and the Harvard Graduate School of Education. Huān yíng!

This edition also has many digital features that will make the concepts and material more accessible, more complete, and more invitingly interactive. The chapters have media clips that illustrate information and introduce students to some of the leaders in our field. Links are also provided to a really vast number of online resources. A brief list of some of the new features of this edition includes:

- A completely new chapter on bilingual language development and second-language acquisition. Benefit: The typical language learner in most cultures is no longer monolingual, and this new chapter reflects an important reality for teachers and therapists in training: Chapter 11.
- Each chapter now contains integration of typical development in a topic area (e.g., speech, vocabulary, reading) with the most commonly observed difficulties and disorders seen in acquiring this skill. Benefit: With new response to intervention (RTI) approaches to treatment, all teachers and therapists must be prepared to recognize the most common delays or problems in children; these are no longer isolated to a single chapter (as in earlier editions), where students may not appreciate them fully. Location in text: All chapters, especially Chapters 2, 3, 4, 5, 6, 8, and 10.
- The chapter on atypical development has been reframed to concentrate on cross-cutting concepts in child communication delay and disorder. Readers are now able to understand common themes across the many causes and manifestations of delay in learning critical communication skills, such as genetics, environmental deprivation, and the common features of developmental disabilities that impair language learning: Chapter 9.

- Each chapter now contains a variety of media links to examples of concepts, firsthand expert interviews, and illustrations that deepen student appreciation of concepts. Benefit: Examples improve student understanding of concepts and deepen student mastery of material: All chapters.
- Coverage of socioeconomic disparities and their impact on children's communication development, provided by an expert in this area, Meredith Rowe of the Harvard Graduate School of Education, who has joined us as a co-author of Chapter 4. Benefit: Students will gain additional understanding of how socioeconomic disparities can influence children's language development: Primarily Chapter 4, but integrated throughout all chapters.
- Updated coverage of neurological, genetic, and anthropological research that places children's language development in a larger context. Benefit: Major advances in mapping the brain, understanding the genetic contributions to language and language disorders, and describing the unique capacity for human language clarify what enables children to succeed at the process of learning language: Primarily Chapter 1, but interwoven through almost all chapters.

As in the past, each chapter is written by outstanding scholars who are known for their expertise in the areas that they discuss. For students, each chapter provides a helpful summary and a list of suggested course papers and projects. The key words used in the chapter are printed in boldface, and the book includes a comprehensive glossary that clearly explains each of these key terms. References are now in one place at the end of the book, rather than with each chapter.

The book is intended as a text for upper-level undergraduate or graduate courses in language development or as readings for courses in psycholinguistics, cognition, developmental psychology, speech pathology, education, and related subjects. The book also serves as a resource for professionals in all of the fields just noted.

In order to benefit from the book, readers do not need previous knowledge of linguistics; each chapter presents its material along with whatever linguistic background information is relevant. This means that there will be some repetition of major concepts, which will help to reinforce them and make them clearer. On the other hand, we assume that readers are familiar with basic concepts in psychology (e.g., *object permanence*) and with the work of major figures such as Jean Piaget and B. F. Skinner. Many books on language development are concerned only with language acquisition by young children and have tended to assume that development is complete when complex syntactic structures have been attained. But linguistic development, like psychological development, does not stop when the individual reaches physical maturity, and so we have included development through the school years, with the understanding that language development continues over the life span.

This book is written by a number of authors, and we believe that is one of its strengths: The study of language development has grown rapidly in recent years, and there are now many topics that are highly specialized. Not many researchers are experts in all areas of this expanding field. For instance, there are few investigators who are authorities on both speech perception in infants and learning to write in a second language, yet both topics are covered here. Fortunately, a number of leading researchers in their fields have agreed to contribute to the book. The chapters, therefore, are written by authors who are known for their research in the topic area and their ability to clearly explain complex topics to a broad audience. Each presents a survey of the salient ideas and the most recent and relevant studies in their own specialty area.

Since development is always the result of an interaction between innate capacities and environmental forces, we take an interactive perspective, one that takes into account both the biological endowment that makes language possible and the environmental factors that foster development. In particular, in this edition, we also highlight factors that may impede development but be responsive to intervention.

Instructors who adopt the text will be happy to learn that a new instructor's manual accompanies the text. The manual provides Internet resources, sample exam questions, and helpful outlines of the chapters that can be used in structuring lectures. It emphasizes key points and provides suggestions for classroom activities.

» Acknowledgments

We are indebted to many people who helped make this book possible. We are grateful, first of all, to our co-authors, who devoted so much time and thought to their chapters. Thanks also to Ann Davis, our editor at Pearson Education. And thanks to Sridhar Annadurai at Lumina Datamatics for his excellent work in making our book project a successful one. We thank the following reviewers for their comments and suggestions: Joseph Galasso, California State University, Northridge; Steven Long, Marquette University; Angela E. Rickford, San Jose State University; and Horabail “Giri” Venkatagiri, Iowa State University.

Sample pages

Sample pages

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The Development of Language

An Overview and a Preview

By the time they are 3 or 4 years old, children everywhere in the world have acquired the major elements of the languages spoken around them, regardless of how complex they may be. The development of language is an amazing, yet basically universal, human achievement. It poses some of the most challenging theoretical and practical questions of our times: Do infants, or even developing fetuses, process language? If so, what aspects of speech and language can they perceive? How do young children acquire complex grammar? Are humans unique, or do other animals have language as we define it? What if we raised a chimp as if it were our own child—would it learn to use language in the same way that a human child does? Do parrots who talk know what they are saying? Are there theories that can adequately account for language development? Is language a separate capacity, or is it simply one facet of our general cognitive ability? What is it that individuals actually must know in order to have complete adult language, and to what extent is the development of language representative of universal processes, like learning to walk? What about individual differences? What happens when language develops atypically, and is there anything we can do about it? Can children acquire two or more languages with native-like proficiency? Can adults? Or is there a point when it is too late to learn a second language? These are some of the questions that intrigue researchers in language development, and they have led to the plan of this book.

Once children begin to acquire language, they make rapid progress. By the time they are of school age and even before they can read, they can vary their speech to suit the social and communicative nature of a situation; they know the meaning and pronunciation of literally thousands of words, and they use the major sentence types and grammatical forms—subjects, objects, verbs, plurals, and tenses—of their language quite correctly. Language development does not cease when people reach school age, nor, for that matter, adolescence or maturity; language development continues throughout our lives. This book is written from a developmental perspective that concentrates on language development through the school years in detail, and discusses later development in many appropriate places. We have also included information on what can happen when development does not proceed smoothly or typically.

This chapter is divided into four major sections. The first section provides a brief overview of *the course of language development* from early infancy through the school years. It serves as a preview of the chapters that follow.

The second section describes the major *linguistic systems* that individuals must acquire. Rather than endorsing any particular linguistic theory, we present descriptive information that has provided the framework for much basic research in language acquisition. More technical linguistic material is presented in the chapters devoted to particular topics such as the acquisition of the sound system (Chapter 3) or of syntax (Chapter 5). If there is a unifying perspective that the authors of this book share, it is the view that

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Learning Outcomes

After reading this chapter, the student will be able to:

- Summarize the broad areas of language knowledge that children must master in order to become competent listeners, speakers, readers, and writers of a language;
- Describe the rule systems that apply to all human languages by defining what is meant by *phonology, morphology, syntax, semantics, and pragmatics*;
- Compare and contrast communication systems used by nonhuman animals with the rule systems and knowledge that characterize human languages and their use;
- Describe the features of language acquisition and use that provide evidence of its biological basis;
- Briefly summarize how the study of child language acquisition has changed since its earliest accounts, concluding with a discussion of modern research approaches and concerns.

individuals acquire during their lives an **internalized representation** of language that is systematic in nature and amenable to study.

The third section notes some of the unique *biological foundations* for language that make its development possible in humans. Our biological endowment is necessary but not sufficient to ensure language development, which does not occur without social interaction.

The fourth and final section of this chapter focuses on the background and methods of the *study of language development*.

» An Overview of the Course of Language Development

Communication Development in Infancy

Even before babies are born, they are listening to the language spoken around them: Research shows that newborns prefer to hear the language or languages they heard while *in utero*. During their first months, infants have communicative abilities that underlie language, long before they say their first words. Babies are intensely social beings: They gaze into the eyes of their caregivers and are sensitive to the emotional tone of the voices around them. They pay attention to the language spoken to them; they take their turn in conversation, even if that turn is only a burble. If they want something, they learn to make their intentions known. In addition to possessing the social motivations that are evidenced so early in life, infants are also physiologically equipped to process incoming speech signals; they are even capable of making fine distinctions among speech sounds. In fact, they are better at it than we are! By the age of 6 months, babies have already begun to categorize the sounds of their own language, much as adult speakers do. By the age of about 11 months, many babies understand 50 or more common words, and point happily at Tabitha Twitchit when someone asks, “Where’s the kitty?”

At approximately the same age that they take their first steps, many infants produce their first words. Like walking, early language appears at around the same age and in much the same way all over the world, regardless of the society or culture or the characteristics of the language that is being acquired. The precursors of language development that emerge before infants begin to speak are discussed in Chapter 2.

Phonological Development: Learning Sounds and Sound Patterns

Midway through their first year, infants begin to babble, playing with sound much as they play with their fingers and toes. Early in their second year, for most children, the babbling of the prelinguistic infant gives way to words as babbling blends into early speech. The infant who babbled “ba ba ba” may now use *baba* as an early word for *bottle*. Once infants have begun to speak, the course of language development appears to have some universal characteristics. Toddlers’ early utterances often contain only one word, which is usually simple to pronounce and concrete in meaning. It is important to recognize that different constraints act upon the child’s **comprehension** and **production** of a particular form; children may comprehend things more complex than what they are able to produce. Some sounds are more difficult to pronounce than others, and combinations of consonants may prove particularly problematic. Within a given language, or when acquiring more than one language, children solve the phonological problems they encounter in varying ways. A framework for the study of children’s acquisition of the phonology, or sound system, of their language is provided in Chapter 3.

Semantic Development: Learning the Meanings of Words

The ways in which speakers connect words to their referents and their meanings are the subject matter of **semantic development**. Just as there are constraints on the phonological shapes of children’s early words, there appear to be limits on the kinds of meanings

of those early words; for instance, very young children's vocabularies are more likely to contain words that refer to objects that move (*bus*) than objects that are immobile (*bench*). Their vocabularies reflect their daily lives and are unlikely to refer to events that are distant in time or space or to anything of an abstract nature. Early words like *hi*, *doggie*, *Mommy*, and *juice* refer to the objects, events, and people in the child's immediate surroundings. As they enter the school years, children's words become increasingly complex and interconnected, and they also gain a new kind of knowledge: **metalinguistic awareness**, the ability to think about language itself, understand what words are, and even answer a question like *Is "pumpernickel" a word?* Investigations of children's early words and their meanings, as well as the ways that meaning systems develop into complex semantic networks, are discussed in Chapter 4.

Putting Words Together: Morphology and Syntax in the Preschool Years

Sometime before their second birthday, after they know about 50 words, most children progress to a stage of two-word combinations. Words that they said in the one-word stage are now combined into these simple utterances, without the grammatical modifications that adult language requires. The child can now say such things as "That doggie," meaning "That is a doggie," and "Mommy juice," meaning "Mommy's juice," or "Mommy, give me my juice," or "Mommy is drinking her juice."

An examination of children's two-word utterances in many different language communities has shown that everywhere in the world children at this age are expressing the same kinds of thoughts and intentions in the same kinds of utterances. They ask for more of something; they say no to something; they notice something, or they notice that it has disappeared. This leads them to produce utterances like "More milk!" "No bed!" "Hi, kitty!" and "All-gone cookie!"

A little later in the two-word stage, another dozen or so kinds of meanings appear. For instance, children may name an actor and a verb: "Daddy eat." They may modify a noun: "Bad doggie." They may specify a location: "Kitty table." They may name a verb and an object, leaving out the subject: "Eat lunch." At this stage children are expressing these basic meanings, but they cannot use the language forms that indicate number, gender, and tense. Toddler language is about what is happening now; there is no tomorrow and no yesterday in language at the two-word stage. What children can say is closely related to their level of cognitive and social development, and a child who cannot conceive of the past is unlikely to speak of it. As the child's utterances grow longer, grammatical forms begin to appear. In English, articles, prepositions, and inflections begin to be heard. Although the two-word stage has some universal characteristics across all languages, what is acquired next depends on the features of the language being learned. English-speaking children learn the articles *a* and *the*, but in a language such as Russian, there are no articles; Russian has other features that English grammar does not. One remarkable finding has been that children acquiring a given language do so in essentially the same order (but not at the same rate). In English, for instance, children learn *in* and *on* before other prepositions such as *under*. After they learn regular plurals and pasts, like *juices* and *heated*, they create some **overregularized** forms of their own, like *gooses* and *eated*.

Researchers account for children's early utterances in varying ways. However, children's unique ability to acquire complex grammar, regardless of how and why they do it, remains at the heart of linguistic inquiry. Early grammar is examined in Chapter 5.

Language in Social Contexts: Development of Communicative Competence

Language development includes acquiring the ability to use language *appropriately* in many different situations. This complex ability is often referred to as **communicative competence**. The system of rules that dictates the way language is used to

accomplish social ends is often called pragmatics. An individual who acquires the phonology, morphology, syntax, and semantics of a language has acquired **linguistic competence**. A sentence such as “Pardon me, sir, but might I borrow your writing instrument for a moment?” certainly shows that the speaker has linguistic competence, since it is perfectly grammatical. If, however, this sentence is addressed to a kindergartner, it is just as certainly inappropriate. Linguistic competence is not sufficient; speakers must also acquire communicative competence, which goes beyond linguistic competence to include the ability to use language appropriately in many different situations. In other words, it requires knowledge of the social rules for language use, or pragmatics. During the preschool years, young children learn to respond to social situations by making polite requests or clarifying their own utterances. Their parents are typically eager that they learn to be polite. Parents’ intuitions about the importance of using language in socially appropriate ways are borne out by research that shows that inappropriate children are often unpopular or disliked. Speakers ultimately learn important variations in language that serve to mark their gender, regional origin, social class, and occupation. Other necessary variations are associated with such things as the social setting, topic of discourse, and characteristics of the person being addressed. The development of communicative competence is discussed in Chapter 6.

Theoretical Approaches to Language Acquisition

In general, explaining what it is that children acquire during the course of language development is easier than explaining how they do it. Do parents shape their children’s early babbling into speech through reinforcement and teaching strategies? Or is language perhaps an independent and **innate** faculty, built into the human genome? Learning theorists and formal linguistic theorists do not agree on these basic principles. Between the theoretical poles represented by learning theorists, on the one hand, and formal linguistic theorists, on the other, lie three different interactionist perspectives.

1. *Cognitive interactionists*, who rely primarily on the theories of Piaget, believe that language is just one facet of human cognition and that children in acquiring language are basically learning to pair words with concepts they have already acquired. Other recent work by cognitive interactionists has studied language from the perspective of the neural architecture that supports it. They see children as processors of information, and they use computers to model the ways neural connections supporting language are strengthened through exposure to adult speech.
2. *Social interactionists* emphasize the child’s motivation to communicate with others. They emphasize the role that the special features of **child-directed speech (CDS)** may play in facilitating children’s language acquisition.
3. *Gestural and usage-based theorists* are more concerned with the roots of language that are demonstrated when even very young children begin to communicate through gestures, pointing, shared attention, and other nonverbal but goal-directed and social behaviors. A discussion and an evaluation of language development theories are included in Chapter 7.

Variation in Language Development: Implications for Research and Theory

It is important to know that individual differences have been found in almost every aspect of language acquisition, even during the earliest period of development. In the acquisition of phonology, for instance, some children are quite conservative and avoid words they have difficulty pronouncing; others are willing to take a chance. Early words and early word combinations reveal different strategies in acquiring language. Although much research has been devoted to finding commonalities in language acquisition across children, there is also variation in the onset of speech, the rate at which language develops, and the style of language used by the child. This should not surprise us; we know that babies differ in temperament, cognitive style, and in many other ways. In addition, children’s early language may reflect their social class, their gender, whether they are growing

up mono- or bilingual, and preferences of adults in their society; for instance, American parents stress the names of things, but nouns are not so important in all societies. Any comprehensive theory of language development must account for individual differences; those who work with children must be aware of them. Individual differences are the topic of Chapter 8.

Atypical Language Development

Each of our topical chapters has a section outlining some of the problems that language learners may have when acquiring the aspects of language under discussion—for instance, when learning to read is difficult. Chapter 9 puts these diverse findings into perspective. Language has been a human endowment for so many millennia that it is exceptionally robust. There are conditions, however, that may lead to atypical language development—for instance, sensory problems such as deafness. In this case the capacity for language is intact, but lack of accessible auditory input makes the acquisition of oral language difficult. In some cases, technology can provide access to the auditory signal using hearing aids or cochlear implants; in other cases, children with hearing impairment who learn a manual language such as **American Sign Language (ASL)** are able to communicate in a complete and sophisticated language.

Children who are diagnosed with intellectual disability, such as most children with **Down syndrome**, may show rather standard patterns of language development, but at a slower rate than typically developing children. On the other hand, children with **autism spectrum disorder** often exhibit patterns of language development that are atypical in multiple ways; they may have particular problems, for instance, in understanding what other people know and in adjusting their language accordingly. Occasionally, children suffer from **specific language impairment**, problems in language development accompanied by no other obvious physical, sensory, or emotional difficulties. Still other children have particular problems producing speech, even though their internal representation of language is intact: They may stutter or have motor or physical impairments. Atypical language development is presented in Chapter 9.

Language and Literacy in the School Years

By the time they get to kindergarten, children have amassed a vocabulary of about 8,000 words, and they can handle questions, negative statements, dependent clauses, compound sentences, and a great variety of other constructions. They have also learned much more than vocabulary and grammar—they have learned to use language in many different social situations. They can, for instance, talk baby talk to babies, tell jokes to their friends, and speak politely to strangers. Jokes, riddles, and play with language constitute a substantial portion of schoolchildren's spontaneous speech.

As they approach the task of learning to read, children call upon two evolving language skills: One is their growing ability to produce language that contains many connected utterances, for example, in stories they tell. The second is that, as Chapter 4 emphasizes, a new cognitive attainment in the school years, metalinguistic awareness, makes it possible for children to think about language itself. For instance, what is a word? And what sound does a particular word begin with? To succeed in school, children must also learn to use **decontextualized language**: language that is not tied to the here and now. They develop the ability to provide explanations and descriptions using decontextualized language. Study of the cognitive processes involved in reading and the development of adequate models that represent the acquisition of this skill are topics that actively involve researchers in developmental psycholinguistics.

Children who come from literate households know a great deal about reading and writing before formal instruction begins and thus are at an advantage in school. Children who are bilingual may have some advantages in the acquisition of the metalinguistic knowledge that develops in the school years. Once children have acquired the ability to read and write, these new skills, in turn, have profound effects upon their spoken language. Learning to read is not an easy task for all children; this extremely complex activity requires intricate

coordination of a number of separate abilities. Humans have been speaking since the earliest days of our prehistory, but reading has been a common requirement only in very modern times; we should not be surprised, therefore, that reading skills vary greatly in the population. Reading problems, such as **dyslexia**, pose serious theoretical and practical problems for researchers and educators. The acquisition of literacy skills and increasingly complex language during the school years and through adolescence are the main topics of Chapter 10.

Bilingual Language Development

In the early decades of language acquisition research in the United States, researchers tended to concentrate on acquisition by monolingual English-speaking children. It has become increasingly clear, however, that understanding the development of language among bilingual children and adults, and how it is both similar to and different from single language acquisition, is important from both theoretical and practical perspectives. Researchers often make a distinction between bilingual acquisition (the acquisition of two languages at the same time) and second language (L2) acquisition, which implies that a second language is learned after a first one, but when we say an individual is bilingual we generally mean that the person can speak two languages.

Bilingualism is a common phenomenon all over the world, and a growing trend in the United States: About 20 percent of schoolchildren in the United States speak a language other than English at home. Although Spanish is the most common language spoken at home by children whose families do not speak English (about 80 percent), nearly 400 different languages are spoken in the homes of school-age children in the United States. Our schools have children who arrive knowing languages as diverse as Hmong, Cantonese, Russian, Vietnamese, and Haitian Creole.

The study of bilingualism and L2 acquisition has been undertaken by researchers from a number of different fields. These include child language researchers, linguists, sociocultural researchers, and psycholinguists. What are the best conditions for acquiring two languages? Does age matter? Is bilingual development just like monolingual development? Is it possible to be a “perfect” bilingual? What are the advantages and disadvantages of learning two languages? These are some of the questions that will be answered in Chapter 11.

»» The Structure of Language: Learning the System

Competence and Performance

A speaker who knows the syntactic rules of a language is said to have *linguistic competence*. Competence in this case refers to the inner, largely unconscious, knowledge of the rules, not to the way the person speaks on any particular occasion. The expression of the rules in everyday speech is *performance*. In the normal course of events, speakers produce utterances that include false starts, slips of the tongue, and various other errors. These are performance errors and are not thought to reflect the speakers’ underlying competence. There is also a general assumption among linguists that, within a given linguistic community, all adults who are native speakers of the language and not neurologically impaired in some way share linguistic competence; this claim, however, has never been substantiated, and there is increasing evidence that, though all typically developing children acquire language, they do not all do so in the same way, nor do they all arrive at the same level of competence (Arnon & Clark, 2011). It is possible to find out a great deal about adults’ syntax by asking them to judge the grammatical acceptability of a sentence. However, in studying children, researchers must either rely on performance for clues to competence or design clever experiments to probe inner knowledge, since young children do not have the metalinguistic ability required to discuss questions of “grammaticality.”

When children learn language, what is it that they must learn? Language has many subsystems having to do with sound, grammar, meaning, vocabulary, and knowing the right way to say something on a particular occasion in order to accomplish a specific

purpose. Knowing the language entails knowing its phonology, morphology, syntax, and semantics, as well as its social rules, or pragmatics. The speaker who knows all this has acquired *communicative competence*.

Phonology

What are the sounds of English? Although we all speak the language, without specific training it is difficult to describe the sounds we make when we speak, and even harder to explain the rules for their combination. For instance, can you think of any sounds in English that never appear at the beginning of a word or at the end of a word? (Answer is at the end of this paragraph.) *Phonetics* is the science of speech sounds. The *phonology* of a language includes all of the important speech sounds it uses, the rules for combining them to make words, and such things as the stress and intonation patterns that accompany them. Each language has its own set of important sounds, which are actually categories of sounds that include a number of variations. For instance, in English we pronounce the sound /t/ in many different ways: At the beginning of a word like *top* it is pronounced with a strong aspiration, or puff of air. We pronounce a word like *stop* without the puff of air, unaspirated. Some speakers produce a different, unreleased /t/ when they say a word like *hat* at the end of a sentence: They leave their tongues in place at the point of articulation. Many speakers pronounce yet another kind of /t/ in a word like *Manhattan* by releasing the air through their noses at the end. A phonetician would hear these /t/ sounds as four different sounds: aspirated, unaspirated, unreleased, and nasally released. For ordinary English speakers, however, these are all just one sound. Groups of similar sounds that are regarded as all the same by the speakers of a language are called **phonemes**. The different /t/ sounds just described are all part of one /t/ phoneme in English. Children have to learn to recognize and produce the phonemes of their own language and to combine those phonemes into words and sentences with the right sorts of intonational patterns. Some parts of the system, such as consonant–vowel combinations, are acquired early on. Others are not acquired until well into the elementary school years: for instance, the ability to distinguish between the stress patterns of *HOT dog* (frankfurter, at the picnic) and *hot DOG* (Ruby, at the beach) when the words are presented without a context. (Answer to question at the beginning of this section: English words cannot begin with the “ng” sound that we pronounce at the end of words like *sing*; they never end with the actual sound represented by the letter “h,” even though it may be written. For instance, what is written *hurrah* does not end with the same breathy sound that begins it.)

Morphology

When a new word like *vape* comes into the English language (what does it mean?) adult speakers can immediately tell that its past tense is *vaped*; they do not have to look it up in a dictionary or consult with an expert. They are able to make a past or plural of a word that they have never heard before because they know the English inflectional morphological system. A **morpheme** is the smallest unit of meaning in a language; it cannot be broken into any smaller parts that have meaning. Words are made up of one or more morphemes. The words *cat* and *danger* each consist of one morpheme, which is called a **free morpheme** because it can stand alone. **Bound morphemes**, on the other hand, cannot stand alone and are always found attached to free morphemes; *happiness*, *unclear*, and *singing* contain the bound morphemes *-ness*, *un-*, and *-ing*. Bound morphemes can be used to change one word into another word that may be a different part of speech; for instance, *-ness* turns the adjective *happy* into the noun *happiness*. In this case, they are called **derivational morphemes** because they can be used to derive new words.

Other bound morphemes do not change the basic word’s meaning so much as they modify it to indicate such things as tense, person, number, case, and gender. These variations on a basic word are *inflections*, and the morphemes that signal these changes are *inflectional morphemes*. Languages like Latin, Russian, and Hungarian are highly inflected. The verb *to love* (*amare*) in Latin has six separate forms in the present tense: the singular forms *amo*, *amas*, and *amat* (I love, you love, he/she loves) and the plural forms *amamus*, *amatis*, and *amant* (we love, you love, they love).

Compared with Latin, English has few verb inflections in the present tense: an added *-s* for the third person (he *loves*) and no inflection for other persons (I, we, you, they *love*). Latin indicates the subject and object of its sentences using case inflections—*agricola amat puellam* and *puellam amat agricola* both mean “The farmer [he’s the *agricola*] loves the girl [she’s the *puella*].” The endings of the words mark the subject and the object. English does not have case endings on its nouns: word order alone indicates whether the girl loves the farmer or the farmer loves the girl. Our old grammar teachers, perhaps influenced by their knowledge of Latin, tended to confuse the issue, and us, by referring to English nouns as being in the subjective or objective case when, in fact, there are no separate noun case forms in English. Pronouns, on the other hand, have subjective, objective, and possessive forms: *I*, *me*, and *my*.

English inflectional morphology includes the progressive of the verb (e.g., *singing*); the past, pronounced with /d/, /t/, or /əd/ (*played*, *hopped*, *landed*); and the third-person singular verb and the noun plural and possessive, all of which use /z/, /s/, or /əz/ in spoken language (*dogs*, *cats*, *watches*). The forms of the inflections vary depending on the last sound of the word being inflected, and there is a complex set of rules that adult speakers know (at some level) that enables them to make a plural or past tense of a word that they have never heard before.

One task for the student of language development is to determine whether children have knowledge of morphology and, if so, how it is acquired and to what extent it resembles the rule system that adults follow.

Syntax

The syntactic system includes the rules for how to combine words into acceptable phrases and sentences and how to transform sentences into other sentences. A competent speaker can take a basic sentence like “The cat bites the dog” and make a number of permutations of it: “The cat bit the dog,” “The cat didn’t bite the dog,” “Did the cat bite the dog?,” and “Wasn’t the dog bitten by the cat?” Knowledge of syntax allows the speaker to generate an almost endless number of new sentences and to recognize those that are not grammatically acceptable. If you heard a sentence like “The daksy Wug was miggled by the mimsy zibber,” you wouldn’t know what happened to the poor Wug, because the vocabulary is unfamiliar. On the other hand, the morphology and syntax of the sentence convey a great deal, and with this information you could make a number of new, perfectly grammatical sentences, even if you don’t know what you are talking about: “The Wug is daksy,” “The zibber miggled the Wug,” and “The zibber is mimsy.”

There is controversy among researchers as to whether young children just learning language are acquiring syntactic structures, that is, grammatical rules, or whether it is more reasonable to characterize their early utterances in terms of the semantic relations they are trying to express. The child who says, “Mommy eat lunch,” can be said to have learned to produce subject–verb–object constructions and to be following English syntactic rules specifying that the subject comes first in active sentences. To describe the language of young children, however, it may be more useful to note the kinds of semantic relations the children are using. In this case the child is expressing knowledge that an action (eat) is taking place and that there is an agent (Mom) and an object (lunch).

Once children begin to produce longer sentences, however, they add the grammatical words of the language and begin to build sentences according to syntactic rules. They learn how to make negatives, questions, compound sentences, passives, and imperatives. Later, they add very complex structures, including embedded forms. The child who early on was limited to sentences like “Mommy eat lunch” can eventually comprehend and produce “The lunch that Grandpa cooked the baby sitter was eaten by Mommy” in full confidence that the cherished baby sitter was neither cooked by Grandpa nor eaten by Mom.

Semantics

The semantic system includes our mental dictionary, or lexicon. Word meanings are complicated to learn; words are related to one another in complex networks, and awareness of words—for example, the ability to think about words—comes later than does word use.

A very young child may use a word that occurs in adult language, but that word does not mean exactly the same thing, nor does it have the same internal status for the child as it does for the adult. Two-year-olds who say “doggie,” for instance, may call sheep, cows, cats, and horses “doggie,” or they may use the word only in reference to a particular dog, without knowing that it refers to a whole class of animals. Vocabulary is structured hierarchically, and words are attached to one another in semantic networks. Dogs are a class of animals, and the adult who knows the meaning of *dog* also knows, for instance, that it belongs to a group known as domestic animals, it is a pet, it is related to wolves, it is animate, and so on. Studying semantic development in children involves examining how they acquire the semantic system, beginning with simple vocabulary. Ultimately, it includes studying their metalinguistic knowledge, which enables them to notice the words in their language and comment on them.

The Social Rules for Language Use

Linguistic competence involves knowing how to construct grammatically acceptable sentences. Language, however, must be used in a social setting to accomplish various ends. Speakers who know how to use language *appropriately* have more than linguistic competence; they have communicative competence, a term first used by the anthropologist Dell Hymes in 1972. *Pragmatics*, another term for the social uses of language, refers to the use of language to express one’s intentions and get things done in the world. Adult pragmatics may include many interpersonal or social functions such as denying, refusing, blaming, offering condolences, and flattering, and even very young children use pragmatic functions such as labeling and demanding.

Communicative competence includes being able to express one’s intent appropriately in varying social situations. The importance of knowing the right forms becomes obvious when social rules are violated. Consider the use of directives. If you are seated in an aisle seat of a bus, next to a stranger, and you are cold because the window is open, you can express your intent in a syntactically correct sentence: “Shut that window.” This could lead to an angry reaction or, at the very least, to the impression that you are a rude person. If, instead, you say, “I wonder if you would mind shutting the window?,” compliance and the beginning of a pleasant conversation will probably ensue.

Knowing the politeness rules of language is part of communicative competence. Every type of interaction between individuals requires observance of social conventions, and adults do not leave children’s development of these rules to chance: Whereas they may not correct syntactic violations except in the most superficial cases (see Chapter 5), they are active participants in their children’s use of the appropriate (often polite) forms (Ely & Gleason, 2006). Just as there are phonological and grammatical rules, there are also rules for the use of language in social context. Mature language users know how to speak like men or women, to conduct discourse, and to speak in appropriate ways to different people. They can talk baby talk to babies and be formal and deferential when appearing in court. All of these are part of communicative competence, which is the goal of language development.

›› The Biological Bases of Language

Animal Communication Systems

Human language has characteristics that have led many researchers to conclude that it is both **species specific** and **species uniform**; that is, it is unique (specific) in the human species and essentially similar, or uniform, in all members of our human species (Lenneberg, 1967; Friederici, 2012). The characteristics that distinguish human language are illuminated when they are compared with those of nonhuman animal communication systems. Other animals are clearly able to communicate at some level with one another as well as with humans. Cats and dogs, for instance, meow and bark and are able to convey a variety

of messages to us by methods such as scratching at the door or looking expectantly at their dishes. These signals are limited in scope and clearly not language, however endearing. More about dogs' ability to comprehend language later.

Bee Communication. Bees have been shown to have an elaborate communication system. The ethologist Karl von Frisch (2014) began to study bees in the 1920s and shared the Nobel Prize in Physiology or Medicine in 1973 for his work. Unlike the expressive meowing of a hungry cat, in many senses the communication system of the bee is *referential*—it tells other bees about, or *refers* to, something in the outside world. A bee returning to the hive after finding nectar-filled flowers collects an audience and then performs a dance that indicates the direction and the approximate distance of the nectar from the hive. Other bees watch, join the dance, and then head for the flowers. The bees perform a round dance if the nectar is near, and a tail-wagging dance if it is at a distance. The measure of how far is conveyed by the timing of the wagging—the longer it takes, the farther the trip. Is this language? Although the movements of the dance have structure and meaning, there is only one possible conversational topic: Finding nectar! Even this repertoire is seriously limited; bees cannot, for instance, tell one another that the flowers are pretty or that they are thinking of quitting and moving to Florida.

Nonprimate Mammals and Birds. Many animals have ways of communicating with other members of their species. Dolphins, who are intelligent and social mammals, employ elaborate systems of whistles that can be heard at a distance by other dolphins under water. This vocal communication reflects highly developed skills on which dolphins rely in surroundings that would make visual interactions difficult. During the first year of its life, each baby bottlenose dolphin learns a “signature whistle” by which it can be recognized (Tyack, 2012). Later on, bottlenose dolphins display vocal learning behaviors that are seen in birds but not in other nonhuman mammals. They are able to imitate the whistles of other dolphins and use this “whistle matching” when they address one another (Janik, 2000). Bottlenosed dolphins also have fairly sophisticated comprehension abilities, as demonstrated by their ability to recognize imperative sentences in an artificial language and carry out instructions based only on the information in the sentences (Schusterman, Thomas, & Wood, 2013).

African elephants communicate with one another in many ways, including seismically. They have as many as 25 different vocal calls and a number of “rumbles” that are below the threshold of human hearing. These subsonic communications are carried through the ground and can be sensed and understood by other elephants as much as a dozen miles away. In one study, Namibian elephants reacted to long-distance predator warnings given by members of their own group, but were unimpressed by similar warnings issued by unfamiliar Kenyan elephants (O’Connell, 2007). An elephant named KoShik has demonstrated the ability to produce recognizable Korean words (Kyon, Kim, & Bae, 2012).

Some birds use a variety of meaningful calls to court one another, to warn of danger, or to indicate that it is time to fly home. The eerie cry of the loon is just one of a number of distinct and meaningful calls made by these inhabitants of northern lakes. Recent research reveals that male loons convey information about their size to potential rivals through the auditory frequency of their yodels (Piper, Mager, & Walcott, 2011).

The communication systems that nonhumans use among themselves serve important purposes, and each one resembles human language in some respect, but they are all tied to the stimulus situation, limited to the “here and now” and to a restricted set of messages. Human language has characteristics not found in their entirety in these other systems.

Not all researchers agree on the list of criteria that should be used in describing true *language*. However, most would agree on at least these three, cited by Roger Brown (1973):

1. True language is marked by *productivity* in the sense that speakers can make many new utterances and can recombine or expand the forms they already know to say things they have never heard before. This feature is also called *recombination*, *recursion*, or *generativity*, depending on the author and emphasis.

2. It also has *semanticity* (or *symbolism*); that is, language represents ideas, events, and objects symbolically. A word is a symbol that stands for something else. It doesn't have to sound like the thing it represents, though some words like *bark* and *meow* might.
3. Language offers the possibility of *displacement*—messages need not be tied to the immediate context.

Human language is unique because it enables its users to comment on any aspect of their experience and to consider the past and the future, as well as referents that may be continents away or only in the imagination. The natural communication systems of non-humans do not meet these criteria of language.

Attempts to teach human language to talking birds, however, have produced some extremely provocative results. An African grey parrot named Alex, who was trained by the American cognitive psychologist Irene Pepperberg, was the subject of perhaps the best known set of language studies with birds. Alex knew the word *yummy* and he knew the word *bread*. When someone brought in a birthday cake, something he had never seen before, he tasted his portion and exclaimed, “Yummy bread!” The ability to combine communicative concepts as shown in this example has long been thought to be exclusive to humans. Alex could recognize the colors, shapes, and numbers of objects and answer novel questions about them in English. Faced with an array of blocks, he was asked, “How many blue blocks?” Alex correctly answered, “Six.” He was right about 80 percent of the time (Pepperberg, 2009). Alex died unexpectedly in 2007, but Dr. Pepperberg continues the research with several other young African greys. You can see some of Alex's talents in video 1.1.

Experiments with a number of young grey parrots have shown that they can learn to label common objects if they have human tutors who provide interactive lessons; they do not learn from passive listening to lessons on audio recordings or from watching videos, but do best when the words are presented in context by a friendly and informative person. Interacting with a parrot can be an unnerving experience—one that makes us marvel that a bird whose brain is the size of a walnut can speak to us in clear and appropriate human language. Do African grey parrots have the same sort of linguistic skill human children do? One view is that they do not and that the birds are responding to complex learned cues. Another conclusion is that Alex had the skills of a 3-year-old child and language is not a unitary set of features, but a continuum on which African grey parrots have clearly alighted.

Dogs have recently made their entrance into the comprehension side of the human language arena. Dogs are not able to produce human words, except, after much coaxing, some very limited approximations to expressions such as “I love you.” A version of this modified yowling by a husky named Mishka has been viewed approximately 96 million times on YouTube, which you can watch in video 1.2.

There is, however, some recent intriguing research on language comprehension by a breed often viewed as the smartest of all pups, the border collie. In one set of studies, Chaser, a border collie owned and trained by Professor John W. Pilley, acquired the names of 1,022 objects during a 3-year period and could very accurately select a toy with the right name from a large array. Even more impressive, Chaser was able to infer that a name she had never heard before belonged to a new, unnamed object among the ones she already knew. For instance, an unfamiliar doll was included among her toys. When asked to bring “Darwin,” a name she had not heard before, she correctly inferred that the unfamiliar name belonged to the unfamiliar object and promptly delivered the doll (Pilley & Reid, 2011). By inferring that a



1.1 Pathways—Chapter 2 —Alex the Parrot

<http://www.youtube.com/watch?v=dKvVaRlZ0Y4>

Alex could tell you what color these blocks are, and he could count them as well.



Irene M. Pepperberg

**1.2** Husky Dog Talking, "I Love You"

[www.youtube.com/
watch?v=qXo3NFqkaRM](http://www.youtube.com/watch?v=qXo3NFqkaRM)

**1.3** The Dog Who Knows 1,000 Words

[http://www.youtube.com/
watch?v=_6479QAJuz8](http://www.youtube.com/watch?v=_6479QAJuz8)

new name must belong to a novel object, Chaser was demonstrating a principle of vocabulary acquisition commonly ascribed to human children. In video 1.3, you can meet Chaser and see her demonstrate some linguistic and cognitive skills.

Primate Language. Researchers have long wondered if primates are capable of learning human language. Chimpanzees, in particular, have been the subject of much research. Chimpanzees are intelligent, social, and communicative animals. They use a variety of vocal cries in the wild, including a food bark and a danger cry. There have been numerous attempts to teach language to chimpanzees, who possess genetic structures very similar to our own and are our closest relatives in the animal world, and at least one major gorilla language project is still ongoing (Hillix & Rumbaugh, 2013). Koko the gorilla, born in 1974, knows thousands of signs and words. Her trainer, Dr. Francine Patterson, has also reported that Koko is able to express very humanlike feelings, such as her sadness at the death of a kitten. Koko is featured in books and films and on her own website, www.koko.org. In some of the most recent work with Koko, Dr. Patterson and her colleagues have shown that she possesses an ability heretofore thought found only in humans: while playing with harmonicas and other wind instruments, Koko can control her breath, one of the skills needed in producing speech (Perlman, Patterson, & Cohn, 2012).

Gua and Viki. In 1931 Indiana University professor Winthrop Kellogg and his wife, Luella, became the first American family to raise a chimpanzee and a child together (Kellogg, 1980). The Kelloggs brought an infant chimpanzee named Gua into their home; she stayed with them and their infant son, Donald, for 9 months. No special effort was made to teach Gua to talk, and although Gua was ahead of Donald in her motor development, she did not babble and did not learn to say any words. Some wonderful, somewhat unsettling, old films comparing Donald and Gua are available on the Internet. These can be found if you search for comparative tests of human and chimp infants.



Pam Gleason

In the 1940s psychologists Catherine and Keith Hayes (Hayes, 1951) set out to raise a baby chimpanzee named Viki as if she were their own child. This included outfitting her in little dresses and introducing her to strangers as their daughter. (One horrified motel owner actually believed that Catherine Hayes had given birth to Viki.) The Hayeses tried to teach language to Viki. They assumed that chimpanzees were rather like children with developmental delays and that with love and patient instruction Viki would learn to talk. After 6 years of training, Viki understood a great deal, but she was able to produce, with great difficulty, only four words: *mama*, *papa*, *cup*, and *up*. She was never able to say more, and in order to pronounce a /p/, she had to hold her lips together with her fingers. The Hayeses' research with Viki showed that chimpanzees do not have the specialized articulatory and physiological abilities that make spoken language possible. You can see Keith Hayes and Viki in the archival film in video 1.4.

After these failed experiments, other researchers began to realize that true language need not be spoken. The deaf

community in the United States, for instance, uses a gestural rather than a spoken language, American Sign Language (ASL). ASL is a complete language, with its own grammar and a rich vocabulary, all of which can be conveyed by facial expression, movements of the upper torso, and the shape and movement of the hands in front of the body; it is the equal of vocal language in its capacity to communicate complex human thought (Valli & Lucas, 2000). A new appreciation of the richness of ASL led to innovative experiments with chimpanzees.

Washoe. The first attempt to capitalize on the ability to comprehend language and the natural gestural ability of a chimpanzee by teaching her signed human language was made by Beatrice and Allen Gardner at the University of Nevada in 1966 (Gardner & Gardner, 1969). The Gardners moved a 10-month-old chimpanzee named Washoe (for the county in Nevada where she was born) into a trailer behind their house and began to teach her ASL. Washoe became a chimp celebrity. During the time she was involved in this project, she learned over 130 ASL signs, as well as how to combine them into utterances of several signs (Jensvold, Wilding, & Schulze, 2014). On seeing her trainer, she was able to sign “Please tickle hug hurry,” “Gimme food drink,” and similar requests.

Washoe was able to sign many of the same things that are said by children in the early stages of language acquisition before they learn the grammatical refinements of their own language. Unlike English-speaking children, she did not pay attention to word order, and at the time her training ceased in the 51st month, it was not clear whether her sign language was actually grammatically structured in the sense that even a young child’s is (Brown, 1970; Klima & Bellugi, 1972). However, through vocabulary tests of Washoe, as well as of several other chimpanzees they worked with, the Gardners were able to demonstrate that children’s and chimpanzees’ first 50 words are very similar.

The chimpanzees studied by the Gardners also extended, or generalized, their words in much the same way that humans do—for instance, calling a hat they had never seen before *hat*. The question of whether a chimpanzee is capable of syntax remained open. This is an important theoretical question, because syntax makes *productivity*—one of the hallmarks of human language—possible. On the practical side, the remarkable successes attained with chimps led to innovative programs that teach sign language to children with communication disorders (Toth, 2009).

Nim Chimpsky. An attempt to answer the question of whether chimpanzees can make grammatical sentences was made by a professor at Columbia University, Herbert S. Terrace (1980). Terrace adopted a young male chimp, whom he named Nim Chimpsky (a play on the name of Noam Chomsky, the well-known linguist). The plan was to raise Nim in a rich human environment, teach him ASL, and then analyze the chimp’s emerging ability to combine signs into utterances, paying special attention to any evidence that he could indeed produce grammatical signed sentences. Nim began to sign early: He produced his first sign, “drink,” when he was only 4 months old. However, his later utterances never progressed much beyond the two- or three-sign stage. He signed “Eat Nim” and “Banana me eat,” but when he made four-sign utterances, he added no new information, and unlike even young children, he used no particular word order. He signed “Banana me eat banana,” in which the additional word is merely repetitive. Analyzing the extensive data collected in this project, Terrace concluded that there was no evidence that the chimp could produce anything that might be called a sentence.

An even more serious question regarding the chimpanzee’s linguistic capability was raised after Terrace and his associates studied the videotaped interactions of young Nim and his many teachers. They found that Nim understood little about conversational turn taking, often interrupting his teachers, and that very little of what Nim signed actually originated with the chimp. Most of what he signed was prompted by the teacher and contained major constituents of the teacher’s prior signed utterance to him.

Terrace carried his study further by analyzing films made available to him by other ape-language projects and arrived at the same conclusion: Much of what the chimps signed had just been signed to them. The signing chimps appeared to be responding at least in



1.4 1950—Vocalization and Speech in Chimpanzees

<https://www.youtube.com/watch?v=wbeLCDGqEE>

part to subtle cues from their trainers. Armed with this information, some critics went so far as to suggest that the chimps were modern equivalents of Clever Hans. Clever Hans was a horse who was famous for his mental powers in early twentieth-century Germany, until it was discovered that, rather than doing arithmetic, he was sensitive to minute physical cues in the people around him who knew the answers to the questions he was being asked. The question of the apes' potential was not completely settled by this study, since, as other researchers pointed out, children also interrupt and repeat parts of what adults say. Recent statistical and computational approaches to the corpus of ASL utterances produced by Nim indicate that his language did not have the kinds of grammatical structure seen in early child language (Yang, 2013). Nim Chimpsky died in 2000 at the age of 26.

Kanzi. Although it may be true that apes are not capable of adult language as we know it, the chimpanzee studies have indicated that there are substantial similarities between very young children's and chimpanzees' abilities to engage in symbolic communication. Early chimpanzee studies used the common chimp (*Pan troglodytes*) and had the same self-limiting characteristic: Common chimps can become difficult, even dangerous, to work with once sexual maturity is attained.

Research by D. M. Rumbaugh and E. S. Savage-Rumbaugh with a pygmy chimp, or bonobo (*Pan paniscus*) named Kanzi, who was born in 1980 and now lives at the Great Ape Trust of Iowa in Des Moines (Greenfield & Savage-Rumbaugh, 2013), led to new speculation about primate cultural and linguistic abilities. The bonobo was unknown until the mid-1970s, when they were found in the remote rain forests of the Democratic Republic of Congo. Bonobos are smaller, less aggressive, more social, more intelligent, and more communicative than the common chimp. Kanzi surprised his trainers when he acquired some manual signs merely by observing his mother's lessons. He has been the subject of an intensive longitudinal study, and he understands complex language and at least 500 spoken words, as well as English word order and basic syntax. For instance, if asked to "Put the milk in the jelly" or to "Put the jelly in the milk," Kanzi obligingly does so, proving that he is attending to language word order and not simply carrying out activities that are evident from the nonverbal situation. He became a father in 2010 with the birth of his son, Teco. Kanzi now has a complex social life; he makes tools and engages in artistic and musical activities, and his accomplishments have gone far beyond those of any of the earlier chimps. Kanzi communicates with a 438-character signboard; his linguistic abilities remain at the level of a young child. It is not clear whether his (or any nonhuman's) linguistic skills are on the same continuum as our own, or if they are qualitatively different (Trachsel, 2010). You can read about Kanzi and his companions online at www.greatapetrust.org.

The Biological Base: Humans, Ancient and Modern

Language in humans is clearly dependent on their having a society in which to learn it, other humans to speak to, and the emotional motivation and intelligence to make it possible; we have also evolved with specialized biological capacities for speech and neural mechanisms related to language. Some of these adaptations are in the structures we rely on in order to produce speech, while others are in our hearing organs, our brains, and in the neural connections among them. In addition to possessing specialized brain structures, humans have a long list of adaptations in such things as the development of their heads, faces, vocal cords, and larynxes, and the ability to coordinate making speech sounds with breathing and swallowing. Humans perform a remarkably complex set of actions when they engage in everyday activities such as having a talk over lunch.

Specificity and Uniformity of Language in Humans. Some of the best evidence for the biological component of language were listed by Lenneberg (1967), to show that language is specific to humans and uniform across our species in its major characteristics:

1. *The onset of speech is regular.* The order of appearance of developmental milestones, including speech, is regular in the species—it is not affected by culture or the language to be learned.

2. *Speech is not suppressible.* Typically developing children learn to talk if they are in contact with older speakers. The wide variations that exist within and across cultures have all provided suitable environments for children to learn language.
3. *Language cannot be taught to other species.* Lenneberg made this claim in the 1960s, before there were results from the ape and parrot studies, and time may have proven him right. However, it is also clear that chimpanzees and gorillas can be taught sign language comparable to the language of young children and parrots can do more than ask for crackers; thus, this claim's validity hinges on a particular definition of language.
4. *Languages have some universal features.* They are all structured in accordance with principles of human cognition, and a human infant can learn any language. At the same time, there are universal constraints on the kinds of rules that children can learn. The universals that are found in all languages include phonology, grammar, and semantics, as well as social rules for language use.

A Genetic Basis: FOXP2. Work in genetics has pointed to a specific gene on chromosome 7, **FOXP2**, that is related to speech and language and that may have been the result of a mutation that occurred in our human ancestors at some distant time (Pääbo, 2003). Our close primate relatives do not have the physical capacity for speech, nor do they have our variant of FOXP2. People with damaged FOXP2 genes have a variety of communicative disorders, and mice who are given our version of the gene are exceptionally vocal and good at problem solving (Schreiweis et al., 2014). It is clear, however, that no single gene could account for the complexity and robustness of human language. FOXP2, in other words, is not the “language gene,” although it is related to language. Other genes have also been implicated in language development, such as those referred to as ASPM and MCPH1, and current thinking in the molecular genetics world is that these genes are regulatory in nature and that they are part of a complex signaling system that affects many different traits (Misyak & Christiansen, 2011).

The Ancient Origins of Language. For about a hundred years, the origin of language was a topic that could not be discussed in scientific circles, because there was no evidence, but there were so many theories with ardent supporters. In 1866, the Linguistic Society of Paris banned all discussion of the subject. A few years later, the London Philological Society and then others made similar rules. In the 1970s, with new research methods at hand, the topic was once again raised, and recent years have seen a resurgence of findings informed by work in 3-D computer modeling, the neurosciences, and new tools in archeology.

These sophisticated methods of investigation have led some researchers to conclude that the capacity for human language evolved no less than 400,000 years ago (Johansson, 2011), even before the advent of *Homo sapiens*. Of course, others disagree and think it was more recent, but the lower limit is about 120,000 years, and it is worth considering what the upper limit might be: Evidence now suggests that the human capacity for speech existed in Neanderthals, who shared our variant of FOXP2. Neanderthals lived along with, and were succeeded by, our ancestors, *Homo sapiens*. They lived on the European continent 400,000 years ago and appear to have been fully capable of speech. In earlier studies based on fossil vocal tract reconstructions, some scholars had thought that Neanderthals were not able to produce the rapidly articulated speech common to all modern humans (Lieberman, 2011). However, recent 3-D imaging analysis of a 60,000-year-old Neanderthal hyoid (a bone in the neck that supports the tongue and makes intricate movements possible) revealed that it is basically identical to that of modern humans (D’Anastasio et al. 2013).

Archeological findings indicate that Neanderthals had much more complex societies than we had previously thought, that they lived in families, had funerals, wore decorations, sewed hides into clothing, made tools, and engaged in other familiar activities that seem to be language-dependent (Dediu & Levinson, 2013). DNA evidence has also shown that Neanderthals and *Homo sapiens* intermarried and it seems unlikely that there were marriages of talkers and non-talkers. Today, people of European descent have an average

of 2.7 percent Neanderthal DNA. Since it now appears that both early *Homo sapiens* and *Homo neanderthalensis* were equipped for language, the changes leading to this capacity likely took place in our common ancestor—possibly *Homo heidelbergensis* (Tomasello, 2010), and that moves the origins of language to at least 400,000 years ago, and perhaps a great deal earlier.

Social and Affective Biological Bases. Although children who are physiologically and psychologically intact will acquire language, this happens only if they grow up among people who speak to them. This human social interaction is necessary; there is no evidence that infants can acquire language from watching television, for instance. Some of the biological specifications that underlie language are the social and affective characteristics of infants that tie them to the adults around them and serve as precursors to language development. For instance, infants are intensely interested in human faces, and there is evidence that the infant brain contains neurons that are specialized for the identification of human faces and for the recognition of emotions in faces (Locke, 1993). As they interact with the people around them, infants build a social brain that helps direct them to the information that is important to process—speech sounds, for instance, and not a variety of environmental noises.

Mirror Neurons. Researchers are currently intrigued by the discovery of **mirror neurons** and their possible role in cognitive, linguistic, and social development (Fogassi & Ferrari, 2007). Mirror neurons are a class of neurons that activate when an individual either engages in an activity or observes another engage in that activity, or hears associated sounds (Kohler et al., 2002). Mirror neurons may be an integral part of what we recognize as empathy and imitation—the explanation, for instance, for why it is that when you stick your tongue out at a newborn baby, she then sticks her tongue out at you! One of the many implications for language development is the likelihood that when adults speak to babies, they are actually activating the infants’ neural patterns for language.

Language-Related Areas in the Brain. Specialized areas of the brain contribute to our uniqueness for language. Unlike our primate relatives, humans have areas in the cerebral cortex that are known to be associated with language. Language, however, is not *in* those areas of the brain. The contemporary view is very much that language localization patterns result from the dynamic activity of neural networks that are constantly optimizing the storage and retrieval of information (Ross, 2010). The two hemispheres of the brain are not symmetrical (Geschwind, 1982). Most individuals, about 85+ percent of the population in literate societies, are right-handed, and almost all right-handers have their language functions represented in their left hemisphere. Of the left-handed population, most also have their language sensitive areas in the left hemisphere; therefore, the vast majority of the populace is **lateralized** for language in the left hemisphere. The right hemisphere, however, also participates in some aspects of language processing. For instance, recognition of the emotional tone of speech appears to be a right-hemisphere function.

Imaging techniques such as functional magnetic resonance imaging (fMRI) have made it possible to study the normal brain in action. Before imaging techniques were developed, most of our information about specialized areas came from the study of what happens when the brain is injured, through an accident, for instance, or as a result of a stroke. Damage to the language-sensitive areas of the brain results in **aphasia**, a generalized communication disorder with varying characteristics depending on the site of the lesion (Goodglass, 1993). There are at least three well-established major language-related areas in the left hemisphere (see Figure 1.1.)

- **Broca’s area** in the left frontal region (inferior frontal gyrus) is very near to that part of the motor strip that controls the tongue and lips, and damage to Broca’s area results in a typical aphasic syndrome, called *Broca’s aphasia*, in which the patient has good comprehension but much difficulty with pronunciation and producing the little words of the language, such as articles and prepositions. For instance, when one patient seen in Boston was asked how he planned to spend the weekend at home, he replied, with labored articulation, “Boston College. Football. Saturday.”

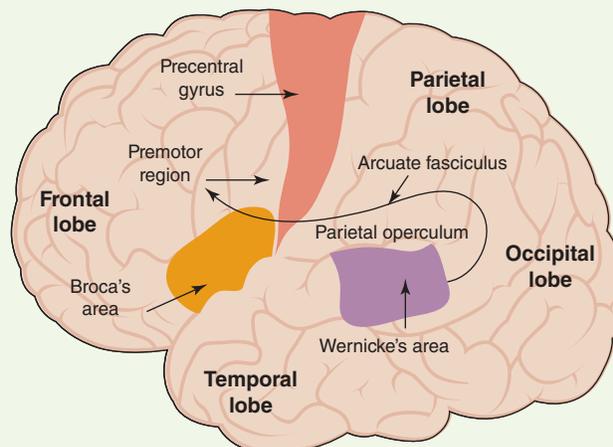
- **Wernicke's area** is located in the posterior left temporal lobe, near the auditory association areas of the brain. Damage to Wernicke's area produces an aphasia that is characterized by fluent speech with many **neologisms** (nonsense words) and poor comprehension. One patient with Wernicke's aphasia, when asked to name an ash-tray, said, "That's a fremser." When he was later asked to point to the fremser, however, he had no idea what the examiner meant.
- The **arcuate fasciculus** is a band of subcortical fibers that connects Wernicke's area with Broca's area (see Figure 1.1). If you ask someone to repeat what you say, the incoming message is processed in Wernicke's area and then sent out over the arcuate fasciculus to Broca's area, where it is programmed for production. Patients with lesions in the arcuate fasciculus are unable to repeat; their disorder is called **conduction aphasia**. There are also areas of the brain known to be associated with written language; damage to the angular gyrus, for instance, impairs the ability to read.

A child aged 5 or 6 who suffers left-brain damage will in all likelihood recover complete use and comprehension of language. However, adults who become aphasic are liable to remain so if they do not recover in the first half-year after their injury. Specialized language areas of the brain are found in adults, but there is evidence that in young children, the neural circuits are not yet so firmly committed, and the nonlanguage hemisphere can take over in the event of damage to the dominant hemisphere.

The brains of infants are not fully formed and organized at birth. The brains of newborns have many fewer synapses (connections) than those of adults. By the age of about 2 years, the number of synapses reaches adult levels, and then increases rapidly between the ages of 4 and 10, far exceeding adult levels. During this period of synaptic growth, there is a concurrent pruning process as connections that are not used die off. This process may help to explain the neurological bases of sensitive or critical periods in development. If, for instance, an infant does not hear language or does not establish an emotional bond with an adult, the neural networks that underlie language and emotion may be weakened. By the age of 15 or 16, the number of synapses has returned to adult levels.

Figure 1.1 ‹‹ Language Areas in the Left Hemisphere.

Broca's area, at the foot of the motor strip, is involved in the programming of speech for production. Wernicke's area, adjacent to the auditory cortex, is involved in the comprehension of language we hear. The arcuate fasciculus is a bundle of subcortical fibers that connects Broca's and Wernicke's areas. In order to repeat a word we hear (e.g., *cat*), we process it first in Wernicke's area, and then send a representation of it via the arcuate fasciculus to Broca's area, where its spoken form is organized. Damage to the arcuate fasciculus results in conduction aphasia, characterized by an inability to repeat words.



» The Study of Language Development

Interest in Language Acquisition in Ancient Times

Probably the first recorded account of a language acquisition study is found in the work of the Greek historian Herodotus. Herodotus, sometimes called the father of history, lived from about 484 to 425 B.C.E. In Book 2 of his *History*, he relates the story of the Egyptian king Psamtik I (664–610 B.C.E.), also called Psammetichus, who wanted to prove that the Egyptians were the original human race.

In order to do this, Psamtik ordered a shepherd to raise two children, caring for their needs but not speaking to them. “His object herein was to know, after the indistinct babblings of infancy were over, what word they would first articulate.” The king believed that the children would begin to speak in the language of the oldest group of humans, without ever hearing any language. This is perhaps the strongest version of a nativist theory of language development that one could have: Babies arrive in the world with a specific language already in their brains.

When the children were about 2 years old, the shepherd went to their quarters one day. They ran up to him with their hands outstretched, saying “Becos.” *Becos* was not a word that anyone recognized. The king, according to Herodotus, asked around the kingdom and eventually was told that *becos* meant “bread” in the Phrygian language, whereupon the Egyptians gave up their claim to being the oldest race of humans and decided that they were in *second* place, behind the Phrygians.

Even though interest in language development has ancient roots, the systematic study of children’s language is fairly recent, in part because the science of linguistics, with its special analytic techniques, came of age in the twentieth century. In earlier times the structural nature of language was not well understood, and research tended to concentrate on the kinds of things that children said rather than on their acquisition of productive linguistic subsystems.

Studies in the Nineteenth and Twentieth Centuries

Many studies of children, including notes on their language, were published in Germany, France, and England during the second half of the nineteenth century and the early years of the twentieth century. One of the main early figures in the United States in the field of developmental psychology, G. Stanley Hall, taught at Clark University in Worcester, Massachusetts. Hall (1907) was interested in “the content of children’s minds.” Hall inspired a school of American students of child language.

The kinds of questions that child language researchers asked during this period were related primarily to philosophical inquiries into human nature. This was true of Charles Darwin (1877), who kept careful diaries on the language development of one of his sons. Many of these early investigations included valuable insights into language. The early studies were typically in the form of diaries with observations of the authors’ own children. Notable exceptions were studies of “wild children” and isolated children who had failed to acquire language. Just as in antiquity, there was philosophical concern with the effects of isolation on language development; that concern has been sustained to the present day. *The Wild Boy of Aveyron*, a landmark study of a feral child called Victor, written in the eighteenth century (and retold by Lane, 1979), and the story of Genie, an American “wild child” born in 1957 who was kept isolated from other humans, have both been the subjects of intense popular and scientific interest (Curtiss, 2014).

During the first half of the twentieth century, many psychologists still kept diary records of their children. In the field of education, children’s language was studied in order to arrive at norms, to describe gender and social class differences, and to search for the causes and cures of developmental difficulties. Educational psychologists frequently used group tests with large numbers of children, and there was a great interest in such things as the average sentence length used by children at different grade levels, or the kinds of errors they made in grammar or pronunciation (McCarthy, 1954).

Research in the Modern Era

The mid-1950s saw a revolution in both linguistics and child language studies. Work on descriptive linguistics (Gleason, 1955) and the early work of Noam Chomsky (1957) provided new models of language for researchers to explore. At the same time, a behaviorist theory of language put forth by B. F. Skinner (1957) inspired other groups of investigators to design studies aimed at testing this learning theory.

Psycholinguistics came into being as a field when linguists and psychologists combined the techniques of their disciplines to investigate whether the systems described by the linguist had psychological reality in the minds of speakers. The linguistic description of English might, for instance, point out that the plural of words ending in /s/ or /z/ is formed by adding /əz/, as, for example, in *kiss* and *kisses*. A task for the psycholinguist was to demonstrate that the linguistic description matched what speakers actually do, that speakers have a “rule” for the formation of the plural that is isomorphic (i.e., identical in form) with the linguist’s descriptive rule. Some of the earliest questions in cognitive science dealt with the mental representation of the units of language.

In the decade of the 1960s, after the powerful grammatical model advanced by Chomsky became widely known, there was an explosion of research into children’s acquisition of syntax. The 1960s were characterized by studies of grammar; many projects studied a small number of children over a period of time, writing grammars of the children’s developing language. At Harvard University, for instance, a group of researchers, many of whom were to become prominent individually, worked with Roger Brown (1973) on a project that studied the language development of three children called Adam, Eve, and Sarah (not their real names).

Members of Brown’s research group visited the children once a month in their homes and made tape recordings of each child with his or her parents, engaged in everyday activities. The recordings were brought back to the laboratory and transcribed, and the resulting transcriptions were studied by a team of faculty and graduate students that met in a weekly seminar. Adam, Eve, and Sarah became very famous in the linguistics community.

As the 1960s drew to a close, the dominance of syntax in research gave way to a broadening interest that included the context in which children’s language emerges and an emphasis on the kinds of semantic relations children are trying to express in their early utterances. The early 1970s saw a spate of studies on the language addressed to children; many of these were conducted to shed light on the innateness controversy. Researchers wanted to know whether children were innately programmed to discover the rules of language all by themselves, or whether adults provided them with help or even with language-learning lessons.

Studies of the 1980s and 1990s included all of the traditional linguistic topics: phonology, morphology, syntax, semantics, and pragmatics. Now, in the second decade of the twenty-first century, there is growing interest in bilingualism and cross-cultural research in language development and in understanding how language development interfaces with other aspects of children’s social and psychological development; in acquiring a language, children become members of a society, with all of its unique cultural practices and belief systems.

Cross-cultural studies and studies of children in nontypical developmental situations are also vital to our ultimate

Roger Brown conducted the study on Adam and Eve and Sarah at Harvard in the 1960s and is regarded by many as the father of the modern field of child language research.



Harvard Archives

understanding of the process of language acquisition. What happens, for instance, if a child spends her first year in one language community and then, just as she is about to begin speaking, she finds herself in a new family that speaks a new and totally unrelated language? This is the case with international adoptions. In the past few years, thousands of young children have come to the United States from a variety of countries. These children are of great interest to the linguistics community.

While historically, research with typical and atypical language learners often was conducted and reported in different settings and journals, researchers are increasingly integrating work across populations to gain better insights into the bases of language in all populations.

The study of language acquisition has obviously changed in major ways in the twenty-first century. It has become more international and interdisciplinary, and researchers now make use of sophisticated contemporary technology. Early studies were typically of monolingual, middle-class, English-speaking children. There is now a community of scholars from all over the world, many of whom are members of the International Association for the Study of Child Language (IASCL). Study of many different languages and cultures is changing our ideas about what might be universal in acquisition. The inclusion of atypical populations and dual language learners is helping build theory. At the same time this research provides information that has real-world applications in the development of both remedial programs for children at risk and educational programs for children who, for example, speak different languages at home and at school. Language development researchers now acknowledge that most children in the world are not monolingual.

Research Methods

Modern technology has made it possible to collect accurate data on language development and for researchers around the world to share data and data analysis programs.

Equipment. Increasingly sophisticated audio and video equipment has greatly simplified data collection. Powerful computers with immense memory capacity make it possible to conduct research that was unimaginable just a few years ago. For instance, in a remarkable recent project, Deb Roy, a researcher at MIT with an engineering background, recorded 230,000 hours of the home life of his son over the first 3 years of his life, including everything that was said to the child as well as every utterance of the child, making it possible to follow the evolution, in context, of every word that he acquired. The data are not yet fully analyzed.

Studies of prelinguistic infants or of cortical reactions to linguistic stimuli at any age require especially sensitive recording equipment and may use sophisticated imaging technology. Imaging is a way of observing mental activity related to language. It can show if even a very young infant is able to distinguish among speech sounds, because if the infant notices a difference, there will be some kind of reaction in the brain that can be measured. Imaging devices are able to do this in various noninvasive ways.

They can measure *electrical changes* in the brain, because brain activity produces electrical current; **event-related potentials (ERPs)** measure changes in current. **Magnetoencephalography (MEG)** measures the tiny magnetic changes that accompany changes in electrical activity.

They can measure *blood flow*, because increased brain activity is accompanied by increased blood flow to the area that is activated; **functional magnetic resonance imaging (fMRI)** measures changes in oxygen; increased blood flow to an activated area carries more oxygen with it. **Near-infrared spectroscopy (NIRS)** also measures blood changes, but in this case the machine records the changes in hemoglobin that accompany increased blood flow.

With the exception of event-related potential equipment, imaging is expensive and not easily accessible. Imaging studies also require rather restricted and careful experimental tasks. They have, however, provided answers to questions that have intrigued us for a long time. For instance, if you are in one language community as an infant and then are

adopted to another country and become a monolingual speaker of a new language, does the first language disappear from your brain? The answer is no: Researchers in Canada used fMRI to study three groups of children—monolingual French speakers, children adopted as infants from China, and Chinese-French bilinguals. They were astonished to find that the adopted children, who had no memory or knowledge of Chinese, showed the same brain activation patterns as the bilingual speakers when they listened to Chinese speech sounds. They had unconsciously maintained aspects of their lost language (Pierce, Klein, Chen, Delcenserie, & Genesee, 2014).

Many important language development studies still use standard laboratory equipment, and others collect data with easily acquired video and audio recorders. This makes it possible to film in the laboratory or in participants' homes with a minimum of intrusion. Regardless of the method of recording, it is necessary to make a transcription of the data for analysis. This involves writing down as exactly as possible everything that is said on the recording, preferably following a standard format that makes computer analysis possible (see Figure 1.2).

Research Design. Language development studies can be either *cross-sectional* or *longitudinal* in their design. Cross-sectional studies use two or more groups of participants. If, for instance, you wanted to study the development of the negative between the ages of 2 and 4, you could study a group of 2-year-olds and a group of 4-year-olds and then describe the differences in the two groups' use of negation. Longitudinal studies follow individual participants over time; one might study the same children's use of negatives at specified periods between the ages of 2 and 4.

Cross-sectional studies make it possible to obtain a great deal of data about a large number of participants in a short time; one doesn't have to wait 2 years to get results. Longitudinal designs are used to study individuals over time when questions such as the persistence of traits or the effects of early experience are relevant. If, for instance, you wanted to know whether children who are late talkers have problems learning to read, you would have to use a longitudinal design.

Figure 1.2 » Sample Transcript.

This excerpt from CHILDES can be analyzed by a number of CLAN programs that can automatically compute MLU, list all vocabulary by speaker, and derive many standardized measures.

```
@Begin
@Participants: CHI Charlie Child,
MOT Mother, FAT Father
@Date: 7-JUL-1996
@Filename: CHARLIE.CHA
@Situation: Home Dinner
Conversation.
*MOT: did you tell Dad what we did
today?
*MOT: who'd we see?
*CHI: who?
*MOT: remember?
*CHI: Judy and my friend.
*MOT: did we see Michael?
*CHI: yes.
*FAT: was Mike at the beach?
*CHI: no.
*FAT: that's because he had work to
do.
*FAT: do you remember the name of
the beach you went to?
*CHI: not this time.
*FAT: you don't remember it this
time?
*FAT: it was Winger-: what?
*FAT: Winger-Beach?
*CHI: yes.
*FAT: Winger Sheek Beach.
*CHI: Winger Sheek Beach.
*FAT: that's the one.
*CHI: Winger Beach.
*MOT: did you go swimming, Charlie?
*CHI: I went swimming, Dad.
*FAT: you did?
*FAT: did you wear water wings?
*CHI: no.
*FAT: no?
@End
```

Both cross-sectional and longitudinal studies can be either *observational* or *experimental*. Observational studies involve a minimum of intrusion by the researcher. Naturalistic observational studies attempt to capture behavior as it occurs in real life; for instance, one might record and analyze family speech at the dinner table. Controlled observational studies can be carried out in various settings, including the laboratory, where the researcher provides certain constants for all participants. Fathers might come to the laboratory with their daughters and be observed reading them a book provided by the researcher. Observational research can indicate what kinds of behaviors correlate with one another, but it cannot reveal which behavior might cause another.

In experimental research, the researcher has some control and can manipulate variables. Typical experimental research includes:

- Hypotheses about what will happen
- An experimental group of participants that receives the treatment (training, for instance) and a control group that receives no special treatment
- Independent variables, manipulated by the experimenter (training, exposure to a TV program, etc.)
- Dependent variables: the behaviors that are measured (for instance, the participants' use of a particular grammatical form)
- Randomization: assignment of participants at random to control or experimental conditions
- Standardization of procedures (all participants receive the same instructions, etc.)

If you wanted to see whether training makes a difference in the acquisition of the passive voice, for instance, you might take a group of thirty 3-year-olds and randomly assign them to two groups, a control group and an experimental group of 15 children each. The experimental group would receive training in the passive; the control group, no special treatment. Finally, both groups could be asked to describe some pictures they had never seen before, and differential use of the passive would be recorded. If the trained group used passives and the control group did not, there would be evidence that training causes accelerated acquisition of one aspect of grammar. Experimental research can easily be replicated in the laboratory, but it may not be easily generalized to the outside world.

In addition to clear-cut observational and experimental methods, language development researchers use a variety of research techniques. These include *standard assessment measures*, in which participants can be compared or evaluated on the basis of their responses to published standardized language tests. These are useful for indicating whether a participant's language is developing at a typical rate or whether some facet of development is out of line with the others.

Imitation is a technique used by many researchers: You simply ask the child to say what you say. Imitation reveals a great deal about children's language, since they typically cannot imitate sentences that are beyond their stage of development. This is true of adults as well—try imitating a few sentences in Bulgarian the next time you meet someone from Sofia who is willing to say them to you.

Elicitation is a technique that works well when a particular language form is the target and you want to give your participants all the help they need (short of the answer itself). In investigating the plural through elicitation, you might show your participants a picture, first of one and then of two birdlike creatures, and say, "This is a wug. Now there is another one. There are two of them. There are two?" The participant obligingly fills in "wugs." This technique works well with aphasic patients, especially those with severe Broca's aphasia who have very little voluntary speech.

The *interview* is an old technique, but one that can be very effective if the researcher has the time to do more than ask a list of questions and fill in a form. Researchers of the Piagetian school frequently use an interview type called the *clinical method*. This is an open-ended interview in which the sequence of questions depends on the answers the participant has given. In studying metalinguistic awareness, the investigator might ask a series of questions, such as "Is *horse* a word? Why? (Or why not?) What is a word? How do you know? What is your favorite word? Why?" The choice of method depends very much

on the theoretical inclination of the investigator. Since without some sort of intervention on the part of the researcher it might take a very long time before participants say the kinds of things that interest us, many ingenious methods for studying language production have been designed (Menn & Bernstein Ratner, 2000).

CHILDES

One of the most significant events in language development research has been the creation of the Child Language Data Exchange System (**CHILDES**). CHILDES was launched in 1984 at Carnegie Mellon University under the direction of Brian MacWhinney and Catherine Snow (Berko Gleason & Thompson, 2002; MacWhinney, 2000). You can visit the project and its open-access databases and freely distributed software at <http://childes.psy.cmu.edu>. CHILDES is the child language portion of an even larger system called TalkBank, which has increasingly sophisticated data and tools for the analysis of conversational interaction in many kinds of populations. CHILDES is made up of three main parts:

1. Transcription rules for transcribing spoken language in a standardized way that makes computer analysis possible. The rules are called **CHAT** (acronym for Codes for the Human Analysis of Transcripts). Figure 1.2 shows a sample transcript.
2. Computer programs that can run on the CHAT files to do such things as instantly list every word used by a child. The programs are called **CLAN** (acronym for Computerized Language Analysis programs). They can also search for groups of words, compute linguistic attributes of utterances, and analyze discourse patterns between participants in conversations.
3. The database: digital files in more than two dozen different languages, containing language data that have been contributed from over 100 research projects around the world.

CHILDES is Web-based and available without cost to researchers everywhere. A visit to its main website is recommended. There you will find the programs and data, as well as much useful information. Many powerful computer programs are included in CLAN (MacWhinney, 2000). Some of the advantages of CHILDES are that it allows (1) data sharing among researchers, who can test their hypotheses on many more participants; (2) increased precision and standardization in coding; and (3) automation of many coding procedures. CLAN programs can operate on any or all speakers' output and can automatically derive the mean length of utterance (see Chapter 5), a total list of words used as well as their frequency, and other data of immense value to the language researcher. Data from many studies in English and other languages are available; even older studies, such as Brown's famous work on Adam, Eve, and Sarah from the 1960s, have been scanned and entered, thus making these data available to anyone who wants them.

One of the most recent developments in CHILDES is an interactive Internet resource that links transcripts with digitized video and audio data: It is possible to read the transcript online, view the participants, and hear the actual speech, all at the same time (MacWhinney, 2001).

Summary ‹

Babies seek the love and attention of their caregivers. Before they are even 1 year old, they are able to make fine discriminations among the speech sounds they hear, and they begin to communicate nonverbally with those around them. Young children acquire the basic components of their native language in just a few years: *phonology*, *morphology*, *semantics*, *syntax*, and the social rules for language use, often called *pragmatics*. By the time they are of school age, children control all of the major grammatical and semantic features. Language development, however, proceeds throughout the life cycle; as individuals grow older, they acquire new skills at every stage of their lives.

Babies begin to acquire language during their first months, long before they say their first words; language is built upon an earlier affective communicative base. Midway through the first year, infants begin to babble, an event seen by many researchers

as evidence of linguistic capacity. Near their first birthdays, infants say their first words. Early words, word meanings, and word combinations have universal characteristics, since toddlers' language is similar across cultures. Children's progress toward learning the particular grammatical structure of their own language follows a predictable order that is common to all children learning that language.

Although there are universal characteristics, there are also patterns of individual variation in language development. Different theories of language development emphasize *innate mechanisms*, *learning principles*, *cognitive characteristics*, *social interaction*, and the *gestural-usage* bases of language.

During the school years, children perfect their knowledge of complex grammar, and they learn to use language in many different social situations. They develop *metalinguistic awareness*, the ability to consider language as an object. At the same time, they learn another major linguistic system: the written language. The demands of literacy remove a child's language from the here and now and emphasize *decontextualized language*. Not all children learn to read with ease. Just as some children may have difficulty learning to read, others have trouble with different aspects of language. These problems may arise from no known cause, or they may be related to developmental conditions such as hearing impairment, autism spectrum disorder, or Down syndrome. Although early work on language development focused on monolingual learners, we now recognize that most of the world is bilingual, at least to some extent.

Human language has special properties that have led many researchers to conclude that it is *species specific* and *species uniform*. Humans can talk about any part of their experience. Sea mammals employ communicative systems of whistles and grunts, and many birds have been shown to have a variety of meaningful calls. None of these systems equals human language, however, which is *productive*, has *semantics*, and offers the possibility of *displacement*.

During the past 75 years, many researchers have attempted to discover whether language is really unique to humans or if it can be learned by other species. Recent studies have shown that African grey parrots and dogs have some sophisticated linguistic abilities. Early studies that tried to teach spoken language to chimpanzees showed conclusively that primates cannot speak as humans do. More recent studies that have taught American Sign Language (ASL) to chimpanzees and gorillas have met with mixed results. The signing apes may be responding at least in part to subtle cues from their trainers, but the question of their potential is not completely settled. Language development requires social interaction, but spoken language in humans is possible only because we have evolved with specialized biologically based characteristics that support language; these are ancient in our species, probably descended from the common ancestor we share with Neanderthals. Other evidence of humans' biological disposition for language includes the regular onset of speech and the facts that speech is not suppressible, language cannot be taught to other species, and languages everywhere have universals. There are special language areas in the brain, such as *Broca's area*, *Wernicke's area*, and the *arcuate fasciculus*.

The study of language development includes research into major linguistic subsystems. The *phonological system* is composed of the significant sounds of the language and the rules for their combination; the *morphological system* includes the minimal units that carry meaning; *syntax* refers to the rules by which sentences are constructed in a given language; and the *semantic systems* contain the meanings of words and the relationships between them. Finally, to function in society, speakers must know the social or *pragmatic rules* for language use. Individuals must be able to comprehend and produce all of these systems in order to attain *communicative competence*.

Although interest in language development has ancient roots, the scientific study of this subject began in the 1950s, with the appearance of new linguistic and psychological theories of language that gave birth to the combined discipline now known as *developmental psycholinguistics*. Developmental psycholinguists use all of the research techniques, designs, and resources employed by psychologists, neuroscientists, and linguists, as well as a few that are unique, such as CHILDES, a shared computerized bank of language data, as well as specialized transcription formats and computer programs for analyzing language.

Suggested Projects «

1. Watch the news in Hungarian (assuming you are not a speaker). If you are, find news in a language you do not know.

Write a brief report: Discuss what you hear, and whether you can imitate any of it. Do you think that you, or an infant, could learn Hungarian from watching the news many times? If so, how do you think that would happen? Or how would you go about it? If not, describe the ways you would have to change the broadcast in order to learn Hungarian from it. Why do you think it would be particularly difficult to learn this language?

2. List some stereotypic notions people have about language development. For instance: Girls talk more than boys. Babies say “goo goo, ga ga.” Children call rabbits “wabbits.” Children can learn a language watching television, and so on. Pick one of these beliefs and design a study to find out if it is true. Since this is a thought experiment, you don’t have to worry about how long it would take or how much it would cost, but be explicit in describing exactly how you would proceed, what data you would need to collect, and how you would analyze it in order to answer your question.
3. Read papers on studies with the border collie Chaser, the gorilla Koko, the chimp Kanzi, and the parrot Alex. Summarize the language claims that are made for each of these animals and draw some conclusions of your own about which of them you think comes closest to having language.



1.5 Clickclickclick.com
in Hungarian News

<https://www.youtube.com/watch?v=XdJGgGByyQg>

Sample pages