Right hand or left? How the brain solves a perceptual puzzle

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(Medical Xpress) -- When you see a picture of a hand, how do you know whether it's a right or left hand? This "hand laterality" problem may seem obscure, but it reveals a lot about how the brain sorts out confusing perceptions. Now, a study which will be published in a forthcoming issue of Psychological Science, a journal published by the Association for Psychological Science, challenges the long-held consensus about how we solve this problem. "For decades, the theory was that you use your motor imagination," says Shivakumar Viswanathan, who conducted the study with University of California Santa Barbara colleagues Courtney Fritz and Scott T. Grafton. Judging from response times, psychologists thought we imagine flipping a mental image of each of our own hands to find the one matching the picture. These imagined movements were thought to recruit the same brain processes used to command muscles to move-a high-level cognitive feat.

The study, however, finds that the brain is adept at decoding a left or right hand without these mental gymnastics. Judging laterality is "a low-level sensory problem that uses processes that bring different senses into register"- a process called binding, says Viswanathan. Seeing a hand of unknown laterality leads the brain to bind the seen hand to the correct felt hand. If they are still out of register because of their conflicting positions, an illusory movement arises from the brain's attempt to bring the seen and felt hand into the same position. But "this feeling of moving only comes after you already know which hand it is."

In the study, participants couldn't see their own hands, which were held palm down. They saw hand shapes tilted at different angles, with a colored dot on them indicating a palm-up or down posture. One group of participants saw the shape first and then the dot; and the other, the dot first. Participants in both groups put the shape and dot together mentally and indicated which hand it was by pushing a button with that hand. However, when the shape and dot were shown simultaneously, participants in the first group felt movements of their right hands when seeing a left hand and vice versa; the other group always felt a movement of the correct hand. This behavioral difference (which experimenters gleaned from response time) was due to differences in participants' perception of the seen hand-establishing that an earlier sensory process made the decision.

In a second experiment, participants were told which hand it was and had to judge whether its palm was down or up, indicating their answer with one hand only. This time, the illusory hand-movement occurred only when the seen hand-shape matched that of the participant's own palm-down responding hand, but not otherwise. Even though no right/left judgments were required, the response was dominated by an automatic binding of the seen and felt hands, and the illusory movement followed, says Viswanathan.

The study helps us understand the experience of amputees, who sometimes sense an uncontrollable itch or clenching in the "phantom" body part. Showing the opposite hand or leg in a mirror allows the patient to "feel" the absent limb and mentally relieve the discomfort-a "binding" of vision and feeling.

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