Old and young brains rely on different systems to remember emotional content

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Neuroscientists from Duke University Medical Center have discovered that older people use their brains differently than younger people when it comes to storing memories, particularly those associated with negative emotions.

The study, appearing online in the January issue of *Psychological Science*, is a novel look at how brain connections change with age.

Older adults, average age 70, and younger adults, average age 24, were shown a series of 30 photographs while their brains were imaged in a functional MRI (fMRI) machine. Some of the photos were neutral in nature and others had strong negative content such as attacking snakes, mutilated bodies and violent acts. While in the fMRI machine, the subjects looked at the photos and ranked them on a pleasantness scale. Then they completed an unexpected recall task following the fMRI scan to determine whether the brain activity that occurred while looking at the pictures could predict later memory. The results were sorted according to the numbers of negative and neutral pictures that were remembered or missed by each group.

The scientists found that older adults have less connectivity between an area of the brain that generates emotions and a region involved in memory and learning. But they also found that the older adults have stronger connections with the frontal cortex, the higher thinking area of the brain that controls these lower-order parts of the brain.

Young adults used more of the brain regions typically involved in emotion and recalling memories.

"The younger adults were able to recall more of the negative photos," said Roberto Cabeza, Ph.D., senior author and Duke professor in the Center for Cognitive Neuroscience. If the older adults are using more thinking than feeling, "that may be one reason why older adults showed a reduction in memory for pictures with a more negative emotional content."

"It wasn't surprising that older people showed a reduction in memory for negative pictures, but it was surprising that the older subjects were using a different system to help them to better encode those pictures they could remember," said lead author Peggy St. Jacques, a graduate student in the Cabeza laboratory.

The emotional centers of the older subjects were as active as those of younger subjects -- it was the brain connections that differed.

"If using the frontal regions to perform a memory task was always beneficial, then the young people would use that strategy, too," Cabeza said. "Each way of doing a task has some trade-offs. Older people have learned to be less affected by negative information in order to maintain their well being and emotional state – they may have sacrificed more accurate memory for a negative stimulus, so that they won't be so affected by it."

"Perhaps at different stages of life, there are different brain strategies," Cabeza speculated. "Younger adults might need to keep an accurate memory for both positive and negative information in the world. Older people dwell in a world with a lot of negatives, so perhaps they have learned to reduce the impact of negative information and remember in a different way." According to Cabeza, the results of the study are

consistent with a theory about emotional processes in older adults proposed by Dr. Laura Carstensen at Stanford University, an expert in cognitive processing in old age.

"One thing we might do in the future is to ask subjects to try to actively regulate their emotions as they look at the pictures," St. Jacques said. "Would there be a shift in the neural networks for processing the negative pictures when we asked younger people to regulate their emotional responses? How would that affect their later recall of the negative pictures?"

Source: Duke University Medical Center