MedicalXpress

New study on multitasking reveals switching glitch in aging brain

April 11 2011

Scientists at the University of California, San Francisco have pinpointed a reason older adults have a harder time multitasking than younger adults: they have more difficulty switching between tasks at the level of brain networks.

Juggling multiple tasks requires short-term, or "working," memory – the capacity to hold and manipulate information in the mind for a period of time. Working memory is the basis of all mental operations, from learning a friend's telephone number, and then entering it into a smart phone, to following the train of a conversation, to conducting complex tasks such as reasoning, comprehension and learning.

"Our findings suggest that the negative impact of multitasking on working memory is not necessarily a memory problem, per se, but the result of an interaction between attention and memory," said the senior author of the study, Adam Gazzaley, MD, PhD, UCSF associate professor of neurology, physiology and psychiatry and director of the UCSF Neuroscience Imaging Center.

The finding, reported in the online early edition of *Proceedings of the National Academy of Sciences* (week of April 11, 2011), complements findings by the Gazzaley lab focused not on interruptions, or multitasking, but on distractions. This research showed that the brain's capacity to ignore distractions, or irrelevant information, diminishes with age and that this, too, impacts working memory.

Researchers know that multitasking negatively impacts working memory in both young and older adults. However, anecdotal accounts of "senior moments" – such as forgetting what one wanted to retrieve from the refrigerator after leaving the couch – combined with scientific studies conducted at UCSF and elsewhere indicate that the impact is greater in older people.

In the current study, scientists compared the working memory of healthy young men and women (mean age 24.5) and older men and women (mean age 69.1) in a visual memory test involving multitasking. Using functional magnetic resonance imaging, the researchers tracked blood flow in the participants' brains to identify the activity of neural circuits and networks.

Participants were asked to view a natural scene and maintain it in mind for 14.4 seconds. Then, in the middle of the maintenance period, an interruption occurred: an image of a face popped up and participants were asked to determine its sex and age. They were then asked to recall the original scene.

As expected, older people had more difficulty maintaining the memory of the original image. The fMRI analysis revealed why. When the young and older adults were interrupted, their brains disengaged from a memory maintenance network and reallocated neural resources toward processing the interruption. However, the younger adults re-established connection with the memory maintenance network following the interruption and disengaged from the interrupting image. The older adults, on the other hand, failed both to disengage from the interruption and to reestablish the neural network associated with the disrupted memory.

"These results indicate that deficits in switching between functional brain networks underlie the impact of multitasking on working memory

in older adults," said lead author Wesley C. Clapp, PhD, a postdoctoral fellow in the Gazzaley lab.

The lab's parallel research on the impact of distractions on working memory broadens the perspective of what happens in the aging brain. The ability to ignore irrelevant information – such as most of the faces in a crowded room when looking for a long-lost friend – and to enhance pertinent information such as the face of a new acquaintance met during the search for the old friend -- is key to memory formation.

"The impact of distractions and interruptions reveals the fragility of working memory," said Gazzaley, who also is a member of the W. M. Keck Center for Integrative Neuroscience at UCSF. "This is an important fact to consider, given that we increasingly live in a more demanding, high-interference environment, with a dramatic increase in the accessibility and variety of electronic media and the devices that deliver them, many of which are portable."

In addition to the research studies, Gazzaley's team is exploring the potential of software brain-training programs to help older people improve their ability to mentally process tasks simultaneously. "The ability to dynamically update working memory is critical to cognitive function," he said.

Provided by University of California, San Francisco