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Up, down, right, left -- how visual cues help us understand bodily motion

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(Medical Xpress) -- "Our visual system is tuned towards perceiving other people. We spend so much time doing that—seeing who they are, what they are doing, what they intend to do," says psychology professor Nikolaus F. Troje of Queen's University in Kingston, Ontario.

This process is called biological motion perception, and humans are so good at it that even a few dots on a screen representing the major joints of a body are enough to retrieve all the information we need—as long as they move.

But what role does motion play in that process? Does the visual system use it only to connect the dots to create a coherent, or "global," structure? Troje and his colleagues—Masahiro Hirai and Daniel R. Saunders at Queen's, and Dorita H. F. Chang, now at the University of Birmingham, UK—investigated this question in a new study, to be published in an upcoming issue of *Psychological Science*, a journal of the Association for Psychological Science.

They presented their participants with computer-generated stimuli showing 11 light points representing the shoulder, hip, elbows, wrists, knees, and ankles of a person walking, as on a treadmill. After a two-second display, the observers had to indicate which direction they believed the walker was facing.

This is an easy task, and the participants performed it almost without fail—even though the point-light walker was masked with 100 randomly placed additional dots. But they were also able to do it if the global structure of the body was entirely disrupted by randomly scrambling the 11 dots. “The local motion of individual dots contained enough information about the walker’s facing direction,” says Troje.

But when the whole thing was turned upside-down, the participants could no longer discern which way the figure was walking. Why? Says Troje: “The visual system uses the information contained in these local dot movements—mainly the ones of the feet—only when it is validated by additional properties that do not in themselves carry any information about facing direction”—in this case the proper vertical orientation, feet on the bottom, head on top.

An observer can’t tell the facing direction of a stationary upright figure. But put the local motion together with an upright position, even mix up and mask all the light points. And “direction discrimination of these ‘scrambled’ walkers is almost as good as with structurally coherent walkers,” Troje says.

Why is the visual system so acute even when the shape of a figure is totally broken down? To survive, we have to be able “to detect the presence of a living being in the visual environment—regardless of whether it is a fellow human, a potentially dangerous predator, or even a prey animal,” says Troje. “For that purpose, we need a detection mechanism that is independent of the particular shape of an animal.”

Parsing these effects can help us understand—and appreciate—our extraordinary perceptual assets. “It tells us how sophisticated our visual system is in using information about the structure, the physics, and the regularities of the visual world,” he says.

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