Differences Between Regular and Non-Regular

Video Games Players’ Attention Levels

in Regards to Change Blindness

Jessica Maher

Submitted in partial fulfilment of the requirements of the BA Hons in Psychology at

Dublin Business School, School of Arts, Dublin.

Supervisor: Dr. Katriona O’Sullivan

Head of Department: Dr. Sinead. Eccles

March 2014

Department of Psychology

Dublin Business School
Discussion

4.1. Hypotheses Revisited
4.2. Limitations/Critiques of This Study
4.3. Implications for Future Research
4.4 Conclusion

References

Appendix
ACKNOWLEDGEMENTS

I would like to thank all those involved with the making of this experiment. I would particularly like to thank Michael Nolan for his help and guidance throughout the creation of the attention tasks used within this experiment, and all those who took the time to participate in this study. I would also like to thank Dr. Katriona O’Sullivan for her valuable and insightful guidance throughout this study.
ABSTRACT

This study aims to contribute further research regarding video game playing and attention levels. An experiment was conducted, involving several attention tasks such as; a Flicker task, a Change Blindness task, and a Change Blindness video. Thirty participants (M=11, F=19) partook in this experiment and were classified as either regular video game players (N=15) or non-regular video game players (N=15) depending on the number of days they reported to have played video games over the previous six months. The results from this experiment revealed a significant difference between regular and non-regular video game players in relation to the number of correct responses given within the Flicker and Change Blindness tasks. The other variables tested against the total number of correct scores on the Flicker and Change Blindness tasks, including; platform preference, genre preference, age and gender, showed no indications towards significant results.
INTRODUCTION

1.1 A Brief History of Video Games

Video games have been at the centre of media attention since their arrival into society in the 1960’s. Since the arrival of ‘Spacewar!’,(credited as the first widely available computer game) technology, knowledge and expertise have evolved immensely, and so too have the playable pastimes that are now enjoyed by over 90% of children between the ages of 2 and 17 in the United States of America (NPD Group, 2011). In 1971, the world’s first commercially available video game, ‘Computer Space’, began the technological revolution, and paved the way for the evolution of video games, as we currently know them. Up until 1972, video games were exclusively available for certain computers; however with the release of the Magnavox Odyssey, an entire new level was unlocked in gaming history. The first arcade video games were also created and mass produced during this era, including the still instantly recognisable favourites, ‘Pong’ and ‘Space Invaders’. 1976, now referred to as the “8-bit era”, saw the development of second generation video game consoles, which further boosted the popularity of video games, as well as sales and profits, allowing more funding to go towards the evolution of consoles that were then available. However, the video game industry as it is known today was almost lost in the 1980’s due to several reasons including an overwhelming amount of third party games that lacked quality, and the then increasing influence of personal computers (PCs). Subsequently, a gap was left in the video game market, which was filled by Nintendo, who were able to recuperate the interest in home consoles, with their first instalment, the Nintendo Entertainment System (NES), which also included ‘Super Mario Bros.’, one of the bestselling video games of all time. Throughout the rest of the decade, a console war was initiated between Nintendo and Sega, which was ultimately won by the former, as they released what became the best-selling handheld gaming console for the next 20 years, the Gameboy.
Since then, Nintendo, Sega, and other corporations such as Microsoft and Sony have all evolved, and produced many new generations of gaming consoles, allowing gaming to level up from 8-bit pixels into 3D graphics. Current technology within gaming consoles has allowed gamers and the general public to; get fit from the comfort of their living rooms through the use of the PlayStation(PS)’s ‘Move’ the Wii’s ‘Wii Fit’ and the Xbox 360’s ‘Kinect’, complete basis simple brain exercises on a daily with puzzle solving games such as ‘Dr Kawashima’s Brain Training: How Old Is Your Brain?’ and the ‘Professor Layton’ series, and improve hand eye co-ordination through such games as ‘Link’s Crossbow Training’, ‘Duck Hunt’ and ‘Wii Sports’, which may explain why a “nationally representative study of U.S. teenagers found that up to 99% of boys and 94% of girls” regularly engage in video game playing (Lenhart et al., 2008). It is predicted that several thousand more members of the public, of all ages, may also be drawn into playing video games more often with the release of next generation consoles such as the Xbox One, Wii U, and PS4 and the presentation of new Virtual Reality (VR) equipment, to accompany a number of games such as;the Virtuix Omni, the Oculus Rift, the Delta 6 controller and the As Real As It Gets (ARAIG) Gaming Vest. The Virtuix Omni is described as “an omnidirectional treadmill video game peripheral” by its founding company, Virtuix, is said to allow players to fully control the movement of characters in games such as ‘Skyrim’ and be used in conjunction with the Oculus Rift, a virtual reality head-mounted display which will soon be available commercially. Both of which may also be paired with the Delta 6 controller and ARAIG Gaming Vest, if so desired in order to give players a completely immersed feel when playing video games, and by doing so, may heighten or further develop visual attention, spatial recognition, or general problem solving skills (Presnky, 2012). Although there have been countless advances within the video games industry, the views of the media have not followed suit.
1.2. Video Games, Aggression and Negative Associations within the General Media

In recent years, video games have received an increasing rate of bad publicity, in regards to associations with aggressiveness, shootings, and random killing sprees. Willoughby, Adachi and Good (2012) found, as a result of their study, that “greater violent video game play predicted higher levels of aggression over time”, however it was also noted that higher levels of aggressive behaviour were not predicted for those who played non-violent games. More recently, Hasan and Bushman (2013) also found similar results in regards to whether or not violent video games increase aggression by a means of inducing stress in players. By using cardiac coherence, which was defined as “the synchronisation of the rhythm of breathing to the rhythm of the heart”, Hasan and Bushman were able to deduce that, those who played violent video games in their study had lower cardiac coherence levels and higher stress levels than those who played non-violent video games.

In 2010, Anderson et al., investigated the effects of violent video games on aggressive behaviour, aggressive cognition, aggressive effect, physiological arousal, empathy, desensitisation and prosocial behaviour. This experiment was different from others similar to it at the time, as Anderson et al., stated, it had, “more restrictive methodological quality inclusion criteria than past meta-analyses, cross cultural comparisons, longitudinal students, conservative statistical controls, multiple moderator analyses and sensitivity analyses”. Results from this study revealed that there were significant effects for all of the six outcome variables, which strongly suggested that exposure to violent video games is a causal risk factor for increased aggressive behaviour, aggressive cognition, aggressive effect and a decrease in empathy and prosocial behaviour. It was also noted that there was little evidence to suggest that there are any cultural differences in susceptibility to aggressive behaviour, and no evidence of any gender differences in susceptibility.

Other behavioural and emotional problems have also been linked to video game
playing, including depression, sleep deprivation and increased irritability. In 2011, Lemola et al. carried out a study that examined “whether the amount and circadian time of habitual computer game playing” was related to “depressive symptoms in adolescents and young adults”. 646 young adults and adolescents between the ages of 13 and 30, who regularly play the MMO (Massively Multiplayer Online) game, ‘World of Warcraft’ (WoW), were asked to complete an online questionnaire in relation to their playing habits. Results from these questionnaires allowed Lemola et al., to draw several conclusions. It was found that playing ‘WoW’ regularly between the hours of 10pm and 6am, was linked with an increased risk of high depression scores, regardless of the total amount of playing time. It was also found that those between the ages of 13 and 17 were most at risk of developing depression when routinely playing during 10pm and 12pm, whereas those between the ages of 18 and 22 years displayed more signs of vulnerability when playing after 2am. Lemola et al., found that the effects on young adults and adolescents from playing ‘WoW’ throughout the night, were “partly mediated by daytime sleepiness but not by sleep loss or insomnia problems”.

1.3. Positive Aspects of Video Game Playing

Despite their negative reputation with the media, video games have many redeeming qualities. Ferguson (2007) conducted an experiment that examined both the positive and negative effects of violent video games. The results gained, “indicated that publication bias was a problem for studies of both aggressive behaviour and visuospatial cognition”, suggesting that the outcomes of various studies looking into this particular topic, may have been swayed by what the public wanted to read, in order to be able to place blame on something or someone else, rather than accept their own responsibilities. This lead to Ferguson claiming that once the publication bias was corrected “studies of video game violence provided no support for the hypothesis that violent video game playing is associated with higher aggression”. However, it should be noted that, while the playing of violent video
games had no effect on aggression levels, it remained associated with higher levels of visuospatial cognition. Earlier research in 1994 by Greenfield, Brannon and Lohr examined similar aspects in relation to cognition, such as the development of spatial representational skills in conjunction with regular and non-regular video game playing. Findings from this study indicated that short term video game playing had no effect on a mental exercise specifically aimed to test spatial representation, however it was concluded that “video game expertise, developed over the long-term, had a beneficial effect on the spatial skill” test that was conducted.

Many studies, papers and experiments have been conducted, in relation to the positive aspects and effects of video game playing. In accordance to recent tragic events research has been carried out in order to determine whether or not these random acts of homicide are/were in any way affected or influenced by video games. In 2008, Ferguson examined the relationship between violent video game usage and school shootings. After carrying out strenuous research, Ferguson was able to conclude that “no significant relationship between violent video game exposure and school shootings” were found, leaving readers with the title question of his paper “Is ‘The School Shooting/Violent Video Game Link: a Causal Relationship or Moral Panic’?”. Ferguson and Olsen also found similar results in 2013, when examining the association between the playing of violent video games and increased bullying or criminality in children with either “clinically elevated depressive or attention deficit symptoms”. It was found to have opposite effects, in that the playing of the video games had a “very slight calming effect on youth with attention deficit symptoms” and even helped to decrease their behaviour in regards to aggression and bullying. While confirming that no evidence was found between playing video games and an increase in bullying or criminal behaviour amongst young adults and adolescents with “clinically elevated mental health symptoms”. Ferguson also commented on the connection between violent video games and
school shootings claiming that, “Statistically speaking it would actually be more unusual if a youth delinquent or shooter did not play violent video games, given that the majority of youth and young men play games at least occasionally”. This and other research (Feng, Spence & Pratt, 2007; Mitchell & Savill-Smith, 2004; Griffiths, 2002) has led to advances within the area of the positive aspects of video game playing, leading to the prediction that video games may soon be accepted rather than shunned by the media and used as scapegoats, rather than understand the complex social and moral issues regarding mass homicide.

1.4. Emotional and Motivational Benefits of Video Game Playing

In relation to this and other positive aspects of video game playing, Granic et al., (2013) investigated and summarised the benefits of playing video games on four main categorises; cognitive, motivational, emotional, and social. Regarding the motivational domain, it was found that games provide environments that promote a persistent and optimistic motivational style that may also extend to other contexts such as school and work. Research into the emotional domain lead to reappraisal, an emotion-regulation strategy (Gross & John, 2003), that is an essential aspect for multiple video games. Granic et al., (2013) were able to apply this strategy to many games that continuously deliver new objectives and missions, challenging players to re-evaluate already established strategies in order to reach their goals, such as in ‘Portal’, where players must solve problems by manipulating the rules of physics. Once a problem has been solved, the rules and strategies needed to solve the next problem change suddenly, causing frustration and anxiety in players, as they must “unlearn” what knowledge they previously used and change their appraisal systems in order to uncover the new method needed to solve the next puzzle. This was also seen by Granic et al., (2013) in other games such as ‘Pokémon’, ‘Guild Wars’ and ‘Final Fantasy’, which require player to develop a number of characters, each with unique skills, strengths and weaknesses, and associated social behaviours, meaning that players must
switch between these characters, and by doing so, quickly reappraise any “emotional experiences”. By doing so, players learn the benefits of dealing with emotions such as frustration and anxiety in efficient and adaptive ways.

1.5. Social Benefits of Video Game Playing

In relation to the work of Lenhart et al., (2008), Granic et al., (2013) claimed that “Contrary to stereotypes, the average gamer is not a socially isolated, inept nerd who spends most of his (or her) time alone loafing on the couch”. Research in relation to social skills and video game playing has provided valuable information, as several studies have found an association between community service and gamers. For example Lenhart et al., (2008) found that those who play ‘Guild Wars’ and other similar MMOs are more likely to participate in charitable and communal services in their daily lives by volunteering and raising money for charities. However, it should be noted that this study did not distinguish a causal effect relationship between the two. The research of Ewoldsen et al., (2012) and Velez et al., (2012) has also provided insight into how the cooperative playing of violent video games, increases prosocial and cooperative behaviour outside of gameplay, in comparison to competitive play.

1.6. Cognitive Benefits of Video Game Playing

“Contrary to conventional beliefs that playing video games is intellectually lazy and sedating, it turns out that playing these games promotes a wide range of cognitive skills. This is particularly true for shooter (or action) video games, many of which are violent in nature, e.g. ‘Halo 4’, ‘Grand Theft Auto IV’)” (Granic et al., 2013). Green & Bavelier provided similar insight by conducting a study in relation to cognitive abilities and regular video game playing in 2012. Results from this study concluded that, in comparison to those who very rarely played video games, regular gamers conveyed “faster and more accurate attention allocation, higher spatial resolution in visual processing, and enhanced mental rotation
abilities” (Granic et al., 2013). A meta-analysis by Uttal et al., (2013) examined the differences in cognitive enhancements between video game players and individuals participating in a formal, educational course, which focused on improving spatial skills. Results from this study showed that the skill improvements from playing video games were at the same level, if not higher, than those of the participants who paid to undertake a course specifically designed for the same results. These results show that the playing of video games can have very similar, if not greater improvements in certain skills, to peer reviewed courses, which, it is theorised, that the general public will seek out, in an ongoing effort to improve themselves.

A recent investigation by Tanaka et al., (2013) revealed similar results of “superior visuospatial cognitive performance in action video game experts”, through the use of magnetic resonance imaging (MRI) analysis of grey matter volume in participants. It was found that those who were considered “video game experts” had larger grey matter volume within their right posterior parietal cortices, when compared to “non-experts”, which was suggested to be linked habitual video game playing. However, in 2009, Durlach, Kring and Bowens, were unable to arrive at the same conclusions as Green and Bavelier’s (2003) study, which they were attempting to replicate, as they failed “to find evidence that habitual action video game players were superior to non-players when it came to change detection”. Despite this, results gathered by Castel, Pratt and Drummond (2005), whilst investigating the relationship between video games and visual selective attention, showed that regular video game players “possess faster stimulus-response mappings in visual attention tasks”. The division of visual attention was also examined in relation to video game playing by Greenfield et al., in 1994. In this investigation, the effects of video game playing expertise on divided visual attention were examined through a number of visual tests, taken by college students who either played at an expert, novice, skilful or less skilful level. The
experiments conducted in this study, displayed that “video game experts were similar to novices in manifesting an attentional benefit”, however, unlike the novices, the experts did not show what was labelled as an “attentional cost” i.e. a slower response time during the more advanced stage in testing throughout the experiment. Similarly, Bavelier et al., (2012) unveiled through a functional magnetic resonance imaging (fMRI) study of mechanisms such as the fronto-parietal network (FPN), that mediate attention allocation “were less active during a challenging pattern-detection task in regular gamers than in non-gamers”, suggesting that regular video game players have the ability to distribute their attention more resourcefully and discard irrelevant information more appropriately than those who do not regularly play video games.

1.7. The Purpose of This Study

Although research in relation to both the effects of video games and cognitive processes is available, many studies have found conflicting results in regards to how effective video game playing is on attention levels and even fewer studies have discovered a direct link between video game playing and individuals’ ability to detect change. In order to further add to the research in this area, this study aims to examine the differences in attention levels, and abilities to detect minute changes in the environment, between those who regularly play video games, and those who rarely play video games, through the means of a quasi-experimental design. This study also aims to contribute to the literature regarding attentional levels, change blindness, and both the positive and negative effects of playing video games. By doing so, this study may produce useful information to both professionals and the general public, in regards to knowing the dangers of change blindness, such as failing to see a speeding car changing lanes or an item of personal property being stolen until it is too late, and potential methods in regards to possibly overcoming this visual phenomenon.
1.8. Hypotheses

With this in mind, several hypotheses will be put forward and examined in this study. It is hypothesised that those who play video games regularly will have significantly greater attention levels than those who do not play video games as frequently, attention levels will be assessed by participants’ results in regards to the attention tasks used in this experiment. Participants will also be asked which platform they prefer to play video games on in this study, therefore it is hypothesised that there will be a significant difference in attention levels in regards to participants’ personal preferences. It is also hypothesised that there will be a significant difference in attention levels in regards to participant’s video game genre preferences. Furthermore, it is hypothesised that there will be significant differences between the genders and ages of participants’ attention levels. Finally, it is also hypothesised that non regular video game players will score significantly lower than regular video game players on the change blindness video task. Overall, the results from this study will contribute to literature regarding attention levels, change blindness and the general effects of playing video games, and may also produce useful information to both professionals, and the general public, in regards to knowing the dangers of change blindness.
METHODOLOGY

2.1. Participants

The convenience sample used in this study included thirty (M=11, F=19) participants consisting of friends, family members and college and university students within the Republic of Ireland. Participants for this study were recruited by email, social networks and oral invitations. All participants took part in this study willingly and were not offered any rewards. All participants received the same questionnaire and set of tasks for this experiment, however the order of trials within each task was randomised for each participant, in an attempt to resolve experimenter bias.

Inclusion criteria for this experiment required participants to be eighteen or older. The exclusion criteria for this experiment were outlined on the consent form given to each participant, which they were required to sign before the experiment could begin, and did not allow those who met any of the following conditions to partake: being younger than eighteen years old or suffering from epilepsy, poor/uncorrected vision, colour vision deficiency (colour blindness), or any negative side/effects from flashing lights/screens. Participants were categorised into two groups; regular video game players (M=9, F=6) and non-video game players (M=2, F=13), based on their answers to the demographic questionnaire and previous studies by Green and Bavelier (2003) and Castel et al. (2005).

2.2. Design

This study used a quasi-experimental design, which was selected based on the aim of this study; to establish a causal relationship between video game playing and attention levels. The independent variable within this experiment consisted of the number of hours participants spent recreationally playing video games. The dependent variables in this experiment consisted of participants’ total scores in regards to the cognitive tasks (i.e. the
number of times each participant responded correctly), and participants’ platform preferences. The cognitive tasks administered in this experiment included; a Change Blindness (CB) task (Beck & Levin, 2003), a Flicker task (Rensink, O’Regan & Clark, 1997) and a change blindness inducing video, based on the work by Simons and Chabris (1999).

Participants in this experiment included those who regularly played video games and those who very rarely played, if at all, and were divided accordingly. This experiment followed the same criterion as Green and Bavelier (2003) and Castel et al. (2005) to categorise participants as either regular, or non-regular video game players. Regular video game players were defined as those who played for four or more days a week, for the past six months, whereas non-regular video game players were distinguished by not meeting the criterion to be classed as a regular video game player.

2.3. Materials

This experiment was conducted throughout various different settings, as there were no particular environmental issues required in order to complete the questionnaire and tasks provided, other than the exception of a lack of excessive noise and/or similar distractors. All essential materials for this experiment were self-provided, such as pen and paper questionnaires with attached consent forms. Chairs and tables for the participants’ comfort were already made available in the settings or environments in which the experiment took place. The questionnaire used throughout this experiment, was created by the experimenter, and was utilised in order to gain demographic information, and record certain responses for the tasks completed by participants. Both the questionnaire and consent form used in this experiment can be seen in full in the appendices.
2.4. Apparatus

The attention tasks within this experiment were generated by a 15.6" High-Definition LED HP Brightview Display (1366 x 768) HP Pavilion G6, with the software, E-Run. Each attention task was self-created, self-supplied, and based on previous research as referenced accordingly, through the use of E-Prime, Bandicam and SuperLab versions 4.0.8-5.0. In the case of the Flicker task (Rensink, O'Regan & Clark, 1997), participants’ responses were reported verbally and were recorded on paper by the experimenter. Participant’s responses in the CB task (Beck & Levin, 2003) were recorded electronically, through the software E-Prime. The responses for the CB video were recorded on paper, in the space provided at end of the distributed questionnaire. All responses were later entered into IBM’s Statistical Package for the Social Sciences (SPSSv21) software, for further analysis.

2.5. Procedural Overview

The convenience sample for this experiment were asked to participate either verbally, or through written invitation through emails and social network messaging. Once participants’ agreement to take part in this study was confirmed, an agreed time was assigned to each member of the sample. Participants were met at their convenience, in generally quiet environments, so as they were not to be disturbed during the experiment.

Upon meeting with the potential participant, it was suggested to move to the quietest place possible within the vicinity, in an attempt to avoid distraction, and gain the most accurate results possible. Once the optimal level of noise and lack of distractors had been reached, the experimental procedure was fully explained to each participant, after which, they were invited to ask any questions they may have had in relation to the experiment itself, or anything in relation to the research and/or topic of this study. All participants were then informed, both verbally and later through the use of the distributed consent form, that the
results obtained from this study were anonymous, and that they were free to leave at any point during the experiment with no negative consequences. A questionnaire with an attached consent form was then distributed to each participant. Participants were required to read through and tick the appropriate box, declaring that they were over the age of eighteen and did not suffer from any of the health issues outlined, before the experiment began. Anonymity was ensured by placing completed questionnaires and consent forms in a sealed envelope. Each participant was given a number determined by sequential order, which was solely used to connect results from questionnaires and cognitive tasks. This number in no way allowed the experimenter to determine the identity of participants. This was explained in full to each member of the sample before the experiment began.

2.6. Completion of Demographic Questionnaire

The experiment began once participants had completed the first section of the self-provided questionnaire, which involved purely demographic questions. The software, E-Run was then initiated, and the appropriate experiment file was opened. Participants could begin the cognitive tasks presented throughout this experiment, at their own pace, by pressing the spacebar; this instruction was given both verbally, and presented as a written instruction at the beginning of the experiment. Participants were then required to complete a CB task (Beck & Levin, 2003), Flicker task (Rensink, O’Regan & Clark, 1997) and CB video, based on the work by Simons and Chabris (1999). The tasks within this experiment could not be administered at random, due to restrictions within E-Prime, however it was possible to randomise the trials within each task.

2.7. Flicker Task

The Flicker task used in this experiment was designed and based upon the information provided in Rensink, O’Regan and Clark’s paper, published in 1997. Within this paper,
several experiments were conducted, all of which followed a similar general method. This method explained that the Flicker sequences were “composed of an original image A” and a “modified version A’, displayed in the sequence A, A, A’, A’ ” (see Figure. 1). Each image throughout the Flicker task was displayed for 240ms, and was followed by an 80ms interstimulus interval (ISI), which erased the screen, causing a ‘flicker’. It was noted by the original experimenters that each image was to be presented twice before being modified or changed in any way in order to create “a degree of temporal uncertainty as to when the change was being made”.

The Flicker task used in this experiment followed the same general method as described above, and used “forty-eight colour images of real-world scenes” to create forty-eight trials within this task. Attempts were made by the experimenter to contact the original researchers in an effort to gain access to the original images. This however proved unsuccessful, leading to the images used in this task being self-supplied by the experimenter. Within each of these trials, a distinct change; either colour, location, or presence/absence was made to a particular section in the modified (A’) picture.

Due to the software, E-Prime, not being able to carry out the functions that were required to create this task, the experimenter was required to create each trial for this task within SuperLab, before transferring the final output into E-Prime. This was achieved by developing each trial within this task individually, to follow the sequence A, A, A’, A’, for a duration of sixty seconds, and then running the trial, whilst using the screen capture software, Bandicam, to create sixty second videos of each Flicker. This was a necessary step, as it allowed for participants to be able to stop the trial at any time, in order to signal that they noticed a change, rather than having to wait for the full sixty seconds for the entire sequence to finish, before being able to comment.
Before starting the forty-eight trials within this task, participants were given a series of instructions, explaining the possible types of changes that may occur between images, and to press the spacebar when these changes were noticed. Further instructions explained to participants that once they had noticed the change occurring, and had pressed the spacebar, they were to verbally describe the change that they believed to have occurred. These responses were recorded on paper by the experimenter, and were later analysed to determine whether or not they were correct. In order for a response to be considered correct, participants were required to both state the object that was being modified, and the change that was taking place. Participants were then informed that they would be taking part in six practice trials for this task, in order to fully understand what the task would entail. Once the participants had completed the practice trials, they were informed that the real trials for this task would begin after they pressed the spacebar. The practice and real trials within this task were shown
at random, within their respective sections. Three practice trials demonstrating each of the possible types of changes occurring within the images can be seen in Figures 2-4.

**Figure 2.** Flicker Task Practice Trial 1 - demonstrating a colour change (circled) that could occur during the trials in this task.

**Figure 3.** Flicker Task Practice Trial 4 - demonstrating a location change (circled) that could occur during the trials in this task.
2.8. Change Blindness (CB) Task:

The CB task used in this experiment was centred around the work of Beck and Levin in 2003. Similarly to Rensink, O’Regan and Clark’s paper (1997), Beck and Levin (2003) conducted a number of experiments, all of which followed the same general method. However, it should be noted that there were slight differences between each of the experiments carried out by Beck and Levin (2003), and that the CB task within this experiment focused mainly on “Experiment 1”. The CB task used in this experiment, involved an array of images that were created using the two-hundred-and-sixty images found in Snodgrass and Vanderwart’s (1980) paper. During the creation and design of this task, great detail and care were taken by the experimenter in order to ensure that each image was equal in size, by measuring each image to be approximately 4.5cm high or wide. This task consisted of sixty trials, four of which, were practice trails, added by the experimenter, in order to maximise the probability of obtaining accurate results.

During their creation, these trials were divided into four categories by the experimenter; Line Modification, Line Replacement, Scatter Modification and Scatter
Replacement, in an attempt to replicate the original paper’s use of pre and postchange arrays, in the fairest way possible. Arrays of pre and postchange images were described to “vary in size from 3 to 16 objects”, and it was explained that within each trial of this experiment “all objects were the same except that 1 of the objects in the postchange array (postchange object) was different from the corresponding location of the prechange array (prechange object).” These differences could involve either the replacement or modification of the postchange object. Following Beck and Levin’s (2003) original paper, the “objects were randomly chosen” for each array of images and the “postchange object was randomly chosen from all images except those already in the prechange array”.

Similarly to the Flicker task, E-Prime was not able to carry out the required functions to create the CB task for this experiment. Therefore, the same general steps regarding the procedure for creating the Flicker tasks were carried out during the production of the trials for this task. This involved setting up each trial individually in SuperLab and running the experimental file, whilst using the screen capture software, Bandicam, to create four second videos of each array of images. These videos were then transferred and used to create the trials for this task, within E-Prime.

This task began with the presentation of onscreen instructions, detailing that the participants would be shown a number of trials. It was explained that in each of these trials, participants would be shown an array of images for two seconds, followed by a brief gap (a 350ms ISI in which the screen was erased) and finally the same array of images with a slight difference, for a further two seconds. Participants were informed that their task was to identify and select the object which they believed to have changed. A question screen was presented after each set of images, prompting participants to select, what they believed to be the object that had been modified or replaced by pressing the A, B, C, or D button on the keyboard. The results for this task were recorded electronically by E-Run as the experiment
was being carried out. Each trial within this task was programmed to identify the correct response key and to be able to detect which option participants had chosen. For example, E-Run was able to determine if participants had selected the correct answer by pressing the D key, or if they had selected an incorrect answer, by pressing the A key. An example of each of the practice trials for this task, outlining the different types of changes that took place throughout this experiment, as well their corresponding question screens, can be seen in Figures 5.1-8.2. In an effort to ensure that this task was as fair as possible, the four practice and fifty-six real trials were also randomised in the respective sections.

![Figure 5.1. CB Task Practice Trial 1 - demonstrating a modification change (circled) that could occur during the trials in this task.](image)

![Figure 5.2. CB Task Practice Trial 1 - question screen.](image)
Figure 7.1. CB Task Practice Trial 3 - demonstrating a modification change (circled) that could occur during the trials in this task.

Figure 7.2. CB Task Practice Trial 3 - question screen.

Figure 6.1. CB Task Practice Trial 2 - demonstrating a replacement change (circled) that could occur during the trials in this task.

Figure 6.2. CB Task Practice Trial 2 - question screen.
**2.9. Change Blindness Inducing Video:**

This experiment also included a thirty-two second video clip, which was edited appropriately by the experimenter through the use of Windows Movie Maker. This clip was designed to induce change blindness and was based on the work by Simons and Chabris (1999). Before this video clip was shown, participants were given onscreen instructions, explaining that they would be shown a brief video, and to press the spacebar when they wished to begin the task. At this point, it was also brought to the attention of the participants to turn to page four of the questionnaire before progressing any further. Upon pressing the spacebar, the video began with additional onscreen instructions to “Count the number of times the seagull drops the stick” before showing the actual change blindness inducing clip. The video shown consisted of a beach setting with a number of seagulls, one of which was seen to ‘drop’ or ‘throw’ a stick five times throughout the duration of the video. At the end of this brief scene, participants were asked if they noticed anything unusual, and if they did, to
record their answers/comments in the space provided on the questionnaire. It was later recorded electronically by the experimenter, through the use of SPSS 21, whether or not participants answered the question accurately regarding the number of times the seagull dropped the stick, and whether or not they noticed the large and prominent crocodile at the bottom right hand corner of the screen. Responses for this task were recorded on paper (within the relevant section on the questionnaire) by the participants, and were later analysed by the experimenter. Responses for the number of times the seagull dropped the stick were either deemed correct, if it was reported that the seagull dropped the stick five times, or incorrect if participants answered otherwise. Responses to the question regarding anything unusual being seen in this video were also recorded in this way. These responses were analysed by the experimenter and deemed as either being correct; i.e. participants answered yes to noticing something unusual and correctly identified the crocodile and its position, or no i.e. participants did not report seeing anything unusual throughout the video. A number of screenshots of this video, including the point at which the crocodile is present, can be seen in Figures 10, 11 and 12. This video, rather than the original video shown in Simons and Chabris’ (1999) study, was used in an attempt to gain the most reliable results, as many of the participants involved in this study were students of psychology and had previously seen the “Gorillas in our midst” video and therefore may have been considered a biased sample.
Figure 10. CB Video Task – seagull shown holding the stick (circled).

Figure 11. CB Video – seagull shown dropping the stick (circled).

Figure 12. CB Video – crocodile (circled), shown roughly seventeen seconds into the clip.
RESULTS

A total of thirty participants partook in this experiment, nineteen were female (F=19) and eleven were male (M=11). Each participant was exposed to all conditions of this experiment; therefore there were no group divisions. This study aimed to test the differences in attention levels between people who regularly played video games and those who do not. The data collected in this experiment was tested for normality through the use of skewness and kurtosis analysis in SPSS results showed that the data met criteria for parametric analysis.

3.1. Descriptive Statistics

Descriptive statistics were run for the following variables within this study; age, whether or not participants liked to play video games, how often participants spent playing games, and were split based on whether or not participants were classified as gamers (i.e. those who played video games for 4-5 days or more per week) or non-gamers (i.e. those who played video games less than 4-5 days per week). Descriptive statistics for the above variables included mean, standard deviation, range, minimum and maximum. Gamers had a mean age of 22.47 (SD = 4.49), whereas non gamers had a mean age of 29.80 (SD = 11.86).

The mean number of hours per day spent by non-gamers playing video games was 1.13 (SD = .516) whereas gamers spent a mean of 2.47 (SD = 1.06) hours per day playing video games. Gamers reported to have spent a mean of 2.73 (SD = 1.21) hours per week playing video games, and non-gamers reported to have spent a mean of 1 (SD = .00) hour per week of video game playing.
3.2. Gamers vs. Non-Gamers in Relation to the Number of Correct Responses for the Flicker and CB Tasks

In relation to gamers and non-gamers, an independent t-test was utilised to determine the differences for overall correct results for the Flicker task. Gamers (mean = 27.53, SD = 5.93) were found to have a greater number of correct responses in regards to the flicker task, than non-gamers (mean = 23.07, SD = 5.15). The 95% confidence limits show that the population mean difference of the variables lies somewhere between .315 and 8.618. An independent samples t-test found that there was a statistically significant difference between the number of correct responses of the flicker task of gamers and non-gamers (t (28) = 2.20, p = .036). Therefore the null hypothesis was rejected. Similarly gamers (mean = 41.13, SD = 2.17) were found to have more correct responses in relation to the CB task distributed in this experiment, than non-gamers (mean = 37.80, SD = 4.93) leading to the discovery, through the use of another independent samples t-test, of a statistically significant difference between the number of correct responses within the CB task of gamers and non-gamers (t (28) = 2.04, p = .023). Therefore the null hypothesis was again rejected. See Table 1.

![Bar chart showing significant results in relation to the average number of correct scores in the Flicker and CB tasks between gamers and non-gamers.](attachment:table1_bar_chart.png)

Table 1. Bar chart showing significant results in relation to the average number of correct scores in the Flicker and CB tasks between gamers and non-gamers.
3.3. Gender Differences in Relation to the Number of Correct Responses for the Flicker and CB Tasks

An independent samples t-test was administered in relation to gender differences and the number of total correct responses for participants in relation to the Flicker and CB tasks. Although, males (mean = 27.73, SD = 8.13) were found to have answered more trials correctly than females in regards to the Flicker Task (mean = 23.89, SD = 3.73). No significant difference was found between males and females in regards to the number of correct answers reported for the Flicker task. Therefore the null could not be rejected. The independent samples t-test revealed similar results in relation to the number of correct responses within the CB task although, males (mean = 41.18, SD = 3.46) were found to have answered more trials correctly than females in regards to the CB task (mean = 38.47, SD = 4.21) the difference was not significant, therefore the null was accepted.

3.4. Age Differences in Relation to the Number of Correct Responses for the Flicker and CB Tasks

For the purpose of this analysis, participants were divided into two age groups; twenty-five and below(N=20), and twenty-six and over(N=10). Those twenty-five and below had a greater number of correct responses in relation to the Flicker task (mean = 26.65, SD = 5.86) than those who were twenty-six and older (mean = 22.60, SD = 2.75). The independent samples t-test used found that there was not a significant difference between the age groups regarding the number of correct answers reported for the Flicker task. Therefore, in this case, the null was accepted. Similar results were derived in relation to the number of correct responses in the CB task between the two age groups (25 and below mean = 39.75, SD = 3.28, 26 and above mean = 38.90, SD = 5.59), as the independent samples t-test resulted in no significant difference, therefore the null was accepted.
3.5. Differences in the Number of Correct Responses for the CB and Flicker Tasks in Relation to Participants’ Genre and Platform Preferences

A Pearson’s R Correlation was also used during the analysis of the data presented in this experiment. This method of data analysis was used to examine the differences between genre preferences and the number of correct responses within the Flicker and CB tasks. The twelve genres within this experiment were categorised into four sections during this analysis of results. These categories included Genre AAF (Action, Adventure, FPS), Genre SDS (Sports, Driving, Simulation), Genre HON (Horror, Other, None) and Genre MMO (MMO, RPG, Puzzle). A Pearson Correlation Coefficient found that there was no significant relationship between the number of correct responses for the Flicker task and AFF genre preference group \((r (30) = .426, p > .05)\), or between the number of correct responses for the CB Task and AFF genre preference group \((r (30) = .596, p > .05)\). Both null hypotheses were accepted. A Pearson Correlation Coefficient found that there was no significant relationship between the number of correct responses for the Flicker task and SDS genre preference group \((r (30) = .168, p > .05)\), or between the number of correct responses for the CB Task and SDS genre preference group \((r (30) = .608, p > .05)\). The null hypotheses were accepted. No significant relationship was shown between the number of correct responses to the Flicker task and HON genre \((r (30) = .833, p > .05)\) or the number of correct responses to the CB task and HON genre \((r (30) = .187, p > .05)\). The null hypotheses were accepted. A Pearson Correlation Coefficient found that there was no significant relationship between the number of correct responses for the Flicker task and MMO genre preference group \((r (30) = .191, p > .05)\), or between the number of correct responses for the CB Task and MMO genre preference group \((r (30) = .748, p > .05)\). The null hypotheses could not be rejected.

The difference between platforming preferences and the number of correct responses in the CB and Flicker tasks were also examined. The twelve platforms within this experiment
were categorised into four main sections during this analysis of results. These categories included Nintendo (Wii, Wii U, Nintendo 3DS, DS(i)(Lite)(XL)), Microsoft (Xbox360, XboxOne), Sony (PS3, PS4, PSP) and PC/Other (PC, Other, None). ‘Other’ platforms included iPads, IOS and Android Phones, GameCubes and Super Nintendo Entertainment Systems (SNES’). A Pearson Correlation Coefficient found that there was no significant relationship between the number of correct responses for the Flicker task and Nintendo preference group \( r (30) = .840, p > .05 \), or between the number of correct responses for the CB Task and AFF genre preference group \( r (30) = .133, p > .05 \). Both null hypotheses were accepted. A Pearson Correlation Coefficient found that there was no significant relationship between the number of correct responses for the Flicker task and Sony preference group \( r (30) = .175, p > .05 \), or between the number of correct responses for the CB Task and Sony preference group \( r (30) = .676, p > .05 \). The null hypotheses were accepted. No significant relationship was shown between the number of correct responses to the Flicker task and Microsoft \( r (30) = .728, p > .05 \) or the number of correct responses to the CB task and Microsoft preference \( r (30) = .351, p > .05 \). The null hypotheses were accepted. A Pearson Correlation Coefficient found that there was no significant relationship between the number of correct responses for the Flicker task and PC/Other preference \( r (30) = .366, p > .05 \), or between the number of correct responses for the CB Task and PC/Other preference \( r (30) = .456, p > .05 \). The null hypotheses could not be rejected.

3.6. CB Video Results

It was noted that none of the thirty participants noticed the crocodile, shown in the CB video and Figure 12, therefore the hypothesis that gamers would be more accurate in relation to the detection of changes within the video clip shown, was disproven, and is therefore rejected. The bar chart shown below (see Table 2) provides illustrative information, in
regards to the accuracy of all participants, in relation to the number of times the seagull in the video was shown to drop the stick.

**Table 2.** A bar chart illustrating the frequency table used to statistically analyse participants’ responses in relation to the number of times the seagull was believed to have dropped the stick during the CB video.
DISCUSSION

The aim of this study was to examine if there were any differences in attention levels, particularly in regards to change blindness, between those who regularly play video games and those who do not. This study also aimed to add to the current positive information in regards to video games such as the findings put forward by Granic et al., (2013), as the majority of information made public focuses mainly on negative aspects of video games such as; aggression (Willoughby, Adachi & Good, 2012; Hasan & Bushman, 2013) social problems, emotional instability, sleeping problems, and increased irritability (Lemola et al., 2011).

The findings of this study contradict those of Durlach, Kring and Bowens (2009) who failed to notice any direct link between video games and attention levels. This study did however provided similar findings as Green and Bavelier (2003), Castel, Pratt and Drummond (2005), and Ferguson (2007) in relation to a significant difference between those who regularly play video games and those who do not, in regards to attention tasks. This suggests that there may be other advantages to playing video games, such as “superior visuospatial cognitive performance” (Tanaka et al., (2013) and a larger “development of spatial representational skills” (Greenfield, Brannon & Lohr, 1994) other than merely boosting attentional levels, as was somewhat demonstrated in this study.

4.1. Hypotheses Revisited

It was hypothesised that there would be a significant difference between regular and non-regular video game players in relation to the ability to detect change blindness, by examining the results gathered from the distributed questionnaire. However, this study concluded no significant results in relation to this hypothesis, as every participant in this experiment failed to notice the occurrence of the change blindness image (i.e. the crocodile),
during the presentation of the CB video. This may have been influenced by an inability to see the screen at an adequate level, due to gleam/sunlight, or because of lack of information from participants in regards to the true nature of eyesight. Another reason suggests that participants may simply have not been paying full attention to the video whilst it was being shown, due to distractors or lack of interest. Future experiments involving CB videos are advised to ensure the maximum quality of the videos used is reached, before their administration to participants.

It was also hypothesised that there would be a significant difference between regular and non-regular video game players in relation attention levels. Attention levels were determined by the number of correct responses given by the participants in the Flicker and CB tasks. A significant result was found in this case, revealing that regular gamers, scored significantly higher in terms of the number of correct answers in the Flicker and CB tasks, than non-regular gamers. This may have been due to the competitive nature of the regular video game playing participants, as witnessed by the experimenter, or simply because of superior cognitive skills. This may also have been due to the learned helplessness displayed by some non-regular video game players, whilst completing the CB task.

A hypothesis in relation to differences in gender and attention levels was also suggested. No significant results were gained from this investigation. This may have been due to the uneven ratio of females to males within this experiment (19:11). This may also have been related to the uneven ratio of regular and non-regular video game players, within each gender, i.e. there were thirteen non-regular gaming females, and only six regular gaming females, as well as there being two non-regular gaming males, and nine regular gaming males. Future studies may be able to investigate this hypothesis further, and provide more valuable results, with an even number of regular and non-regular video game playing males and females.
It was also hypothesised that there would be a significant difference in regards to the age of participants and their attention levels. An independent samples t-test found no significant result for this hypothesis, which may have again been due to an uneven distribution of participants, as there were twenty people who claimed to be twenty-six years old or older, and only ten people who claimed to be twenty-five years old or younger.

Furthermore, it was hypothesised that there would be a significant relationship between participant’s platforming preferences and their attention levels. No significant results were found in relation to this. As previously stated, this hypothesis may have again been affected by an uneven distribution of platform preferences amongst participants. Five participants reported preferring to play the Wii, Wii U, Nintendo DS (3DS/DS i/DS Lite/DS XL), nine participants claimed that they preferred to play the Xbox360 or XboxOne, three participants reported to prefer playing the PS3, PS4 or PSP, and the majority of participants (N=18) claimed to prefer playing the PC, other consoles, or to have no preference at all.

Finally, it was hypothesised that there would be a significant difference in attention levels between the participants’ personal preferences in relation to video game genres. Again, no significant results were found in relation to this hypothesis. This may have been due to the grouping of similar genres by the experimenter, in an attempt to ease the difficulty when examining the relationship. Future studies may be able to rectify this error, by diving future experiments into segments, to examine one particular genre preference at a time. Further analysis of this relationship may provide a valuable source of information for console producing companies which, in turn, may be used as marketing campaign, or during the production of new products.

4.2. Limitations/Critiques of This Study

Several limitations were met during the development, and administration of the experiment used within this study. Firstly, the softwares required in order to create the
experiments used within this experiment were not readily available due to licensing requirements and purchases. Two computers with one of the softwares, were made available by Dublin Business School (DBS), however, due to the heavy demand that was currently placed on these computers at the time of creation of this experiment, accesses to these computers was very limited. Therefore, reliance on the head of information technology within the establishment was necessary, which caused significant time delays, as said IT consultant was also faced with the task of assisting at least fifty other students simultaneously. It was also noticed by the experimenter that those who were known to be fanatic and regular video game players were sometimes classed as otherwise, due to the focus of the question being presented. Participants were asked ‘Over the past six months, roughly, how many days per week have you played video games?’ therefore, it should be noted that due to the timing in which this study was conducted, several participants were under copious amounts of stress to meet deadlines, and therefore may not have played video games as much as they usually would, if they had a lighter workload. Participants for this experiment consisted mainly of those in full time education, or in full time work, therefore this study was slightly limited, as several of the participants used in this study were difficult to pinpoint and reach on desired occasions. In contrast to this, it also found that certain participants who readily expressed desire to take part in this experiment, were unfortunately not over the age of eighteen, and therefore did not meet the criteria necessary to take part.

The experiment used in this study was also rather time consuming, as it took participants roughly five to ten minutes to complete the demographic questionnaire, and anywhere from thirty to sixty minutes to complete the attention tasks. This caused some participants to become aggravated during the administration of the experiment, which may have affected their responses to the questions asked, which may also have caused participants to display symptoms of learned helplessness, as mentioned above. This limitation was
resolved however, through the experimenter’s use of appealing to the competitive nature of the participants, by challenging them to produce greater scores than those of the other participants known to them to have been a part of the experiment.

Furthermore, it was noted that some of the participants who volunteered in this experiment, did not speak English as their first language. Therefore, some difficulties were met, in regards to the understanding of the onscreen written instructions, when completing the attention tasks and completing the questionnaire. Finally, it was noted by several participants that there were rather prominent lags on some of the trials in the Flicker task. This may be because of the restrictions the experimenter endured when creating the trials and tasks, as in certain occasions, there were only demonstrative versions of the softwares required available. This may have been rectified by using the computers made available within DBS, however, due to time and resource restrictions, this was not a reliable option.

4.3. Implications for Future Research

As a result of a statistically significant difference in regard to attention levels (i.e. the total number of correct responses within the Flicker and CB tasks), the main implication of this study will be an indication and foundation for future research and studies in the area. Although no significant findings were drawn from the analysis of other variables, an encouraging start has been made in relation to the examination of attention levels, platforming and genre preferences, which will provided the basis of future studies. This study may also be expanded by the experimenter at a higher level of education so as to continue and further positive research within the field of video games and their effects. The results and research found from this study will also highlight the visual phenomenon that is change blindness, and have several implications in relation to the general publics’ awareness and attention levels, as it has been made particularly clear, through the use of the experiment
within this study, that human beings have not yet fully adapted to detecting everything within their environment and immediate proximity. By doing so, this study will highlight the dangers of change blindness which, in turn, will provide eye opening information so as to avoid any unnecessary road collisions, hit and run incidents, or other similar situations which involve spilt second changes in the environment.

4.4. Conclusion

In conclusion, this study has broadened the current knowledge in relation to video game playing and attention levels. Several significant observations have been discovered, suggesting that the playing of video games, despite what has been previously negatively reported, may actually provide various benefits, such as a heightened ability to notice and detect changes in the environment. Although the null hypotheses were accept in certain aspects of this study, the foundations in relation to platforming and genre preferences and their effects on attention levels have been laid. This study has also helped to provide more positive information for video game playing and has outlined how dangerous and slightly unnerving change blindness and lacks in attention can be, as it has been demonstrated that several of the participants within this study could not identify a change that was repeatedly changing in front of their eyes.
REFERENCES


Hi, my name is Jessica Maher. I’m a final year undergraduate Psychology student at Dublin Business School, currently doing my thesis and would like to enlist your help. I’m conducting an experiment in relation to the differences in attention levels between those who regularly play video games and those who do not. My study will consist of filling out the attached survey and completing a few cognitive tasks. Please only fill out this survey if you are 18 years old or over, and do not suffer from any of the following:

- Epilepsy
- Poor/uncorrected vision
- Colour Vision Deficiency (Colour Blindness)
- Any negative side/effects from flashing lights/screens

All data gathered will be anonymous, so please do not include your name or student number on any part of this form. All data gathered from this study will be stored on a password protected hard drive and deleted a year after my final examinations in April/May 2014. As participation in this experiment is completely anonymous, it will not be possible to withdraw from participation once the experiment is completed.

This survey will take approximately 5 to 10 minutes to complete. The cognitive tasks will take approximately 30-45 minutes to complete. Please feel free to ask any questions you may have at any time during this experiment. By ticking the box below you are confirming that you are over the age of 18 and do not suffer for any of the health problems mentioned above.

I have read the above terms for participating in this experiment and confirm that I am over 18 years of age and do not suffer from any of the health issues mentioned above.
Thank you for taking the time to fill out this form, your help is greatly appreciated.

Please circle the answer that applies most to you.

Age: ________

Gender: Male    Female

Do you like to play video games? Yes    No

Over the past six months, roughly how many days per week have you played video games?

0-1    1-2    2-3    3-4    5+

Over the past six months, roughly how many hours per day have you played video games?

0-1    1-2    2-3    3-4    5+

Over the past six months, roughly how many hours per week have you played video games?

0-5    5-10   10-15   15+

Which is/are your favourite genre(s) of video games?

Action / Adventure / Horror / Role-Playing Game (RPG) / Sport / Driving / Simulation / Massively Multiplayer Online (MMO) / First Person Shooter (FPS) / Puzzle / Other / None

If Other, please specify ____________________________
Please circle the answer that applies most to you.

**What gaming platform(s) do you currently own?**

Wii / Wii U / Xbox360 / Xbox One / PS3 / PS4 / PC / Nintendo DS(i)(Lite)(XL) / Nintendo 3DS / Sony PSP / Other / None

**If Other, please specify** ____________________________________________

**Which gaming platform(s) do you prefer?**

Wii / Wii U / Xbox360 / Xbox One / PS3 / PS4 / PC / Nintendo DS(i)(Lite)(XL) / Nintendo 3DS / Sony PSP / Other / No Preference

**If Other please specify** ____________________________________________
SEE VIDEO
How many times did the seagull drop the stick? ____________________________

Did you notice anything unusual? Please specify:

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
Please remove this sheet if you would like to avail of the services mentioned below, or would like to get in touch in regards to any other questions or the results of this experiment.

If you feel you may be affected by any of the questions or images shown throughout this experiment, there are some useful support services provided below:

- The Aware Helpline: 1890 303 302 or email info@aware.ie
  Available Monday – Sunday 10am-10pm.

- Samaritans Ireland: 1850 60 90 90 or email jo@samaritans.ie
  Available 24 hours a day, 365 days a year.

- DBS student services

Thanks for participating in this study. Please direct any questions in relation to this experiment to