CHAPTER 6
Infancy—Perception, Cognition, and Language

CHAPTER OUTLINE
I. Perception, cognition, and language What do infants understand when they look at an object? This chapter considers perception, the interpretation of sensory information, and cognition, the thought processes and mental activities that include attention, concept formation, and problem solving. Language skills and development are also considered. These three processes form the basis for the more complex aspects of development described throughout the book.

II. Perception Theorists debate how infants come to perceive their world. Constructivists believe that infants gradually come to construct their world through experience. Nativists, on the other hand, believe infants are born with a set of core principles and mechanisms to process sensory input.

A. Visual perception Visual information processing in infants under two months of age is governed primarily by relatively simple elements such as contours, angles, and motion. After two months of age, scanning becomes more systematic. The externality effect refers to the fact that infants less than two months old tend to look only at the outer contours of a complex stimulus. Older infants, however, will scan the internal features of a complex stimulus, thereby processing the entire pattern. The recognition of “subjective” contours is a source of evidence that by three to four months of age infants perceive patterns rather than isolated angles or features.

1. Face perception. The face is a visual pattern that is obviously important to the infant and is preferred very early in infancy, although controversy exists as to why infants prefer faces. Some researchers believe infants have an inborn preference arising from a primitive sub-cortical visual system. Others believe preferences for faces is just another example of infants’ general tendencies to prefer top-heavy arrangement of stimuli.

2. Object perception. Kinetic cues are helpful in identifying objects. Three-month-olds (but not newborns) will perceive a partially occluded object as a unified whole if the visible pieces of the object are seen moving together. Other characteristics of the occluded form, as well as motion, influence perception. Memory for viewing an object also interacts with contours and motion. Kinetic cues are also used in the perception of biological motion.

3. Depth perception. The ability to perceive depth is partly a result of binocular vision, the reception of slightly different visual inputs by the two eyes. The synthesis of these two images into a single, three-dimensional percept is called stereopsis. Depth perception is also made possible by kinetic cues that come from eye movements, head or body movements, and movements of objects in the environment. Studies using the visual cliff have found that infants who are able to crawl usually will not crawl to the deep side of the cliff. The ability to perceive depth occurs independently each time the infant learns to crawl, sit, and walk. At five to seven months, infants appear able to detect pictorial depth cues (which can be perceived by one eye) such as relative size, shadows, interposition of surfaces, and linear perspective.

B. Auditory perception Infants of two to three months begin to recognize changes in sound patterns, such as the duration of intervals between bursts of sound. Six-month-olds can...
distinguish more complex rhythms and melodies. Eight-month-olds can recognize changes in short melodies. Infants also prefer to listen to music that adults would judge as “good” or natural. The importance of sound pattern perception applies not only to music appreciation but also to the phrasing and perception of the sound rhythms that underlie speech.

1. **Speech perception.** Infants under six months have the perceptual capacities to discriminate the basic distinctive speech sounds called *phonemes* in any of the hundreds of languages spoken around the world. Theoretical accounts of these findings suggest that infants either are born with a “speech module,” an innate capacity to detect and process speech sound, or make use of general auditory capacities and quickly learn to use these abilities to process speech sounds. Evidence for innate speech perception comes from studies on categorical perception. *Categorical perception* occurs, for example, when small changes in voice onset time (VOT) of a phoneme such as *ba* are not perceived but changes in VOT across a category boundary such as *ba* versus *pa* are detected. Infants as young as one month demonstrate categorical perception for many speech sounds. However, by about one year of age, infants who have not heard certain phonemes in their language environment lose the ability to perceive them.

C. **Intermodal perception** The coordination of information from multiple sensory systems is called *intermodal perception*. According to James and Eleanor Gibson, infants are amodal at birth; that is, they may be unable to differentiate stimulation from the different sense organs. As they gain experience, infants and children learn *perceptual differentiation*. Alternative theoretical perspectives posit that infants can identify separate sensory inputs but must learn (through enrichment, for example) to coordinate the relationships among them. To determine whether infants link visual and auditory events, Elizabeth Spelke presented infants with the option to view two films. A soundtrack playing in the background matched one of the films, and four-month-old infants preferred to watch the film that matched the soundtrack. Intermodal perception extends to social and linguistic information. Other research shows coordination between sight and touch. For instance, infants seem to recognize (by sight) the difference between hard and soft objects that they had been given the opportunity to mouth.

III. **Piaget’s theory and infancy** Piaget’s theory was introduced in Chapter 1. We saw that he described the child as actively constructing and building knowledge (schemes) through the processes of assimilation and accommodation to achieve equilibrium in understanding. Piaget was a stage theorist, maintaining that cognition becomes qualitatively reorganized as the child progresses through four stages of cognitive development.

A. **Sensorimotor stage** Piaget believed that cognitive development results from maturational factors and environmental experiences. He specified four stages through which all children progress in an invariable order. The first stage, the *sensorimotor stage* (birth to two years), is characterized by the child’s actions on the environment. The child undergoes three major achievements during this initial stage (which contains six substages). The first accomplishment involves a progression from actions that are reflexive to more goal-directed actions called *means-end behavior*. A second accomplishment involves the child’s gradual changing focus from the self to a greater orientation to the external world. The completion of sensorimotor stage is signaled by the child’s display of *deferred imitation*.

B. **Object concept** Another accomplishment in this initial stage is the attainment of the *object concept*, or object permanence. Children who reach this stage understand that objects continue to exist even though they are not in immediate sight or within reach to be acted upon. When do children reach this stage? While Piaget thought they reached this stage at 18 months, more current research suggests that children as young as 4 months have a primitive understanding of object concept, due to the fact they have *core knowledge* (such as solidity and movement) about objects. However, Munakata and her colleagues believe infants’ representations of hidden objects are weaker than for visible objects.
C. **A not B error** Infants under seven months of age may have a limited ability to inhibit reaching for an object that had been hidden in a given location even though they may understand that the object is no longer hiding there (the “A not B” error). Memory problems, lack of object permanence, failure to inhibit the response to reach for A, or failure to update the representation of the events have all been suggested as possible reasons.

D. **Early spatial reasoning** Children also organize information in terms of their location in physical space. Children initially locate objects by relying on the positions of their own bodies, particularly if no external environmental cues are available. When landmarks, or distinct cues, are available, infants approximately 9 months of age could make sufficient use of them to locate objects in large spatial environments.

IV. **Concepts** The child’s use of concepts, or the way in which the child organizes information on the basis of some general or abstract principle, increases the efficiency of cognitive processing. For example, concepts make possible the classification of pieces of information on the basis of common properties or themes.

A. **Early classification skills** Children’s earliest classifications appear to be largely perceptually based. Between one and three, children experience a rapid growth in classification skills. The reliance on shared perceptual features decreases with age. Initial groupings of objects tend to occur at a basic level: objects go together when they look alike or are used in similar ways. Two-year-olds will classify based on thematic relations or occasionally taxonomically.

B. **Infants’ responses to number** Even newborns and very young infants may be able to detect differences between small numbers of objects, although whether this ability is on the basis of number or other criteria, such as amount of contour, is more difficult to determine. Infants may even be able to detect addition or subtraction of items to a set of stimuli.

V. **Memory** The ability to remember is critical for performing cognitive activities. Thus, memory has been an important area of developmental research and has been conceptualized in many different ways. Psychologists have distinguished between recognition memory, the ability to recognize whether a stimulus was previously encountered, and recall memory, the ability to reproduce stimuli that were previously encountered.

A. **Studying infant memory** Infant memory has been observed very early in development with techniques such as habituation, the paired-comparison procedure, and operant conditioning. Recall memory is often studied by deferred imitation, in which infants are shown a series of actions and then observed to see if they imitate those behaviors at a later time, or elicited imitation, in which infants repeat a sequence of events demonstrated by the experimenter.

B. **Infant memory capabilities** Studies suggest that recognition memory is a rudimentary ability available even in early infancy. The ability to recognize familiar stimuli endures for long periods of time. However, early memories can be disrupted by changes in the context of the activity. Reminders within a certain number of days, or time windows, appear to be important for maintaining recognition memory for longer durations in infants. As infants mature, they store information more rapidly and need fewer trials of study in order to remember sequences of events.

C. **Brain development and memory** Neuroscientists often study animal models to shed light on human behavior. When the hippocampus of infant monkeys is removed, preference for novelty disappears. Human work is done directly using PET scans, even in infancy. Changes in temporal and prefrontal lobes seem to correspond to developmental improvements in memory.

VI. **The development of problem-solving skills** Problem-solving skills, which typically involve several steps in analyzing a body of information, have been noted in young children. Investigators have observed children as young as twelve months intentionally combine several subgoals to
reach a goal. More sophisticated skills, such as transferring or generalizing elements of one problem to solve a problem in a different domain, have also been seen in infants.

VII. Vygotsky’s sociocultural theory and infancy  Vygotsky, in contrast to Piaget, emphasized that development must be understood within the context of the culture in which a child is reared. The social activity surrounding formal and informal exchanges with others plays a significant role in development. Intersubjectivity is the mutual attention and shared communication that takes place between an expert and learner. Others provide a scaffolding for cognitive development—that is, temporary support by demonstrating cognitive skills and techniques in which the child is deficient and that the child eventually incorporates as part of her or his own thinking.

VIII. The course of language acquisition  Language is multifaceted, consisting of complex verbal and nonverbal skills that are learned in a relatively short period of time. The newborn infant must first learn the phonology of his or her language—the rules for combining the fundamental sound units of the language. The child also must learn semantics, or the meanings of words.

A. Early responses to human speech  The first task of the newborn infant is to establish phonological skills in order to receive and produce messages. Newborns show a distinct preference for human voices over other sounds. Very young infants can discriminate among different phonemes categorically and are sensitive to the prosody of the language, or its patterns of intonation, stress, and rhythm that communicate meaning. Infants prefer to listen to motherese, which has a relatively higher pitch than speech direct to adults. From an early age, infants can detect differences in a variety of languages.

B. Finding words in others’ speech  By 6–8 months, infants can detect the beginnings and endings of specific words in a stream of speech. Several features, such as motherese, presence of the infant’s name, and other familiar words, can help this process.

C. Cooing and babbling: Pre-linguistic speech  By six to eight weeks, the child begins to produce cooing sounds, vowel-like utterances occasionally accompanied by consonants. At about three to six months of age, the child produces consonant-vowel combinations (babbling), and shortly thereafter vocalizations feature canonical babbling, which sounds almost like the child is trying to say words. From a phonological perspective, the infant’s ability to make different sounds is somewhat restricted. The discovery of cultural differences in babbling and differences in the preverbal utterances of deaf and normal-hearing infants suggests that prelinguistic utterances are influenced by environmental as well as biological factors.

D. Later phonological development  Around one year of age, some of the child’s babbles start to sound like words. However, the infant’s ability to make different sounds is still restricted, and a limited number of consonants appear in their babbles. First words typically appear about 12 months.

E. Gesture as a communication tool  Gestures used to call an adult’s attention to an object (protodeclarative communication) or to get an adult to perform an action (protoimperative communication) develop along with verbal skills in infancy, but eventually drop out by the second year.

F. One-word stage  Children begin to speak one word at a time at twelve to twenty months. Children’s first words are mostly nominals, labels for objects, people, or events. At about eighteen months, most children show a vocabulary spurt. Many of the child’s first words are bound to a specific context; that is, the child applies a word to a narrower class of objects than the word signifies. This type of error is called underextension. Another type of error, called overextension, occurs when the child applies a word to a broader category than the word signifies.

G. Comprehension versus production  Children’s comprehension of language, or receptive language, far exceeds their productive language. In general, children show common trends in the way they acquire language. But children vary in terms of the age of the first word uttered, whether or not a vocabulary spurt occurs.
H. Individual and cultural differences in language development Cultural differences can be found in how children speak even during the one-word stage. For instance, some children display a referential style (mostly object words) while others display an expressive style (words that direct the behaviors of others).

IX. Atypical development A variety of assessment tools are available to determine if a child has developmental delays. One of the most widely used tests is the Bayley Scales of Infant Development, which can be used to predict later childhood competence. If a child has been identified as having a developmental delay, a multidisciplinary team might be called in to provide assistance.

X. Language in the context of social interactions The social interaction perspective views language as a social activity. Parents often speak to their children in a simplified version of spoken language called parentese. Infants appear to be especially responsive to such speech. In this form of communication, questions are often used to encourage turn taking, alternating vocalization by parent and child, and as turnabout to explicitly request a response from the child. In addition, parents often follow the child’s verbalizations with a recast, repeating what the child has said but correcting any errors. Parentese may assist the child’s acquisition of word meaning and facilitate the acquisition of syntax. Cross-cultural studies, however, indicate that motherese is not a universal phenomenon. Gender differences are also apparent as infants communicate with their mothers and fathers.

Research Applied to Parenting: Reading to Children

Speech tends to be particularly diverse, expressive, and socially interactive when mothers read to their children. A program of dialogic reading presents advice to parents on how to read more effectively to young children. The program suggests that parents ask questions that stimulate the child to speak, follow up with further questions, recast the child’s utterances, model answers, and provide praise and social support in a gamelike atmosphere.