Team explains a longtime visual puzzler in new way

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A team of neuroscientists at Duke University Medical Center has suggested an entirely new way to explain a puzzling visual phenomenon called the flash-lag effect.

Experts have debated for the past 100 years about why -- when a flash of light is presented in alignment with a moving object -- the flash is perceived to lag behind the position of the object.

"The point of this paper was to present a completely different way of thinking about how this effect can and should be explained," said Dale Purves, M.D., professor of neurobiology and director of the Duke Center for Cognitive Neuroscience. "We decided to look at the effect empirically, based on another visual problem, called the inverse optics problem, which is that the image on your retina can't be directly, logically related to what is happening in the world."

Objects moving at many different speeds and in different directions in the real world can generate the same speed on your retina, Purves said.

The Duke scientists asked how it is that humans routinely make correct behavioral choices in the world "when we can't know from the information on our retinas what is actually out there," Purves said.

"The solution lies in humans accumulating, over millions of years of trial-and-error, the information that derives from seeing a speed on the retina and making a move in response, which either works or doesn't," Purves

said. "You ultimately die or you survive based on the success of what you do in the world, and if you do survive, the improvements in visual circuitry that allowed this success are passed on to the next generation. This is standard evolutionary thinking. Eventually, you end up with a system that can make the link between what is really in the world and what is recorded on your retina."

The study was published in *PNAS* Early Edition online on October 13.

Other explanations of the flash-lag effect have included theories that the effect is a mismatch between systems dedicated to the perception of speed and the perception of position, and also theories of how stimuli are integrated over time.

The researchers measured the flash-lag effect over its full range, with objects moving at different speeds in the field of vision.

Study subjects viewed a projection screen through a hole and used a remote control to reposition an LED (light-emitting diode) light so that it would align with the center of a moving vertical bar of laser light. The vertical bar moved at different speeds.

Purves and colleagues found that the lag time increased in a nonlinear manner as the moving object increased its speed. The empirical relationship between moving objects in a simulated world and their projection onto a simulated retina accurately predicted the function derived in this way.

The study thus showed that the perception of lag is the result of accumulated experience with image speeds, which allows successful visual behavior in response to real-world sources whose speeds and positions cannot be known directly, Purves said.

The lag is present in all normal motion perceptions, but has to be demonstrated in the lab. "We are simply not aware of it since we have no trouble dealing with moving objects," he said.

Source: Duke University Medical Center