Brain activity

“Brain activity” refers to the patterns of electrical and chemical activity that occur in the brain. The brain is composed of billions of neurons, which are specialized cells that transmit information through electrical and chemical signals. When neurons communicate with each other, they generate patterns of activity that can be detected and measured.

There are several methods used to study and measure brain activity, including:

Electroencephalography (EEG).

Magnetoencephalography (MEG).

Functional Magnetic Resonance Imaging (fMRI): fMRI measures changes in blood flow and oxygenation to infer neural activity. It is widely used in neuroimaging studies to identify brain regions involved in specific tasks or processes. However, it has lower temporal resolution compared to EEG and MEG.

Positron Emission Tomography (PET): This imaging technique involves injecting a radioactive tracer into the bloodstream, which is then detected by a PET scanner. It provides information about metabolic activity in the brain.

Single-Unit Recording: This method involves inserting tiny electrodes into individual neurons to record their electrical activity. It provides very detailed information about the activity of specific neurons but is usually done in animal studies or, in rare cases, in humans undergoing brain surgery.

Understanding brain activity is crucial for unraveling the mysteries of cognition, behavior, and various neurological and psychiatric disorders. Researchers use these methods to investigate how different brain regions function, how they communicate, and how alterations in brain activity may be associated with various conditions or diseases. Additionally, advancements in neuroscience continue to refine our understanding of brain activity and its role in human experience and health.

Using brain activity directly as input for assistive tool control can circumventmuscular dysfunction and increase functional independence for physically impaired people. The motor cortex is commonly targeted for recordings, while growing evidence shows that there exists decodable movement-related neural activity outside of the motor cortex. Several decoding studies demonstrated significant decoding from distributed areas separately. Here, we combine information from all recorded non-motor brain areas and decode executed and imagined movements using a Riemannian decoder. We recorded neural activity from 8 epilepsy patients implanted with stereotactic-electroencephalographic electrodes (sEEG), while they performed an executed and imagined grasping tasks. Before decoding, we excluded all contacts in or adjacent to the central sulcus. The decoder extracts a low-dimensional representation of varying number of components, and classified move/no-move using a minimum-distance-to-geometric-mean Riemannian classifier. We show that executed and imagined movements can be decoded from distributed non-motor brain areas using a Riemannian decoder, reaching an area under the receiver operator characteristic of 0.83 ± 0.11. Furthermore, we highlight the distributedness of the movement-related neural activity, as no single brain area is the main driver of performance. Our decoding results demonstrate a first application of a Riemannian decoder on sEEG data and show that it is able to decode from distributed brain-wide recordings outside of the motor cortex. This brief report highlights the perspective to explore motor-related neural activity beyond the motor cortex, as many areas contain decodable information [1)]

Your brain activity differs depending on whether you're working on a task, or at rest — and just how much that activity differs may be linked to how smart you are, a new study finds.

Researchers found that people who displayed similar brain activity while at rest compared to while they were completing a mental task performed those tasks more efficiently than people whose brain activity differed more between their resting state and when they were working on a task.

In the study, the researchers analyzed a series of brain scans on 100 healthy adults who had participated in the Human Connectome Project, an ongoing neuroscience effort that involves researchers at many U.S. institutions, including the University of Southern California and Harvard University. The participants were asked to sit quietly during one of the brain scans so that scientists could see how their brains looked in a "resting state." Then, the participants were asked to perform a series of cognitive tests while having their brains scanned

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The cause of the cessation of brain activity (CBA) can usually be determined by a combination of medical history, physical examination, laboratory tests and imaging studies.

see Brain death

[1)]
Ottenhoff MC, Verwoert M, Goulis S, Colon AJ, Wagner L, Tousseyn S, van Dijk JP, Kubben PL, Herff C. Decoding executed and imagined grasping movements from distributed non-motor brain areas using a Riemannian decoder. Front Neurosci. 2023 Nov 23;17:1283491. doi: 10.3389/fnins.2023.1283491. PMID: 38075279; PMCID: PMC10701391.