From Reflexes to Voluntary Movements

Every basic **motor skill** (any movement ability) develops over the first two years of life. The sequence of motor skills first begins with **reflexes**. Infants are equipped with several reflexes, or involuntary movements in response to stimulation, and some are necessary for survival. These include the breathing reflex, or the need to maintain an oxygen supply (this includes hiccups, sneezing, and thrashing reflexes), reflexes that maintain body temperature (crying, shivering, tucking the legs close, and pushing away blankets), the sucking reflex, or automatically sucking on objects that touch their lips, and the rooting reflex, which involves turning toward any object that touches the cheek (which manages feeding, including the search for a nipple). Other reflexes are not necessary for survival but signify the state of brain and body functions. Some of these include: the Babinski reflex (toes fan upward when feet are stroked), the stepping reflex (babies move their legs as if to walk when feet touch a flat surface), the palmar grasp (the infant will tightly grasp any object placed in its palm), and the Moro reflex (babies will fling arms out and then bring to chest if they hear a loud noise). These movements occur automatically and are signals that the infant is
IV. LEARNING ACTIVITIES
C. EXERCISE III:
functioning well neurologically. Within the first several weeks of life, these reflexes are replaced with voluntary movements or motor skills.

Motor development

Motor development occurs in an orderly sequence as infants move from reflexive reactions (e.g., sucking and rooting) to more advanced motor functioning. This development proceeds in a cephalocaudal (from head-down) and proximodistal (from center-out) direction. For instance, babies first learn to hold their heads up, then sit with assistance, then sit unassisted, followed later by crawling, pulling up, cruising, and then walking. As motor skills develop, there are certain developmental milestones that young children should achieve. For each milestone, there is an average age, as well as a range of ages in which the milestone should be reached. An example of a developmental milestone is a baby holding up its head.

Babies on average can hold up their head at 6 weeks old, and 90% of babies achieve this between 3 weeks and 4 months old. If a baby is not holding up his head by 4 months old, he is showing a delay. On average, most babies sit alone at 7 months old. Sitting involves both coordination and muscle strength, and 90% of babies achieve this milestone between 5 and 9 months old (CDC, 2018). If the child is displaying delays on several milestones, that is a reason for concern, and the parent or caregiver should discuss this with the child’s pediatrician. Some developmental delays can be identified and addressed through early intervention.
IV. LEARNING ACTIVITIES
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Gross motor skills are voluntary movements that involve the use of large muscle groups and are typically large movements of the arms, legs, head, and torso. These skills begin to develop first. Examples include moving to bring the chin up when lying on the stomach, moving the chest up, rocking back and forth on hands and knees. But it also includes exploring an object with one’s feet as many babies do, as early as 8 weeks of age, if seated in a carrier or other device that frees the hips. This may be easier than reaching for an object with the hands, which requires much more practice (Berk, 2007). And sometimes an infant will try to move toward an object while crawling and surprisingly move backward because of the greater amount of strength in the arms than in the legs!

Fine Motor Skills

Fine motor skills are more exact movements of the hands and fingers and include the ability to reach and grasp an object. These skills focus on the muscles in the fingers, toes, and eyes, and enable coordination of small actions (e.g., grasping a toy, writing with a pencil, and using a spoon). Newborns cannot grasp objects voluntarily but do wave their arms toward objects of interest. At about 4 months of age, the infant is able to reach for an object, first with both arms and within a few weeks, with only one arm. Grasping an object involves the use of the fingers and palm, but no thumbs. Stop reading for a moment and try to grasp an object using the fingers and the palm. How does that feel? How much control do you have over the object? If it is a pen or pencil, are you able to write with it? Can you draw a picture? The answer is, probably not. Use of the thumb comes at about 9 months of age when the infant can grasp an object using...
IV. LEARNING ACTIVITIES
C. EXERCISE III:

the forefinger and thumb (the pincer grasp). This ability greatly enhances the ability to control and
manipulate an object, and infants take great delight in this newfound ability. They may spend hours picking
up small objects from the floor and placing them in containers. By 9 months, an infant can also watch a
moving object, reach for it as it approaches, and grab it. This is quite a complicated set of actions if we
remember how difficult this would have been just a few months earlier.

<table>
<thead>
<tr>
<th>Age</th>
<th>Developmental Milestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>~2 months</td>
<td>• Can hold head upright on own</td>
</tr>
<tr>
<td>~2 months</td>
<td>• Smiles at sound of familiar voices and follows movement with eyes</td>
</tr>
<tr>
<td>~2 months</td>
<td>• Can raise head and chest from prone position</td>
</tr>
<tr>
<td>~2 months</td>
<td>• Smiles at others</td>
</tr>
<tr>
<td>~3 months</td>
<td>• Grasps objects</td>
</tr>
<tr>
<td>~3 months</td>
<td>• Rolls from side to back</td>
</tr>
<tr>
<td>~4-5 months</td>
<td>• Babbles, laughs, and tries to imitate sounds</td>
</tr>
<tr>
<td>~4-5 months</td>
<td>• Begins to roll from back to side</td>
</tr>
</tbody>
</table>
IV. LEARNING ACTIVITIES
   C. EXERCISE III:

   ~6 months
   - Moves objects from hand to hand
   - Can sit without support
   - May begin to crawl

   ~7-8 months
   - Responds to own name
   - Finds partially hidden objects

   ~8-9 months
   - Walks while holding on
   - Babbles “mama” and “dada”
   - Claps
   - Stands alone
   - Begins to walk

   ~11-12 months
   - Says at least one word
   - Can stack two blocks

   ~18 months
   - Walks independently
IV. **LEARNING ACTIVITIES**

**C. EXERCISE III:**

- Drinks from a cup
- Says at least 15 words
- Points to body parts
- Runs and jumps
- Uses two-word sentences

**~2 years**

- Follows simple instructions
- Begins make-believe play
- Speaks in multi-word sentences

**~3 years**

- Sorts objects by shape and color
- Draws circles and squares
- Rides a tricycle

**~4 years**

- Gets along with people outside of the family
- Gets dressed
C. Exercise III:

- Can jump, hop, and skip
- Knows name and address
- Counts ten or more objects

Sensory Development

As infants and children grow, their senses play a vital role in encouraging and stimulating the mind and in helping them observe their surroundings. Two terms are important to understand when learning about the senses. The first is sensation, or the interaction of information with the sensory receptors. The second is perception, or the process of interpreting what is sensed. It is possible for someone to sense something without perceiving it. Gradually, infants become more adept at perceiving with their senses, making them more aware of their environment and presenting more affordances or opportunities to interact with objects.

Vision

What can young infants see, hear, and smell? Newborn infants’ sensory abilities are significant, but their senses are not yet fully developed. Many of a newborn’s innate preferences facilitate interaction with caregivers and other humans. The womb is a dark environment void of visual stimulation. Consequently, vision is the most poorly developed sense at birth. Newborns typically cannot see further than 8 to 16 inches.
IV. LEARNING ACTIVITIES
C. EXERCISE III:

away from their faces, have difficulty keeping a moving object within their gaze, and can detect contrast more than color differences. If you have ever seen a newborn struggle to see, you can appreciate the cognitive efforts being made to take in visual stimulation and build those neural pathways between the eye and the brain.

Although vision is their least developed sense, newborns already show a preference for faces. When you glance at a person, where do you look? Chances are you look into their eyes. If so, why? It is probably because there is more information there than in other parts of the face. Newborns do not scan objects this way; rather, they tend to look at the chin or another less detailed part of the face. However, by 2 or 3 months, they will seek more detail when visually exploring an object and begin showing preferences for unusual images over familiar ones, for patterns over solids, faces over patterns, and three-dimensional objects over flat images. Newborns have difficulty distinguishing between colors, but within a few months are able to distinguish between colors as well as adults. Infants can also sense depth as binocular vision develops at about 2 months of age. By 6 months, the infant can perceive depth in pictures as well (Sen, Yonas, & Knill, 2001). Infants who have experience crawling and exploring will pay greater attention to visual cues of depth and modify their actions accordingly (Berk, 2007).

Hearing

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IV. LEARNING ACTIVITIES
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The infant's sense of hearing is very keen at birth. If you remember from an earlier module, this ability to hear is evidenced as soon as the 5th month of prenatal development. In fact, an infant can distinguish between very similar sounds as early as one month after birth and can distinguish between a familiar and non-familiar voice even earlier. Babies who are just a few days old prefer human voices, they will listen to voices longer than sounds that do not involve speech (Vouloumanos & Werker, 2004), and they seem to prefer their mother's voice over a stranger's voice (Mills & Melhuish, 1974). In an interesting experiment, 3-week-old babies were given pacifiers that played a recording of the infant's mother's voice and of a stranger's voice. When the infants heard their mother's voice, they sucked more strongly at the pacifier (Mills & Melhuish, 1974). Some of this ability will be lost by 7 or 8 months as a child becomes familiar with the sounds of a particular language and less sensitive to sounds that are part of an unfamiliar language.

Pain and Touch

Immediately after birth, a newborn is sensitive to touch and temperature, and is also sensitive to pain, responding with crying and cardiovascular responses. Newborns who are circumcised (the surgical removal of the foreskin of the penis) without anesthesia experience pain, as demonstrated by increased blood pressure, increased heart rate, decreased oxygen in the blood, and a surge of stress hormones (United States National Library of Medicine, 2016). According to the American Academy of Pediatrics (AAP), there are medical benefits and risks to circumcision. They do not recommend routine circumcision, however, they
IV. LEARNING ACTIVITIES
   C. EXERCISE III:

stated that because of the possible benefits (including prevention from urinary tract infections, penile cancer, and some STDs) parents should have the option to circumcise their sons if they want to (AAP, 2012).

The sense of touch is acute in infants and is essential to a baby’s growth of physical abilities, language and cognitive skills, and socio-emotional competency. Touch not only impacts short-term development during infancy and early childhood but also has long-term effects, suggesting the power of positive gentle touch from birth. Through touch, infants learn about their world, bond with their caregiver, and communicate their needs and wants. Research emphasizes the great benefits of touch for premature babies, but the presence of such contact has been shown to benefit all children (Stack, D. M. (2010)). In an extreme example, some children in Romania were reared in orphanages in which a single care worker may have had as many as 10 infants to care for at one time. These infants were not often helped or given toys with which to play. As a result, many of them were developmentally delayed (Nelson, Fox, & Zeanah, 2014). When we discuss emotional and social development later in this module, you will also see the important role that touch plays in helping infants feel safe and protected, which builds trust and secure attachments between the child and their caregiver.

Taste and Smell

Not only are infants sensitive to touch, but newborns can also distinguish between sour, bitter, sweet, and salty flavors and show a preference for sweet flavors. They can distinguish between their mother’s scent and
IV. LEARNING ACTIVITIES
   C. EXERCISE III:

that of others and prefer the smell of their mothers. A newborn placed on the mother’s chest will inch up to
the mother’s breast, as it is a potent source of the maternal odor. Even on the first day of life, infants orient
to their mother’s odor and are soothed, when crying, by their mother’s odor (Sullivan et al., 2011).


STUDENT RESPONSE: (Use Separate Pages)