Hand has role in how we see objects in space, researchers find

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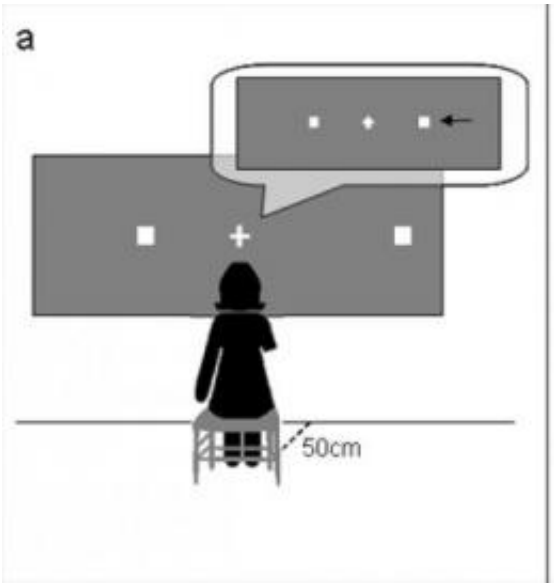

Volunteers were instructed to look at a central cross on a screen while two white squares were briefly shown to the left and right side of the cross. The volunteers had to indicate which of the squares was farther away from the cross. The results reveal that hand amputations affect visuospatial perception. Credit: Dr. Tamar R. Makin

We know exactly where an object is when we say it is “within the reach of our hand.” But if we don’t have a hand, can we still see the object just where it is?

Apparently not, say researchers at the Hebrew University of Jerusalem

and Hadassah Hospital-Mount Scopus. The space within reach of our hands — where actions such as grasping and touching occur — is known as the "action space." Research has shown that visual information in this area is organized in hand-centered coordinates — in other words, the representation of objects in the human brain depends on their spatial position with respect to the hand.

According to new research published in Psychological Science, a journal of the Association for Psychological Science, amputation of the hand results in distorted visuospatial perception of the action space. The article was written by neuroscientists Dr. Tamar R. Makin, Meytal Wilf and Dr. Ehud Zohary of the Alexander Silberman Institute of Life Sciences at the Hebrew University of Jerusalem along with Dr. Isabella Schwartz of Hadassah Mount Scopus Hospital in Jerusalem.

They sought to investigate how hand amputations affect visuospatial perception in near space. Volunteers with either left- or right-hand amputations participated in this experiment. They were instructed to look at a central cross on a screen while two white squares were briefly shown to the left and right side of the cross. The volunteers had to indicate which of the squares was farther away from the cross.

The results reveal that hand amputations affect visuospatial perception. When the right square was slightly farther away from the center, participants with right-hand amputations tended to perceive it as being at the same distance from the center as the left square; this suggests that these volunteers underestimated the distance of the right square relative to the left. Conversely, when the left square was farther away, left-hand amputees perceived both squares as being equally far away from the center — these participants underestimated the left side of near space.

Interestingly, when the volunteers were seated farther away from the screen, they were more accurate in judging the distances, indicating that

hand amputations may only affect perception of the space close to the body.

The findings suggest that losing a hand may shrink the action space on the amputated side, leading to permanent distortions in spatial perception. According to the researchers, “This shows that the possibility for action in near space shapes our perception — the space near our hands is really special, and our ability to move in that space affects how we perceive it.”

The researchers note that these results have implications for spatial hemineglect — a condition (often following brain injury) in which the patient cannot perceive objects on one side of space. This condition is very often associated with paralysis of the hand in the neglected side, which, based on the current study, might exasperate the perceptual neglect.

The authors suggest that, based on their findings, “current rehabilitation approaches that emphasize action on the affected side may reverse this process.” For example, encouraging the use of the affected hand or by providing visual feedback (through prism adaptation or mirrors) may help overcome hemineglect by increasing the size of the action space on the affected side.

Source: Hebrew University of Jerusalem