Study finds that a surprise stimulus helps people stop an action

February 14 2018, by Richard C. Lewis

Researchers from the University of Iowa studied how people stopped an action--first by measuring participants' brain waves and second by clocking the amount of time it took participants to stop an action when prompted to do so. The researchers found that an outside stimulus--the experimenters used a tone--led to a 15 percent improvement in the subjects' ability to physically stop an action. The finding offers promising insight in the brain's communication with the motor system, insight that could help clinicians treat patients with neurodegenerative disorders that involve motor-control deficiencies, from

Parkinson's disease to aging. Credit: Tim Schoon, University of Iowa

Imagine reaching to pet your cat, and it hisses at you. How does your brain take stock of the sound and communicate with your body to pull back your hand?

Neuroscientists are interested in how the brain communicates with the motor system to help your body stop an action. This communication is vital because it helps us avoid surprises and react to potentially dangerous or unforeseen circumstances.

In a new study, University of Iowa researchers studied how people stopped an action. The researchers found that when participants heard an unexpected sound, they stopped an action more often than when they heard no sound at all.

The finding offers promising insight in how an external stimulus—an auditory, visual, or other sensory cue—could speed up the brain's communication with the motor system. That could help clinicians treat patients with motor-control disorders, such as Parkinson's disease and ADHD, as well as address the decline in motor control that accompanies aging.

"It seems like the brain's communication with the motor system is so hard wired, and this ability to stop an action is so innate that even repeated practice won't really alter it," says Jan Wessel, assistant professor in the UI Department of Psychological and Brain Sciences and corresponding author on the study, published in the *Journal of Neuroscience*. "Therefore, finding other avenues to trigger the brain's rapid stopping and improve stopping outcomes could be of great potential."

Wessel's team instructed a small group of participants to tap their foot on a pedal when they saw the letter "W" on a computer screen. The respondents tapped the right foot when the letter appeared on the right side of the screen, and the left foot when the letter appeared on the left side of the screen. When a stop signal (the letter "M") appeared on screen, the participants were told to not tap either foot, meaning to stop their action.

The twist is the researchers played a bird sound—without warning—during some instances when they displayed the stop signal.

The test takers stopped their action 80 percent of the time when the bird sound accompanied the stop signal, compared to 65 percent of the time when no sound accompanied the stop signal. That's a 15 percent increase in successfully stopping the action.

"The main behavioral result is when the stop signal is accompanied by an unexpected event, people are more likely to stop," says Wessel, who has an appointment in the UI Department of Neurology and with the Iowa Neuroscience Institute. "And the reason we think that happens is your mind is telling the motor system, 'I know you're currently carrying out this action, but stop it, rapidly, right now.'

"It doesn't really matter that it's a sound. It's an unexpected event," Wessel says. "The hypothesis is that an unexpected visual event, or an unexpected vibration on your skin, would have the same effect. It's just the fact that something happened that was unanticipated."

The researchers repeated the motor-control experiment to learn what was happening in the brain. They outfitted participants with caps that measured electrical activity in regions of the brain known to inhibit movement. In those tests, the researchers found that brainwave activity increased when the bird sound accompanied instructions to stop.

"What that showed is when there is an unexpected event, the stopping signal from the brain is increased," Wessel says. "So, now, with both experiments, we show a link between the brain signaling to stop, and the physiological manifestation with the motor system."

The communication between the brain and the motor system is nearly instantaneous, occurring in fractions of a second. Wessel thinks this is a basic survival mechanism, rooted in the earliest humans.

"It really is that basic," Wessel says. "Our brain has evolved to do this. The human brain is adapted for survival, and I think that's why these systems are hardwired with one another."

The paper is titled "Perceptual surprise improves action stopping by non-selectively suppressing motor activity via a neural mechanism for motor inhibition." Its first author is Isabella Dutra, a UI junior psychology major from Northfield, Illinois.

"I was able to gain a much deeper understanding of the relationships between human flexible behavior and the underlying involvement of human neurological processes," says Dutra, who earned a fellowship from the Iowa Center for Research by Undergraduates to be involved in the study.

More information: Isabella C. Dutra et al, Perceptual Surprise Improves Action Stopping by Nonselectively Suppressing Motor Activity via a Neural Mechanism for Motor Inhibition, *The Journal of Neuroscience* (2018). DOI: 10.1523/JNEUROSCI.3091-17.2017

Provided by University of Iowa

Medical Xpress

Citation: Study finds that a surprise stimulus helps people stop an action (2018, February 14) retrieved 6 May 2024 from https://medicalxpress.com/news/2018-02-stimulus-people-action.html

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.