Study: Your brain sees things you don't

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Courtesy of the University of Arizona
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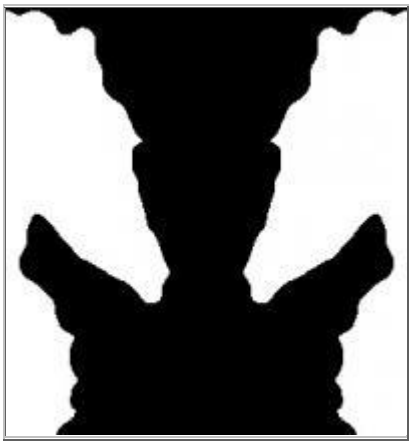
The brain processes and understands visual input that we may never consciously perceive, a study suggests.

The finding challenges current views on how the brain processes visual information, said University of Arizona doctoral degree candidate Jay Sanguinetti, who authored the study. It is published online in the journal *Psychological Science*.



Sanguinetti showed study participants images of what appeared to be an abstract black object. Sometimes, however, there were real-world objects hidden at the borders of the black silhouette. In this image, the outlines of two seahorses can be seen in the white spaces surrounding the black object. (Credit: Jay Sanguinetti)

Sanguinetti showed study participants a series of black silhouettes, some of which contained real-world objects hidden in the white spaces on the outside. He worked with psychologists at the university to monitor people's brainwaves while they viewed the objects.

"We were asking the question of whether the brain was processing the meaning of the objects that are on the outside of these silhouettes," Sanguinetti said. "The specific question was, 'Does the brain process those hidden shapes to the level of meaning, even when the subject doesn't consciously see them?"

The answer, he added, seems to be yes. Study participants' brainwaves indicated that even if a person never consciously recognized the shapes on the outside of the image, their brains still processed those shapes to the level of understanding their meaning.

"There's a brain signature for meaningful processing," Sanguinetti said. A peak in the averaged brainwaves called N400 indicates that the brain has recognized an object and associated it with a particular meaning, he explained.

"It happens about 400 milliseconds after the image is shown, less than a half a second," said Mary Peterson, Sanguinetti's adviser and director of the university's cognitive science program, who worked with him.

"The participants in our experiments don't see those shapes on the outside; nonetheless, the brain signature tells us that they have processed the meaning of those shapes," said Peterson. "But the brain rejects them as interpretations, and if it rejects the shapes from conscious perception, then you won't have any awareness of them."

The finding raises the question of why the brain would process the meaning of a shape when a person is ultimately not going to perceive it, Sanguinetti said. "The traditional opinion in vision research is that this would be wasteful in terms of resources," he explained. "If you're not going to ultimately see the object on the outside why would the brain waste all these processing resources and process that image up to the level of meaning?"

"Many, many theorists assume that because it takes a lot of energy for brain processing, that the brain is only going to spend time processing what you're ultimately going to perceive," added Peterson. "But in fact the brain is deciding what you're going to perceive, and it's processing all of the information and then it's determining what's the best interpretation."

"This is a window into what the brain is doing all the time," Peterson said. "It's always sifting through a variety of possibilities and finding the best interpretation for what's out there. And the best interpretation may vary with the situation."

Our brains may have evolved to sift through the barrage of visual input in our eyes and identify those things that are most important for us to consciously perceive, such as a threat or resources such as food, Peterson suggested. In the future, Peterson and Sanguinetti plan to look for the specific regions in the brain where the processing of meaning occurs.