

No experience required: Category-specific brain organization in sighted and blind humans

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A new study finds a surprising similarity in the way neural circuits linked to vision process information in both sighted individuals and those who have been blind since birth. The research, published by Cell Press in the August 13th issue of the journal *Neuron*, reveals that category-specific localized activation of a critical part of the visual cortex does not require any prior visual experience and provides fascinating and valuable insight into the evolutionary history of the human brain.

The ability to recognize visually presented objects relies on a critical neural pathway called the ventral stream. Previous imaging studies of the human [brain](#) have demonstrated that the sight of nonliving objects, such as tools and houses, activates different regions within the ventral stream than the sight of living things, such as animals and faces. It is not known whether category-specific neural responses in the ventral stream depend on visual experience.

One way to answer this question is to explore whether category-specific activation of the ventral stream is observed in adults who have been blind since birth. Although previous research with blind humans has shown that tactile exploration of objects or imagery of object shape based on sound activates the ventral stream, it is not clear whether stimuli from different conceptual domains activate localized regions within the ventral stream.

"In particular, it is unknown whether individuals who are blind since birth will show differential responses in medial regions of the ventral stream when thinking about nonliving things," says lead study author, Dr. Bradford Mahon, who is currently at the Department of Brain and Cognitive Sciences at the University of Rochester. "Similarly, it is unknown whether, in the absence of visual experience, stimuli corresponding to living things will lead to differential responses in regions that show the same category preference in sighted individuals."

Dr. Mahon and colleagues at the Center for Mind/Brain Sciences (CIMEC) at the University of Trento, Italy, and Harvard University designed a study to test whether the medial-to-lateral organization of the ventral stream, reflecting preferences for nonliving-to-living stimuli, respectively, was present in individuals with no sight experience. Sighted and blind individuals performed a size judgment task where groups of words all belonging to the same category (nonliving or living) were presented and subjects were asked to think about the size of the first item and compare it to subsequent items. All of the individuals kept their eyes closed during the task.

"Using functional magnetic resonance imaging, we found that the same regions of the ventral stream that show category preferences for nonliving stimuli and animals in sighted adults, show the same category preferences in adults who are blind since birth," explains senior study author Dr. Alfonso Caramazza from the CIMEC and Harvard University. "Our findings suggest that the organization of the ventral stream innately anticipates the different types of computations that must be carried out over objects from different conceptual domains."

Perhaps the most exciting possibility suggested by this research is that the functional organization of the human brain is strongly constrained by innate factors. The researchers discuss a theory in their article proposing that significant parts of the human brain are innately structured around a

few domains of knowledge that were critical in humans' evolutionary history, such as animals, conspecifics, and perhaps tools.

Source: Cell Press ([news](#) : [web](#))

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