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Morse code is key to learning mechanisms in the brain

Researchers at Bergmannsheil University Hospital find "adaptive neuroplasticity"

3-Tesla MRI scanner gives insights into the working brain

Researchers at Bergmannsheil University Hospital have investigated how the brain behaves during a learning process and which areas of the brain play a part in solving different analytical tasks. In a recent study they asked participants to learn and decode parts of the Morse alphabet. A magnetic resonance imaging (MRI) scanner measured their brain activity during the tasks. The scientists were able to show that a common network of brain areas is activated. Depending on the task at hand, further areas are recruited – the neuroscientists call this "adaptive neuroplasticity". The journal "Human Brain Mapping" has published these findings.

Morse code ideal for study

Researchers at the Bergmannsheil's Neurological Clinic (neuroplasticity group led by Prof. Dr. Tobias Schmidt-Wilcke) are investigating how brain activity develops during learning and which parts of the brain are accessed for different tasks. The Morse alphabet has proven to be especially suitable for such an analysis. It is a system of transmitting text by short and long signals, as well as pauses, which is still used in radio transmissions today. The participants of the study did not previously know Morse code, which made it ideal to examine learning processes, similar to acquiring written language. Furthermore, the properties of the Morse alphabet allow for the analysis of different levels of processing using the same signal set. During the study, participants were asked, in different sessions, to analyze length and meaning of Morse code.

fMRI scans show common brain network

Before and after the learning phase, the subjects were scanned in the Ruhr University's own 3-Tesla magnetic resonance imaging (MRI) scanner, while analyzing the length and meaning of Morse code. Functional MRI (fMRI), an imaging technique, which combines the indirect measurement of local blood oxygenation in the brain with statistical methods, gives neuroscientists a view of the brain at work. The scans showed that during the relatively simple task of determining the signal length, as well as during the more complex decoding of meaning, a common network of brain areas is active. A remarkable feature of this network is its ability to recruit additional brain areas as the learning of Morse code progresses. Triggered by learning, the network is extended to include new cortical areas, which are then accessed to complete specific tasks. "Our study shows the development of dynamic networks during the learning

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process. These networks then recruit new parts of the brain to tackle particular tasks. We call this ‘adaptive neuroplasticity’, “ explains PhD student Lara Schlaffke.

Research grant

The study was performed as part of the Collaborative Research Center 874 and is the joint effort of two sub-projects. Collaborative Research Center 874 is funded by the German Research Foundation (Deutsche Forschungsgemeinschaft – DFG) to investigate how sensory input is processed in the brain and how this results in complex behavior and memory formation.

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