Memory and Aging

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One of the key concerns of older adults is the experience of memory loss, especially as it is one of the hallmark symptoms of Alzheimer's disease. However, memory loss is qualitatively different in normal aging from the kind of memory loss associated with a diagnosis of Alzheimer's. Occasional lapses in memory are normal in aging adults, and understanding the distinction between normal symptoms and warning signs of Alzheimer's is critical.

Mild cognitive impairment

Recent research has identified a transitional state between the cognitive changes of normal aging and Alzheimer's disease (AD), known as mild cognitive impairment (MCI). Many people who experience mild cognitive impairment are at a high risk of developing Alzheimer's disease. Several studies have indicated that MCI individuals are at an increased risk for developing AD, ranging from 1% to 25% per year; 24% of MCI patients progressed to AD in 2 years and 20% more over 3 years, whereas a recent study indicated that the progression of MCI subjects was 55% in 4.5 years.

Memory decline in normal aging

Normal aging is associated with a decline in various memory abilities in many cognitive tasks; the phenomenon is known as age-related memory impairment (AMI) or age-associated memory impairment (AAMI). The ability to encode new memories of events or facts and working memory shows decline in both cross-sectional and longitudinal studies. Studies comparing the effects of aging on episodic memory, semantic memory, short-term memory and priming find that episodic memory is especially impaired in normal aging; some types of short-term memory are also impaired. The deficits may be related to impairments seen in the ability to refresh recently processed information. Source information is one type of episodic memory that suffers with old age; this kind of knowledge includes where and when the person learned the information. Knowing the source and context of information can be extremely important in daily decision-making, so this is one way in which memory decline can affect the lives of the elderly. Therefore, reliance on political stereotypes is one way to use their knowledge about the sources when making judgments, and the use of metacognitive knowledge gains importance. This deficit may be related to declines in the ability to bind information together in memory during encoding and retrieve those associations at a later time.

In particular, associative learning, which is another type of episodic memory, is vulnerable to the effects of aging, and this has been demonstrated across various study paradigms. This has been explained by the Associative Deficit Hypothesis (ADH), which states that aging it associated with a deficiency in creating and retrieving links between single units of information. This can include knowledge about context, events or items. The ability to bind pieces of information together with

their episodic context in a coherent whole has been reduced in the elderly population. Furthermore, the older adults' performances in free recall involved temporal contiguity to a lesser extent than for younger people, indicating that associations regarding contiguity become weaker with age.

Several reasons have been speculated as to why older adults use less effective encoding and retrieval strategies as they age. The first is the "disuse" view, which states that memory strategies are used less by older adults as they move further away from the educational system. Second is the "diminished attentional capacity" hypothesis, which means that older people engage less in self-initiated encoding due to reduced attentional capacity. The third reason is the "memory self-efficacy," which indicates that older people do not have confidence in their own memory performances, leading to poor consequences.

A biological explanation for memory deficits in aging includes a postmortem examination of five brains of elderly people with better memory than average. These people are called the "super aged," and it was found that these individuals had less fiber-like tangles of tau protein than in typical elderly brains. However, a similar amount of amyloid plaque was found.

Prevention and treatment

Various actions have been suggested to prevent memory loss or even improve memory. The Mayo Clinic has suggested seven steps: stay mentally active, socialize regularly, get organized, eat a healthy diet, include physical activity in your daily routine, and manage chronic conditions. Because some of the causes of memory loss include medications, stress, depression, heart disease, alcohol abuse, thyroid problems, vitamin B12 deficiency, not drinking enough water, and not eating nutritiously, fixing those problems could be a simple, effective way to slow down dementia. Some say that exercise is the best way to prevent memory problems, because that would increase blood flow to the brain and perhaps help new brain cells grow. A healthy diet is also critical, partly because it has been demonstrated that healthy eaters are much less likely to develop Alzheimer's disease.

The treatment will depend on the cause of memory loss, but various drugs to treat Alzheimer's disease have been suggested in recent years. There are four drugs currently approved by the FDA for the treatment of Alzheimer's, and they all act on the cholinergic system: Donepezil (Aricept), Galantamine (Reminyl), Rivastigmine (Exelon), and Tacrine (Cognex). Although these medications are not the cure for Alzheimer's, symptoms can be reduced to mild dementia.

Also, modality is important in determining the strength of the memory. For instance, auditory creates stronger memory abilities than visual. This is shown by the higher recency and primacy effects of an auditory recall test compared to that of a visual test. Research has shown that auditory training, through instrumental musical activity or practice, can help preserve memory

abilities as one ages. Specifically, in Hanna-Pladdy and McKay's experiment, they tested and found that the # of years of musical training, all things equal, leads to a better performance in non-verbal memory and increases the life span on cognition abilities in one's advanced years.

Another important aspect that helps memory as one ages is spacing. Spacing improves and facilitates the inductive and repetition learning, while mass learning is not helpful in improving memory (which is contrary to what the participants thought).

Invertebrate models

There are several model systems for AMI, including nematodes, flies and bees. In the nematode, C. elegans, AMI includes age-related changes in associative learning and memory that are modulated by insulin/IGF-1 signal and serotonin/octomamine signal.

Domains of memory mostly spared

In contrast, implicit, or procedural memory, typically shows no decline with age. Other types of short-term memory show little decline, and semantic knowledge (e.g. vocabulary) actually improves with age. In addition, the enhancement seen in memory for emotional events is also maintained with age.

Recently, experiments that have tested for the significant of under performance of memory for an older adult group as compared to a young adult group, hypothesized that the deficit in associate memory due to age can be linked with a physical deficit. This deficit can be explained by the inefficient processing in the medial-temporal regions. This region is important in episodic memory, which is one of the two long-term human memory, and it contains the hippocampi, which is crucial in creating memorial association between items.

Theories about memory and aging

First, the tests and data that show that as people age, the contiguity effect weakens. This is supported by the associative deficit theory of memory, which asserts old people's poor memory performance is attributed to their difficulty in creating and retaining cohesive episodes. The supporting research in this test, after controlling for sex, education, and other health-related issues, show that greater age was associated with lower hit and greater false alarm rates, and also a more liberal bias response on recognition tests. Second, the higher tendency for older people to make outside intrusions during a memory test can be attributed to the inhibition effect. Inhibition caused participants to take longer time in recalling or recognizing an item, and also subjected the participants to make more frequent errors. For instance, in a study using metaphors as the test subject, older participants rejected correct metaphors more often than literally false statements.

Qualitative changes

Most research on memory and aging has focused on how older adults perform less well at a particular memory task. However, recently researchers have also discovered that simply saying that older adults are doing the same thing, only less of it, is not always accurate. In some cases, older adults seem to be using different strategies than younger adults. For example, brain imaging studies have revealed that older adults are more likely to use both hemispheres when completing memory tasks than younger adults. In addition, older adults sometimes show a positivity effect when remembering information, which seems to be a result of the increased focus on regulating emotion seen with age. For instance, eye tracking reveals that older adults showed preferential looking toward happy faces and away from sad faces.