

How Video Games Affect Your Brain

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STORY AT-A-GLANCE

- › Playing video games may lead to improvements in areas of attention, cognitive control and workload, visuospatial skills and more
- › Video games may alter the reward-processing areas of your brain, potentially leading to addiction, and may desensitize players to violence
- › If you play video games on your TV or computer at night, be sure to take steps to protect yourself from exposure to blue light from the screen (such as wearing blue-blocking glasses after sundown)

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Video gaming is an incredibly popular pastime in the U.S., with more than 150 million regular users, defined as those who play at least three hours a week. In fact, the majority of U.S. households (65%) are home to at least one person who plays video games regularly. According to the Entertainment Software Association's (ESA) 2017 Essential Facts About the Computer and Video Game Industry, the typical gamer is 35 years old and most (72%) are 18 years or older.¹

Among children, video games have somewhat of a bad reputation, in particular for the potentially negative effects caused by being exposed to violent behavior. Further, 71% of parents told ESA that video games played a positive role in their child's life, and 67% play video games with their child at least once a week. One thing that's for certain is that the

industry is experiencing tremendous growth, bringing in more than \$34 billion in revenue in 2016, ESA reported.

If you or your children play video games regularly, there are some factors to consider — from how it affects your time spent sitting to exposure to blue light from the screen. Research also highlights the very real changes that video gaming can cause in your brain, for better or for worse.

Video Games Play a Complex Role in Brain Health

A meta-analysis of 116 studies published in *Frontiers in Human Neuroscience* set out to determine the "neural basis of video gaming," or what effects gaming has on your brain. The authors noted:²

"It is not uncommon to hear both positive and negative health claims related to VGs [video games] in the mass media. Most of the time, these are unverified and sensationalist statements, based on 'expert' opinions, but lacking evidence behind them.

On the other side, as VGs become more complex (due to improvements in computer hardware), they cater to audiences other than children, appealing to older audiences, and VGs have gained prevalence as a mainstream entertainment option. Consequently, the number of people who spend hours daily playing these kinds of games is increasing.

There is interest in knowing the possible effects of long-term exposure to VGs, and whether these effects are generally positive (in the shape of cognitive, emotional, motivation and social benefits) ... or negative (exposure to graphic violence, contribution to obesity, addiction, cardio-metabolic deficiencies, etc.)."

Because of the wide scope of the research, the researchers grouped the study into six main sections based on different cognitive functions and were able to reveal both positive and negative brain effects related to video games. Specifically:

- **Attention** – The evidence suggests that video games may benefit attention, and video game players show improvements in selective attention, divided attention and sustained attention.

"Improvements in bottom-up and top-down attention, optimization of attentional resources, integration between attentional and sensorimotor areas, and improvements in selective and peripheral visual attention have been featured in a large number of studies," the researchers noted.

- **Visuospatial skills** – Visuospatial skills refer to your ability to visually perceive the spatial relationship between objects. Some brain regions directly related to visuospatial and navigational skills are increased in video game players, and research suggests such skills may be enhanced in regular players.
- **Cognitive workload** – This describes the mental resources required by a person engaged in a specific task or at a certain point in time. Video games play a role in cognitive workload, the researchers said, "Namely, the number of stimuli appearing simultaneously on the screen and the complexity of each stimulus seem to elicit different responses from the brain."³
- **Cognitive control** – Cognitive control includes abilities such as reactive and proactive inhibition, task switching and working memory, all of which may be required during any given video game session.

This is yet another area that video games appear to benefit, with researchers noting, "... [Ev]en short VG training paradigms showed improvements in cognitive control related functions, particularly working memory, linked to changes in prefrontal [brain] areas."⁴

- **Skill acquisition** – This is another area where video game players seem to benefit, with overall skill acquisition improving after regular playing. According to the researchers, "It is likely that the exposure to a task first leads to an increase of activity in the associated regions, but ultimately, as the performance improves after repeated exposures, less cortical resources are needed for the same task."⁵

One of the studies included in the meta-analysis specifically noted that skills learned via playing video games may transfer to real life:⁶

"Playing video games for as few as 10–20 h [sic] has been shown to improve performance on a number of attentional and perceptual tasks ... and on tasks requiring executive control. Such evidence has led to the development of video games that purportedly improve memory, attention, processing speed and performance in daily life.

The assumption underlying these assertions is that skills acquired through training on one task (i.e., the video game) transfer to other untrained tasks, including complex real world tasks."

The Downside of Video Games to Your Brain

While potentially leading to improvements in areas of attention, cognitive control, visuospatial skills and more, the downside may be their effects on reward-processing areas of your brain. Many such areas have been shown to be affected in people with video game addiction, "an impulse-control disorder with psychological consequences, not unlike other addictive disorders, especially nonsubstance addictions such as pathological gambling," the study noted.⁷

"Internet gaming disorder" has been suggested as a new psychiatric diagnosis to be included in the American Psychiatric Association's "Diagnostic and Statistical Manual of Mental Disorders" latest edition, although others have suggested including such addiction under the broader category of "internet addiction."

What's interesting is the researchers noted distinct differences in the brains of those addicted to video games as compared to professional and expert gamers, differences that persisted even after controlling for the amount of time spent playing video games. The neural patterns displayed by addicted video game players were indicative of an unbalanced reward system in the brain.

The other potential downside is exposure to violent content, which is a prevalent theme in many adult video games. "It is likely that repeated exposure to violent content will trigger desensitization processes that affect regions linked to emotional and attentional processing," the researchers wrote.

"It is hypothesized that this desensitization may result in diminished emotional responses toward violent situations, preventing empathy and lowering the threshold for nonadaptive behaviors linked to aggressiveness."⁸

Separate research attempted to tease out some of the variables that may influence problematic versus nonproblematic video game playing in middle schoolers and revealed that the types of video games more often responsible for problematic use were role-play games and first-person shooter games.⁹ Negative consequences of video game playing were reported more often by girls than boys in this study and included:

- Eating problems
- Sleep and vision problems
- Conflicts with parents
- Loss of time
- Lack of school investment

Does Playing Video Games Encourage Flow?

Flow, according to psychologist Mihaly Csikszentmihalyi, is the secret to happiness and occurs when you are completely absorbed in an activity (often one that involves creativity).¹⁰

When you're immersed in flow, your sense of time becomes distorted because nearly all of your brain's available inputs are devoted to the activity at hand, Csikszentmihalyi states. While engaging in [mindfulness](#) and meditation may get you into a mental state of flow, so can hobbies you enjoy, like [knitting](#) and, perhaps, playing video games.

According to the featured analysis:

"VGs provide the appropriate context in which flow states are encouraged to occur, since feedback is offered continuously and the level of difficulty is programmed to raise progressively, in order to match the improving skills of the player. Therefore, VGs are perfect candidates to operationalize the components involved in the flow theory."

One downside to this may be that research shows a link between more flow states and increased video game playing, which in turn led adolescents to go to sleep later and potentially miss out on getting enough sleep.¹¹

Further, another study revealed that experiencing a flow-like state during video game playing may point to an increased risk of addiction.¹² The research found one flow factor in particular – the perception of time being altered during play – was a significant predictor of video game addiction.

Are Brain-Training Video Games Beneficial?

Specialized "brain-training" video games are a fast-growing niche market targeting aging Americans looking to sharpen their memory, attention and problem-solving skills by giving their brain a mental "workout." Lumosity is one such company that offers brain-training games that are supposedly scientifically backed to improve your cognition.¹³

However, when researchers put the program to the test, offering 10 weeks of training with either Lumosity or web-based video games that do not specifically claim to offer brain-training benefits to a group of young adults, the results were disappointing.¹⁴ No advantages were seen in the Lumosity group compared to the control group. They did not show greater improvements in memory, reasoning or other cognitive skills, nor did they show reductions in risky decision making.

Lumos Labs, the company behind Lumosity, was also fined \$2 million in 2016 by the U.S. Federal Trade Commission (FTC) for making deceptive claims that the product could help delay age-related memory declines or lead to improved cognitive performance.¹⁵

Jessica Rich, director of the FTC's Bureau of Consumer Protection, said in a press release, "Lumosity preyed on consumers' fears about age-related cognitive decline, suggesting their games could stave off memory loss, dementia and even [Alzheimer's disease](#) ... But Lumosity simply did not have the science to back up its ads."¹⁶

Video Games Expose You to Blue Light From the Screen

Exposure to [LED-backlit computer screens](#) or TVs at night significantly suppresses melatonin production and feelings of sleepiness. When your brain "sees" blue light at night, the mixed message can add up to serious health issues.

In 2011, for instance, researchers found that evening exposure to LED-backlit computer screens affect circadian physiology. Among 13 young men, exposure to five hours of an LED-lit screen at night significantly suppressed melatonin production along with sleepiness.¹⁷

The issue extends far beyond sleep, however. LEDs have virtually no beneficial infrared light and an excess of blue light that generates reactive oxygen species (ROS), harming your vision and possibly leading to [age-related macular degeneration](#) (AMD), which is the leading cause of blindness among the elderly in the U.S. LED lights may also exacerbate mitochondrial dysfunction leading to chronic conditions ranging from metabolic disorders to cancer.

If you play video games at night, it's therefore essential to block your exposure to blue light while doing so. If you play the games on your computer, you can install a program to automatically lower the color temperature of your screen. If you play video games on your TV, be sure to wear blue-blocking glasses after sundown.

Video Games May Increase Your Sedentary Time

The other issue with playing video games is that it's typically a sedentary behavior (the exception being the newer games that encourage physical movement). Too much

sedentary behavior presents body-wide risks that may contribute to obesity and growing rates of chronic disease in both childhood and adulthood.

For instance, excessive sitting significantly impacts your cardiovascular and metabolic function. This raises your risk for heart attack, Type 2 diabetes, insomnia, arthritis and certain types of cancer — and that's just the tip of the iceberg. Sitting for extended periods of time increases your risk for **premature death**. This is especially concerning given the fact that you may be vulnerable to these risks even if you exercise regularly.

Research even shows that among boys aged 15 to 19 years old, the longer the time spent in front of screens, including playing video games, the lower their bone mineral density measured.¹⁸

Excessive use of electronics takes away many opportunities to engage in weight-bearing activities, which is key for building strong bones. So it's important to be mindful of the time you spend playing video games and to change your physical position — from sitting positions to standing to even moving around — often while doing so.

Overall, video games can be a safe and entertaining hobby with the potential to offer some benefits to your brain, but those benefits must be weighed against the risks of playing, such as addiction and exposure to violence. Some of this can be tempered by choosing nonviolent games, but it's still important to limit your time spent playing and balance it with other more active and socially engaging pursuits.

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