CHAPTER 5

The Beginnings—Infant Communication

The small group had wandered some distance from their village. Their ancestors had warned them about the strange people living beyond the giant forest. Perhaps they had gone too far, but this particular day they had experienced such good fortune in gathering plump, sweet berries. In fact, they had been scolding one another for eating too many as they picked them. After such a long absence, it would be especially important to return with a good supply to show for their efforts.

As they consumed more berries they became increasingly thirsty. Thirst soon became an urgent issue. With few words and many gestures, they decided to head toward "laj bon"—the lost stream. They traveled quietly with a measure of apprehension. The stream was called "lost" because once the people beyond the forest began using it, no one from their tribe had ever returned to it. As they approached the water, they heard a strange sound. A gurgling, bubbling sound. At first it sounded like the stream itself, but as they drew closer they noticed a large round basket lodged against a rock in the babbling brook. Over the rim they could see two small hands. It was a "tiny one!" (They had no word for infant.) This tiny one made so many noises.

As they retrieved the basket and withdrew the tiny one, a note fell to the ground unnoticed. In a language alien to them nonetheless, it read, "Please, take care of my baby! He is 9 months old." As they carried this tiny one back to their village, they discussed a name for him. As they walked he continued to produce a stream of noises different from any of their tiny ones who rode in their mothers' slings all day. As they approached their village, they determined that his name should be Ilo Kushinari, which translates as "Look who is talking."

This chapter addresses the following questions:

- Which motor, cognitive, and social developments contribute to infants' communication behaviors?
- How do infants' auditory abilities contribute to the development of speech behavior?
- What traditional milestones of speech behavior are achieved by infants prior to the first words?
- What infant behaviors prompt the interactions that lead to communication?
- How do caregivers interact with infants to establish and facilitate communication?
- How do infants adapt their behaviors to influence those around them?

Several decades ago this chapter may not have existed in a text on language development. The prevailing view for many years had been that language does not begin until the first word has occurred. The traditional "rule of thumb" for the first word places its occurrence around the first birthday. Therefore, the first year of life was thought to precede true language development.

According to the *American Heritage Dictionary* (1970), the word *infant* is derived from the Latin "enfant" meaning "one unable to speak." Traditional accounts typically acknowledged the development of infant vocal behaviors (cooing, babbling, vocal play, etc.) and presumed that they were somehow related to the eventual form of speech. However, beyond this, there was little recognition that the first year of life was directly related to language development.

Subsequently, researchers and the prevailing models of language expanded their scope of interest from the forms of language to its meanings and, finally, to the functions of language. This latest development resulted in a surge of information regarding the interactions of infants and caregivers from birth through the first year. As research focused on the pragmatic functions of language, it provided the framework to analyze communication behavior.

In this chapter, it will become apparent that there is a continual evolution of infant and caregiver behaviors throughout the first year. However, infants' evolution can no longer be viewed as going from *no* communication toward the *onset* of communication; communication, at some level, is *present from birth.* The repertoire of behaviors available to infants, their emerging control over them, and the ability to interact effectively is evolving from the beginning *as a result of* communicating with those around them (Locke, 1993).

In fact, the custom of organizing formation in chapters is unfortunate one. It scures the continual olution of our mmunication behavior roughout the life span. ■

Development in Related Domains

Language does not develop in isolation as a separate system of behavior with special status. The behaviors that eventually evolve into recognizable language behavior are supported by the child's whole development in the motor, cognitive, and social domains.

Each domain—motor, cognitive, and social—builds on development in the others. Although our focus is on language, it is important to view the entire process and to understand how these related domains set the stage for language to evolve.

The first year is an eventful one. So many changes occur so rapidly in all the domains: motor, cognitive, and social. The changes in these systems do more than precede language. These changes continuously channel infants' evolution toward true language. What follows is a brief summary of the highlights that characterize developments in each area throughout the first year (Lane & Molyneaux, 1992; Owens, 2005; Shulman, 1994). These selected highlights can only provide a glimpse of the myriad of significant developments that occur so rapidly. However, it is hoped they will provide a backdrop against which the evolution of language makes sense.

Motor Developments

Motor development arises from biological maturation of the nervous and skeletal muscle systems and each individual's experiences in coordinating their use. Infants generally progress from random, involuntary movement to more controlled, volitional actions. The following developments are evident throughout the first year:

- Motor control begins developing from the head down following birth.
- Visual acuity is best within 8 inches from birth until around 1 month.
- Achieves visual focus around 2 months.
- Reaches for and grasps objects around 3 months.
- Establishes head control around 4 months.
- Sits up with slight support around 5 months.
- Jaw control for chewing improves; grasps and transfers objects with both hands around 6 months.
- Crawls and pulls self to standing around 7 months.
- Manipulates objects and explores with index finger around 8 months.
- Stands briefly without support and rolls into and out of sitting position around 9 months.

Children do not develop at precisely the same rate. To emphasize this, the developmental ages are stated as approximations, as in "around 6 months." ■

- Makes stepping movements; holds and drinks from cup around 10 months.
- Takes first independent step around 11 months.
- Walks with one hand held; picks up objects with thumb-finger apposition around 12 months.

Cognitive Developments

Cognitive development describes the process of experiencing and understanding the world. Infants' cognitive abilities develop with accumulated experience with objects, people, and events. These developments are illustrated by the following characteristics during an infant's first year:

- Visually prefers movement and contrasting visual patterns following birth.
- Demonstrates regard for caregiver's face and nearby objects around 1 month.
- Recognizes caregiver's face and anticipates objects' appearance around 2 months.
- Visually searches for sources of sound around 3 months.
- Localizes sound sources; stares at place from which object was dropped around 4 months.
- Recognizes familiar objects; explores objects through mouthing and touching around 5 months.
- Enjoys dropping and picking up objects; shakes toys to make noise around 6 months.
- Imitates complex behaviors already achieved when able to view own performance around 7 months.
- Prefers novel and relatively complex toys; unwraps wrapped objects around 8 months.
- Uncovers hidden object if observes act of hiding; imitates familiar actions around 9 months.
- Points to body parts on request; attains goal with trial-and-error approach around 10 months.
- Recognizes own name when called; imitates increasingly around 11 months.
- Uses common objects appropriately; imitates movements not already in repertoire around 12 months.

Social Developments

Social development is evidenced in increasingly sophisticated interactions with others. Infants become increasingly attached to their caregivers and

eventually more responsive. The following developments throughout an infant's first year contribute to this process:

- Quiets to soft, high-pitched voices; smiles reflexively following birth.
- Establishes eye contact with caregiver; quiets to gentle touching, holding, rocking around 1 month.
- Excites when sees people; exhibits unselective spontaneous smile around 2 months.
- Visually discriminates different people and things; exhibits selective "social" smile around 3 months.
- Prefers smiling face versus angry face; anticipates being lifted around 4 months.
- Distinguishes family members from strangers; reacts differently to smiling and scolding around 5 months.
- Prefers people games ("peek-a-boo"); focuses on speaker's mouth more than speaker's eyes around 6 months.
- Enjoys bath time as play time; exhibits "teasing" as beginning of humor around 7 months.
- Cries for mother out of attachment; reaches for and touches other babies around 8 months.
- Shouts for attention; "performs" for family around 9 months.
- Indicates wants by gesturing; gives toy on request around 10 months.
- Seeks approval; attempts modifying caregiver's goal around 11 months.
- Expresses people preferences; exhibits different emotions (e.g., jealousy, affections, sympathy) around 12 months.

Language Expectations

During infants' first year, a number of foundational behaviors will emerge. Initially, these behaviors are primarily physiological in nature. That is, they are "built in" through the infants' reflexive capabilities for reacting to stimuli. Later in this period, the elements in these behaviors come under increasing voluntary control—reflexive behaviors are inhibited and their voluntary counterparts are gradually exhibited in more selective and socialized contexts. The following overview is intended to provide an initial picture of the overall developments expected during this period:

- Infants will produce a variety of unintentional, undifferentiated motor and vocal behaviors that reflect the reflexive responses of an immature nervous system.
- Infants will localize, attend to, and eventually respond to familiar sounds in their environment (e.g., voices, household sounds, pet sounds).

- Infants will produce sounds that are initially undifferentiated and unrecognizable and will increasingly become recognizable as approximations of fully developed speech sounds.
- Infants will produce gestures and accompanying speech sounds that become increasingly intentional as part of turn-taking and game-playing interactions with caregivers.
- Specific words spoken by others, especially names, will become signals for infants to localize and search for familiar people, pets, toys, and so on.
- Consistent gestures and stereotypical vocalizations will come to be used as "tools" to obtain objects, attention, and interaction.
- Infants will become familiar with books as objects of exploration and interaction displayed to them by their caregivers.

The Prelinguistic Foundations for Language

Infants eventually recognize much of what they hear and gain more control over their speech structures. Even though they may be alert to hearing a familiar word or produce a string of sounds that are almost recognizable, these abilities are still prelinguistic; that is, they precede true language. Nonetheless, they represent the seeds of conventional language behaviors.

Researchers have attempted to describe and understand the capacities available to infants long before their first word will occur. This includes their ability to hear differences among speech sounds and to produce sounds that appear to lead to speech.

Infant Speech Perception

It does not take a rocket scientist to see that, beyond scholarly curiosity, the classic "nature versus nurture" controversy was driving much of this research. ■

Researchers have been interested in infants' readiness to attend to, select, store, and recognize the significant sounds they hear in the speech stream. Researchers have developed several innovative procedures to investigate infants' ability to distinguish among the sounds present in speech. The issue that has intrigued researchers is whether infants are able from birth to discriminate the important differences that contrast classes of speech sounds (voicing, place, manner of production) or whether this ability requires experience.

The two most commonly reported procedures differ in their response modes. One uses infants' sucking response and the second utilizes infants' visual behavior. The first method, *nonnutritive sucking* (NNS), is also called the *high-amplitude suck* (HAS) paradigm. This technique is used frequently with younger infants, although it has not proven reliable with infants younger than 1 month old. In this procedure, infants suck on a pacifier-type nipple connected by tubing to a device that measures the fluctuations in air pressure caused by their sucking. In this way, the frequency and strength of infants' sucking can be recorded.

It has been found that infants will learn to suck the nonnutritive nipple when it is followed by a novel auditory stimulus (e.g., the syllable */da/*). When this stimulus is no longer novel, infants' sucking is no longer reinforced by it and the sucking response diminishes. When the rate of sucking slows to a criterion level, the stimulus is changed (e.g., to the syllable */ta/*). If infants are capable of discriminating the difference, the new stimulus is again novel and reinforcing, resulting in increased sucking.

The other procedure, *visually reinforced infant speech discrimination* (VRISD), relies on conditioning infants to anticipate a change in their visual field when they perceive a similar change in the sound stimulus (e.g., from */da/* to */ta/*). First, a sound stimulus is repeated while toys are visible in front of the infant. When the sound stimulus is changed, a visually reinforcing toy (e.g., a drum-playing bear) appears to one side. This eventually conditions the infant to anticipate the visually reinforcing toy when a change in sounds is detected. The infant's discrimination of contrasting sounds is inferred from the occurrence of searching responses following sound changes.

Through these and similar procedures, newborns have demonstrated remarkable auditory abilities. Infants just 16 hours old have evidenced a quieting response in preference to recordings of their own cry (to which they obviously have had limited exposure) versus those of other infants (Martin & Clark, 1982). One-day-old infants have learned to suck at rates to "select" recordings of their mother's voice as opposed to that of another adult female. Of course, here again they have had very limited time to hear their mother's voice following birth. Although in some studies infants have not demonstrated a preference for their own cry, it has been found that within hours of birth, infants exhibit vocal suppression or a quieting response when exposed to cry stimuli (Riccillo and Watterson, 1984). This response has implications for infants' attending behaviors and their ability to interact with their environment. As your third-grade teacher probably told you, "You can't listen if you're talking"—or in this case, crying.

Responses that indicate preference for their mother's voice could reflect both prenatal and postnatal auditory learning, because the mother's voice has been internally transmitted to the fetus prior to birth. In fact, in early sessions of this research infants preferred a version of their mother's voice that had been filtered to sound much like it would have in the womb. In later sessions, infants preferred their mother's voice in its normal state, reflecting their most recent experience of it (DeCasper & Fifer, 1980).

Researchers have also found that infants' impressive auditory abilities extend beyond recognizing the broader acoustic characteristics of cries and voices. Infants within the first few months following birth are capable of discriminating a number of consonant pair contrasts (e.g., /ma/ from /pa/, /pa/ from /ba/, and /ba/ from /ga/), vowel pairs (e.g., /a/ from /i/, /i/ from /u/), and changes in intonation and stress across bisyllables (e.g., ['baba] versus [ba'ba]) (Jusczyk, 1992). These contrasts represent differences that are not only acoustically subtle, but also linguistically significant; that is, they contrast different words and meanings.

Our understanding of *categorical perception*, the ability to hear groups of sounds based on very fine differences, had been established with adult listeners. Researchers have shown that mature speakers do not detect small changes *within* a consonant category. For example, in listening to the syllable */ba/*, in spite of small differences in the delay of voicing for the vowel following /b/ ("voice onset time"), we hear the various productions all as */b/*. However, at some point, the delay crosses a perceptual boundary and results in the perception of another category of sounds, for example */p/*.

Because adults would have had extensive experience responding to such contrasts (*/p/* versus */b/*), these findings were illuminating, but not necessarily surprising. However, the presence of these abilities in young infants, with seemingly limited experience, certainly seemed remarkable. This, in fact, caused some researchers to propose that human infants are born with specialized neural structures, making them innately prewired for detecting the acoustic boundaries between different speech categories (Eimas, 1974).

Eimas (1974) proposed innate Linguistic Feature Detectors, analogous to Chomsky's LAD, to account for this phonetic ability. ■

With further research, however, a number of other findings emerged that qualified speculations about infants' specialized perceptual readiness. Although the abilities that had been demonstrated were impressive, the contrasts tested represented only a small sample of the contrasts and syllabic contexts that are possible, given the number of available variables (i.e., different consonants, vowels, syllable positions, etc.).

Eventually, research revealed that infants are not initially capable of detecting a number of other contrasting consonants such as /sa/ from /za/, and /fa/ from /ta/ (Eilers & Minifie, 1975), or syllable sequences (Trehub, 1973). Discrimination for some contrasts does not emerge until the second half of the first year. Furthermore, given what is known about the fetal acoustic environment, it may be that the fetus may have been exposed to speech and its intonational variations. Finally, researchers have found that rhesus monkeys (Morse & Snowden, 1975; Waters & Wilson, 1976) and chinchillas (Kuhl & Miller, 1975) are also capable of discriminating the voiced-voiceless contrast in speech sounds.

Locke (1993) discussed many of the issues that must be resolved before a final model of infant speech perception emerges. It must be recognized that if there are any specialized neural structures, they may receive more prenatal experience than we have previously appreciated. Furthermore, it appears that such auditory abilities may not be unique to humans (Kuhl, 1989); they may be present in a broad range of mammals. Initially, the contrasts that are most efficiently detected by these structures may have been merely acoustic, and only later were they adapted by humans to signaling linguistic contrasts, that is, different words.

In view of these considerations, Locke (1993) and others have suggested that it may be valid to reverse the innateness reasoning. Perhaps these acoustic contrasts only became relevant or useful in human speech because humans (like other primates or mammalians) evolved with the biological capacities to detect them. Certain contrasts became functional in speech

only because they were perceptible to us and affected communication. In fact, there are contrasts that infants are capable of detecting that will not be significant to them as adult speakers (Trehub, 1976). If certain contrasts are not present in the language environment, communicating effectively does not rely on responding differently to them. The capability to perceive them will diminish whereas others are maintained. This selection process reflects the influence of the interaction of our biological capacity with the language environment and the practical value in responding effectively to the language spoken to us (Kuhl, 1991).

Summary

- Researchers have developed experimental procedures to study infants' **speech discrimination** abilities.
- Newborn infants can recognize their own cry, their mother's voice, and they can perceive a number of significant speech sound categories.
- Adults' categorization of sounds that differ equally along some dimension is called categorical perception.
- Infants' ability to detect phoneme categories does not extend to all speech sound contrasts and similar abilities are exhibited in several other mammals.
- The extent to which infants' speech perception abilities are innate or require experience with speech sounds is not clear at this time.

speech discrimination The ability to distinguish meaningful differences between speech sounds.

Prelinguistic Development of Speech

Regardless of the underlying auditory capabilities possessed by infants, their development of speech sounds has been well documented. A number of researchers have carefully observed and classified the sounds produced by infants at their various stages of development.

Traditionally, infants' development toward speech and language was viewed simply as progression toward the proverbial "first word." Because the traditional view emphasized that these behaviors preceded true language, they are considered to be *prelinguistic*.

Developmental Milestones in Infant Speech

Certain behaviors have been traditionally associated with the time lines in which their development would be expected. These time lines, called "milestones," gauge infants' progress during that first year along the road to language. Table 5–1 presents the traditional milestones of prelinguistic development. The behaviors included as milestones for prelinguistic developmental focus on the various sounds produced by infants, based on the notion that this is a period of practicing sounds prior to "real speech."

Table 5–1. Traditional milestones in infant prelinguistic development.

Age Range (Approx.)	Prelinguistic Behaviors
0–1 mo.	Birth cry, vegetative sounds
1–4 mos.	Cooing
4–6 mos.	Marginal babbling
6–8 mos.	Vocal play, reduplicated, and nonreduplicated babbling
8–12 mos.	Echolalia
9–12 mos.	Jargon

Several disclaimers regarding the milestones are in order. First, the behaviors included are labeled with terms that are familiar to most; however, some unintended connotations carried by these traditional terms may be misleading. Second, the ages noted for each period are fairly conventional, but sources may vary somewhat. Finally, as with any outline of developmental progression, the ages are approximate; individual infants can vary substantially in their rate of development and there will most likely be an overlapping of periods.

More information about the significance of infant cries is presented later in this chapter. ■

vegetative sounds Infant oral sounds (e.g., clicks, burps) associated with feeding and digestion.

quasi-resonant nuclei Early infant oral sounds that are not as resonant as mature vowel sounds.

cooing Infant sound productions in the first few months that are vowel-like and associated with comfortable states.

marginal babbling Infant sound productions with a variety of vowels and consonant-like productions that approximate syllables.

Birth to 4 Weeks: Crying/Vegetative Sounds. The first sounds noted during the period immediately following birth are cries, vegetative sounds, and early pleasure sounds. The reflexive cry is assumed to be physiologically based starting with the first breath and later in reaction to internal stimuli such as pain and hunger. Oral **vegetative sounds** (lip and tongue clicks, burps, coughs) are associated with feeding and digesting. Finally, noncrying sounds occur when infants are in a pleasurable state. Some of these sighlike sounds, called **quasi-resonant nuclei (QRN),** are almost vowel like (hence, the prefix *quasi-*) but are not as fully resonant as vowel sounds will be eventually (Oller, 1978).

One to Four Months: Cooing. The second milestone behavior, cooing, is thought to appear around 4 weeks of age. **Cooing** is described as sound productions that are more vowel like in nature, typically with an /u/ — /oo/ quality. As the name of this vocal behavior suggests, this vocalic sound may be preceded by velar or uvular sounds that are almost a /k/ or /g/ in their consonantal quality. Traditionally, it has been believed that infants are most likely to emit these sounds in comfortable, pleasurable states. This often occurs in face-to-face interactions with their caregivers.

Four to Six Months: Marginal Babbling. This period has been portrayed as containing perhaps the most significant developments for later speech. During this time, infants begin to exhibit **marginal babbling,**

described as the production of a variety of vowel-like sounds with occasional vocal tract closure, which together approximate simple consonant-vowel (CV) syllables, as in /ba/, or vowel-consonant (VC) syllables, as in /ab/ (Oller, 1978). In addition to including sounds that approach consonants, infants' vowels resonate more fully. These resulting tones are referred to as **fully resonant nuclei (FRN).** The pitch and duration of these vowel sounds can be quite variable.

fully resonant nuclei Infant sound productions that more closely approximate mature vowels.


The debate over the relationship of babbling to later speech is covered later. ■

Initially, there are fewer consonants produced in this period. In shifting from the back sounds associated with cooing, the early consonants of babbling tend to be front and middle sounds, including the labial (/p/, /b/) and alveolar sounds (/t/, /d/). With developing motor control in the front structures of the mouth, labial sounds become most prevalent by the end of this period.

There is generally an expansion in the variety of consonants, vowels, and their combinations as time goes on. Infants' earlier sounds also tend to be predominately stop-plosives; the all-or-none production of stop-plosives (e.g., /p, b, t, d, k, g/) is considered physically simpler than the fine control required to form and maintain the smaller apertures or openings for fricatives (e.g., /f/, /ð/), affricates (e.g., /tʃ/, /d_3/), and sibilants (e.g., /s/, /z/, /ʃ/).

Six to Eight Months: Vocal Play. As infants gradually exhibit a greater variety of sounds, it has been traditionally suggested that infants are "playfully" experimenting with different combinations. Whether infants are consciously experimenting or the sounds are randomly produced as they attempt to control the vocal tract is not entirely clear, but the repertoire of infants' sounds expands conspicuously from 6 to 8 months.

vocal play Infant sound productions exhibiting longer strings of varied syllables.

The traditional term for this period, **vocal play,** refers to the longer strings of syllables that expand out of marginal babbling as infants continue to "play" with sounds. In total, there are three phases of babbling. In the previous period, marginal babbling, infants were producing single CV or VC syllables. During the present period, vocal play, their babbling passes through two more phases—reduplicated and nonreduplicated babbling.

reduplicated babbling Babbling in which a syllable is repeated in strings, as in *dadada.*

In **reduplicated babbling,** the syllable is duplicated in strings of repetitive syllables. For example, where /da/ might have occurred in marginal babbling, this syllable would be repeated as /da-da-da-da/ in reduplicated babbling.

nonreduplicated babbling (also **variegated babbling**) Babbling that consists of strings of varied syllables.

During the final phase of babbling, called **nonreduplicated babbling** or **variegated babbling,** the strings of syllables are more varied. The consonants and vowels may change from one syllable to the next within the same string, as in /gabida/. Often the effect for the listener is even closer approximations to the character of true words—a greater mix of consonants in multisyllabic forms.


The *echoic* described by Skinner may have its roots in the babbling period, but it becomes especially recognizable at this stage. ■

Eight to Twelve Months: Echolalia. By the time infants are 8 months old much has changed. A maturing neurological system and a wealth of experience listening to and producing sounds have brought infants ever closer