

# AN EXPLORATORY STUDY ON THE IMPROVEMENTS IN COGNITIVE FUNCTIONALITY ACHIEVED THROUGH GAMING

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## ABSTRACT

*The issue of whether video games have any real-world cognitive benefits have been an area of study and debate, especially when they are surrounded by common myths as to the effect they have on minors or young adults in particular. These same claims also link video games predominantly of the action genre to real world violence. Individual studies have been conducted to measure improvements in various aspects of cognitive functionality such as attention, memory, perception and decision-making prior to this. The purpose of this study is to compile relevant studies into a cohesive whole in order to further substantiate the hypothesis. The link between video games and real-world violence has also been explored.*

**Keywords:** Action, Attention, Cognition, Decision-making, Gaming, Genre, Improvement, Memory, Perception, Priming, Processing, Violence, Visuospatial.

## 1. INTRODUCTION

### 1.1Effects of Gaming

Gaming has several effects on the player including psychological, social and cognitive. One of the prime psychological effects of gaming on individuals, which is also societal concern is addiction. In 2005 Qui Chengwei, a Shanghai based gamer stabbed his friend to death over a virtual sword he had sold online for \$738 without his consent. Another incident occurred in 2009, where 17-year old Daniel Petric was sentenced to 23 years in prison by the Ohio state court for shooting his mother. The incident took place after his parents confiscated his copy of Halo 3. The court revealed that Daniel was addicted to the game after he was left house bound after a jetski injury. In 2011 the New Mexico court sentenced Rebecca Colleen Christie to 25 years in prison after she spent hours playing World of Warcraft, leaving her three-and-a-half-year daughter to die of malnutrition. Despite prominent cases like these, video game addiction is still a subject of controversy. Extreme cases of video game addiction go back to the 1990's when Wired ran a story on players addicted to MUD's (Multi-User Dungeons). In the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) that was recently released, among the disorders being considered for future study and as an addition to later DSM editions, Internet Gaming Disorder is one of them (Vitelli, 2013). In the current scenario video game addiction is not considered a disorder. 1.7 percent of ninth graders and 0.5 percent of all gamers experience symptoms or after effects associated with excessive video game use. Clinics for video game addicts have been established worldwide especially in the Netherlands, Australia and China. This includes Online Gamers Anonymous in the

United States. The age group most prone to video game addiction are adolescents, particularly male adolescents (Van Rooij AJ, 2010). Researchers have however linked video game addiction to various personality traits, such as higher acceptance of violence, lower social skills, impulsiveness and trouble coping with life in general. Individuals inflicted with stress or depression are often more likely to become video game addicts and are most likely to be diagnosed with other disorders, such as attention-deficit hyperactivity disorder (ADHD), depression and anxiety. Researchers have looked at the amount of time spent online as a risk factor, but even game genre should be taken into consideration. Role playing gamers strategy gamers, action gamers are more prone to addiction. A recent study found that reduced social competence, longer gaming time and an impulsive behaviour history increase the likelihood of video game addiction after a period of two years (Gentile et al.,2011). Pathological gaming may lead to social phobias, depression, poor performance and anxiety. Studies have also found that six months later reduced social skills lead to increased problem game behaviour although the opposite was not observed (Jeroen S.Lemmens, 2011). Pathological gaming is often rooted in loneliness although vice versa was not true for satisfaction. A study was also conducted to identify a link between problem gaming behaviour and social and personality risk factors over time. 1217 fourth grade students were surveyed by Dirk Baier and Florian Rehbein of Germany's Criminological research institute of Lower Saxony. The survey was repeated five years later. The study found that the biggest factor that determined video game addiction was the male gender, also including the single-parent family factor. Problem video game behaviour was found to persist over a period of time and children with addiction in the fourth grade were more likely to have addiction even five years later, hence as common myth suggests children do not automatically grow out of it on their own.

Gaming also has social effects on gamers specifically students. Social skills of students addicted to computer games were compared to normal students. The study found that there was a significant difference in social skills between the two groups, consequently normal students had much higher levels of social skills than students addicted to computer games (A. Kheradmand, 2012). Often lesser social skills usually lead to social withdrawal and isolation which in turn lead to several other complications. This kind of addiction generally affects personal relationships and individuals tend to neglect every other aspect of life in order to give time to feed the addiction. An addiction of this sort at a younger adolescent age can hamper development of social skills leading to social awkwardness in the real world and isolationism. Gaming also has its effect on the physical and mental well-being of the individual. Research has been done analysing the same and it has been found that gaming to the point of addiction has a correlation with the physical and mental health of a person in dimensions of physical health, sleeplessness and anxiety. Pathological use of video games has been associated with key indicators of psychosocial well-being, this includes low life satisfaction, loneliness, low social competence and low self-esteem (Jeroen S.Lemmens, 2011). Studies in the past have shown that these indicators are causes or consequences of pathological gaming. Lower psychosocial wellbeing is considered as an antecedent among adolescent gamers, of pathological gaming. This also explains deterioration of real-world relationships due to the displacement of real-world social interaction resulting from excess gaming thus resulting in loneliness.

Previous studies have also suggested various physical effects on individuals who game over long periods of time. This includes obesity, sleep loss and cardiovascular risks. Particularly children, or the youth in general are more susceptible to sleep deprivation, disorders associated with poor cardio-metabolic health as well as obesity. Obesity has becoming a major crisis over the years and studies in the past have suggested that this is partly due to the exposure to electronic gameplay of various kinds, or in other words, gaming (Sandra L. Calvert, 2013). The idea is the promotion of a sedentary lifestyle and behaviour encouraging the consumption of high calorie foods and beverages low in nutritional value. However electronic games have also contributed to bring healthier outcomes in the paediatric obstruction crisis. The physical effects in each case have shown to impact the overall well being, especially social interactions and relationships (Ofir Turel, 2016). The biggest of all factors of influence was curtailed sleep due to addiction. One of the biggest topics of controversy in the recent years has been the effect of violent video games on young children. Studies in the past have suggested that playing violent video games may lead to an increase in angry feelings, aggressive thoughts, physiological arousal, aggressive behaviour and a increased heart rate (Association For Psychological Science, 2011). Meta analytical studies in the past have also shown a link between increased aggression after playing violent video games. Another linked aspect is the phenomenon of desensitization where children exposed to violence in the form of video games over a long period of time tend to get desensitized from such portrayals of violence even in the real world. Another aspect that is significantly impacted with respect to children is academic performance, where video games serve as the perfect distraction. Surveys in the past have shown this consistent trend with video game players having comparatively lower grades than non-gamers although this isn't always true. The same studies also suggest a decrease in altruism and a lack of empathy for others. Another aspect of violent video games is the phenomenon of priming where individuals associate virtual world emotions to the real world without being able to make a distinction, this leads to the possibility of virtual violence escalating to the real world. Although the same studies also suggest that such video games also help individuals with stress management. This study also aims to prove that there is no priming in video games and thus no real threat to the real world with such violent video games.

Video game controversies are societal scale scientific arguments about whether the content of video games changes the attitudes and behaviours of a player, and whether this is reflected in the overall video game culture. Since the beginning of the 2000s, advocates of video games have emphasized their use as an expressive outlet or medium, arguing for their protection under the laws governing freedom of speech and also as an effective educational tool. Detractors and critics argue that video games are harmful and therefore should be subject to legislative restrictions and oversight. The negative and positive characteristics and effects of video games are the subject of scientific study. Results of investigations into links between video games and violence, aggression, addiction, social development, and a variety of sexual morality and stereotyping issues are debated. Theories of negative effects of video games generally tend to focus on players' modeling of behaviors demonstrated in the game. These effects may be exacerbated due to the interactive and intuitive nature of these games. The General Aggression Model (GAM), is the most well-known theory of such effects which proposes that playing violent video games may create cognitive scripts of aggression which will be activated or

lead to a trigger in incidents in which individuals think others are acting out with hostility. Playing violent video games, thus, becomes an opportunity to rehearse and plan out acts of aggression, which then become more common in real life. This is also known as priming. The general aggression model suggests the simulated violence of video games may influence a player's real feelings, thoughts and physical arousal, affecting individuals' interpretation of others' behavior and increasing their own aggressive behaviour by a factor (Koojimens, 2004). Some scholars have criticized the general aggression model, arguing that the model erroneously assumes that aggression is primarily learned and that the brain does not distinguish fiction from reality. Some recent studies have explicitly claimed to find strong evidence against the GAM. Some biological theories of aggression have excluded video game and other media effects because the evidence for such effects is considered flimsy and weak and the impact too distant. For example, the catalyst model of aggression hails from a diathesis-stress perspective, implying that aggression is due to a combination of environmental strain and genetic risk. The catalyst model suggests that antisocial personality, coupled with stress are salient factors leading to aggression. It does allow that proximal influences such as peers or family may alter aggressiveness but not games and media.

## **2. REVIEW OF LITERATURE**

In the 2014 issue of the American Journal of Play, an article written by researchers C. Shawn Green, Adam Eichenbaum and Daphne Bavelier made its mark as it summarized all current research demonstrating the various imprinting or long-lasting cognitive benefits of gaming (Adam Eichenbaum, 2014). These effects include various basic mental processes such as decision-making, attention, memory and perception. A bulk of the research generally involves testing the effects of Action video games on individuals. This is due to the fact that such games usually require players to move quickly, hold a great deal of information at a time, make split second decisions and keep track of multiple items at once. These games make gamers tap into the exact abilities that are considered building blocks of intelligence by psychologists. Research of this form usually use two strategies, experimental and correlational. Experimental research is the best to prove cognitive improvements in gamers as the experiment begins with non-gamers, from which a few are asked to play particular games for a few number hours a day, and few days in a week for the experiment. These individuals are then tested against the control group to measure basic perceptual and cognitive abilities with the numbers typically being higher for the test group. Correlational methods on the other hand compare gamers to non-gamers in their natural habitat in order to prove gamers perform better than non-gamers at various tests, such methods may suggest the same but can't prove it. The findings of the review suggested improvement in basic visual processes such as improved visual contrast sensitivity, the ability to distinguish between subtle in shades of grey in comparison to the control group (Renjie Li, 2009). The successful treatment of Amblyopia, more commonly known as lazy eye was found in gaming as tests with the sole usage of the affected eye was found to improve its condition (Roger W. Li, 2011). Improved spatial attention was observed as it was found that action video gaming improved the ability to locate quickly in a field of distractors. The ability to track moving objects among other identical moving objects was observed among children and adults who played action video games (Naina Sethi, 2005). Action games have been shown to reduce impulsiveness by testing the ability to refrain from responding to non-

target stimulus. It has even shown to help overcome dyslexia, as dyslexia in most cases is a problem arising from visual attention. The improvement in performance was much greater than in specially designed training programmes to treat the same. Executive functioning was significantly improved to allow quick and efficient problem solving and decision-making. Most experiments show positive improvements of video game training on executive functioning. This includes the ability to multitask and increased mental flexibility. The review also shows a significant reversing of the mental decline that is accompanied with aging, this includes abstract reasoning, working memory, cognitive flexibility and attention.

The relationship between the neural correlates and the use of video games can only be understood by taking into account the various cognitive factors it encompasses. A systematic review was conducted in 2017 that included neuro-imaging techniques with reference to changes in brain structure and functionality as well as the presence of video games, which were used as standardised operators (Palau et al., 2017). Healthy participants of any age and gender were used, this included participants that reported gaming addiction or met the criteria for Internet Gaming Disorder (IGD). The primary outcome was measured with any sort of change in brain structure and functionality using any sort of neuro-imaging techniques, this included PET (Positron Emission Tomography), CT (Computed Tomography), MRI (Magnetic Resonance imaging), fMRI (functional Magnetic Resonance Imaging) or any others. The academic articles were located on two primary databases, Web of Science and MEDLINE, and studies weren't limited by the year of publication. The combined data acquired from the reviewed articles were categorized based on cognitive functions for convenience, the six categories were visuospatial skills, cognitive workload, reward processing, attention, cognitive control and skill acquisition. Structural and function correlates are discussed with each function. Attentional resources are the most involved in terms of cognitive functions with video games and are closely related to other regions of the brain. Evidence suggests that gamers display increased performance (Marc Palau, 2017) in a range of top-down attentional control areas such as sustained attention, selective attention and divided attention. It is an area that consistently shows functional activity during video game play. Habitual gamers are shown to have more effective top-down resource allocation in attentional demanding tasks. In terms of video game genre, action games prove to be better at increasing selective attention than slower games like Role playing games or strategy (Krishnan L, 2012). Neural correlates related to visuospatial skills have been found in terms of structural volume enlargements of the right hippocampus of the brain thus showing improvements in visuospatial skills in gamers as opposed to non-gamers. Cognitive demands of the environment determine brain activation patterns on the associated level of workload. When this variable is manipulated neural correlates are observed as neural recruitment mechanisms are seen as cognitive demands increase. Cognitive workload associated with attention and working memory demands tend to increase with increase in difficulty during video game play with expert video game players. In terms of cognitive control structural and functional changes are observed showing improvements in executive functions post video game training although transfer effects aren't as big. Electroencephalography studies have shown correlations that reflect cognitive control engagement during the training video game. Studies also identified a correlation between striatum activity which is associated with learning and performance levels in a video game. Reward processing on the other hand is usually associate with

the game addiction aspect. Even in professional and expert gamers who control the amount of time they play video games show different neural patterns as opposed to addicted video game players, together they may signify an unbalanced reward system.

In previous studies the effects of environment enrichment and its neural foundation have been studied in detail on rodents. An example of this would be changing an animal's living environment to further enhance sensory stimulation and may increase neuroplasticity and hippocampal cognition. This can alleviate defects associated with aging and neurodegenerative diseases. A study in 2015 tried to test the same on humans using the variety of virtual environments in video games as a correlate to environment enrichment (Clemenson GD, 2015). It was observed that video gamers who preferred complex 3D video games performed comparatively better at demanding memory recognition tasks that assess participant ability to discriminate highly similar lure items from repeated items. After training two weeks on Super Mario 3D World below-average video gamers showed improvements on a virtual water maze task as well as mnemonic discrimination ability. Two other control groups were used, one passive and the other training in the 2D game Angry Birds. All games were played on a Wii U with a 32-inch LED television. The participants were made to go through enumeration tasks and various experimental designs including pre-tests and post-tests from the gaming sessions such as virtual water maze probe trials. Neither control groups showed any consequential improvement despite no difference in visual perception. Both Non-gamers, and gamers training with Angry Birds operated similarly. Individual performance in both hippocampal-associated behaviours did not correlate with Angry Birds, but did correlate with Super Mario proving that the nature of individual exploration of virtual environments determine hippocampal behaviour. By using both a 3D and an active 2D control condition, the data suggests that the visuospatial aspect of the environment may have a specific impact on hippocampus-dependent behaviour. The typical video game is made keeping any specific cognitive processes in mind and are usually meant to immerse the player into the story or adventure, modern video games draw on multiple cognitive processes which include critical thinking, attention, emotional, spatial, working memory and problem-solving abilities. Video games which therefore try to parallel natural experience may help translate enriching experiences into functional gains. The relevance of this study shows that video games that have been played by children for decades due to enriching 3D environments and engaging experiences, may finally be providing useful stimulation to the brain. Hence modern-day video games may provide meaningful hippocampal stimulation.

### **3. METHODOLOGY**

#### **3.1 Research Objectives**

The researcher formulated four objectives that further streamlined his study. These objectives are:

- 1.To assess the various positive cognitive benefits of gaming on the individual.
- 2.To identify the kind of games that actually trigger improvement.
- 3.To identify if there's a link between video games and real-world violence.

- 4.To analyse improvement in a person's attention, memory, perception and decision making after gaming.
- 5.To analyse titles from the action and RPG genre which trigger improvement.
- 6.To identify if there's priming in video games.

### **3.2 Research Design**

Based on the type and nature of the research questions, the researcher found the survey research design and systematic review effective and appropriate, as it answers all the researcher's questions mentioned above. In a survey research design, a group of people relevant to the study are studied by analysing and collecting data from them.

### **3.3 Population of the study**

The target population of the for this research are men and women, ideally college students between the age of 16-25 who identify as gamers to some extent, or see themselves as part of the gaming community.

### **3.4 Sampling**

In a country like India where the gaming industry is still growing factors such as rise in popularity of gaming and the advent of the internet hence it is impossible to study the effects of gaming on every gaming individual. Therefore, this study involves the researcher studying a sample. For this study the sample population of the study stood at a melange of 100 individuals who identify themselves as gamers, be it at light, moderate or enthusiast levels of gaming expertise.

### **3.5 Sampling Techniques**

The sampling method used for this study was purposive sampling. Purposive sampling is a non-probability method of sampling and is based on specific characteristics of the population itself. The studies selected for the systematic review are based on a specific agenda, as well as certain inclusion and exclusion criteria, hence purposive sampling is the ideal sampling technique for this study.

### **3.6 Instruments for data collection**

Quantitative methodologies have been used for the study. Qualitative data collection method used for this study is a systematic review. The quantitative method of data collection used in this study is the questionnaire method. A questionnaire is basically a form of research instrument comprising of a series of questions for the purposes of gathering or acquiring information from respondents. Questionnaires are usually designed for statistical analysis but this is not always the case. For this particular study questionnaire method is ideal for data gathering as it makes it easier for the researcher to collect and quantify responses for the questions. The instrument was structured in such a way that it gave respondents an array of options or replies to choose from.

### **3.7 Theoretical Framework**

For this study the theories relevant to it are the Social cognitive theory as well as cultivation theory, which are commonly used in communication and education. It holds that portion of an individual's knowledge acquisition which could be directly observed in others within the social interaction context. Social cognitive theory has been used in the past to understand the motivation behind playing digital games. Understanding the

cognitive effects of gaming on the individual requires such a framework. It also offers a flexible framework to understand various determinants of playing games of specific genre. The social cognitive theory is also the ideal framework to understand human behaviour as it states that people can learn through observation to input, perceive, organize, store and then synthesize information in the same manner as a computer does. This is the same manner in which cognitive changes are observed in individuals after constant exposure to video games. The cultivation theory on the other hand analyses the long-term effects of television, or in this context gaming media. The primary proposition of the cultivation theory states that the more time people spend in the television world the more likely they are to believe social reality aligns with reality portrayed on television, or in this context the virtual world of video games. This is ideal to study the long-term effects of violent video games and its links to real world crime and violence.

#### 4. DATA ANALYSIS

##### 4.1 Discussions and Findings

Table 4.1.1 Age group and demography of respondents

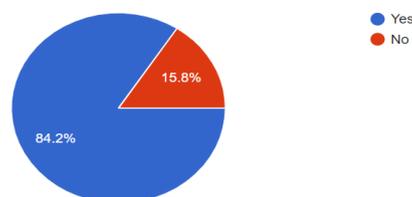
Total population	n=57
Age group	18-25
Percentage	100%
Research City	Bangalore

The table describes the basic demography of the population chosen for the survey. The population size of the sample was 57. The age group of the respondents chosen for the survey were between 18 and 25. Research location chosen was the city of Bangalore.

Fig 4.1.2 Identification as a gamer

1) Do you consider yourself a gamer ?

57 responses

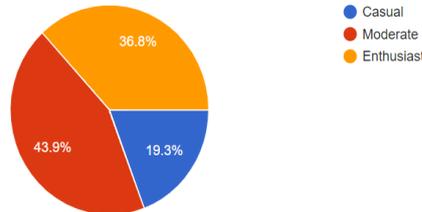


The figure above represents the nature of the individuals who took part in the survey in terms of gaming identity. Based on gaming experience individuals may or may not identify themselves as gamers. The above demographic shows that 84% of the population considers themselves as gamers, while 15.8% of the population does not identify with the same title.

Fig 4.1.3 Gaming experience of respondents

2) At what level would you consider your gaming experience to be ?

57 responses

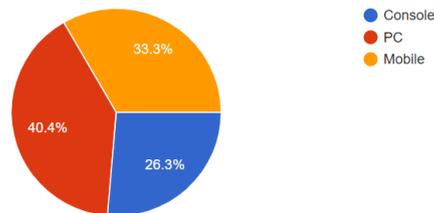


The demographics shown above reflect the gaming experience of the total population, ranging from casual gamers, moderate gamers, all the way to enthusiasts. The above table shows that 19.3% of gamers in the population consider themselves casual gamers, or those with little gaming experience. 43% of the population considers themselves as moderate gamers i.e. the average gamer, while 36.8% of gamers call themselves enthusiasts, or dedicated gamers. A majority of the population is shown to have either average or more than average gaming experience to give credible opinions.

Fig 4.1.4 Primary gaming platform for respondents

5) What platform do you game on primarily ?

57 responses

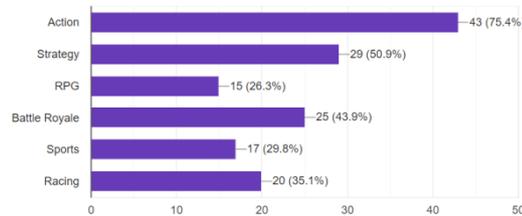


The figure shows the demographic of the platform preference of the gamers. The three options offered to them were console, PC and mobile gaming platforms. The data shows that 40.4% of gamers use personal computers as their primary gaming outlet, both desktops and laptops in consideration. 26.3% of gamers use consoles as their primary outlet, either a PlayStation, Xbox or any other vendor, while 33% of the population has mobile gaming as their primary gaming platform. The data reflects the dominance of the personal computer platform in the gaming industry.

Fig 4.1.5 Game genre preferences of respondents

6) What genre of games do you prefer ?

57 responses

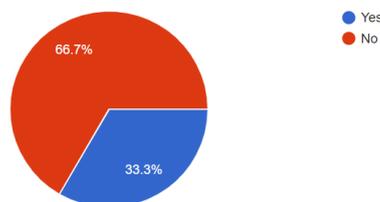


The above demography shows the genre preferences of gamers across the board. Respondents were allowed to choose multiple options in terms of preference and were offered the most popular genre to choose from. The data showed that 75.4% of the population preferred the action genre, 50.9% of the population preferred the strategy genre, 26.3% of the population preferred the RPG (Role playing game) genre, 43.9% of the population preferred the battle royale genre and 29.8% of the population preferred the racing genre. The data reflects a comparison of the various genre among the population with a majority of gamers choosing the action genre as one of their preferences.

Fig 4.1.6 Respondent’s opinion on whether action games are violent or not

11) Do you find action games to be violent ?

57 responses

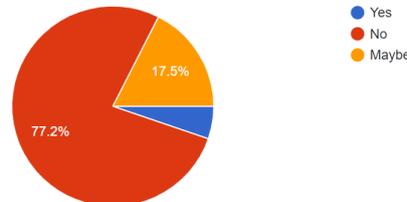


The figure shows the demographic of the respondents who found action games to be violent or otherwise. The data shows that 66.7% of the population did not find action games to be violent whereas 33.3% of the population found action games to be violent. The data reflects the view of the general gaming population of which a majority do not believe action games are violent.

Fig 4.1.7 Respondents opinion on desensitization to real-world violence due to action games

12) Do you feel desensitized to real world violence due to exposure to action game violence ?

57 responses

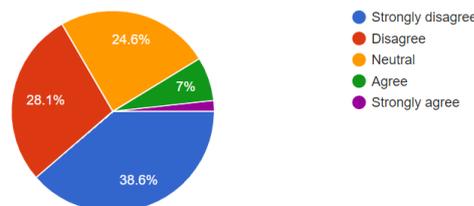


The above demographic represents the respondent's take based on experiential knowledge on the effect of action games on desensitization to real-world violence. The data shows that 77.2% of the population did not feel desensitized to real-world violence and said yes, 5.3% of the population felt desensitized to real-world violence and said no whereas 17.5% of the population said maybe, indicating that they weren't sure of its effects. The data reflects that a majority of the population did not feel desensitized to real world violence after exposure to action games.

Fig 4.1.8 Respondents opinion on the effect of violent video games leading to real world violence

13) Do you agree with the contention that violent video games lead to real world violence ?

57 responses

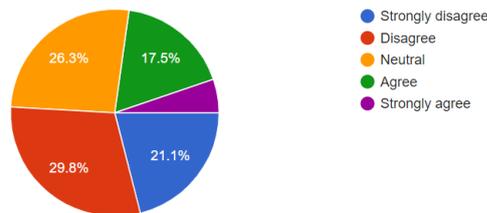


The above figure shows the demographic of the opinion of the population on the link between violent video games and real world violence, the likert scale was used for the same. The data shows that 38.6% of the population disagreed strongly with the contention that violent video games lead to real world violence, 28.1% of the population disagreed with the contention, 24% of the population were neutral about the contention, 7% of the population agreed with the contention whereas 1.8% strongly agreed with the contention. The data reflects that a majority of the population disagreed with the contention that violent video games lead to real world violence.

Fig 4.1.9 Respondents opinion on effect of gaming on aggression in individuals

14) Do you agree with the contention that action video games can lead to increased levels of aggression in individuals ?

57 responses

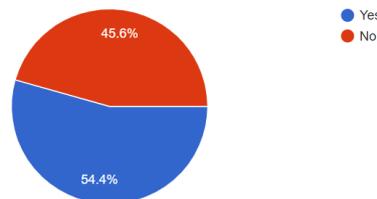


The figure shows the demographic of the opinion of the population on the link between action video games and increased level of aggression in individuals. The data shows that 21% of the population strongly disagreed with the contention that action video games can lead to increased aggression in individuals, 29.8% of the population disagreed with the contention, 26.3% of the population were neutral about the contention, 17.5% of the population agreed with the contention while 5.3% strongly agreed with the contention. The data reflects the Overwhelming opinion of the population that there is no link between action video games and increased aggression in individuals.

Fig 4.1.10 Being told to avoid gaming due to allegations of violence and aggression in individuals as an outcome

15) Have people advised you not to game based on the same allegation ?

57 responses

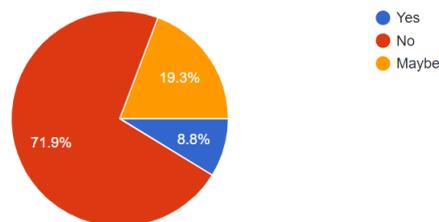


The above figure shows the demographic of the population that was told by their peers, relatives or others not to engage in gaming due to allegations of it leading to increased aggression and violent tendencies. The data shows that 54.4% of the population has been told by one or more person not to game due to its causal relation in increased aggressions in individuals while 45.6% of the population were not. The data shows that the pervasive myth of gaming leading to increased aggression is still abundant among the gaming community

Fig 4.1.11 Respondents opinion on the correlation of video games in crime

16) Do you believe there is any correlation between video games and crime ?

57 responses

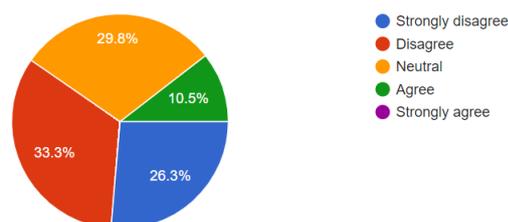


The above figure shows the demographic of the opinion of the population on the causal nature of video games on crime. The data shows that 71.9% of the population disagreed with the contention and said no, 8.8% of the population agreed with the contention and said yes, whereas 19.3 percent of the population were on the fence about the issue. The data reflects the majority opinion of individuals in the gaming community that do not believe violent video games or video games in general have any correlation with real world crime.

Chart 4.1.12 Respondents opinion on the ability to differentiate between reality and fiction post gaming sessions

17) Do you agree that players are not able to differentiate between reality and fiction after a gaming session ?

57 responses

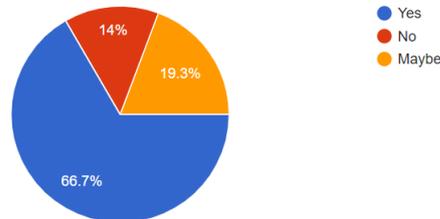


The above figure shows the demographic of agreeability of the population with the contention that players are not able to differentiate between reality and fiction post gaming sessions. The data shows that 26.3% of the population strongly disagrees with the contention, 33.3% disagrees with the contention, 29.8% of the population is on the fence about the issue, 10.5% of the population agrees with the contention whereas 0% of the population strongly agrees with the contention. The data reflects the overwhelming disagreement of the population with the contention that players are not able to distinguish between reality and fiction post gaming sessions.

Chart 4.1.13 Cognitive benefits of gaming

19) Do you feel there are any cognitive benefits of gaming ?

57 responses

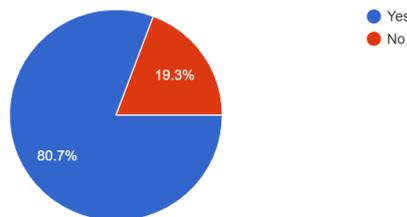


The above figure shows the demographic of the opinion of the population on the cognitive benefits of gaming. The data shows that 66.7% of the population felt that there were cognitive benefits of gaming and said yes, 14% of the population felt that there were no cognitive benefits of gaming and said no while 19% of the population wasn't sure about cognitive impact. The data reflects the overwhelming opinion among gamers that there are cognitive benefits of gaming.

Fig 4.1.14 Personal experience in terms of cognitive improvements from gaming

21) Have you felt any personal improvement in cognitive faculties through gaming ?

57 responses

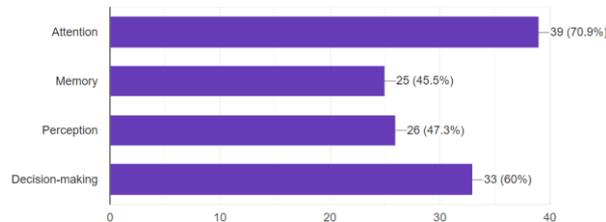


The above figure shows the demographic of the population which experienced personal cognitive improvement through gaming, be it decision making, memory, attention, perception or any other faculty. The data shows that 80.7% of the population felt they experienced cognitive improvement through gaming sessions, whereas 19.3% of the population did not experience any cognitive improvement through gaming. The data reflects the majority opinion of the population that gaming improves various cognitive faculties at an experiential level.

Fig 4.1.15 Cognitive improvements in memory, attention, decision making and perception

22) Do you feel any difference in any cognitive areas such as attention, memory, perception and decision-making post gaming sessions ?

55 responses

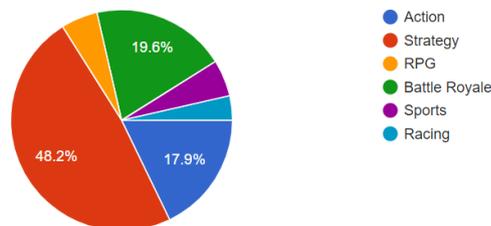


The above figure analysed the population’s opinion on which cognitive area they felt improvement the most post gaming sessions. The data showed that 70.9% of the population felt improvement in attention, 45.5% of the population felt improvement in memory, 47.3% of the population felt improvement in perception whereas 60% of the population felt improvement in decision making. The data overall reflects the cognitive faculty that was affected the most through gaming in terms of improvement.

Fig 4.1.16 Game genre with most cognitive benefit

25) Which game genre do you believe provides most cognitive benefit ?

56 responses



The above figure shows the demographic of the population’s opinion on which game genre provides the most cognitive benefit. The data shows that 17.9% of the population felt the action genre provided most cognitive benefit, 48.2% of the population felt the strategy genre provided the most cognitive benefit, 5.4% of the population felt the RPG genre provided most cognitive benefit, 19.6% of the population felt the battle royale genre provided the most cognitive benefit, 5.4% of the population felt the sports genre provided most benefit while 3.6% of the population felt the racing genre provided most cognitive benefit. Strategy, action and battle royale genres are shown to be the dominant opinion among gamers in terms of cognitive benefit.

## **5. CONCLUSION**

In conclusion this thesis has explored previous literature in the fields of gaming, cognition and neuroscientific research in order to further substantiate the hypothesis that positive cognitive improvements are achievable through gaming. The various areas of cognition explored for improvement through gaming included memory, perception, attention, decision making above all. The data analysis of the research was conducted using two different methods. The method used for the study was the questionnaire method. The links between gaming and violence were also explored through the methods used. The researcher used the questionnaire method or an online survey to identify the experiences and perceptions of the target populace in terms of possible enhancements to existing cognitive functionality, be it direct or indirect.

The online survey sent by the researcher to individuals in the gaming community in and around Bangalore to get a better understanding of what gamers feel about the video game genres, violent content and cognitive developments and the relation between the three. The survey yielded a total of 57 participants from which the final results showed with certainty that there indeed were cognitive benefits gained through gaming sessions, as well as the absence of any sort direct correlation between real world violence and video games. Some of the questions in the survey were focused on the benefits in terms of cognitive functionality of which a majority of the population agreed that there were cognitive benefits associated with gaming. The cognitive faculty that was voted the most to have improved through gaming sessions was attention, followed by decision making. Other questions focused on the violent nature of video games and its correlation with real world violence, of which the majority of the population believed there was no correlation between the two. In terms of genre popularity action games were found to be the most popular among the gaming populace, whereas action and strategy games were shown to be the genres with most cognitive benefit. It was also established that people were able to distinguish between reality and fiction post gaming sessions.

The two theories that this dissertation was based on was the cultivation theory, as well as the social cognitive theory. The cultivation theory helped analyse the long-term effects of violent video games on individuals who game on a continual basis and are constantly exposed to games of violent nature. The social cognitive theory also helped analyse cognitive improvements in individuals and the nature of these changes. This was done by treating humans as computers which synthesize information that they receive, they learn through observation to organize, store, perceive and input information. This helped explain the significant differences in cognitive functionality post gaming sessions.

The research paper was done with the purpose of identifying all possible improvements in cognitive functionality through gaming, be it through console, mobile or PC gaming. A host of cognitive functions were identified and through the methods and methodologies chosen each were evaluated to observe the degree of changes in specific cognitive functions. Improvements in problem solving skills, attention, perception, memory, visuospatial skills, decision making, multitasking, reaction time and several other aspects in cognition were established. Decision making in particular was the primary focus in terms of cognition and was found to be the most prevalent faculty in all the data collected. No links between action games or violent games were found

with real life crime. The data in fact suggests the contrary, with the gaming industry rapidly expanding, crime rates have been coming down. The data shows no indication of priming whatsoever, or any sort of association of in game tropes with real life interactions. Gamers are able to distinguish between reality and fiction without blurring the lines between the two. Direct interaction with violent gaming has nowhere shown to increase aggression in individuals, no changes have been observed post gaming sessions. It has also been established that desensitization does not occur with continuous exposure to games of violent nature. It was found that the most popular genre was the action and strategy genres, whereas the genre with the most cognitive benefit was found to be action and strategy games. They trigger they most improvement in terms of cognitive functionality and improve multiple faculties simultaneously. Gaming was a also found to be a positive psychological outlet with respect to emotional release although there was a possibility of that leading into addiction. With all the positive effects of gaming discussed.

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