

Babies can see things that adults cannot

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New research shows that infants younger than 7 months can perceive objects that older infants and adults cannot see because of a phenomenon called "visual backward masking." Credit: Chuo University, LAIMAN

We can generally recognize an object, even if it is presented for a very brief time. However, if another object appears immediately following the first object, the perception on the first object is impaired such that we do not notice its existence. This perceptual phenomenon, called "visual backward masking," is used in vision science to study how visual perception is processed in the brain. Interestingly, this phenomenon occurs even if the second object does not spatially overlap the first object, such as a contour or four dots surrounding the object.

The occurrence of this phenomenon is assumed to be due to a disruption of "feedback processing." When we see something, [visual information](#) is serially processed from lower to higher visual areas in the brain in a bottom-up manner. However, top-down feedback processing, in which visual signals are sent back from higher to lower areas, also plays a critical role in visual perception. Visual backward masking is thought to occur owing to interference with feedback processing.

"We applied backward masking to [infants](#) aged 3-8 months to examine the development of feedback processing," says Yusuke Nakashima, a postdoctoral fellow at Chuo University in Tokyo and the study's lead author. "Recent studies in vision science revealed the importance of feedback processing in visual [perception](#), but its development is poorly understood."

To test whether backward masking occurs in infants, the researchers presented images of faces on a computer screen and measured the length of time that infants spent looking at them. As infants tend to look longer at faces, researchers can test whether infants perceive faces by measuring their looking time. The faces were presented in two ways. In one condition, a face was followed by a mask image, in which infants would not see the face if backward masking occurred. In another

condition, nothing appeared after the face; thus, infants would be able to see the face.

The researchers found that infants aged 7-8 months could not see faces followed by the mask, indicating that backward masking occurred, similar to adults. In contrast, infants aged 3-6 months could perceive faces even when the faces were followed by the mask image, indicating that masking did not occur and that younger infants could see faces that older infants could not.

"These results suggest that feedback processing is immature in infants younger than 7 months," says Nakashima. "That is, younger infants do not have feedback processing that backward masking should interfere, and thus, masking is ineffective for them." The results of the study demonstrated that the mechanisms for [visual perception](#) change drastically in the second half of the first year of life, from the bottom-up system to the system incorporating top-down processing.

The results also showed that objects that can be perceived in early infancy become imperceptible during development. "This might seem counterintuitive," says Masami Yamaguchi, a professor at Chuo University. "Instead, important visual abilities would be acquired by the maturation of feedback processing."

For example, feedback processing is essential for robustly perceiving ambiguous visual images, such as occluded objects. "Younger infants whose [feedback](#) processing is immature might perceive the external world ambiguously," says Yamaguchi. "In return for susceptibility to visual masking, we acquire the ability to robustly perceive ambiguous visual scenes."

More information: Yusuke Nakashima et al, Perception of invisible masked objects in early infancy, *Proceedings of the National Academy of*

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