Faster brain waves make shorter gaps in the visual stream

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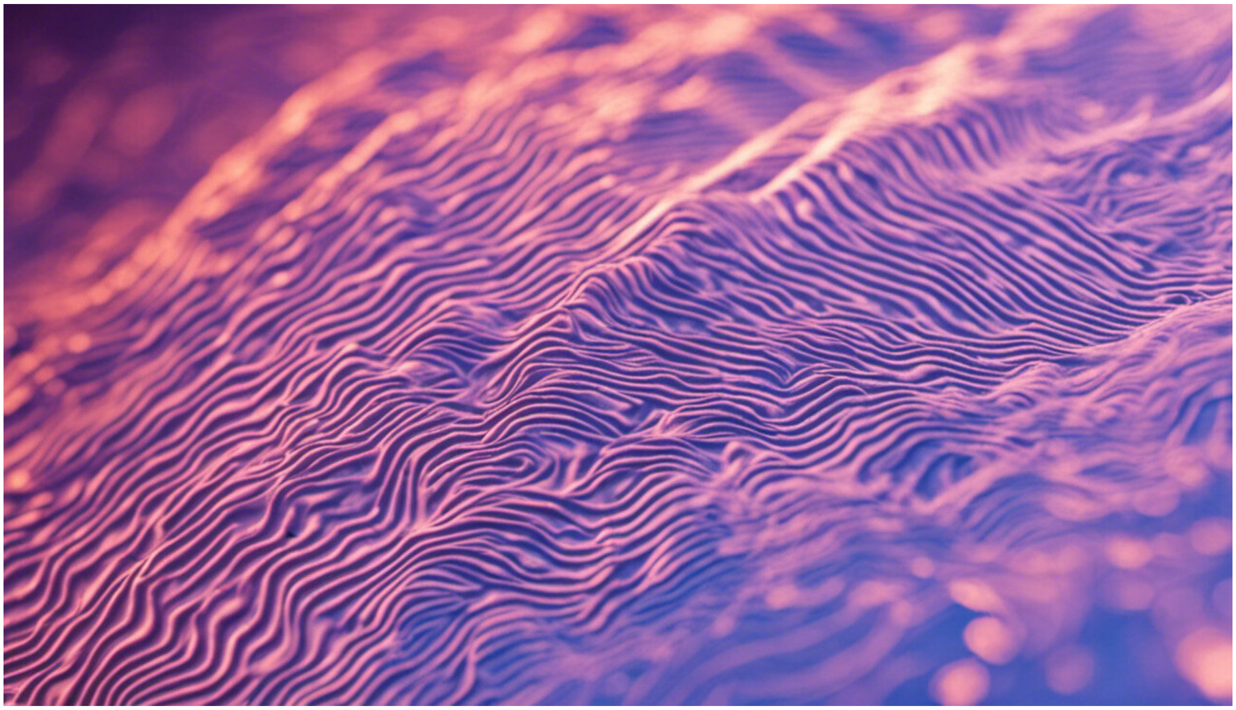

Credit: AI-generated image (disclaimer)

"Blink and you'll miss it" isn't only for eyelids. The human brain also blinks, dropping a few frames of visual information here and there.

Those lapses of attention come fast—maybe just once every tenth of a second. But some people may be missing more than others, according to psychologists at the University of Wisconsin-Madison.

"Intuitively we have this sense that we're viewing the world in a continuous stream, constantly taking in the same amount of information," says Jason Samaha, a UW-Madison doctoral student in psychology. "So if I told people that every 100 milliseconds their brains were taking a bit of a break, I think that would surprise a lot of them."

Samaha and UW-Madison psychology Professor Brad Postle have drawn a connection between that quick blink in the visual processing system and a rhythmic pattern in the brain's electrical activity called the alpha oscillation.

Alpha oscillations are regular fluctuations in the electrical activity in the back of the human brain—an area that includes the visual cortex, responsible for processing signals from the eyes. These alpha oscillations rise and fall endlessly, tracing a wave-like thrum of brain activity.

Recently, brain researchers demonstrated that our visual acuity is at its best when a visual stimulus appears as the alpha wave is near a certain peak. The farther from that peak, the more likely a flash of visual information falls on the retina without consciously registering on the viewer.

"That made us wonder: Maybe this is a neural marker that can predict the rate at which we sample the world visually," says Samaha, whose work on that marker was published recently in the journal *Current Biology*. "Someone with a faster alpha oscillation has more of those peaks. It's almost as if they're sampling the world more frequently than someone with a slower alpha oscillation."

To test that idea, Samaha sat people in front of a screen and asked them to watch closely spaced flashes of light. Their alpha oscillations were recorded before and during the task.

"The flashes can be so close together that they appear to be one," Samaha says. "A delay of 10 milliseconds (just one-hundredth of a second), for example, is just too fast for you to perceive two flashes."

The longer the delay between flashes, the more likely the test subjects could correctly discern two flashes from one. But the subjects began to sort themselves out based on alpha frequency.

"People with a faster alpha frequency can perceive two flashes with a significantly shorter gap between them—maybe 25 milliseconds," says Samaha, "whereas someone with a slower alpha frequency can't perceive two flashes until they have closer to 45 milliseconds delay."

The faster the regular rhythm of the working brain (represented by alpha oscillation), the more fine-grained the resolution in visual perception.

Of course, precious few discrete events take place within a couple dozen milliseconds. Blinking eyelids can take 400 milliseconds—a relatively pregnant pause—to close and reopen. But in cases where physical reaction time is at a premium, every bit helps.

Samaha thinks of a baseball player. In the 400 milliseconds it takes a professionally thrown fastball to reach the plate, the batter has to budget time for locating the baseball, identifying its spin, deciding whether and where to swing, and actually whipping the bat around to the right spot.

"In a very brief window of time, you have to choose to begin a reaction and where to direct it," says Samaha. "Having finer resolution may help in cases like that. Maybe good hitters—and other people who can react quickly to a visual stimulus—have very fast alpha oscillations."

World Series outcomes aside, Samaha sees the study's results contributing to deeper discussions of how we relate to the world around us.

"The more interesting implications of the research concern what constitutes our conscious visual perception of the world," he says. "We seem to find a neural marker of conscious visual updating, and that's interesting to a lot of people who are looking for neural correlates of consciousness."

Provided by University of Wisconsin-Madison

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