3.4: Sensory Capabilities

Throughout much of history, the newborn was considered a passive, disorganized being who possessed minimal abilities. William James, an early psychologist, had described the newborn's world as "a blooming, buzzing confusion," (Shaffer, 1985). However, current research techniques have demonstrated just how developed the newborn is with especially organized sensory and perceptual abilities.

Vision

The womb is a dark environment void of visual stimulation. Consequently, vision is the most poorly developed sense at birth and time is needed to build those neural pathways between the eye and the brain. Newborns typically cannot see further than 8 to 16 inches away from their faces, and their visual acuity is about 20/400, which means that an infant can see something at 20 feet that an adult with normal vision could see at 400 feet. Thus, the world probably looks blurry to young infants. Because of their poor visual acuity, they look longer at checkerboards with fewer large squares than with many small squares. Infants' thresholds for seeing a visual pattern are higher than adults'. Thus, toys for infants are sometimes manufactured with black and white patterns rather than pastel colors because the higher contrast between black and white makes the pattern more visible to the immature visual system. By about 6 months, infants' visual acuity improves and approximates adult 20/25 acuity.

When viewing a person's face, newborns do not look at the eyes the way adults do; rather, they tend to look at the chin a less detailed part of the face. However, by 2 or 3 months, they will seek more detail when exploring an object visually and begin showing preferences for unusual images over familiar ones, for patterns over solids, for faces over patterns, and for three-dimensional objects over flat images. Newborns have difficulty distinguishing between colors, but within a few months they are able to discriminate between colors as well as adults. Sensitivity to binocular depth cues, which require inputs from both eyes, is evident by about 3 months and continues to develop during the first 6 months. By 6 months, the infant can perceive depth perception 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

The infant's sense of hearing is very keen at birth, and the ability to hear is evidenced as soon as the 7th 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. Infants are especially sensitive to the frequencies of sounds in human speech and prefer the exaggeration of infant-directed speech, which will be discussed later. Additionally, infants are innately ready to respond to the sounds of any language, but some of this ability will be lost by 7 or 8 months as the infant becomes familiar with the sounds of a particular language and less sensitive to sounds that are part of an unfamiliar language.

Figure 3.9. Source.

Newborns also prefer their mother’s voices over another female when speaking the same material (DeCasper & Fifer, 1980). Additionally, they will register in utero specific information heard from their mother’s voice. DeCasper and Spence (1986) tested 16 infants (average age of 55.8 hours) whose mothers had previously read to them prenatally. The mothers read several passages to their fetuses, including the first 28 paragraphs of the Cat in the Hat, beginning when they were 7 months pregnant. The fetuses had been exposed to the stories an average of 67 times or 3.5 hours. When the experimental infants were tested, the target stories (previously heard) were more reinforcing than the novel story as measured by their rate of sucking. However, for control infants, the target stories were not more reinforcing than the novel story indicating that the experimental infants had heard them before.

Touch and Pain

Immediately after birth, a newborn is sensitive to touch and temperature, and is also highly sensitive to pain, responding with crying and cardiovascular responses (Balaban & Reisenauer, 2013). Newborns who are Circumcised, which is 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). Research has demonstrated that infants who were circumcised without anesthesia experienced more pain and fear during routine childhood vaccines. Fortunately, many local pain killers are currently used during circumcision.
Taste and Smell

Studies of taste and smell demonstrate that babies respond with different facial expressions, suggesting that certain preferences are innate. Newborns can distinguish between sour, bitter, sweet, and salty flavors and show a preference for sweet flavors. Newborns also prefer the smell of their mothers. An infant only 6 days old is significantly more likely to turn toward its own mother’s breast pad than to the breast pad of another baby’s mother (Porter, Makin, Davis, & Christensen, 1992), and within hours of birth an infant also shows a preference for the face of its own mother (Bushnell, 2001; Bushnell, Sai, & Mullin, 1989).

Infants seem to be born with the ability to perceive the world in an intermodal way; that is, through stimulation from more than one sensory modality. For example, infants who sucked on a pacifier with either a smooth or textured surface preferred to look at a corresponding (smooth or textured) visual model of the pacifier. By 4 months, infants can match lip movements with speech sounds and can match other audiovisual events. Although sensory development emphasizes the afferent processes used to take in information from the environment, these sensory processes can be affected by the infant's developing motor abilities. Reaching, crawling, and other actions allow the infant to see, touch, and organize his or her experiences in new ways.

How are Infants Tested

**Habituation Procedures**, _that is measuring decreased responsiveness to a stimulus after repeated presentations_, have increasingly been used to evaluate infants to study the development of perceptual and memory skills. Phelps (2005) describes a habituation procedure used when measuring the rate of the sucking reflex. Researchers first measure the initial baseline rate of sucking to a pacifier equipped with transducers that measure muscle contractions. Next, an auditory stimulus is presented, such as a human voice uttering a speech sound such as “da.” The rate of sucking will typically increase with the new sound, but then decrease to baseline levels as “da” is repeatedly presented, showing habituation. If the sound “ma” was then presented, the rate of sucking would again increase, demonstrating that the infant can discriminate between these two stimuli.

Additionally, the speed or efficiency with which infants show habituation has been shown to predict outcomes in behaviors such as language acquisition and verbal and nonverbal intelligence. Infants who show difficulty during habituation, or habituate at slower than normal rates, have been found to be at an increased risk for significant developmental delays. Infants with Down syndrome, teratogen-exposed infants, malnourished infants, and premature...
infants have all been studied. Researchers have found that at the age of 16 months, high-risk infants show rates of habituation comparable to newborn infants (Phelps, 2005).