

"Looking Glass Syndrome" discovered by UCSD neuroscientists

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"LOOKING GLASS SYNDROME" DISCOVERED BY UCSD NEUROSCIENTISTS

Go ask Alice, and she'd tell you the objects in the mirror are so real she could literally cross over into her looking-glass world and touch them.

Now, neuroscientists from the University of California, San Diego have discovered a small group of patients with certain brain lesions who share the same beliefs about mirrors as Alice.

When shown an object like a pen or candy on their left, the patients kept banging their hands against a mirror to their right, as if they believed the object in the mirror was not a reflection, but was real.

Call it the "looking-glass syndrome," says Vilayanur S. Ramachandran, director of the Brain and Perception Laboratory at UCSD.

"This type of confusing an object in the mirror with a real object is only seen in children less than age 2 and in lower primates, monkeys," said Ramachandran. "This is the first example of a human adult patient with a specific neurological deficit that shows this response."

Ramachandran, along with UCSD co-investigators Eric L. Altschuler and Steven Hillyer, describe this condition, technically referred to as "mirror agnosia," in a recent issue of the Proceedings of the Royal Society of London.

In their study, the researchers focus on four patients whose right hemispheres-- specifically, their parietal lobes--were damaged by stroke. In each case, the patients experienced a curious syndrome in which the patient ignores or neglects everything on the left side of their world, even though their vision is not impaired. For example, the patient may eat from only the right side of the plate, apply make-up only on the right side of her face, and when asked to draw flowers, will draw only half of it.

Ramachandran's mirror research was an outgrowth of his studies with this curious syndrome.

"We knew the patients ignored things on their left," he explained. "We wanted to know if they saw a reflection of the object in a mirror, would they ignore the reflection or would the mirror correct the neglect? It was a simple question."

As a prop for their experiment, the researchers used a 2-foot by 1.5-foot wooden-framed mirror, with dust on the surface so the mirror wouldn't be confused with open space. To ensure that each knew it was a mirror, each patient was asked if he or she knew what the investigator was holding, to which the patient responded "a mirror."

Upon receiving a cue, a second investigator standing on the patient's left side held out a pen or candy bar well within the reach of the patient's non-paralyzed right hand, and entirely within the neglected (left) visual field. The

size and location of the mirror was adjusted to allow the patient to see not only the pen or candy bar, but also the second investigator's arm, torso and shoulder in the mirror.

When asked to grab the pen, the patient without hesitation reached straight into the mirror, repeatedly banging their hands. In frustration, the patients would tell the investigator "you are not holding it within my reach," or "it's behind the mirror."

Said Ramachandran: "To us, this response was astonishing. Here you have people who otherwise are intelligent and completely lucid about other things, but they are unable to make logical inferences about the mirror.

"For them, the laws of optics have changed in this corner of the Universe."

Ramachandran said the cause of this new neurological syndrome was not clear, although it may be a specific consequence of neglect. "It is as though the patient was saying to him or herself, 'Since the reflection is in the mirror, the pen must be on my left. But left does not exist in my world--therefore it must be inside the mirror,' he said.

It's possible the syndrome is not a consequence of neglect, but instead is related to a subtle deficit in how the brain processes visual information. Brain researchers believe that visual information is processed in the brain along two pathways--a "what" or object-recognition pathway which mediates conscious vision; and a "where" pathway, which allows you to grab or avoid objects.

"Normally these two work in harmony," said Ramachandran. "But because of this damage there is an uncoupling. The "where" pathway therefore could reach out in almost zombie-like fashion to an object in the mirror. Normally, the other pathway would be there to say the object is some place else."

In future experiments, Ramachandran wants to explore the use of mirrors as potential therapeutic tools to coax these patients out of their neglect.

"Perhaps if you prod them repeatedly, move the mirror from the front to the side gradually, then with repeated practice they'll get the hang of it," he said.

Beyond the specific deficits seen in these patients, Ramachandran added that the research points out how basic beliefs can be altered when specific regions of the brain are damaged.

"The patient's belief systems and ability to reason intellectually about such matters have become selectively distorted to accommodate the strange looking-glass world in which they now find themselves trapped," he said. "It is remarkable that such a domain specific tolerance for absurdities can be provoked by the mere use of a mirror."

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