Medical Xpress

Study shows human brain pre-plays anticipated events in fast motion

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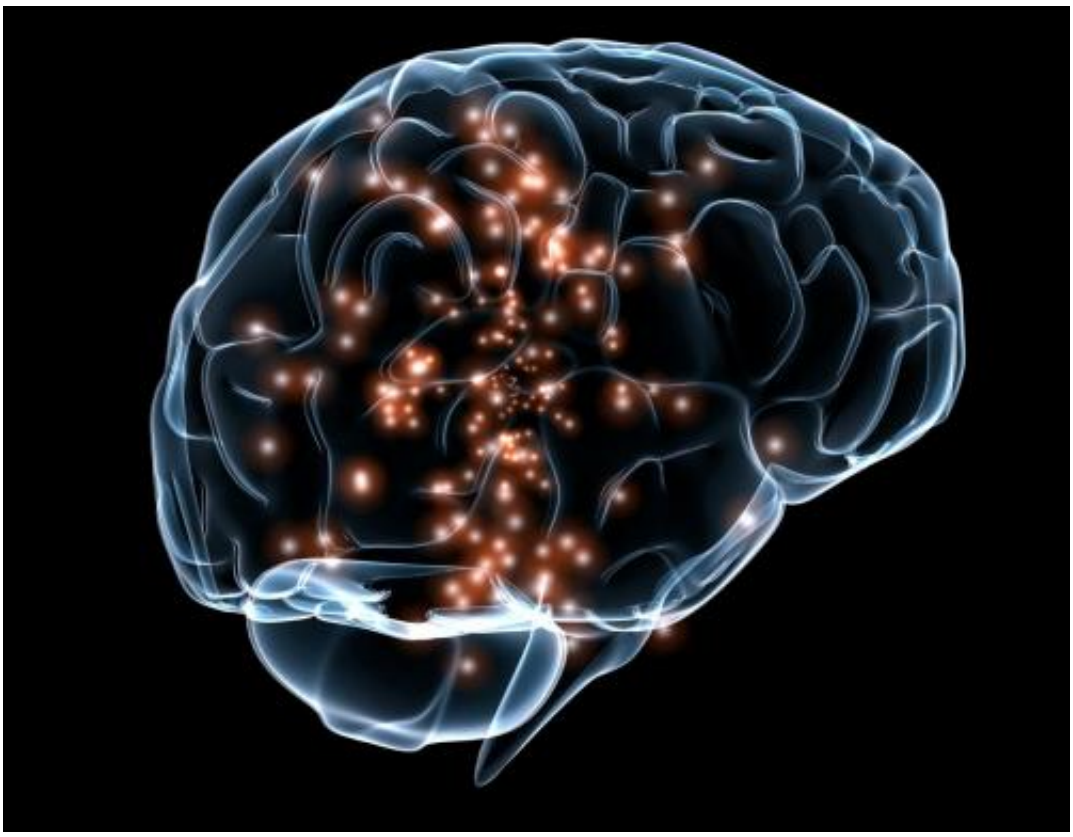

Credit: Wikimedia Commons

(Medical Xpress)—A trio of researchers with Radboud University Nijmegen in the Netherlands has found evidence that suggests the human brain learns how some objects move and then replays it when it predicts a familiar scenario is about to unfold—and it does so in fast

motion. In their paper published in the journal *Nature Communications*, Matthias Ekman, Peter Kok and Floris P. de Lange describe experiments they carried out with volunteers watching moving objects while being observed via fMRI.

Brain scientists have noted for some time the human ability to forecast the motion of external objects. Examples include athletes anticipating where a ball will come down after being batted into the air, or sportsmen gauging the distance they have to lead an animal before pulling the trigger. But the neural dynamics have not been understood. In this new effort, the researchers found what they believe is a part of the puzzle—time-compressed preplay of anticipated events.

To learn more about what happens in our brains when we are learning how to anticipate the path of a moving object, the researchers subjected 29 volunteers to fMRI scanning while they watched a white dot move first one way across a screen and then back, repeatedly over several minutes. In looking at the scans, the researchers discovered which parts of the brain were involved in the learning process, particularly in the visual cortex.

The same volunteers were allowed to rest for five minutes and then were shown the white dots on the screen again, but this time, they only saw the beginning of the sequence. But that was enough, the researchers report, to push the brain into action—it lit up in the same ways it had when watching the full sequence, suggesting that it was replaying what it had been seen earlier, allowing the person to visualize what was going to happen—but faster. The replay ran approximately twice as fast as the actual event, which, the researchers note, would give the person time to anticipate something that was about to occur—the route a car would take as it passed through the intersection in front of them, for example, or a dog running across their path.

The researchers acknowledge that real-world conditions are obviously far more complex, but suggest that what they observed in their scans likely plays a role in such events as well.

More information: Matthias Ekman et al. Time-compressed preplay of anticipated events in human primary visual cortex, *Nature Communications* (2017). DOI: 10.1038/ncomms15276

Abstract
Perception is guided by the anticipation of future events. It has been hypothesized that this process may be implemented by pattern completion in early visual cortex, in which a stimulus sequence is recreated after only a subset of the visual input is provided. Here we test this hypothesis using ultra-fast functional magnetic resonance imaging to measure BOLD activity at precisely defined receptive field locations in visual cortex (V1) of human volunteers. We find that after familiarizing subjects with a spatial sequence, flashing only the starting point of the sequence triggers an activity wave in V1 that resembles the full stimulus sequence. This preplay activity is temporally compressed compared to the actual stimulus sequence and remains present even when attention is diverted from the stimulus sequence. Preplay might therefore constitute an automatic prediction mechanism for temporal sequences in V1.