



Ever wondered what playing video games does to your brain?

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Reviewed by:



Sean
5 years old

Children today interact with media an average of 7 hours a day, every day including weekends. That is more than the weekly time adults spend at work. What is the impact of so much media consumption? Research in this field is still in its infancy, but an emerging field on video game and the brain suggests that we are in for some surprises.



Nora
5 years old



Anaya
12 years old

ADULTS KEEP COMPLAINING ABOUT VIDEO GAME PLAY DUMBING DOWN OUR GENERATION. ARE THERE BENEFITS TO PLAYING VIDEO GAMES?

You often hear that too much time spent on a computer screen is bad for your vision, but in a surprising twist, some of the most decried games – first person, action-packed video games where the player typically needs to aim at bad guys, zombies, or monsters – have been found to enhance how well you see.

The studies use tools from vision science in which participants have to make a rather dull decision on whether a Gabor patch (small black and white lines) is or is not present [1]. By manipulating the amount

of contrast in the Gabor patch (Figure 1), its spatial frequency (Figure 2) or the time it stays on the screen, it was shown that playing action video games improves several aspects of vision.

Among the visual functions improved are (i) contrast sensitivity or how well one can distinguish among different levels of gray (Figure 3), (ii) crowding acuity or the ability to resolve small details in the context of clutter as, when for example, you read very small font text and all the letters seem to jumble into each other, (iii) visual masking or the ability to see and recognize very briefly presented visual stimuli. Some of the participants in these studies even complained that they could see the 60 Hz flicker from computer screen because of their game play!

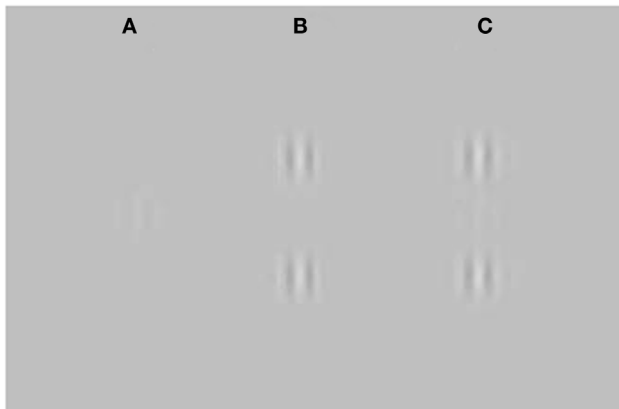


FIGURE 1 - Can you see it?
 The Gabor patches in A and B vary in their contrast allowing vision scientists to measure contrast sensitivity. The center Gabor patch in A is easier to see than the one in C because of the two flanking Gabors – our visual resolution in the presence of flankers is called crowding acuity [1].

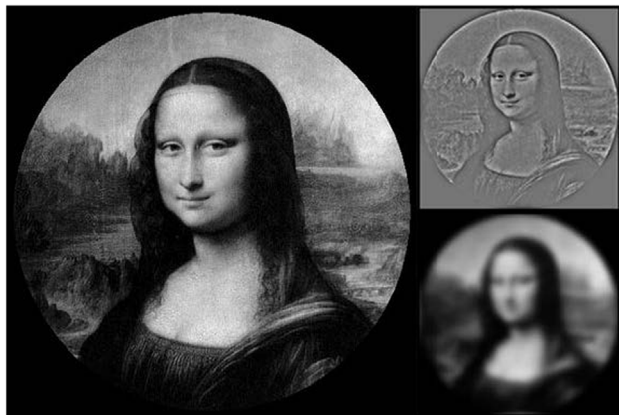


FIGURE 2 - Spatial frequency corresponds roughly to the level of details you can see.
 The blurry Mona Lisa (down right) has mostly low spatial frequencies, whereas the one above has mostly high frequencies (in that case the image conveys where the light changes very rapidly between dark and bright).
 With very special thanks to Gerry Harp for the illustration.

WAIT, MAYBE PEOPLE WHO CHOOSE TO PLAY THESE GAMES HAVE BETTER VISION TO START WITH, RIGHT? HOW DO YOU REALLY KNOW IT IS THE VIDEO GAME PLAY THAT GIVES RISE TO THESE CHANGES?

To establish the link between action game play and enhanced vision, training studies are needed. In such



FIGURE 3 - Difference in contrast sensitivity in observers who do not play fast-paced action games versus those who are habitual players of such games (5 hours per week or more for at least 6 months and often years).
 Picture courtesy of Walter Makous.

studies, individuals who are not habitual players of any video game genres are recruited to come and participate in a study. As part of the study, they first come to the lab to get their vision pre-tested, then each participant is randomly assigned to one of the two groups: the first group is asked to play an action video game, the second group is asked to play a control game. In many studies, different kinds of commercially available video games are contrasted – for example, the action group would be asked to play Call of Duty or Medal of Honor, and the control group, a social game like Sims, or a time management game like Restaurant Empire.

Participants play for about one hour a day, 5 days a week over a period of 10 weeks for a total of 50 hours. During that time period, they are not allowed to play any other video games. At the end of their training, participants return to the lab and get their vision tested again. Those participants trained on the action games showed greater improvement from pre- to post-test in the vision test than those trained on the control games (Figure 4). This is what allows us to conclude that action video game play enhances vision. Note that if the experimental design did not include a control group to compare the action group, the improvement could have been attributable to varied confounds such as the fact that the participants decided to commit to an experiment, the attention they received from the experimenters, or just greater time spent on a computer screen!

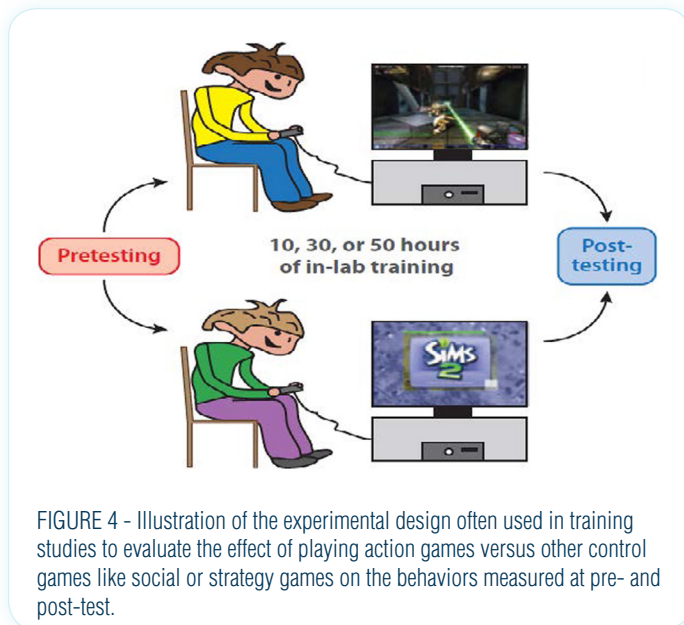


FIGURE 4 - Illustration of the experimental design often used in training studies to evaluate the effect of playing action games versus other control games like social or strategy games on the behaviors measured at pre- and post-test.

Based on these results, several teams have begun to look at how to best use video games to help patients who suffer from amblyopia. Amblyopia is a weakening of vision due to abnormal visual experience early in life (for example, when a baby develops a cataract whereby the light cannot reach the back of the eye because the lens is clouded). Often the problem with the eye can be fixed but, because the brain has not received the correct visual inputs early in development, it does not wire properly and the patient continues to have weak vision despite having a now normally functioning eye. Video game play seems to be a promising new way to teach the brain how to see again!

ARE THERE ANY OTHER BENEFITS BEYOND VISION? DO WE KNOW OF ANY EVERY DAY LIFE BENEFITS?

A number of other benefits to video game play have been documented in the past 10 years. Beyond vision, action video game play changes for the better skills as varied as how well one can pay attention, multitask, or mentally rotate objects' in one's head as when reading a map to find one's way [2]. This is not to say that all aspects of behavior change, and

certainly not always for the better! Commercially available action video games all happen to be violent and exposure to violent media results in more aggressive behavior just after being exposed. In the future, we hope to be able to have access to games devoid of violence but that have the same mechanics of action games to better harness their positive potential for change.

The impact of gaming on everyday life is well illustrated by recent studies showing that laparoscopic surgeons, or surgeons who perform computer-aided surgery, are better surgeons when they play video games [3]. A study contrasting young inexperienced surgeons who played video games to seasoned surgeons who had years of surgery experience but little gaming experience found that the young surgeons performed the surgery faster and made less errors.

ARE THESE EFFECTS LONG TERM OR SHORT TERM? DO THEY APPLY TO PEOPLE OF ALL AGES OR JUST CHILDREN?

The benefits from action video games appear long lasting. For vision, the positive effects of 50 hours of training over 10 weeks were still visible 5 months after the end of training; and for the participants, we could follow-up 2 years after the end of training. Similarly, a training study looking at the impact of 10 hours of action game play on mental rotation showed effects not just a few days after the end of training but up to 5 months. Sustained, long-lasting impact is important as our goal is to use this research either for education or health applications.

One limitation of our current knowledge is that we are not sure, at what age the brain can be re-wired by video game play. Most of the published studies have been performed in college students between 18 and 35 years of age. A few reports suggest that similar effects are at play in children, and that even older adults may also benefit from this approach. In a recent study, the group of Adam Gazzaley [4] trained older adults on an adapted version of a driving game,

where the driving was often disrupted by other tasks. The study showed that older adults not only improved on the game but also indicated benefits in other skills, not directly related to the game. But clearly more work is needed.

SINCE PLAYING VIDEO GAMES IS GOOD FOR ME, ARE MY PARENTS WRONG TO TELL ME TO STOP?

Not so fast! First, every activity in excess is bad for you. Just like drinking too much water can be bad for your health, or too much exercise can be bad for your muscles, too much video game play can be bad for your brain. A healthy diet should include physical exercise, mental stimulation, and social activities – so if you turn into a recluse who plays alone for hours on end, this is not healthy and your parents are right to fight you!

A thorny issue concerns how much game play is too much. The published scientific studies are certainly not an excuse for binging on game play. Most studies nowadays consider that about 30–40 min of game play every day may be the ideal schedule. From what we know of learning and brain plasticity, more would not be better and it could even be worse. Now, if you were on your computer playing at most 30 min per day, your parents would certainly be less worried!

The main issue is whether you can control your gaming habits. Are you in charge, or is the pull of your gaming world so great that you are ready to ignore schoolwork, friends and family? As you age, a key part of your brain – the frontal cortex – matures and develops. This is the slowest developing part of your brain: it does not mature to the adult level until around 20 years of age! This is the key part of the brain for self-regulation and control, as well as for planning, like organizing your school day. Learning how to regulate the urge to play from

a really young age and mastering the art of stopping on demand can be an incredibly valuable lesson for setting the frontal cortex on the right developmental path.

So, as you see, the brain is complex and we still have much to learn. Although action video games enhance some of your every day life skills, it is also the case that every activity in excess is bad for you. So you must be able to stop yourself and manage your gaming time. And after all, since gaming improves your skills, you might as well make the most of them in the real world!

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REVIEWED BY:



Sean, 5 years old

I love books and articles with wry humor, and think my father is the funniest guy in the world. My other love is mechanisms, and I am frustrated that I have not yet learned the math needed to build a spaceship. But I am working on it, meanwhile honing my logical skills by reviewing.



Nora, 5 years old

I love to grow flowers (to put into bouquets) and vegetables (to eat). I work hard on my violin lessons, and enjoys going to new cities and countries. I am extremely organized, and keep a planner to make sure I stay on top of things, like reviewing deadlines.



Anaya, 12 years old

About two years ago I moved to Europe. I love traveling and I've been to many places such as Mexico, Italy, Spain and Canada – foreign food is yummy! Sports is also high on my list – Right now I do karate, and since I live near the French Alps, I ski and rock-climb a lot. And last but not least, I love science – I probably wouldn't be writing this right now if I didn't!

AUTHORS



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