idw - Informationsdienst Wissenschaft
Nachrichten, Termine, Experten

Pressemitteilung

Max-Planck-Institut für empirische Ästhetik
Dr. Keyvan Sarkhosh

24.03.2025
http://idw-online.de/de/news849434

Forschungsergebnisse
Medizin, Psychologie, Sportwissenschaft
überregional

How the Brain Predicts the Immediate Future

Scientists Discover the Neural Signatures of Anticipation

Imagine a boxer dodging a punch, a musician perfectly timing a note, or a driver anticipating a green light—the brain can be seen as an amazing tool that is constantly predicting the future. But how does it do this? A team of neuroscientists from the Max Planck Institute for Empirical Aesthetics (MPIEA), the Ernst Strüngmann Institute (ESI) for Neuroscience, both in Frankfurt am Main, Germany, and the Goethe University Frankfurt, Germany, has shown for the first time how specific brain rhythms predict the timing of future events. The results were recently published in the journal Nature Communications.
The study reveals the key variable shaping our ability to anticipate upcoming events: probability over time. This probability is represented in brain waves that have a certain number of oscillations per second. These oscillations occur in the frequency ranges alpha, with seven to twelve hertz, and beta, with 15 to 30 hertz:

“The results show that brain waves in these frequency ranges forecast the time point at which future events will occur. The more predictable an event, the stronger the neural oscillations. This allows the brain to react faster and more efficiently,” explains first author Matthias Grabenhorst from ESI (formerly MPIEA).

Using magnetoencephalography (MEG), the research team was able to locate three key areas of the brain that track when something is likely to happen: First, the posterior parietal cortex, which is a hub for timing and motor preparation, plays an important role. In addition, the posterior middle temporal gyrus, which is crucial for processing events over time, is active. And also, the sensorimotor cortex plays a role, as it is directly involved in movements to predicted events.

The findings could have wide-ranging implications for our understanding of decision-making and attention, as well as athletic performance and neurological disorders:

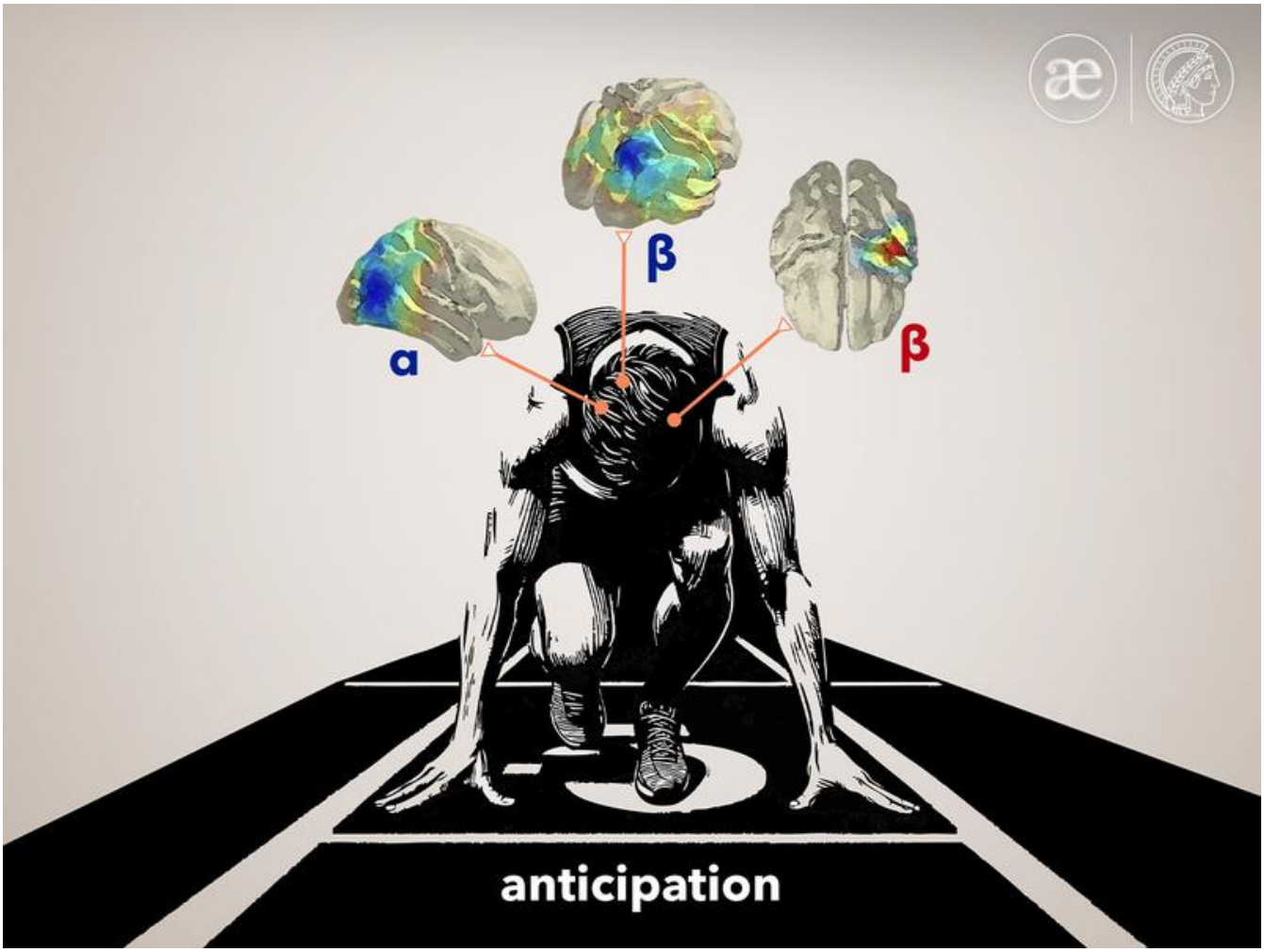
“The study opens new doors for exploring the fundamental role of brain rhythms in how we navigate time and the future. For example, these rhythms could one day be used to train the brain to think ahead. Or disruptions in these signals could explain why certain diseases such as ADHD or Parkinson’s affect timing and reaction speed,” concludes senior author Georgios Michalareas of Goethe University, who participated in the study as a researcher at the MPIEA.

The study is part of a larger research project, “The Anticipation of Events in Time,” from which two studies have already been published.

wissenschaftliche Ansprechpartner:
Matthias Grabenhorst
Georgios Michalareas

Originalpublikation:

Grabenhorst, M., Poeppel, D., & Michalareas, G. (2025). Neural Signatures of Temporal Anticipation in Human Cortex Represent Event Probability Density. Nature Communications. https://doi.org/10.1038/s41467-025-57813-7



Three key areas in the brain track when something is likely to happen.
Collage: MPIEA