New evidence of an unrecognized visual process

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(Medical Xpress) -- We don't see only what meets the eye. The visual system constantly takes in ambiguous stimuli, weighs its options, and decides what it perceives. This normally happens effortlessly. Sometimes, however, an ambiguity is persistent, and the visual system waffles on which perception is right. Such instances interest scientists because they help us understand how the eyes and the brain make sense of what we see.

Most scientists believe rivalry occurs only when there's "spatial conflict"—two objects striking the same place on the retina at the same time as our eyes move. But the retina isn't the only filter or organizer of visual information. There's also the "non-retinal reference frame"—objects such as mountains or chairs that locate things in space and make the world appear stable even when our eyes are moving.

"We asked: what if visual ambiguities are not presented on the same spot on the retina, but on the objects [in the frame] as they move around," says California Institute of Technology cognitive scientist Jeroen J.A. van Boxtel. Indeed, he and colleague Christof Koch found evidence of rivalry in this reference frame, with surprising effects on the better-understood spatial conflict. The findings, which will appear in an upcoming issue of *Psychological Science*, a journal published by the Association of Psychological Science, offer intriguing clues to how the visual system works.

In their experiments, van Boxtel and Koch created spatial conflict with a

"motion quartet," which changes the arrangement of four dots. If the dots are displaced in certain ways, the visual system isn't sure if the movement is vertical or horizontal. If the dots move to an altogether different space, there's no rivalry. Then the researchers upped the perceptual ante by creating an object reference frame with three white discs and shifting it, too, along with or in opposition to the smaller dots.

Seven male and female participants viewed the changing arrangements in four conditions. In one, both dots and discs remained stationary (creating spatial rivalry); in each of two, either dots or discs moved right or left; in the fourth, both moved horizontally together (creating ambiguity in the frame). Each time, participants had to press a button indicating whether the dots moved horizontally or vertically. The presses were analyzed for perceived movement "bias" (more horizontal or vertical) and duration—evidence either of rivalry or visual clarity.

The results: Even when the dots moved to another space altogether—so there was no spatial conflict—the moving discs created the effect of perceptual ambiguity. But the researchers also found that visual rivalry disappeared when the dots were stationary and the disks moved (that is, the dots were not linked to the disks). It was as if the brain had bigger fish—object-frame rivalry—to fry.

In subsequent experiments—one changing the vertical relationship of the dots and one placing the dots outside the white discs—the researchers got results similar to those they would have gotten without the frame. Their conclusion: The visual system is working out object-frame rivalry as it would spatial rivalry, probably with the same brain regions and processes.

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