# Researchers pinpoint brain waves that distinguish false memories from real ones

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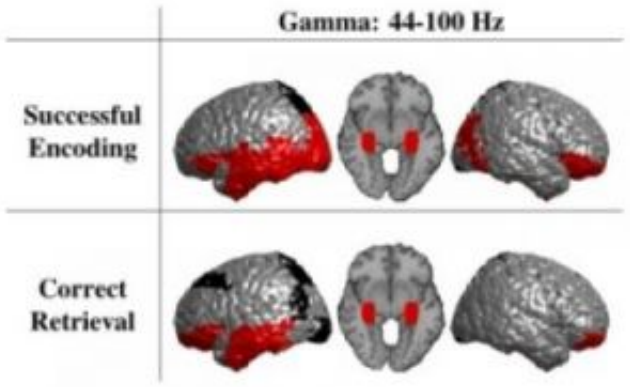


EEG imaging demonstrates that the same parts of the brain are used to encode and correctly retrieve information. Credit: Psychological Science, Per B. Sederberg, University of Pennsylvania

For the first time, researchers at the University of Pennsylvania are able to pinpoint brain waves that distinguish true from false memories, providing a better understanding of how memory works and creating a new strategy to help epilepsy patients retain cognitive function.

The study, the first to show that brain waves predict the veracity of human memories, is available online in the journal *Psychological Science* and in the November 2007 print edition.

To test whether distinct patterns of electrophysiological activity prior to

a response can distinguish true from false memories, psychologists at Penn recorded brain activity from 52 neurosurgical patients being treated for drug-resistant epilepsy. Patients were asked to perform a verbal free-recall task while researchers used an array of implanted electrodes and intracranial electroencephalographic recordings to locate where in their brains the patients' seizures originated. Patients volunteered to study lists of words which they were then asked to recall at a later time. When asked to recall the studied words, participants recalled some number of correct items and also made a small number of errors, recalling words that had not appeared on the target list.

While patients performed the memory game, scientists observed electrical activity in their brains to determine whether specific brain waves were associated with successfully storing and retrieving memories. Researchers found that a fast brain wave, known as the gamma rhythm, increased when participants studied a word that they would later recall. The same gamma waves, whose voltage rises and fall between 50 and 100 times per second, also increased in the half-second prior to participant's correctly recalling an item.

"These analyses revealed that the same pattern of gamma band oscillatory activity in the hippocampus, prefrontal cortex and left temporal lobe that predicts successful memory formation also re-emerged at retrieval, distinguishing correct from incorrect responses," said Per B. Sederberg, lead author and former Penn neuroscientist now performing post-doctoral research at Princeton University. The timing of these oscillatory effects suggests that self-cued memory retrieval initiates in the hippocampus and then spreads to the cortex. Thus, retrieval of true as compared with false memories induces a distinct pattern of gamma oscillations, possibly reflecting recollection of contextual information associated with past experience.

"Gamma waves actually predicted whether or not an item that was about

to be recalled was previously studied," said Michael Kahana, a professor of psychology in Penn's School of Arts and Sciences and lead investigator. "In other words, one could see a difference in brain activity just prior to remembering something that had and had not actually happened."

In addition to providing a better understanding of how memory works, the findings may also provide a clearer picture of how to assist those suffering with epilepsy. In epilepsy's 2.6 million American sufferers, brain oscillations become so strong that they sweep across the brain, producing seizures. Although seizures are controlled with medication in two-thirds of people with epilepsy, the remainder may be candidates for surgery to remove the brain regions where seizures originate.

"Identifying the neural signatures of successful memory storage and retrieval can help neurosurgeons reduce the cognitive deficits that might result from epilepsy surgery," said Brian Litt, associate professor of neurology and bioengineering at Penn, and a co-author of the study.

In addition, these techniques for mapping cognitive networks could give rise to better ways of mapping functional networks in brain, which may help in treating a number of neurological disorders, including depression, schizophrenia, head trauma and affective disorders, Litt said.

Source: University of Pennsylvania