



from parents and strangers, from other babies and older siblings, from picture books and family photographs, from their own walking and talking (Hayne & Simcock, 2009). The dendrites of several areas of the brain grow to reflect remembered experiences.

The crucial insight from information-processing theory is that the brain is a very active organ, changing with each day's events. Therefore, the particulars of early experiences are critically important in determining what a child knows or does not know. Generalization becomes possible as sensations become perceptions, which become expectations (Mullally & Maguire, 2014). Every day of their young lives, infants are processing information and storing conclusions.

Selective Amnesia As we grow older, we forget about spitting up, nursing, crying, and almost everything else from our early years. However, strong emotions (love, fear, mistrust) may leave lifelong traces.

WHAT HAVE YOU LEARNED?

1. Why did Piaget call cognition in the first two years "sensorimotor intelligence"?
2. How does stage one of sensorimotor intelligence lead to stage two?
3. In sensorimotor intelligence, what is the difference between stages three and four?
4. Why is the concept of object permanence important to an infant's development?
5. What does the active experimentation of the stage-five toddler suggest for parents?
6. Why did Piaget underestimate infant cognition?
7. What conditions help 3-month-olds remember something?
8. How does the infant brain respond to experiences?

Language

No other species has anything approaching the neurons and networks that support the 6,000 or so human languages. The human ability to communicate, even at age 2, far surpasses that of full-grown adults of every other species. This includes dolphins, ravens, and chimpanzees, all with much better communication mechanisms than was formerly believed.

Here we describe the beginning of language learning, "from burping to grammar" as one scholar put it (Saxton, 2010, p. 2). Before age 1, babies listen intensely, "acquiring much of their native language before they utter their first word" (Aslin, 2012, p. 191).

The Universal Sequence

The timing of language acquisition varies; the most advanced 10 percent of 2-year-olds speak more than 550 words, and the least-advanced 10 percent speak fewer than 100—a fivefold difference (Merriman, 1999). But although timing varies, the sequence is the same.

LISTENING AND RESPONDING Hearing infants begin learning language before birth, via brain connections. Newborns prefer the language their mother speaks over an unheard language; if their mother is bilingual, newborns respond to both languages (Byers-Heinlein et al., 2010).

The ability to distinguish sounds, mouth movements, and gestures in the language (or languages) of caregivers improves over the first year, while the ability to decipher sounds in an unfamiliar language deteriorates (Narayan et al., 2010). By 1 year, babies are more likely to imitate the actions of a stranger speaking their native tongue than those of a person who speaks another language (Buttelmann et al., 2013).

Early language learning is encouraged everywhere by adults who instinctively use higher pitch, simpler words, repetition, varied speeds, and exaggerated emotional tones when they talk to babies (Bryant & Barrett, 2007). This special language form is sometimes called *baby talk* and sometimes called *motherese*, since mothers universally speak it.

Both these terms may be misleading, since people use that form with lovers as well as babies, and since many nonmothers use it as well. Scientists prefer a more formal designation: **child-directed speech**. No matter what term is used, this mode captures infants' attention.

Sounds are preferred over content. Infants like alliteration, rhymes, repetition, rhythm, and varied pitch (Hayes & Slater, 2008; Saxton, 2010; Schön et al., 2008). Think of your favorite lullaby (itself an alliterative word). All infants listen to whatever they can and appreciate the sounds they hear. Even music is culture-specific: 4- to 8-month-olds prefer their own culture's music (Soley & Hannon, 2010).

child-directed speech

The high-pitched, simplified, and repetitive way adults speak to infants (Also called *baby talk* or *motherese*.)

At About This Time: The Development of Speech Language in the First Two Years

Age*	Means of Communication
Newborn	Reflexive communication—cries, movements, facial expressions
2 months	A range of meaningful noises—cooing, fussing, crying, laughing
3–6 months	New sounds, including squeals, growls, croons, trills, vowel sounds
6–10 months	Babbling, repeating both consonant and vowel sounds
10–12 months	Comprehension of simple words; speech-like intonations; specific vocalizations that have meaning to those who know the infant well. Deaf babies express their first signs; hearing babies also use specific gestures (e.g., pointing) to communicate
12 months	First spoken words that are recognizably part of the native language
13–18 months	Slow growth of vocabulary, up to about 50 words
18 months	Naming explosion—three or more words learned per day. Much variation in age and rate
21 months	First two-word sentence
24 months	Multiword sentences. Half the toddler's utterances are two or more words long

*The ages in this table reflect norms. Many healthy, intelligent children attain each linguistic accomplishment earlier or later than indicated here.



JANEN SZARZYNSKI/AGEITY IMAGES



VISHVAHARISHAI/AGEITY IMAGES

Same Situation, Far Apart: Before Words The Polish babies learning sign language (*left*) and the New York infant interpreting a smile (*right*) are all doing what babies do: trying to understand communication long before they are able to talk.

BABBLING At first, babies mostly listen. By 6 months, they start practicing sounds, repeating certain syllables (*ma-ma-ma*, *da-da-da*, *ba-ba-ba*), a phenomenon referred to as **babbling**. Responses from other people encourage babbling (this is the age of “making interesting events last”).

Toward the end of the first year, babbling begins to sound like the infant’s native language; infants imitate what they hear in accents, cadence, consonants, and so on. Gestures also become more specific as a means of communication.

Consider pointing, an amazing example of social perspective. Most animals cannot interpret pointing; most 10-month-old humans can look toward whatever another person is pointing at and can also point themselves. Pointing is well developed by 12 months, especially when the person who is pointing also speaks (e.g., “look at that”) (Daum et al., 2013).

FIRST WORDS Finally, the average hearing baby utters a few words, usually at about 12 months, although the range for normal babies is 10–18 months. Spoken vocabulary increases gradually (perhaps one new word a week).

However, 6- to 15-month-olds learn meanings rapidly; they understand about 10 times more words than they can say. Initially, the first words are merely labels for familiar things (*mama* and *dada* are common), but soon tone conveys meaning. Imagine “Dada,” “Dada?” and “Dada!” Each is a **holophrase**, a single word that expresses an entire thought.

VERBS AND NOUNS Once vocabulary reaches about 50 *expressed* words (understood words are far more extensive), it builds rapidly, at a rate of 50 to 100 words per month, with 21-month-olds saying twice as many words as 18-month-olds (Adamson & Bakeman, 2006). This language spurt is called the **naming explosion** because many early words are names of people and things.

Early sequence and uttered sounds are universal, but differences soon emerge. For instance, about 30 languages of the world use a click sound as part of the spoken words; infants in those communities become adept at clicking. Similarly, the rolled *r*, the enunciated *l* or *th*, the difference between *b* and *v* are mastered by infants in some languages but not others, depending on what they hear.

Although all new talkers say more nouns than any other parts of speech, the ratio of nouns to verbs varies from place to place. For example, by 18 months, English-speaking infants use relatively more nouns but fewer verbs than Chinese or Korean infants do. Why?

babbling

The extended repetition of certain syllables, such as *ba-ba-ba*, when babies are between 6 and 9 months old.

holophrase

A single word that is used to express a complete, meaningful thought.

naming explosion

A sudden increase in an infant’s vocabulary, especially in the number of nouns, that begins at about 18 months of age.



IMAGE SOURCE: PHOTODISCGETTY IMAGES

Show Me Where Pointing is one of the earliest forms of communication, emerging at about 10 months. As you see here, pointing is useful lifelong for humans.

grammar

All the methods—word order, verb forms, and so on—that languages use to communicate meaning, apart from the words themselves

mean length of utterance (MLU)

The average number of meaningful sound combination in a typical sentence (called utterance, because children may not use conventional words). MLU is often used to indicate a child's language development.

One explanation goes back to the language itself. Mandarin, Cantonese, and Korean are “verb-friendly,” in that verbs are placed at the beginning or end of sentences. That makes them easier to learn. In English, verb position and forms change in illogical ways (e.g., *go, gone, will go, went*). This irregularity makes English verbs harder to learn than nouns.

An alternative explanation considers the social context: Playing with a variety of toys and learning about dozens of objects are crucial in North American culture, whereas East Asian cultures emphasize human interactions—specifically, how one person responds to another.

Accordingly, North American infants are expected to name many objects, whereas Asian infants are expected to act on objects and respond to people. Thus, toddlers within China might learn the equivalent of *come, play, love, carry, run*, and so on earlier than toddlers elsewhere.

A simpler explanation is that young children are sensitive to the sounds of words, with some sounds more salient than others. The infant preference for sounds may be one reason why many English-speaking toddlers who have never been on a farm nonetheless know that a cow says “moo” and a duck says “quack.”

Verbs are learned more easily if they sound like the action (Imai et al., 2008), and such verbs may be more common in some languages than others. In English, most verbs are not onomatopoeic, although perhaps *jump, kiss, and poop*—all learned relatively early in life—are exceptions.

- **PUTTING WORDS TOGETHER** **Grammar** can be defined as including all the methods that languages use to communicate meaning. Word order, prefixes, suffixes, intonation, verb forms, pronouns and negations, prepositions and articles—all of these are aspects of grammar, all varying by whatever language the infant hears (Saxton, 2010).

Grammar can be discerned in holophrases but becomes obvious between 18 and 24 months, when two-word combinations begin. For example, in English, “Baby cry” and “More juice” follow the proper word order. No child asks, “Juice more,” and already by age 2 children know that “cry baby” has an entirely different meaning.

Soon the child combines three words, usually in subject-verb-object order in English (e.g., “Mommy read book”), rather than any of the five other possible sequences of those words.

- Children's proficiency in grammar correlates with the length of their sentences, which is why in every language **mean length of utterance (MLU)** is considered an accurate way to measure a child's language progress (e.g., Miyata et al., 2013). The child who says “Baby is crying” is advanced compared with the child who says “Baby cry” or simply the holophrase “Baby.”

Careful tracing of early language from the information-processing perspective finds periods when vocalization seems to slow down before a burst of new talking erupts, as perception and action are interdependent (Pulvermüller & Fadiga, 2010). This means that sometimes, with new perceptual understanding, verbal output lags behind neurological advance.

This slowdown before a language spurt is not evident in every infant, but many seem temporarily quieter before uttering a string of new words (Parladé & Iverson, 2011). Those who talk relatively late sometimes put two words together almost as soon as they speak their first holophrase.

How Do They Do It?

Worldwide, people who are not yet 2 years old already speak their native tongue. They continue to learn rapidly: Some teenagers compose lyrics or deliver orations that move thousands of their co-linguists. How is language learned so easily and so

well? Answers come from three schools of thought, one emphasizing learning, one emphasizing culture, and the third stressing evolution.

THEORY ONE: INFANTS NEED TO BE TAUGHT The seeds of the first perspective were planted more than 50 years ago, when the dominant theory in North American psychology was behaviorism, or learning theory (see Chapter 1). The essential idea was that all learning is acquired, step by step, through association and reinforcement.

B. F. Skinner (1957) noticed that spontaneous babbling is usually reinforced. Typically, every time the baby says “ma-ma-ma-ma,” a grinning mother appears, repeating the sound as well as showering the baby with attention, praise, and perhaps food. Similarly, parents routinely label objects—“Here is your blanket” . . . “Pet the doggie” . . . “See the truck”—long before babies say those words. Skinner believed that most parents are excellent instructors, responding to their infants’ gestures and sounds, thus reinforcing speech (Saxton, 2010).

Behaviorists note that some 3-year-olds converse in elaborate sentences; others just barely put one simple word with another. Such variations correlate with the amount of language each child has heard, just as behaviorists would predict.

Parents of the most verbal children teach language throughout infancy—singing, explaining, listening, responding, and reading to their babies before their first words. Few parents know the theory of behaviorism, but many use techniques that Skinner would recommend, because these methods succeed (Tamis-LeMonda et al., 2014).

THEORY TWO: SOCIAL INTERACTION FOSTERS INFANT LANGUAGE The second theory arises from the sociocultural reason for language: communication. According to this perspective, infants communicate because humans have evolved as social beings, dependent on one another for survival and joy. Language is designed to further social communication.

It is the emotional messages of speech, not the words, that are the focus of early communication, according to this perspective. The social content of speech is universal, which is why babies learn whatever particular grammar their culture provides.

One study that illustrated this began with Shuar hunter-gatherers, living in isolation near the Andes Mountains and never having heard English. They listened to tapes of North American mothers talking to babies. The Shuar successfully distinguished comfort, approval, attention, and prohibition, without knowing the words (Bryant & Barrett, 2007).

This theory contends that all infants (and no chimpanzees) master words and grammar because they are powerfully driven to join the social world in which they find themselves (Tomasello & Herrmann, 2010). Cultures vary in how they communicate—some using gestures and touch more than words, each using particular sounds and grammar, sometimes quite difficult to pronounce. Whatever it is, babies strive to learn it because they want to join the human community.

A behaviorist might consider the quieter, less verbal child to be developmentally delayed, but this second perspective contends that the crucial aspect of language is social communication. The quieter child may simply be communicating in another way.

THEORY THREE: INFANTS TEACH THEMSELVES A third theory holds that language learning is innate; adults need not teach it, nor is it a by-product of social interaction. It arises from the universal human impulse to imitate. It is experience-expectant: The brain expects language, so very young infants pay attention to speech.

The seeds of this perspective were planted soon after Skinner proposed his theory of verbal learning. Noam Chomsky (1968, 1980) and his followers felt that language is too complex to be mastered merely through step-by-step conditioning.

THINK CRITICALLY: Besides using spoken words, how else do humans communicate?

Family Values Every family encourages the values and abilities their children need to be successful adults. For this family in Ecuador, that means strong legs and lungs to climb the Andes, respecting their parents, and keeping quiet unless spoken to. A “man of few words” is admired. By contrast, many North American parents babble in response to infant babble, celebrate the first spoken word, and stop their conversation to listen to an interrupting child. If a student never talks in class, or another student blurts out irrelevant questions, perhaps the professor should blame the culture rather than the students themselves.



STEVEN J. RAZUTINSKI/ALAMY

Although behaviorists focus on variations among children in vocabulary size, Chomsky stressed similarities in language acquisition—the universals, not the differences.

- Noting that all young children master basic grammar at about the same age, Chomsky cited this *universal grammar* as evidence that humans are born with a mental structure that prepares them to seek some elements of human language—for example, the use of a raised tone at the end of an utterance to indicate a question.
- Chomsky labeled this hypothesized mental structure the **language acquisition device (LAD)**, which enables children to derive the rules of grammar quickly and effectively from the speech they hear every day, regardless of whether their native language is English, Arabic, or Urdu. The social, cooperative habits of *Homo sapiens* 100,000 years ago allowed survival of the species, so evolution led to language. That is evident in every human infant.

language acquisition device (LAD)
Chomsky's term for a hypothesized mental structure that enables humans to learn language, including the basic aspects of grammar, vocabulary, and intonation.

Other scholars agree with Chomsky that infants are innately ready to use their minds to understand and speak whatever language is offered. All babies are eager learners, and language may be considered one more aspect of neurological maturation (Wagner & Lakusta, 2009), experience-expectant for all humans.

This idea does not strip languages and cultures of their differences in sounds, grammar, and almost everything else. Chomsky called those “surface” language. However, the basic idea is that “language is a window into human nature, exposing deep and universal features of our thoughts and feelings” (Pinker, 2007, p. 148). We all want to look out that window.

Research supports this perspective as well. As you remember, newborns are primed to listen to speech (Vouloumanos & Werker, 2007), and all infants babble *ma-ma* and *da-da* sounds (not yet referring to mother or father). No reinforcement or teaching is required; all infants need is for dendrites to grow, mouth muscles to strengthen, synapses to connect, and speech to be heard.

ALL TRUE? Which of these three perspectives is correct? Perhaps all of them.

Infants use language in many ways—to indicate intention, call objects by name, express emotions, talk to family members, sing to themselves, make demands, remember the past, and much more. It may be that some aspects of language learning

are best explained by one theory at one age and others by another theory at another age. Perceptual, social, and linguistic abilities combine to make language learning possible (Golinkoff & Hirsh-Pasek, 2008).

Current thinking is that children are not exclusively behaviorists, social learners, or innately driven, but all three. Learning a new word or grammar form is not an all-or-none accomplishment. Instead, partial learning occurs: A lack of evident mastery of a word makes it easier to learn that word or a related word later on (Yurovsky et al., 2014).

Some scholars, inspired by evolutionary theory, think that language is the crucial trait that makes humans unlike any other species—that “language is entwined with human life” (Pinker, 2007, p. viii). If that is true, then there must be many paths to language learning, to ensure that every human learns.

Adults need to talk often to infants (theory one), encourage social connections (theory two), and appreciate the innate abilities of the child (theory three). As one expert concludes:

In the current view, our best hope for unraveling some of the mysteries of language acquisition rests with approaches that incorporate multiple factors, that is, with approaches that incorporate not only some explicit linguistic model, but also the full range of biological, cultural, and psycholinguistic processes involved.

[Tommasello, 2006, pp. 292–293]

The idea that every theory is correct in some way may seem uncritical, naive, and idealistic. However, a similar conclusion was arrived at by scientists extending and interpreting research on language acquisition. They contend that language learning is neither the direct product of repeated input (behaviorism) nor the result of a specific human neurological capacity (LAD).

Rather, “different elements of the language apparatus may have evolved in different ways,” and thus a “piecemeal and empirical” approach is needed (Marcus & Rabagliati, 2009, p. 281). In other words, no single theory explains how babies learn language.

An analogy can be made to other aspects of body and brain growth. Every newborn needs extensive care for years, but parents use diverse methods of child care, adjusting to their culture as well as to the particular needs of their baby at the moment. The result is children who become capable adults, walking, talking and contributing to their community. Diversity is evident, as are universals. The next chapter continues that theme.

WHAT HAVE YOU LEARNED?

1. What aspects of language develop in the first year?
2. When does vocabulary develop slowly and when does it develop quickly?
3. What are the characteristics of the way adults talk to babies?
4. How would a caregiver who subscribes to the behaviorist theory of language learning respond when an infant babbles?
5. What is typical of the first words that infants speak?
6. What indicates that toddlers use some grammar?
7. According to behaviorism, how do adults teach infants to talk?
8. According to sociocultural theory, why do infants try to communicate?
9. Do people really have a language acquisition device?
10. Why do developmentalists accept several theories of language development?