

THE AUGMENTED BRAIN

HOW VIDEO GAME PLAY ENHANCES PERCEPTION,
ATTENTION, & COGNITION

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ABSTRACT

The negative portrayal of video games in political campaigns and the mass media has caused unnecessary fear and controversy surrounding the consumption of action video games. In this paper, I reveal common misconceptions published in the media, cover several key points surrounding the history of controversial video games, and provide ample evidence that action video games positively augment the brain in the areas of perception, attention, and cognition. My hope is to allay fears that video games are harmful to the brain's development, and to convince gamers and non-gamers alike that the benefits provided by the medium can be utilized in applications beyond gaming.

INTRODUCTION

Video Games are often used as scapegoats or low hanging fruit in larger social issues because of the interactive nature of their content, which is surprising considering their ever-expanding popularity and availability. With the advent of the smart phone and subsequently the tablet, access to platforms capable of executing video game software has proliferated. What was once a niche hobby requiring specialized hardware, has become a common pastime for most of the developed world. According to the Entertainment Software Association's 2017 Essential Facts Report, 67% of U.S. households own a device that is used to play video games, and 65% of those households are home to at least one person

who plays video games for 3 or more hours per week. Furthermore, the amount of consumer spending on the video game industry reached \$30.4 billion in the year 2016 alone (Entertainment Software Association, 2017).

Upon seeing these figures, it is understandable that activities surrounding video gameplay occupy a controversial slot in the public consciousness. For example, the 1993 release of a graphic fighting game, *Mortal Kombat*, led to a politically charged, media fueled frenzy about the corrupting influence of video games on developing minds. The infamous senate hearings that followed, resulted in the formation of the Entertainment Software Ratings Board (Crossley, 2014). Ultimately, concerns related to the harmful effects of video gaming tend to be exacerbated by sensational stories presented by the mass media and a lack of knowledge pertaining to research on the positive aspects of video game exposure. Counter to the societal narrative, playing video games can positively impact brain development in the regions of perception, attention, and cognition.

CONCERNS SURROUNDING VIDEO GAME PLAY

The assignment of particular video game genres or specific video game titles by media outlets as motivation for the perpetrators of tragic events is so common that it has become cliché. You don't have to look far to discover stories from major media organizations blaming the medium for the horrific actions of Adam Lanza, Seung-Hui Cho, Omar Mateen, and countless other violent offenders. A simple Google search with any of these names, followed by "video games" will

produce results from trusted news outlets such as the New York Times, CBS, and NBC all claiming some link between the violent acts and video games. With such negative coverage, it is understandable that the uninformed would be wary of the consequences of gaming. Christopher Ferguson, Ph.D. and co-author of Moral Combat: Why the War on Violent Video Games is Wrong, posits that many fears stem from a form of confirmation bias on the part of society and the media's coverage of mass homicides:

When a mass homicide perpetrator is an older male or (more rarely) a woman, society ignores the issue of violent video games. But when a perpetrator is a young male, society makes a fuss over violent video games, forgetting almost all young men play them. This bias allows the illusion of a correlation to persist even where none exists. (Ferguson, 2016)

Beyond violent acts, there are also concerns about children developing attention disorders and social deficiencies due to exposure to video games. The Article by Perri Klass in the New York Times questions whether increased screen time playing video games is a consequence of A.D.H.D. or the cause of it. The article cites a 2010 study by the journal *Pediatrics* that associates playing video games with subsequent attention problems, and then follows that citation with a conflicting 2007 study in the journal *Media Psychology* that concluded differences between children diagnosed with A.D.H.D and a control group without were more likely a product of family factors and environment (Klass, 2011).

However, a later study in the journal *Pediatrics* espouses the benefits of regular video game play when practiced in moderation. In the study, Dr. Andrew K. Przybylski (2014) analyzed data collected from participants ranging in age from 10 to 15 years old. A subsample of 2436 male and 2463 female adolescents were surveyed on their gaming habits then given assessments of psychosocial adjustment. The results and subsequent analysis provide evidence that children who invest a third of their free time gaming had higher levels of prosocial behavior and lower levels of hyperactivity. Przybylski goes on to suggest that electronic play presents opportunities for identity development along with social and cognitive challenges (Przybylski, 2014).

THE HISTORY OF GAMES IN THE MEDIA

The combination of inconclusive claims, media alarmism, and political fervor are all contributing factors in the public misconception that video games are more harmful than helpful in brain development. To understand how we arrived at this popular notion, it is important to understand the history of the gaming industry and its relatively rapid rise in popular culture as a form of entertainment.

Spacewar, the first interactive computer game ever, was created by an MIT Student named Steve Russell in 1961, but the popular 1970's Pong Arcade and home unit developed by Atari Engineer Al Acorn under the direction of Nolan Bushnell is cemented in the minds of most as the birth of the video game industry. In 1976 Exidy Games released Death Race, a black and white game

that allowed players to drive over stick figures. This produced the first controversy surrounding video games on the national stage via a feature aired on *60 Minutes* (Kent, 2002).

During the next decade Nintendo released the Nintendo Entertainment System home console, which resulted in increased adoption of gaming devices in the home and contributed to the steady decline of video game arcades. The transition away from games being played outside of the home brought increased visibility to parents who were previously unaware of the content their children were consuming (Markey & Ferguson, 2017). As mentioned previously, this visibility directly contributed to the 1993 senate hearings on video game violence. The calls for reform, led by Joe Lieberman, resulted in the industry's creation of a self-policed ratings system to avoid governmental litigation. Regularly referred to as one of the medium's coming of age events, the pioneering Entertainment Software Ratings Board and established ratings codes were developed within five months and are still utilized today (Crossley, 2014).

The moral panic and political outrage induced by the media and concerned parents only added to the momentum of the industry, which has ultimately led to higher exposure and expanding profits. As with many types of popular media that reach critical levels of success, myths have formed about gaming and its influence on the mind. But, the resulting increase in societal mindshare has also spawned interest in the possibility that the technology could positively affect the

brain's development, and many positive discoveries have been revealed through research in the fields of psychology and cognitive science.

THE BENEFITS OF VIDEO GAME PLAY

In the realm of perception, a particularly interesting study published in the *Journal of Applied Developmental Psychology* revealed that playing action games enhances spatial skills among children. In the study, a group of 10 year olds were given a pre-test to determine their proficiency in understanding, reasoning, and remembering spatial relations between objects. Then they were instructed to play the action game Marble Madness or the word game Conjecture for three 45 minute sessions. After their video game training, the subjects were given a post-test, and the results showed spatial skills were vastly improved among the Marble Madness players who had low scores on the pre-test. However, the Conjecture players did not show similar levels of improvement. The test was purposefully conducted on adolescents at an age when their spatial awareness is still developing (Subrahmanyam & Greenfield, 1994). The results provide evidence that video games have a direct, positive impact on the brain's development.

A more recent study published in *Proceedings of National Academy of Sciences* (2014) outlines methods for enhancing perceptual templates through action video game play. Through a series of experiments involving orientation identification tasks, experienced action video game players showed," an

enhanced ability to rapidly learn perceptual templates tuned to the task at hand.” (Bejjanki, Zhang, Li, Pouget, Green, Lu, & Bavelier, 2014) While this disputes video game experience as a means of direct knowledge transfer, it reveals that there are immediate benefits to performance when exposed to new objectives (Bejjanki et al., 2014).

Further research conducted by the University of Rochester’s *Department of Brain and Cognitive Sciences* shows that these enhancements to processing speed related to visual attention do not diminish accuracy when completing a range of tasks. The study compared the reaction times and accuracy of video game players (VGPs) and novice video game players (NVGPs) using a series of computerized interactive tests by the TOVA Company. The results revealed an 11% decrease in reaction time for VGPs with no discernable difference in accuracy when compared to NVGPs (Dye, Green, Bavelier, 2009). Again, action video games were emphasized as the most beneficial for cognitive processing and perceptual reaction times. The games *God of War*, *Halo*, *Unreal Tournament*, *Grand Theft Auto* and *Call of Duty* were referenced as examples in the genre (Dye et al., 2009).

In, *The Benefits of Playing Video Games*, researchers from the Developmental Psychopathology Department outline several studies in which shooter and action games are proven to promote several cognitive skills. For instance, participants with little experience in gaming were randomly assigned to play either a shooting game or another type of game,

Compared to control participants, those in the shooter video game condition show faster and more accurate attention allocation, higher spatial resolution in visual processing, and enhanced mental rotation abilities. (Granic, Lobel, & Engels, 2014)

The research goes on to conclude that the benefits are long lasting, transfer to other spatial scenarios that do not involve gaming, and can be measured utilizing functional magnetic resonance imaging (Granic et al., 2014).

Video Games have also been utilized as a means of Therapy for Cognitive Rehabilitation. A selective review of medical and psychological literature published by the *International Journal of Privacy and Health Information Management* compiles several examples in which the medium has been used as a rehabilitation aid. In the summary provided, Griffiths, Kuss, and Ortiz de Gortari (2017) cite studies that demonstrate sustained attention, increased spatial cognition, and improvements in perceptual motor-skills for patients suffering from ailments such as craniocerebral trauma and stroke patients.

CONCLUSION

Contrary to popular rhetoric that video gameplay has overwhelmingly negative results on brain development, the large body of research covered here suggests the opposite. Materials from the *International Journal of Privacy and Health Information* demonstrated that video game play increased cognitive function in therapy patients, while results from *Department of Brain and Cognitive Sciences*

produced evidence for enhanced reaction times. Perhaps most surprisingly, the studies presented in the *Psychological and Cognitive Science*, *Association for Psychological Sciences* and *American Psychologist* revealed that games from the action and shooter genres provided some of the most immediate and lasting benefits to perception, attention, and cognition. This directly contrasts the misconception that games from those genres negatively impact brain development.

While not every game genre yields measurable positive results, there are several instances of positive brain augmentation occurring throughout the studies. The importance of game genre or type of game in relation to these positive outcomes cannot be ignored, and like any form of training, guidance is necessary for achieving the desired results. As video games become democratized through mass production and adopted for utilization in fields beyond recreation, their ubiquity should no longer be cause for concern but rather cause for celebration. With proper implementation, video games are a boon that rival more traditional means and other interactive software solutions in providing cognitive benefits for the developing brain.

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