Older and younger adults surf different brain waves

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Credit: Rice University

Cognitive scientists have found more evidence that aging brains work differently than younger brains when performing the same memory task, pointing to a potentially new direction for age-related cognitive care and exploration.

The study, led by the Rotman Research Institute at Baycrest Health Sciences, found that younger and older adults show very different brain wave patterns when performing the same memory task. The study was published online in January in the journal *Neurobiology of Learning and Memory*.

"We know that our brains change over time, but fully understanding how we make and recall memories as we age has been a mystery," said Renante Rondina, a University of Toronto and Rotman graduate student in the Department of Psychology and lead author of the study. "Our findings are really novel as they show distinct differences in brain activity from one generation to the next. By mapping these key differences, we may be able to identify new ways to predict, diagnose and screen for cognitive decline."

The findings show that rhythmic activity within key regions of the brain, including the hippocampus, an area that is involved with the formation and retrieval of memories, and the neocortex, the grey matter "wrapping paper" of the brain which is concerned with sight, hearing, attention, and high-level thinking, change with advanced age.

Structural magnetic resonance imaging (MRI), which measures the anatomy and structural integrity of the brain, and magnetoencephalography (MEG), which measures magnetic fields created by the brain's electrical activity, were used to track potential age-related differences as groups of younger and older adults performed a memory task. The median ages of the two groups were 24.8 and 65.9 years, respectively.

Rondina explained that brains are made up of billions of cells, which use electricity to communicate with each other. As signals are sent from one cell to the next, rhythmic patterns of electrical activity, commonly known as brain waves, are generated.

"Past studies have shown that brain waves travelling at slower speeds tend to be important for memory, while slightly faster speed brain waves play a role in our attention," said Rondina. "Other studies have looked at brain wave patterns as we process and recall memories, but our study is one of the first to look at key differences between younger and older adults' brain waves as they make and recall new memories."

While participant accuracy in the memory tasks was consistent across both groups, younger adults showed a surge in theta power (slower brain waves) that was predictive of their memory accuracy. In contrast, older adults demonstrated a rush of alpha oscillatory power (relatively faster brain waves) that was not observed in younger adults.

"It's remarkable to see how different the older participants' brain patterns are from the younger participants, while still maintaining accuracy," said Rondina. "According to the MRIs, there were minimal differences in the brain structures in the two groups, yet the brain waves were very different. With additional study, these results may lead to new, more sensitive ways of screening or diagnosing cognitive decline."

Rondina says the study's results do not immediately change diagnosis or treatment options for age-related cognitive impairments, but it will be interesting to see the long-term implications of these results, as we continue to learn how our brains change as we age.

Provided by Baycrest Centre for Geriatric Care