

## **Vision in infants**

Brianna McGee

Rachel Wu, Ph.D.

University of California, Riverside

There is a great deal of visual development over the first year of life. Many aspects of vision undergo this dramatic change, including visual perception (the ability to see and interpret information), visual acuity (the clarity of our vision), and smooth pursuit (the ability to follow objects). These three aspects are fundamental to early visual experiences that facilitate typical cognitive development. This entry will provide a brief overview of visual perception, visual acuity, and smooth pursuit in human infants.

One of the fundamental aspects of vision in infants is visual perception. There are several components of visual perception: accommodation, convergence, coordination, color vision, and contrast sensitivity. Accommodation refers to the ability to focus the lens in our eyes. Without this ability, our ability to see clearly (our visual acuity) would suffer. The newborn infant has difficulty with accommodation for the first several weeks of life. However, by four months of age, accommodation is almost adult-like. Convergence is the ability to use both eyes to look at the same object. Eight-week-old infants can demonstrate convergence when objects are approximately 15 centimeters away from their face, but objects closer than that make convergence of the eyes rather challenging. Convergence, as well as coordination of the two eyes in general (that is, moving both eyes in synchrony), are adult-like by approximately 6 months of age. Color vision seems to be quite poor at birth, as well. In fact, most scientists agree that newborn infants do not discriminate between blue, yellow, and green for the first several weeks of life. By four months of age, infants' color vision is thought to be comparable to adults with

normal color vision. Newborns can, however, distinguish between colors of high contrast, such as black and white, and red and white. Researchers have devised a clever way to test contrast sensitivity in young infants. Using side-by-side images of circles composed of black and white stripes of varying widths, scientists measure the amount of time human infants spend looking at one circle over the other. The idea is that newborns (with the ability to discriminate between colors of high contrast, such as black and white) will prefer (look longer at) circles of high contrast, compared to circles in which they do not perceive the stripes (which will appear as flat gray circles). Researchers can present infants with smaller and smaller width stripes to test the limits of their contrast sensitivity – when infants lose interest it is thought to be because they perceive the circles as unending gray.

Another fundamental aspect of vision in infants is visual acuity, or the clarity with which we can see distant objects. In adults and children, visual acuity is measured by standing 20 feet away and reporting numbers and letters of various sizes. Perfect (20/20) vision refers to an individual's ability to see clearly from 20 feet away. At birth, human infants are thought to have a visual acuity of approximately 20/400. This metric means that a newborn infant can see an object that is 20 feet away about as clearly as a person with normal vision would see an object from approximately 400 feet away! Visual acuity continues to develop until approximately 6 years of age. By approximately 4 months of age, visual acuity is thought to be between 20/100 and 20/200. By 6 months, visual acuity has developed dramatically, to be between 20/50 and even 20/25.

The third aspect of vision that develops during infancy is smooth pursuit - the ability to make continuous eye movements when following objects in the environment, such as following a caregiver's face as it moves. Newborn infants demonstrate smooth pursuit under some

circumstances, namely when following large objects and items of high contrast, especially when these items are close to their face – approximately 8 to 10 inches from their face. This ability can be measured easily by holding up an object in front of an infant's face, and moving it, although there is a chance that the infant may not want to follow an object when you try it. The inability to track objects beyond this distance is predominantly due to the newborns' poor visual acuity. By 4 to 5 months, infants are already quite advanced in their ability to use their eyes to follow objects. They also become more efficient in their tracking by increasing the frequency with which they turn their heads to follow objects, an ability that requires neck strength.

Unlike other abilities that develop over the first year of life, such as motor, social, and linguistic abilities, the development of visual abilities may not be as obvious to the untrained observer. However, there is no doubt that early visual development plays a large role in an infant's overall development.

#### Further Reading

Aslin, R. N., & Jackson, R. W. (1979). Accommodative-convergence in young infants:

Development of a synergistic sensory-motor system. *Canadian Journal of Psychology/Revue canadienne de psychologie*, 33(4), 222.

Bornstein, M. H., Kessen, W., & Weiskopf, S. (1976). Color vision and hue categorization in

young human infants. *Journal of Experimental Psychology: Human Perception and Performance*, 2(1), 115

Dobson, V., & Teller, D. Y. (1978). Visual acuity in human infants: a review and comparison of

behavioral and electrophysiological studies. *Vision Research*, 18(11), 1469-1483.