CHAPTER 1

Language Development

MAEVE WAS BORN ALREADY RECOGNIZING THE voices of her mother and father. She had been able to hear her mother while in the womb as soon as her ability to hear sound developed by the end of the second trimester of the pregnancy. Soon after, as Maeve's daddy started reading to her and speaking to her in his soothing voice while keeping his mouth close to her mother's belly, she began to respond to the sound of his voice. The clarity of such verbiage to the unborn child has been questioned. But the moment Maeve was born, she responded and turned toward the voices of both Mommy and Daddy.

Maeve's brain at birth will allow her to learn any language and repeat any phonemes (the individual sounds that make up a language) that she hears. If she has been born into a bilingual or multilingual family, she will easily learn the languages that are spoken to her. This ability is short-lived, however. By the time Maeve has been on Earth a year, her brain will have pruned away the neurons (the brain cells that do the learning) that were not used. In other words, her ability to hear some phonemes will be gone or at least partially diminished. She will focus on the sounds that she hears, and by approximately eight months of age, she will begin to attempt to mimic those sounds. Along with the vowels and consonants she will mimic, she may also express other phonemes that are available to her developing brain. Her parents, however, will recognize only the sounds that they know. So when Maeve begins to babble a string of sounds like, ''ma, ba, goo, eh, neh, un,'' what her parents pick up on (especially Mom) is the first sound, ''ma.'' So Mom begins to repeat the sound while she beams

at Maeve. ''Ma, ma, ma ... you said my name: ma, ma, ma.'' Eventually Maeve gets the idea that this particular sound gets a great response from her mother, and she will begin to repeat the sound to please her mother and get instant feedback. It doesn't matter that within her babbling, she may have shared phonemes from multiple other languages. Since no one will repeat these back to her, she won't strengthen the connections for those sounds. As language is learned, brain cells connect to remember and recreate the sounds that are heard, but connections that are not used often grow weak and unusable.

There are almost seven thousand languages in the world, and babies are born with the ability to master any of them. But the brain changes as children develop, and language acquisition can become more difficult. In order to be able to read, a child must first learn the sounds of the language.

From Neural Sensitivity to Neural Commitment

After an infant is six to nine months of age, only those neurons that have learned the sounds of the language's phonemes spoken to the baby remain. They gain in strength and connections as they are repeated. As this specialization occurs, neurons become committed to those sounds (Bronson & Merryman, 2009).

In 2007, a study by Zimmerman, Dimitri, and Meltzoff stated that DVDs and videos directed to babies are actually harmful to them. The researchers had found that infants who watched these DVDs and videos had smaller vocabularies than babies who did not watch. In fact, the more television a child watched, the fewer vocabulary words he or she knew. The authors of the study gave possible reasons for the vocabulary differences they found:

- Some parents put their children in front of the television for up to twenty hours per week. They thought watching this

material would help with brain development, but in fact it meant less time that the babies spent with people talking directly to them.

- Learning speech is partially a process of reading lips. Babies need to see people speaking in order to learn how to move their mouths and lips. Many baby DVDs instead show abstract pictures with voices talking about them.
- It is not possible to segment sounds in speech without seeing people speaking.
- These videos and DVDs lacked the visual and auditory components of speech interaction that are appealing to babies, that is, a face and voice to perform for and respond to.

Videos and DVDs could be made for infants with people speaking directly to the screen, and that might make a little difference. However, this would still leave out the most important component of learning to speak: human interaction.

A recent study published in the *Proceedings of National Academy of Sciences* suggests that babies lip-read as they learn language (Lewkowicz & Hansen-Tift, 2012). The study, from Florida Atlantic University, was conducted using 179 babies aged four, six, ten, and twelve months from English-speaking families. The study stated that the four-month-olds looked at the eyes of the speaker, but as the children got closer to beginning to babble, their gaze shifted from eyes to mouth. By six months of age, the babies spent half of their time looking at the eyes of the speaker and the remaining time at their lips. The eight- and ten-month-old babies spent most of their time watching the mouth of the speaker. As the babies prepared to begin speaking, most at the age of twelve months, their gaze shifted back to eyes. Confirming the need for lip reading was accomplished by having these babies watch a Spanish speaker.

Nature Versus Nurture

Are children born with an innate ability to speak, or is it their experiences and their environment that pave the way for language? Although the brain was once described as a tabula rasa, a blank slate, many researchers believe that the answer lies somewhere in between a blank slate and a preprogrammed mind.

Although children are born with the ability to learn speech, language learning does not occur in a vacuum. Babies don't begin speaking a language that they have never heard. Little Maeve will learn to speak English because her parents and others in her environment speak only English. If Maeve's Russian grandmother lived in the home and spoke only Russian, Maeve would easily pick up that language, too.

Again the eyes shifted to the mouth so babies could see how the sounds were formed.

When Maeve begins to babble, she will make sounds that imitate the phonemes that she has been exposed to and also some sounds from other languages that she has not heard. She will simply be producing whatever sounds she can. Once she becomes more aware of her own language, she will repeat the sounds that she hears.

The Right Way to Babble

It may be hard to believe that babbling has been researched, but the University of Memphis has researchers who have done just that. Analyzing the sounds that babies make beginning at birth (Oller, 2010) has uncovered some interesting milestones in the process of learning language.

Babbling is an element of brain development in both social and emotional areas as well as cognitive development. It represents the learning that is taking place in relationship to language, and it is also an attempt to communicate and interact with the caregiver. A baby who isn't babbling in a typical way may have problems hearing or processing sounds, or perhaps the baby's brain is not being introduced to enough words.

According to pediatrician Perri Klass, babies babble in all of the world's languages. It is a universal sign of neurological development and an indicator of speech readiness. From babbling, infants and toddlers move on to making the sounds of their language and create words appropriate to their environments.

If a baby is not making those combined consonant vowel sounds, there may be a problem. By seven months (remember that development can vary among babies), if the baby is making only vowel sounds, the baby is not getting the practice she needs to begin to form words. Her mouth and tongue are not working the muscles necessary for good speech either (Stoel-Gammon, 2001).

Babbling may be a signal that babies are focused for learning, indicating an opportunity to have the baby's attention as he explores the world and wants to name the objects and people around him.

Encouraging Speech

Parenting experts offer some of the following suggestions for encouraging babies to use their language:

- *Talk a lot.* Between birth and three months, babies begin to acquire language, even though they cannot yet speak, so parents and caregivers are encouraged to talk to babies often.
- *Point out things.* As you talk to the infant, name items and describe what is going on.

- *Help the infant listen.* Point out the sounds around him: ''Do you hear the clock?'' ''Is the dog barking?''
- *Play games.* The rhythm, rhyme, and play of games such as ''Peek-a-boo'' and ''Pat-a-Cake'' show the child that language is fun.

Studies have shown that babies whose mothers talk a lot have larger vocabularies than those whose mothers talk very little. It is possible, however, to take talking to the baby too far. Talking at a baby nonstop is not what promotes good language. Asking questions and responding to what the child says are also important.

The most famous study of children and language was carried out by Betty Hart and Todd Risley from the University of Kansas. Although an older study (1995), it is often still considered the gold standard when it comes to determining language development in children. In this groundbreaking work, researchers went into the homes of families of varying socioeconomic status and videotaped the parents as they interacted with their babies, who were between seven and nine months old at the beginning of the study. The taping was done once a month until the children were three years old.

In their book *Meaningful Differences in the Everyday Experiences of Young American Children* (1995), Hart and Risley state, ''By age 3 the children in professional families would have heard more than 30 million words, the children in working class families 20 million, and the children in welfare families 10 million'' (p. 132). Although the number of words spoken was different, the style of speech and the topics were similar. The more the parents spoke, however, the more likely they were to ask the child questions and the more varied the vocabulary became, so the children received more experience with different language qualities.

In addition to counting the number of words that parents spoke to the children, Hart and Risley also examined the types of reinforcement the children received. Table 1.1 shows the number

Table 1.1 Affirmatives and Prohibitions Given per Hour

	Words Heard per Hour	Affirmatives per Hour	Prohibitions per Hour
Professional family child	2,153	32	5
Working-class family child	1,251	12	7
Welfare family child	616	5	11

of affirmative statements versus prohibitory statements tallied for each socioeconomic group. An example of an affirmation is ''Nice job. You are doing a great job!'' A prohibition may be something like ''Don't do it that way. Can't you do anything right?'' The professional parents offered affirmative feedback much more often (every other minute) than the other groups, and the welfare parents gave their children more than twice as many prohibitions as the professional parents.

Some children in professional families heard 450 different words and 210 questions in the three hours in which the parent spoke most. Another child in that same amount of time heard fewer than 200 different words and 38 questions. The results of the study led all to believe that the most important component of child care is the amount of talking occurring between child and caregiver.

But perhaps they were wrong. Newer research by Catherine Tamis-LeMonda of New York University and Marc Bornstein of the National Institutes of Health lead us down a slightly different path. When comparing maternal responsiveness in children who came from professional families, they found some surprises. The study found that the average child spoke his or her first words by thirteen months and by eighteen months had a vocabulary of about fifty words. However, mothers who were considered high responders, that is, they responded to their child's speech quickly and often, had children who were clearly six months ahead of

the children whose mothers were low responders. These toddlers spoke their first words at ten months, had extensive vocabularies, and could speak in short sentences by fourteen months (Bronson & Merryman, 2009).

This response pattern sent specific messages to the brains of the toddlers. The first message is that what they are saying makes a difference and causes a reaction. In other words, what they are saying is important. The second message the brain receives is that objects and sounds have a connection. Words are not just words; they name things. In this newer study, the findings were based not on economic factors, only on the type of response given. The research by Patricia Kuhl (2007) from the University of Washington suggests that interaction is a crucial component of learning language, and therefore babies need an audience. Michael Goldstein in his B.A.B.Y. lab at Cornell University proved this. He performed a study in which babies were put in denim overalls that contained wireless microphones. Mother and baby were put in a room, and the mother was told simply to play with her baby. She was not to speak to her child, but was told to respond in an affectionate way by smiling and touching. The babies' babbling went from weak and very nasal to a stronger babbling that included consonant and vowel sounds (Goldstein, Bornstein, Schwade, Baldwin, & Brandstadter, 2007). The conclusion was that responding in a positive way to the babbling had a strong effect.

Windows of Opportunity

The concept of windows of opportunity, or critical periods, as some call them, refers to the time when the brain is developing in a specific area. It is thought that if a child is not exposed to stimuli to encourage that development, the window may close and the baby might not learn the skills associated with that development. For example, it is important that babies hear the sounds of their

language or any other language they will be hearing or speaking within the first seven to eleven months of life.

Physically the brain shows change in several ways. First, more brain wave activity can be observed in an area of the brain if it is hooked up to an electroencephalogram, which measures the amount of electrical current present in the various areas. Second, the brain may be found to have more myelin, the white fatty substance that coats neuron axons, the nerve fibers that send information. Myelination offers faster and easier transmission of messages. Third, there may be dendritic growth found in specialized areas. Dendrites are the appendages of the neuron that receive information. More dendrites indicate more uses for that neuron. Finally, synaptic density may increase. Synapses are the spaces between neurons that are necessary for communication between the cells. Some or all of these may be present during these open window periods. Table 1.2 shows the windows of opportunity or critical periods associated with certain developmental milestones.

Experience and Brain Development

With the development of specialized structures in the brain over the first few months of life, babies begin to make sounds that will develop into syllables and then words. It takes the development of many critical areas for the baby to go from being a passive receiver to active participant in conversation.

Experience is key to proper language development. A child's environment and experiences will wire up the brain for a distinct language or languages. So although we know that most infants follow the same schedule for language, each individual life experience makes one child's development different from another's (Sleeper, 2007). If Maeve had been taken from her English-speaking parents and adopted by a family in China, she would just as easily have learned Chinese as she would have learned English. If she was

Table 1.2 Windows of Opportunity for Learning

Type of Learning	Window Opens	Window Narrows
Auditory development	At about four and a half months in utero, the fetus begins to hear sounds. By six months in utero, the fetus can hear voices and shortly after can recognize voices.	Ages eight to ten
First-language development	Birth	Ages ten to twelve
Emotional development	Birth	Continues throughout life
Math development	Birth	Continues throughout life
Music development	Responds to music in utero	Continues throughout life
Memory development	Birth	Continues throughout life
Second-language development	Birth	Continues throughout life; the earlier the better
Visual development	Birth	Critical in the first few months

raised in an environment in which little conversation took place and her primary caregiver did not speak to her, this experience would have a negative effect on her language development and the schedule that is usually followed by the brain for most babies.

The child who is strapped in a car seat and left in a room void of conversation and interaction for the first year or two of life will suffer in many ways, including delayed speech and motor development. Cases of this type of abuse are rare, but they have taught us much about language development. One such case is the famous situation of a girl called Genie (not her real name). Locked in a room and tied to a potty chair by her psychotic father, Genie

wasn't discovered until she was thirteen years old. As a result of her isolation, her language development was arrested. A genie is a creature who comes out of a bottle as an adult, someone who didn't have a normal human childhood. This young girl fit that description. She wasn't locked in the room until she was close to two years old, so she had developed some infantile language before she was removed from much human contact. When she was found and given attention and teaching, she developed a large vocabulary of nouns and verbs, but she never had the ability to put complete sentences together because her brain was deprived during a critical period (James, 2008).

Ages and Stages in Language Development

''Parentese,'' the singsong language that is associated with the way most parents speak to their babies, is an important component of language development. This form of speaking keeps the baby's attention, and since it drags out sounds and syllables, it is easier for the brain to clearly hear and differentiate sounds—for example, ''Mommy is going to snap your sleeper. Onnne, Twoooo, Threee, Fourrrr. Snap!'' (Tallal, 2007).

Here is a brief outline of the stages that children typically go through in developing language:

- *From birth through three months:* Babies begin to coo and make sounds that are similar to vowel sounds. The brain is being stimulated to grow new dendrites and synapses as the baby is exposed to the sounds of language and other noises (Eliot, 2006).
- *From three to six months:* Babies begin to make ''raspberry'' sounds as they play with their language, and babbling becomes a frequent pastime. They copy the tones and cadence of

their primary caregivers, and their vocalizing begins to sound conversational. The baby's vision and speech will progress as the occipital and parietal lobes develop. The occipital lobe stores words as pictures, and the parietal lobe integrates all sensory information, which assists the child in understanding words in an auditory, visual, and tactile way. As the baby sees more clearly, he may try to shape his mouth to match that of the person speaking to him (Stamm, 2007).

- *From six to nine months:* Parentese can be very important at this stage of development as babies begin to imitate the sounds they hear. Their language pathways have been mapped, and the brain continues to strengthen those connections as the baby listens and practices making those sounds.
- *From nine to twelve months:* Babies begin to respond to varied tones of voice, and their memory increases as the hippocampus (the structure in the brain that helps us form long-term memories) is developing. The ability to remember words and understand their meanings increases. Actual speech may begin at this age (Sprenger, 2008). The ability to segment speech (divide words into their sounds) begins at approximately nine months.
- *From twelve to eighteen months:* As the prefrontal lobe (the part of the frontal lobe where higher-level thinking is done) develops, babies begin to think more logically, understand and use gestures, and often follow simple directions. With a clearer understanding of words, they can label objects or point to them as they are named (Christie, Enz, & Vukelich, 2007).
- *From eighteen to twenty-four months:* The toddler may put simple sentences together and sing simple songs, although some words may be unclear to listeners. Language and vocabulary

begin exploding as children add an average of eight or nine words per day. The brain begins using more energy, and the baby's brain has twice the number of connections as an adult brain does (Stamm, 2007). There are so many connections because toddlers are learning more than they will retain. Eventually many of those connections will be pruned away as they begin to use only the connections most important to their lives.

- *From twenty-four to thirty-six months:* More blood flow is seen in the left hemisphere of the brain where speech centers are located, signifying more activity in this area as more energy is burned. Vocabulary increases to as many as one thousand words. Sentence structure improves, and sentences contain more words.
- *From ages four to five:* Pretend play becomes even more important as children grasp language at higher levels. According to Laura Berk (2001), a child development expert, pretend play and talking to peers during this play have been positively associated with the size of a child's vocabulary by the age of five.

An Enriched Environment for Language Development

A child's ability to read is greatly influenced by his or her language development. Just as young Genie had her ability to speak and understand greatly inhibited by her early environment, most children thrive in their surroundings and follow the speech schedule easily.

Is there a difference between a normal environment and an enriched environment when it comes to speech? Obviously

Genie's environment was what Marian Diamond (1997) and other neuroscientists would call impoverished. To see what would constitute the best environment in which children can learn their primary language, compare the following four-year-old children:

• Mia appears to have everything a child could want. Her playroom is filled with blocks, clay, dolls, trucks, and balls. She has both a sand table and a water table. Her play kitchen is in the corner of the room, and she loves to serve food to her guests. When she finishes cooking, she washes and dries her dishes. When Mia's daddy comes home from work, they play. She loves to be an airplane, so Daddy lies on the floor and lifts Mia into the air on the soles of his feet. She giggles when Daddy ''lands'' her on the nearby sofa. Mia is a happy child. When she is tucked in at night, she looks forward to the next day.

• Sam loves to play with trucks. He has about twenty different kinds of trucks that he lines up on the shelf, plays with, and pushes around his room while making loud truck noises. Besides his trucks, Sam loves his train table. He has a conductor's hat, bandana, and train whistle. He yells, ''All aboard,'' and then chugs his train around the track. At night, Sam's parents read him train books. He especially likes *The Little Engine That Could* and *Thomas Wins the Race*.

• Alaska's parents both work. Her mom works at home as a virtual assistant. She does bookkeeping, answers e-mails, and plans meetings for her employer. It takes her hours to complete her daily assignments, and she often works until late in the evening. As she works on the computer, she has little time for Alaska or her siblings. When Alaska's dad comes home from work, he kisses his family hello and sits down in front of the television. Alaska often tries to sit with her dad, but there is little communication between them. Often he just tells her, ''Go play,'' or, ''Quit bothering me.''

Fortunately the house is well babyproofed and Alaska is safe. Mom stops her work to make dinner for the family; however, while the children sit at the table to eat, Mom eats at the computer and Dad eats in front of the TV. Dad puts the kids to bed and reads them one story before he turns out the lights.

• When Jack was three days old, his mom started reading *Goodnight Moon* to him. He couldn't understand one word of the book and the pictures were fuzzy, but he fell in love with reading as he was cradled in his mother's arms feeling warm and cozy. The sound of her voice was soothing to little Jack, and the melodic way she read kept him mesmerized by the sounds. Every night until Jack was old enough to ask for a different book or additional books, he still heard *Goodnight Moon*. Throughout the day, Mommy and Daddy read different books to him, and he grew to love the power and the stories that came from words. When Jack plays in his kitchen, he comes up to visitors with a pad and a crayon to take their order. He pretends to write down what they want and is forthright in telling his customers that he doesn't have certain items. He and Daddy decided to make a menu that Jack could post so his guests would not order anything ''not on the menu.'' Jack dictated to his father as he wrote the menu. Jack ''wrote'' a few words on the menu to personalize it.

Of these children, Alaska receives the least amount of attention and interaction. Mia is happy and has conversations at home, but there is little reading. Sam's environment is good because he is read to and has lots of time for imaginative play, but Jack comes from the most literacy-rich home. His experiences include language, and his parents started him on the road to reading from birth. The sounds of language, the use of language, and even pretending about language all help a child to love communication and eventually love reading.

According to the American Academy of Pediatrics (2005), children need the following elements in their environment in order to reach full potential:

- To feel special
- To feel loved
- To feel safe
- To know what is going to happen (predictability)
- To have guidance
- To have a balance between freedom and limitations
- To be exposed to:
  - Language
  - Play
  - Exploration
  - Books
  - Music

Language and Gender

Gender differences have long been studied in many areas of cognitive development, and researchers have found that boys tend to be about a year and a half behind girls in reading and writing (Gurian, 2007). Boys are at a disadvantage for several reasons: they mature more slowly than girls, they are ill (and absent from school) more often, sometimes their fine motor skills have a slower start, their mastery of language is slower, and they may have self-control issues.

Research suggests, in fact, that boys may be at an extreme disadvantage compared with girls. Most of the major learning

and developmental disorders—including dyslexia, autism, and attention deficit disorder—are found four times as often in boys than in girls (Eliot, 2009). Let's start at the beginning.

Most babies are born with twenty-three pairs of chromosomes, with each pair consisting of one chromosome from Dad and one from Mom. The two chromosomes in each of the first twenty-two look very similar to each other and contain the same genes. If one of the genes on a chromosome is defective, the other chromosome will send genetic material to it in order to fix it. If this is unsuccessful, the perfect chromosome takes over the responsibility for the task of that gene, and the other chromosome in the pair becomes inactive and is sometimes said to ''hibernate.''

For instance, if the number ten chromosome that I received from my father has a defect, my number ten from my mother will try to fix it. Mom's been trying to fix Dad for years, and of course, it doesn't work. So Mom's chromosome takes over and Dad's hibernates, and the defect does not affect me. It sounds like a great plan, and it works very well in most cases; however, if both chromosomes have the same defect, the imperfection is expressed.

When it comes to the twenty-third pair of chromosomes, life is different because these chromosomes determine gender. If you are a male, you receive a Y chromosome from your dad and an X from your mom. The father's chromosome always determines the sex of a child by providing an X or a Y. Mom always provides an X. Xs and Ys have very few genes in common. Since the Human Genome Project identified the genes on our chromosomes, scientists now know that many of the almost two thousand genes on the X involve brain function. A female has the luxury of a backup X if there are any defects on one of them. Males do not have that comfort. From verbal skills to socialization, a damaged gene on the X chromosome can be debilitating to males. Females actually use only one of their Xs, as too much of a good thing is not a good thing, and so the second X is deactivated at least partially very early in brain

development (Medina, 2008). Therefore, the female brain acts much like the male brain. The male brain may be subject to more cognitive disorders, schizophrenia, or autism if the X chromosome has defects.

What about speech and reading? Could there be an effect if a boy's X chromosome is damaged? Researchers in the United Kingdom analyzed several studies and came to the following conclusion: boys have more reading problems than girls (Clark & Burke, 2012). Although this conclusion has also been debated, it appears to make sense: since boy brains and girl brains are different from the beginning, the approach they take toward speech and language may also vary.

Speaking Out of Both Sides of the Brain

The first class on the brain that I took, in the 1980s, was called Left Brain/Right Brain. In that class I was told that 80 percent of all men were ''left brained'' and 80 percent of women were ''right brained.'' The explanation hinged on the fact that the left hemisphere was thought to be more linear, sequential, detail oriented, and focused on one thing at a time, and it controlled feelings. The right hemisphere was considered to be focused on the big picture and be more creative, intuitive, and free with feelings. The female brain was too emotional; the male brain lacked emotion.

As the 1980s progressed, the right brain/left brain theory fell by the wayside as brain research moved on because certainly everyone is whole brained. Surely science could look at the brain in a more productive way. There are differences in the male and female brain; however, they are not so cut-and-dried as right brain/left brain. When it comes to language and reading, it is necessary to take another look at the two hemispheres. Some researchers suggest that the female brain is more left-hemisphere-oriented during the first few years, and that is why baby girls

are more verbal. They also suggest that the male brain has more activity in the right hemisphere, which may account for little boys being more spatially oriented and less verbal than girls (Gurian, Henley, & Trueman, 2001).

The hemispheres work together, but in early development, blood flow and electrical activity can be observed in one hemisphere, in both hemispheres, and cross talk between them. This cross talk is not interference; it is actually a communication in which one hemisphere does its job and then information flows to the other hemisphere to function in another way.

The information flows through the band of fibers called the corpus callosum. This structure is immature at birth, and its growth is encouraged through the communication of the hemispheres. Think of the corpus callosum as a path in the woods that has not yet been traveled enough to have the weeds and debris removed. When you travel this path, you must push the branches of bushes aside and perhaps kick away a few rocks. The more the path is used, the smoother it becomes.

Kusche and Greenberg (2006) discuss the earliest opportunities for the hemispheres to connect, which is through emotional experiences. Before a baby has learned language, the caregiver needs to supply the words. It begins simply: ''See the doll,'' or, ''This is your nose.'' Words need to be provided for experiences as well. For instance, when Maeve falls down as she tries to reach for something, she may cry. Her parents have the choice of saying, ''You're okay. You'll be fine,'' and then help her get up if she cannot do it herself. If, however, they talk about her feelings, both emotional and physical, they can provide an opportunity for the hemispheres to begin connecting. If they say, ''I'm sorry you hurt yourself. Let me kiss your elbow. You must be sad that you fell and couldn't reach your teddy bear,'' they are giving Maeve words that are processed by her left hemisphere and then offer feelings that are processed by the right hemisphere. The path between the two has begun to be laid.

Table 1.3 Functions of the Hemispheres

Left Hemisphere	Right Hemisphere
Detail oriented	Big picture
Sequential	Holistic
Contains speech centers in most humans: expressive and receptive language, speech, grammar, sounds	Prosody and tone of language
	Sensory image memory
	Sends unpleasurable emotional signals
Verbal short-term memory	Receives both pleasant and unpleasant feelings
Pleasurable emotion	Reads body language and facial expression
Facts	Concrete processing
Abstract processing	Emotional significance of knowledge
Knowledge	

Why is this important to language? Table 1.3 shows the functions of each hemisphere. Words and word meanings, for example, are processed in the left hemisphere, but tone and prosody (the pitch, tone, and rhythm of speech), as well as the emotional components of language, are processed in the right. The earlier the brain can begin developing those connections between hemispheres, the easier it will be for the child to understand language, meanings, and words (Kagan & Herschkowitz, 2005).

Activities

There are many ways in which both parents and teachers can encourage the development of language. Before children are in a formal school setting, the child's primary caregivers are her first teacher.

Ages Birth to Two

- Talk to the child. Explain what you are doing as you do it: ''There are three snaps on your jacket . . . one, two, three!''

Mirror Neurons

One of the most exciting discoveries in the brain sciences in the past decade has been that of mirror neurons. If you ever wonder why you yawn when you see someone else do it, mirror neurons are the reason. These brain cells mirror the connections going on in the brain of those you watch and listen to.

In 1995, quite inadvertently, some researchers in Italy were monitoring what was going on in the brains of monkeys as they reached for something (Iacoboni, 2009). A researcher mimicked the monkeys' movements while one was watching, and the response of the neural activity in the monkey's brain was the same as if it were making the movement.

Mirror neurons activate when we watch an action and when we read about it. In learning a language, this stresses the importance of children interacting with others and seeing their facial, mouth, and tongue movements in order to mimic them. A newborn will actually stick out her tongue if the adult holding her is sticking out his. Researchers like Marco Iacoboni, author of *Mirroring People* (2009), believe that a network of mirror neurons plays a role in humans' capacity to learn through imitation, use semantics in language, and feel empathy. When parents and teachers express themselves clearly and respond to the child's attempts at conversation with happy or exciting facial expressions, those mirror neurons respond and feel joy as well. Watching as parents show joy in reading, and especially reading aloud to the child, may also give the child joy and possibly encourage more listening and learning to read.

- Acknowledge and repeat back to the baby any sounds he makes.
- Imitate the baby's facial expressions, and overexaggerate yours. For instance, play peek-a-boo and show an exaggerated surprised look.
- Read aloud to your baby.

- Let your baby look in the mirror and see his mouth as he makes sounds. Make sure he sees your mouth as you talk to him.

Ages Two to Four

- Repeat what your child says so she knows you understand her.
- Read to your child.
- Name things: body parts, objects in the room, and so on.
- Pick up familiar items, and ask your child what they are.
- Sing nursery rhymes and songs. Encourage the child to sing along.
- Show the child photographs, and ask what is happening in them, or ask the child to tell a story about the picture.

Ages Four to Six

- Make sure you have the child's attention before you speak.
- Find objects to sort.
- Pause when you are speaking to give the child a chance to speak too.
- Give simple directions, and see if the child can follow them.
- Read aloud to the child.
- Play pretend games such as house.
- Take the child shopping and discuss what is on your list and the quantity. Have your child count out items for you.

From Six On

- Talk to your child.
- Read to your child.

Summary

Language is a human ability beyond comparison. It is hard-wired in the brain, so there are specific language areas already in place and waiting for the right experiences to help them connect. With the proper environment and with the knowledge gleaned from brain research, children can become better language learners. They can increase their vocabularies and their comprehension of words, so by the time they are ready to read, they understand that sound combinations can have meaning and affect their lives.

New research, however, suggests that there is no prewired pathway in the brain for reading. In the next chapter, we see that reading occurs through the recycling of neurons, in which brain cells are recruited to create a reading pathway, mainly from the language pathway. Therefore, it behooves all involved in the reading success of a child to ensure that the language pathway reaches its peak of productivity. The stronger the language pathway, the easier it will be for the brain to reuse some of those cells to create a strong reading network in the brain.