LEIBNIZ-INSTITUT
FÜR ARBEITSFORSCHUNG
AN DER TU DORTMUND

Leibniz Gemeinschaft

PRESS RELEASE

Leibniz-Institut für Arbeitsforschung in Dortmund

19. August 2025

Under Pressure: How stress affects the brain, and what non-invasive brain stimulation can do about it

Inducing acute stress reliably under controlled conditions remains a major challenge in scientific research. It is difficult to find effective paradigms that can elicit stress reliably and be ecologically valid at the same time. A research team at the Leibniz research centre for Working Environment in Dortmund (IfADo) investigated how acute psychological stress affects the brain and vegetative physiology, and whether non-invasive brain stimulation can reduce stress-related impairments in working memory performance. To induce psychological stress in a targeted way, the team successfully applied a specially developed aversive video paradigm (AVP) to induce deficits in working memory performance and then used non-invasive brain stimulation techniques to rescue them.

Out of Balance: How Stress Shifts Brain Function

As part of the study, the researchers presented emotionally intense video clips to induce acute stress. The participants subjectively reported an increase in anxiety and negative affect. Neurophysiological and physiological stress responses also rose significantly, as evidenced by elevated salivary cortisol levels and decreased heart rate variability. EEG measurements also revealed altered brain activity. “Our analyses indicate reduced top-down control and increased bottom-up processing,” explains Sumit Roy, researcher in the Neuromodulation group at IfADo. “In this state, conscious, goal-directed control of thoughts and actions is impaired, while the processing of sensory stimuli and impulsive reactions is heightened. The result: increased sensitivity to salient stimuli, difficulties concentrating, and problems with impulse control and decision-making, known hallmarks of stress.” Furthermore, it also caused disruption in a working memory task done after the paradigm.

Non-invasive brain stimulation to enhance memory performance

During the experiment, later participants were asked to perform a task immediately after stress induction that measured working memory performance. To do this, participants attended to a series of letters and had to press a button when a letter appeared that was the same as one shown 2, 3, or 4 steps earlier in the sequence.

To reduce the effect of stress on participants' memory performance, the researchers compared the effects of transcranial direct current stimulation (tDCS) to two prefrontal regions, namely the left dorsolateral prefrontal cortex (dlPFC) and the ventromedial prefrontal cortex (vmPFC), which are critically involved in working memory and emotional regulation, respectively.

The strongest effects were observed with vmPFC stimulation – the brain area responsible for emotional regulation and evaluation. Participants were able to concentrate better on the memory task, and cortisol release was also reduced.
The results thus suggest that targeted modulation of vmPFC through transcranial direct current stimulation has the potential to stabilize control processes under stress and reduce neurophysiological stress responses.

Originalpublikationen:

Sumit Roy, Yan Fan, Mohsen Mosayebi-Samani, Maren Claus, Nilay Mutlu, Thomas Kleinsorge, Michael A. Nitsche, 2025. *Multimodal assessment of acute stress dynamics using an aversive video paradigm (AVP).* International Journal of Clinical and Health Psychology 100607. https://doi.org/10.1016/j.ijchp.2025.100607

Sumit Roy, Yan Fan, Mohsen Mosayebi-Samani, Maren Claus, Fatemeh Yavari, Thomas Kleinsorge, Michael A. Nitsche, 2025. *Modulating prefrontal cortex activity to alleviate stress-induced working memory deficits: A transcranial direct current (tDCS) study*. International Journal of Clinical and Health Psychology 100569. https://doi.org/10.1016/j.ijchp.2025.100569

Scientific Contact:

Sumit Roy
E-Mail: roy@ifado.de
Tel.: 0231 1084-473

Prof. Dr. Michael Nitsche
E-Mail: nitsche@ifado.de
Tel.: 0231 1084-301

Pressekontakt:
Saskia Schlesinger
E-Mail: schlesinger@ifado.de
Tel.: 0231 1084 -239