Neurofeedback helps to control learning success

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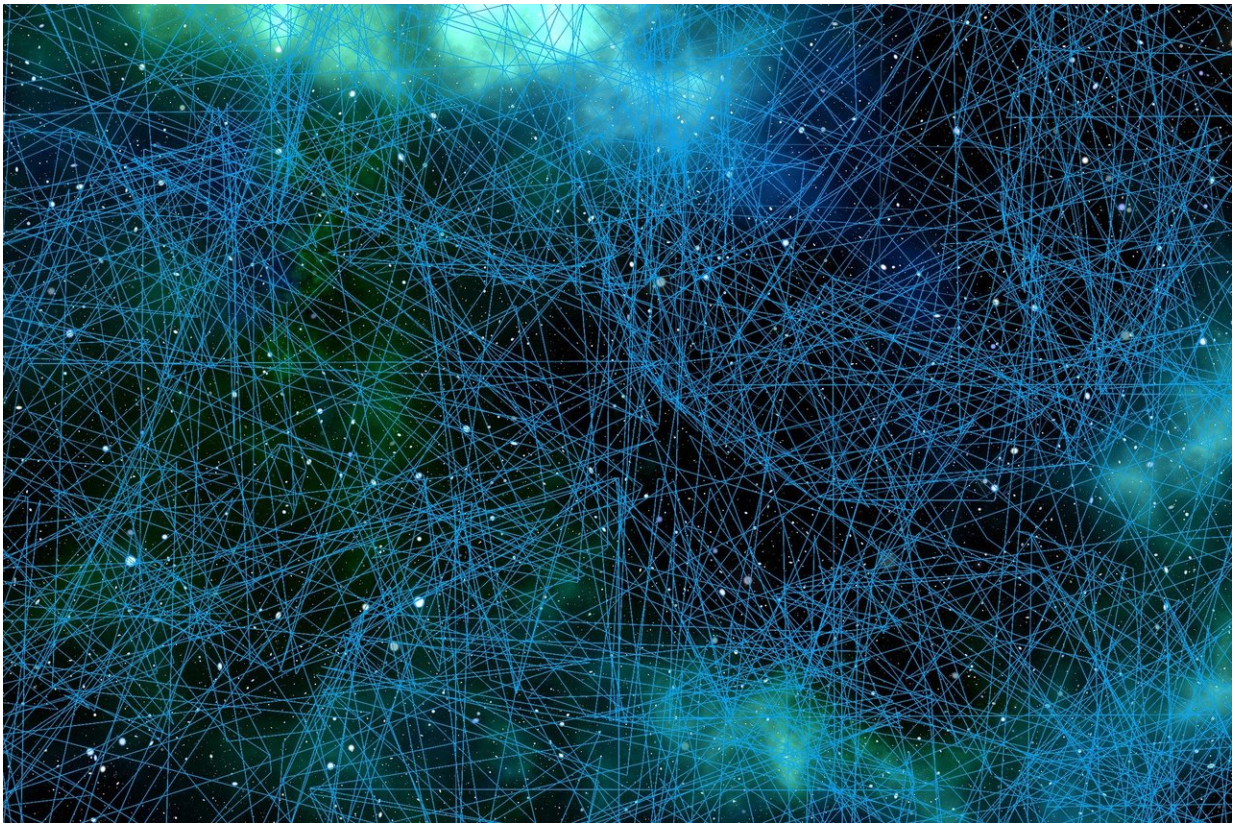

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Thanks to an interplay of inhibition and disinhibition of certain areas, our brain can always guarantee the processing of particularly important stimuli. Neuronal alpha-oscillations regulate the flow of information in

certain regions of the brain so that capacities for the processing of new stimuli are released. "The correct timing of alpha oscillations is strongly related to performance in cognitive tasks and perception tests," explains Dr. Hubert Dinse from the Institute of Neuroinformatics and the Department of Neurology at Bergmannsheil.

So far, however, it has not been clear whether learning outcomes can also be influenced by alpha oscillations. In order to clarify this, the team, which also includes Hubert Dinse, Marion Brickwedde and Marie C. Krüger, taught young healthy people how to regulate their alpha oscillations up or down.

Thoughts and feelings influence the oscillations

For two consecutive days, the test subjects took part in what is known as neurofeedback training, during which they received real-time feedback on their brain signal in the form of colours on a computer screen. "In this way, the participants were able to learn which thoughts or feelings they could use to amplify or reduce alpha oscillations in touch-processing regions of the brain," explains Marion Brickwedde.

Following this, the right index finger of the participants was electrically stimulated for 20 minutes. This stimulates cortical learning processes and improves the sense of touch. This process is independent of previous experience, motivation or attention and thus enables a particularly efficient investigation of the cortical basics of learning.

Participants who were able to successfully amplify their alpha oscillations experienced a particularly strong improvement in their sense of touch. In contrast, participants who reduced their alpha oscillations did not improve at all on average as a result of the stimulation.

This process can be explained by a targeted neuronal distribution of

resources. Strong alpha oscillations reduce information processing, releasing many neuronal resources that are then available for important incoming information. If only a few resources are available, as is the case with low alpha oscillations, information processing is less efficient. "Alpha neurofeedback training could therefore be a means of enhancing learning success in everyday, rehabilitative or clinical contexts," concludes Hubert Dinse.

More information: Marion Brickwedde et al. Somatosensory alpha oscillations gate perceptual learning efficiency, *Nature Communications* (2019). DOI: 10.1038/s41467-018-08012-0

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