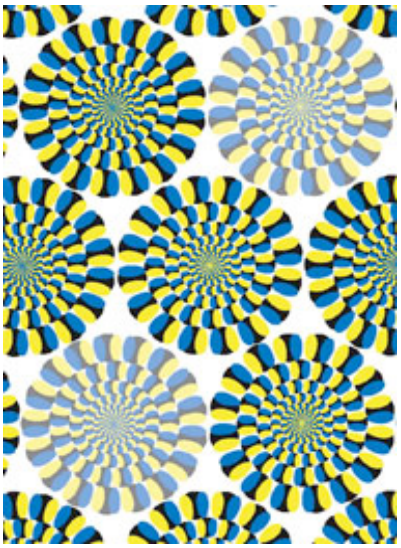

Look closely.
High-contrast objects appear to move faster than low-contrast ones.

Credit: Akiyoshi Kitaoka, Ritsumeikan University, Japan / Alan Stocker, NYU

High-Speed Surprise for Lying Eyes

By Ingrid Wickelgren
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The next time you drive in the fog, check your speedometer. You may be speeding and not know it. That's because--when the visual landscape lacks contrast--people perceive objects moving much slower than they actually are. A new study debuts the first convincing, quantitative explanation for this potentially dangerous visual mistake.

In 1982, psychologist Peter Thompson of York University, United Kingdom, first noticed that when two objects of different contrast are moving at the same speed, people always say the higher contrast object is moving faster. Researchers brushed off this misperception, dubbed "the Thompson effect," as a kink in an otherwise precisely tuned visual machine. But a few years ago, Eero Simoncelli, a computational neuroscientist at New York University in New York City, and his colleagues wondered if they could explain this phenomenon using basic principles of human vision.

Simoncelli knew that the eye does not simply record light patterns like a camera does: Instead, what people see depends greatly on past experience (a cloud looks like a boat to one person and a truck to another, for example). So he and colleagues suspected that, when real information is sketchy (as it is in low-contrast situations), people rely even more heavily on their expectations. In a 2002 paper, the researchers used Bayesian statistics--a branch of mathematics that shows the ideal way to combine expectations with new information--to prove that this was indeed the case. It could also account for the Thompson effect, they argued.

Now Simoncelli and postdoc Alan Stocker have confirmed their theory with a real-life experiment. They asked each of five people to judge which of a pair of gratings on a computer screen appeared to be moving faster. Each person did this about 6000 times with the speed and contrast levels of the gratings changing from one trial to the next.

Stocker and Simoncelli then used Bayesian math to work backwards from each person's speed perceptions to determine what his or her expectations must have been. They confirmed that people expect slow movement over fast, and the team measured just how much more probable people expect slower speeds to be than faster ones. Simoncelli, whose findings appeared online Sunday in *Nature Neuroscience*, says that the findings might someday be used to devise better treatments for stroke victims who have trouble seeing motion or to build better driver-defense systems.

Matteo Carandini, a computational neuroscientist at Smith-Kettlewell Eye Research Institute in San Francisco, California, thinks the work's greatest import may be for basic research. "This opens the door" to finding the location of speed perception in the brain, he says.

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