

BRAIN TRAINING GAMES: AN EFFECTIVE TOOL IN THE FIGHT AGAINST DEMENTIA

Bruno Bonnechère*

REVAL Rehabilitation Research Center, Faculty of Rehabilitation Sciences, Hasselt University, Diepenbeek, Belgium

YOUNG REVIEWER:



NOAH
AGE: 11

When we get older, we tend to have more trouble remembering things and we tend to forget certain things more often. It is normal to have a small decrease in memory with age, but when memory decreases too much it becomes a disease: what is called dementia. Unfortunately, there is currently no treatment for dementia. However, there are certain actions that can be taken to try to prevent dementia, or at least to delay the onset of dementia symptoms. One of these is to use video games to (re)train brain functions. Yes, you read that right—some video games can be used to train the memory!

COGNITION

The process of acquiring knowledge and understanding through thought, experience, and the senses. Cognition is divided into various cognitive functions such as memory, visual abilities, language ability, and arithmetic.

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INTRODUCTION

As life expectancy—the average age people live to—increases, it poses many challenges to health care systems. The World Health Organization (WHO) estimates that there will be 1.5 billion people aged 65 or older by 2050, compared to about 700 million today! Aging is associated with a decrease of **cognition**, which is the name for all of the mental processes that help us learn, remember, and use what

DEMENTIA

The loss of memory, language, problem-solving, and other thinking abilities that is severe enough to interfere with daily life. Alzheimer's disease is the most common cause of dementia.

COGNITIVE RESERVE

The idea that people build up a reserve of thinking skills over the course of their lives. This protects them from losing thinking skills as they age or get sick.

COGNITIVE DECLINE

Cognitive decline in older adults means that a person's thinking, memory, concentration, and other brain functions are not as good as they should be for their age.

MOBILE HEALTH mHEALTH

Medical and public health practices supported by mobile phones, patient-monitoring devices, and other wireless devices.

COGNITIVE TRAINING

Cognitive training is a non-drug method that involves doing a set of regular mental activities that are meant to keep or even improve a person's thinking skills.

we know. For example, older people may have decreased short-term memory, meaning they may forget something that recently happened. While some decrease in cognition is normal, a sharp decrease in memory may indicate a disease called dementia. **Dementia** is a major health problem for both older people and their relatives—dementia patients often lose the ability to do things for themselves and eventually become a major burden for their families and caregivers. Worldwide, an estimated 50 million people are currently living with dementia, and there are nearly 10 million new cases each year. It is clear that dementia is a growing public health problem. The WHO has identified dementia as one of the major health challenges of the twenty-first century and proclaimed it a global mental health priority that must be addressed.

PREVENTION

Studies have identified numerous risk factors for dementia, some of which can be modified (changed; like drinking or smoking) and some of which cannot be modified (like genetic factors). It is estimated that 40% of dementias could be prevented or at least delayed [1]. Among the modifiable risk factors identified for dementia, level of education is one of the most important—that is why it is important to go to school! Education improves **cognitive reserve**, which is your brain's ability to come up with new ideas and find different ways to do things, and thus seems to offer some protection against dementia [2]. However, education is not the only way to increase or maintain cognitive reserve. Continuous learning and participation in brain-stimulating activities, both at home and at work, also increases cognitive reserve and fights against **cognitive decline**, which is the age-induced decline of cognitive functions (see Figure 1).

BRAIN-TRAINING GAMES

Over the past decade, the accessibility of internet access and smartphones has grown rapidly around the world—you probably do not know how to live without them! Along with this rapid growth, the mobile application industry is exploding. Health-related applications represent an important part of this new market. Among the most popular **mobile health (mHealth)** applications are those for mental health: 29% of mHealth applications focus on diagnosis of mental health issues, according to a WHO study. Many applications have been developed to “train” cognition (a process called **cognitive training**) and challenge the brain. These are called brain-training games, and they include the famous *How Old Is Your Brain* game developed by Dr. Kawashima for the Nintendo DS. Although this was not the first brain-training application, it was the one that popularized these kinds of applications with the general public. More recently, it has been shown that the use of the very popular game *Pokémon GO* was not

Figure 1

It is normal to experience a slight decrease in cognitive functions with aging, like thinking a little slower and forgetting some things. It is important to keep this decrease as small as possible (upper line), green zone indicate healthy aging. Regular exercise and challenging the brain with brain-training games can help to keep the brain healthy as long as possible. If the decrease in cognitive functions is too fast, it indicates disease (bottom lines)—either mild cognitive impairment (orange color) or dementia (red color).

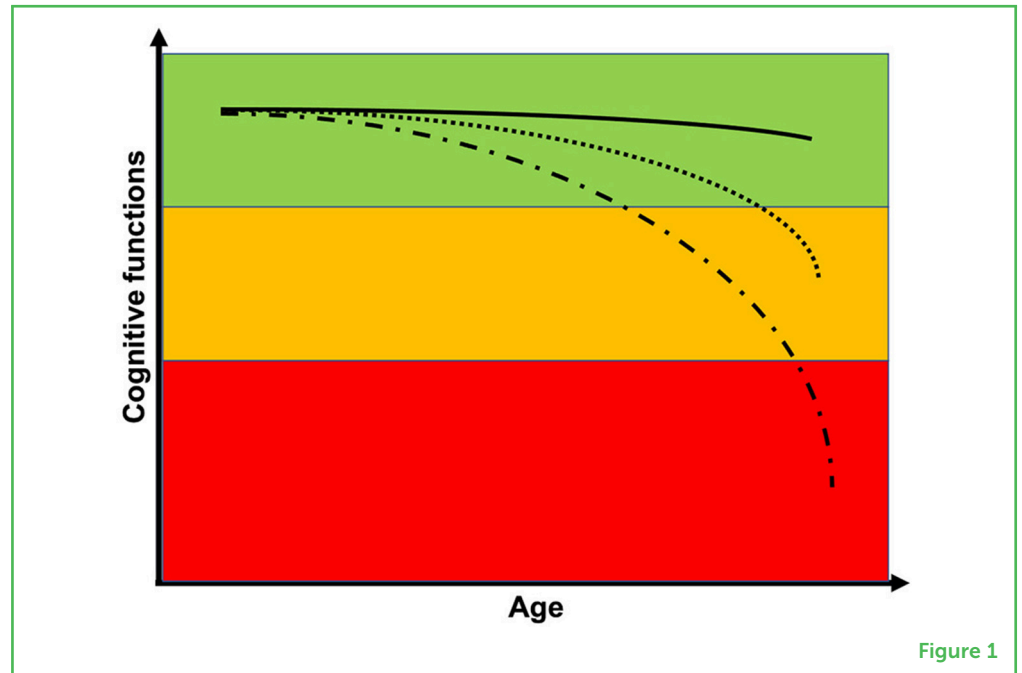


Figure 1

only effective in making players more physically active, but it also increased their cognitive functions [3].

Brain-training applications offer many potential advantages. For example, both the applications themselves and the smartphones or tablets on which they are played are easily available. These applications are also engaging and fun—more so than traditional brain-training exercises like reading and building vocabulary. Brain-training applications allow users to see the evolution of their performance and to compare themselves to other participants. This sort of competition on social networks is very important for motivation! There are many brain-training applications available at a low cost or for free, including *brainHQ*, *Lumosity*, and *Peak Brain Training*. But how effective are these applications at delaying or preventing cognitive decline? Do these games only entertain us, or can we really increase our cognitive functions by using them?

EVIDENCE

When scientists try to develop new treatments for a disease, it is important to test those treatments to see if they work. To do that, we need to perform careful studies that compare the results obtained with the new solutions (the brain-training games, in our case) with the best treatment available (traditional types of cognitive training, like word games and memory exercises).

This article will focus only on mobile brain-training applications that are currently available for download. These applications are widely available, easy to use, and have passed many tests before they became

META-ANALYSIS

A special type of scientific study in which the results of many individual studies on the same topic are summarized into one single study, which makes the results stronger.

available to the public. In a recent **meta-analysis** synthesizing the results of 16 studies (with 1,543 total participants), we demonstrated that commercially available brain-training video games could be used as brain-training tools in people over 60 years old who do not have cognitive decline [4]. The effect of using these games is small but statistically significant. The age of the participants did not influence the results, which indicates that the ability to learn—one of the key factors in the prevention of dementia—is preserved in healthy older people! Encouraging results have also been observed in patients with a low level of dementia, which is called mild cognitive impairment, but we do not know yet whether playing these games can reduce or slow down the progression to dementia [5].

These interesting results, especially those observed in elderly people without much cognitive impairment, make us wonder why brain-training applications are not used more frequently by more people. These games are easily available and relatively inexpensive (some are free, while others cost between 20 and 80€ per year), and they seem to be a promising tool to prevent or delay dementia!

CHALLENGES AND OPPORTUNITIES

To use new technologies to address health issues that arise during aging, such technologies must be accepted by patients as a treatment tool. There are several barriers that make it difficult to use mHealth treatments in older people. The first is the initial cognitive level and education. Motivation, the willingness to do something, is also a barrier to the use of mHealth, as is the actual physical ability of older people to use electronic devices. Also, many old people may not think that eHealth is a valid technique, so they might choose not to use it.

An additional barrier might be that patients and health professionals simply do not know that these applications exist, or they may be unaware of the positive effects these brain-training games can have. Therefore, it is essential that information about these brain-training applications is available to the general public, and that healthcare professionals are trained to use them. Finally, recent studies have highlighted the importance of digital devices for stimulating cognitive activities to delay cognitive decline in older people. Those with smartphones have a slightly decreased risk of dementia [6], so if your grandparents do not have smartphones, you should encourage them to get one!

CONCLUSION

We have shown that cognitive training using brain games is a useful tool to improve cognitive function. Very few negative effects are

reported in the scientific literature, suggesting that these applications are safe. Brain games are also inexpensive and easily available. Brain-training applications should be combined with a healthy lifestyle (physical activity, quitting smoking), and with the control of other health conditions (high blood pressure, diabetes, and obesity) that are known to be risk factors for cognitive decline. This combination of activities might be the best way to maintain optimal brain health as we age, helping us to fight the normal decline of cognitive functions and delay or even prevent dementia.

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YOUNG REVIEWER



NOAH, AGE: 11

I am a 11 year old kid named Noah. I like to code and read during my free time and can type at over 40 words per minute. I like to play the piano and know two guitar chords. My favorite song to play is "Turkish March," by Ludwig van Beethoven. When I grow up, I would like to become a teacher.

AUTHOR



BRUNO BONNECHÈRE

Hi, my name is Bruno Bonnechère, I am a professor of rehabilitation in Hasselt, Belgium. I am passionate about the use of new technologies to help patients and clinicians. I am mainly interested in the development and implementation of mobile applications to monitor and train cognitive functions. Outside of my research, I like to cook and to do many sports in my free time! *bruno.bonnechere@uhasselt.be