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Cognition and leisure time activities of older adults

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Abstract

Older adults have much more leisure time today than they have had in the past. Evidence points to the connection between engagement in physical exercise, a leisure time activity, and the overall health of older adults. Because health is an important issue, especially as we age, it is helpful to know that we have some control over it as we age. Cognition, i.e., our ability to remember, to pay attention, and to think, is also a concern in aging. Is it possible that the choices we make about leisure time activities may influence our cognitive abilities in old age? This critical review of the literature examines the effect of three leisure time activities—socializing, physical exercise, and mental exercise—on cognition in older adults.

Until the past few decades, it was thought that we had little control over how we age and that leisure time activities had little impact on our health and well-being, including our cognitive abilities. However, we now know that our health is influenced by many factors, including leisure time activities such as physical exercise and lifestyle choices such as nutrition. Could it be possible to influence our cognition as we age through leisure time activity choices as well? There certainly appears to be a belief that leisure time activities can influence cognition as reflected in the rise in the interest in cognitively engaging activities such as Sudoku, reading groups, adult education, and lifelong learning opportunities among today's seniors. This paper discusses aging and cognition, reviews research findings regarding leisure activities and cognition, and provides advice on maximizing the benefit of leisure activities on cognition.

Does our cognitive ability change with age? The simple answer to this question is "yes." In the absence of disease, normative age-related changes in cognition do not profoundly affect real-world function; however, a majority of aged adults report that their memory is not as good as it used to be and in laboratory tests a decline in cognition is universal (Hedden & Gabrieli, 2004). Though cognitive decline may be inevitable, there exists the hope that we have some control over our own cognitive change. First, there is tremendous individual variability in the rate and extent of cognitive decline in older adults such that some adults show no symptoms at all while others experience significant loss. Might this variability be the result of lifestyle choices as well as education, genetics and other factors? Second, there is evidence that therapeutic interventions, also known as cognitive training, can improve cognitive performance (see below). It is likely that this variability and trainability of cognition leads many adults to believe that these normal age-related changes might be reversible and possibly mitigated through lifestyle choices and/or therapeutic interventions. Many scientists agree (Hedden and Gabrieli, 2004).

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Therapeutic Interventions

Unlike lifestyle choices we make about our leisure activities, therapeutic intervention, or cognitive training, involves repeated sessions of professional training on a particular dimension of cognition. Cognition is not a single ability but rather a word that describes many different types of thinking-related processes like processing speed, attention, memory, spatial skills, language, and "executive" or self-regulatory capabilities. Some of these abilities, called "fluid," decline as we age because our physical brain shows changes (i.e., processing speed), whereas others, called "crystallized," are acquired via life and learning experiences and increase with age (Cattell, 1971). It may be useful to consider a computer metaphor, with the hard drive representing our fluid abilities and computer software programs representing our crystallized abilities. In aging, fluid abilities decline starting in our 20s to 30s, a decline that is related to loss of neurons in the brain. Crystallized abilities, which rely on learning and experience, tend to increase over the lifespan (Schaie, 2005). While it is possible to compensate for the loss of fluid abilities to enable the increase in crystallized abilities, this ability to compensate for damage to our hardware becomes more difficult as we get older, ultimately affecting the function of our software, too. In other words, learning becomes more difficult.

Dimensions of cognition typically trained in adults are ones that affect crystallized domains, like episodic memory (paired associates: recalling information presented in some linked format), perceptual reasoning (spatial relations: identifying relationships between visually presented objects), perceptual or processing speed (Wechsler Adult Intelligence Scale or WAIS, Digit Symbol subtest), word knowledge (WAIS Vocabulary subtest), and inductive reasoning (i.e., the ability to use logic to make decisions, as assessed in the WAIS Similarities subtest). Such domains require individuals to process new information and access information they have previously learned in a quick and appropriate manner, thereby compensating for underlying changes in fluid abilities.

Cognitive training studies involve repeated sessions of training over several weeks or months on one or more specific aspect(s) of cognition (Schaie, 2005; Ball *et al.*, 2002, Willis *et al.*, 2006). Pre-training performance is compared to post-training performance in both experimental (those receiving training) and control groups (those not receiving training). Performance on these cognitive tasks improves following training sessions, an effect that can last for years. However, a shortcoming of the training is that the benefit is ability-specific. For example, if a person is trained on how to perform spatial rotation tasks, spatial rotation performance will improve, but this benefit does not transfer to other cognitive tasks, such as paired associates (Schaie, 2005). Interestingly, Willis *et al.* (2006) found that cognitive training on inductive reasoning skills resulted in less decline in self-reported daily living abilities such as managing money or shopping. This finding offers some hope that improvement in the laboratory can transfer to issues we face in our everyday activities.

In summary, performance on cognitive tasks can improve following specific training sessions on that cognitive function. This benefit may last for years, but it does not tend to transfer to other cognitive abilities even though it may improve some aspects of functions involved in daily living. However, the usefulness of cognitive training on our daily functions may be limited.

Leisure Activities

There are three categories of leisure activities identified by researchers as important components of "successful aging": social engagement, physical exercise, and mental stimulation (Rowe & Kahn, 1998). Is there evidence that these leisure time activities might benefit cognition too?

Social Engagement and Cognition

Social networks and social engagement have been found to be related to a reduced risk of death and a decrease in a variety of adverse health outcomes in older adults (Berkman *et al.*, 1979; Berkman, 1995). Do these benefits extend over to our thinking and cognition as well? Many recent studies have found that social network size (how many people we see at least once a month) is inversely related to the risk of cognitive impairment (Bennett *et al.*, 2006; Gow *et al.*, 2007, Barnes *et al.*, 2004). In other words, the number of children, family, and friends we have and how often we interact with them may cushion us from cognitive decline. People with large social networks are more likely to engage in cognitive, physical, and social activities, which also mediate cognitive decline and may be involved in the protection provided by social networks.

Physical Exercise and Cognition

While scientists rarely, if ever, say that something is proven, most would agree that there is little doubt that aerobic exercise such as walking, running, swimming, or biking is good for the body. New evidence shows that this benefit extends to the brain and cognition, thereby influencing our fluid and crystallized abilities. In studies published over the past several decades, it has been shown that physically fit adults are more capable on cognitive performance measures than non-fit adults (Churchill *et al.*, 2002; Colcombe *et al.*, 2004). A lifetime of aerobic fitness leads to the most positive outcomes for cognition in aging and cardiovascular fitness training has also been found to improve cognitive performance in otherwise sedentary older adults especially when the aerobic exercise sessions exceeded 30 minutes (Colcombe & Kramer, 2003).

Mental Stimulation and Cognition

Do intellectually demanding activities improve or help maintain cognitive functioning in older adults? Here the evidence appears to be mixed. Schooler and

Mulatu (2001) examined cognitive functioning in people who challenge themselves with complex activities. Complex leisure activities were identified as reading (books and high level magazines, e.g., *Scientific American*), visits to fine art institutions (e.g., museums, concerts, plays), and number of hours spent on special interests, hobbies, and activities. Those who frequently engaged in these complex activities had higher cognitive function than those who did not. Conversely, Salthouse (2006) concluded that while it may be beneficial to believe that mental exercise improves mental function, there is no evidence to support this view. He argues that those with high cognitive ability are likely to seek complex leisure activities. In other words, the type of leisure activity does not affect cognition. Rather, cognitive ability determines what type of leisure activity will be selected.

Do mental exercises improve cognitive function or does high cognitive function inspire someone to engage in mental activities?

While scientists debate whether there is any evidence for the "use it or lose it" theory of cognitive function, many people choose to engage in cognitively challenging activities. Unfortunately it is difficult, if not impossible, to provide evidence that mental stimulation improves cognitive performance in later life for both practical and scientific reasons. Establishing such a relationship can be demonstrated only under carefully controlled experimental procedures which may not be feasible or ecologically valid. For example, to determine whether attending Osher Lifelong Learning Institute (OLLI) classes improves cognition, the ideal study would require participants to be randomly assigned to either the experimental group (those taking OLLI classes) or the control group (those not taking OLLI classes). Random placement in the control or experimental group is critical because adults who self-select to take classes may be different from those who do not take classes in a variety of ways, including initial cognitive ability. All participants would receive a baseline assessment of cognitive function prior to the study. After a year (or some specified period of time) of participating or not participating in OLLI classes, individuals would be brought back to the lab to determine whether cognitive performance had improved in one group more than the other. Unfortunately, because other mental exercise activities may confound the results, during the year of the study all participants would have to refrain from mental exercise activities such as reading, exercising, socializing, or doing any other activity that may somehow stimulate their cognitive skills. Due to the amount of control that would be needed in such a study, it would be very difficult to do and results would most likely not be generalizable to all older adults.

Although causation may be difficult to demonstrate, there are other ways to examine the relationship between mental stimulation and cognitive performance. A common means to determine whether or not leisure activities influence cognition is to distribute a survey asking adults questions about their engagement in mentally stimulating activities. The next step would be to examine the relationship between reported mental activity engagement and performance on cognitive measures. What conclusion would be drawn if it were found that those who participate in many mental exercises are more cognitively fit than those who do not engage in mental exercises? Do mental exercises improve cognitive function or does high cognitive function inspire someone to engage in mental activities? Each of these conclusions is equally plausible, and therefore, we cannot know the causal relationship. Unlike an experiment with random assignment and control groups, this is a correlational study and causation cannot be inferred. However, even though we cannot assume causation from these types of studies, it is interesting to note that several researchers have found a positive relationship between mental exercise engagement and cognitive function (Salthouse, 2006).

Another issue that muddles the discussion of whether mental activities improve cognition is that mental exercises differ in the degree to which they challenge us, depending upon the task and our own unique cognitive strengths and weaknesses. In particular, some activities require minimal cognitive effort to complete while others place a high demand on cognition. Salthouse and colleagues (2002) asked participants to rate the cognitive demand of 22 mental exercise activities in which they engaged. Teaching/attending a class was rated as placing the highest cognitive demand and watching TV was rated the lowest. Games, reading, writing, musical performances, volunteering, and socializing with friends were moderately challenging. These are average ratings, however. Not surprisingly, the level of cognitive demand of each mental exercise depended on the cognitive ability of the rater. In other words, what is challenging for one may not be challenging for another. Two people are not getting the same benefit from completing a crossword puzzle if it took one person five minutes and the other two hours.

In summary, definitive evidence regarding the positive impact of social engagement, aerobic exercise, and mental stimulation may not be forthcoming due to the challenges faced by researchers in designing and conducting the studies to provide unequivocal evidence. However, several studies do suggest that lifestyle choices such as social engagement, aerobic exercise, and mental stimulation may mediate cognitive change in aging. And like cognitive training exercises discussed above, these lifestyle activities may increase crystallized intelligence in adults.

Computer Games and Cognition

Today, business in computer games claiming to enhance cognition in aged adults is flourishing. *The New York Times* reported that in 2005 Americans spent \$2 million on computer products to boost brain function and in 2007 that number was expected to exceed \$80 million (Aamodt & Wang, 2007). The Japanese video game maker Nintendo was one of the first companies to target the older population with video games claiming to "boost the ageing brain." This game, called *Brain Age* in the United States, was created with Ryuta Kawashima, a Japanese scientist noted for his development of mental exercises to improve cognitive function in elderly adults (Fuyuno, 2007). The computer game provides mental workouts by having gamers complete tasks such as reading aloud, completing multiplication problems, or memorizing words. They can also be done as a solitary or team activity and can combine social benefits in the latter case.

Computer games could be considered more like a cognitive training intervention rather than leisure activity mental exercises because the tasks in computer games involve training specific aspects of cognition. These may, at least for a period of time, improve performance on a particular task. Like most mental exercises, engaging in these computer games probably does not hurt and may even improve cognition if the user finds the game challenging and interesting enough to continue playing. Whether any benefit from playing the computer games transfers to everyday living situations has not been demonstrated.

There are at least three disadvantages to the use of computer games to enhance cognition. First, computer gaming involves little to no social interaction when done alone. Second, gaming is sedentary, requiring no aerobic activity. Finally, computer games aimed at improving cognitive speed or computation ability do not promote learning through interaction with one's environment in the sense that other lifestyle activities do. However, computer gaming, if challenging and fun, is more likely to impact our cognition positively, rather than spending that time doing something relatively passive (e.g., watching TV) or doing nothing at all.

However one distills it, remaining cognitively sharp requires us to use what we currently have as well as be open to the process of learning new things. Learning is something we do our entire lives, as is evidenced in the increase in crystallized intelligence over the lifespan. It can happen in the classroom, at cultural events, during travel, when reading, writing, or engaging in conversations with others. Learning can happen when playing games, on the job, or in volunteer positions, and in tackling new projects. While human experience can induce and facilitate learning throughout life many people find that learning on the whole becomes harder as we age.

Advice

Most adults do experience some decline in cognitive function although there is considerable variability regarding when this loss begins and how extensive the loss is. To maximize our cognitive ability in later life the evidence seems to suggest that we (1) maintain a social network that keeps us socially engaged with our world, (2) stay aerobically fit, and (3) expose ourselves to experiences that challenge us and promote learning.

So the next time you sign up for an OLLI class that you find interesting, you should find a parking space as far from your destination as possible. Walk briskly to meet friends to discuss the book you read the day before, current events in the paper that morning, the topic of the next class, etc. Then walk together to the OLLI class and challenge yourself to learn something new.

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