THE EFFECT OF PLAYING FIRST PERSON SHOOTER VIDEO GAMES ON ATTENTION

Psychology Senior Comprehensive Project

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Abstract

This study studied the effect of playing first person shooter (FPS) video games on attention, specifically inhibition control. Allegheny College students (N=24) participated in this study. Twelve participants self-identified as FPS players and 12 participants were considered non-FPS players. Participants filled out a questionnaire asking for demographic information and video game play habits. They also completed two tasks: a spatial cue task and Stroop test. There was an effect of those who play FPS video games on the performance of the cueing task when given an informative cue compared to those who do not play FPS video games. There was not an effect of those who play FPS video games on the performance of the non-informative cue response and Stroop effect compared to those who do not play FPS video games. Further ways to improve this study as well as the outlook on the overall research into the field of video games are explored.

Keywords: FPS video game, reaction time, cue, Stroop, attention, inhibition

The effect of playing first person shooter video games on attention

Video games have been around for almost sixty years starting with the simplest of games which involved little to no programming and a limited storyline. Some popular arcade games included *Pong* and *Space Invaders*. With the invention of home gaming systems, video games have become a mainstay in today's entertainment industry. Through the years, games have evolved to become more sophisticated in game play and more visually realistic. To date, there is a wide variety of video games including action, adventure, driving, puzzle, and strategy. In addition, the same game is available for different consoles allowing game publishers to reach the full range of gamers. Current popular machines include the personal computer, Microsoft's Xbox 360, Sony's PlayStation 3, and Nintendo's Wii. Aside from these machines, gaming has also expanded to mobile devices, such as smartphones and tablets, with the increased development of games for Apple's iOS and Google's Android operating systems (Geekaphone, 2011).

Action video games are games that involve a physical challenge for the game character. Often, these types of games require strong visuomotor coordination and fast reaction times in order to be successful. Even within the realm of action video games there is still a wide assortment of games such as fighting, first person shooters (FPS), and third person shooters (TPS). FPS games are one of the most popular action video games played compared to fighting and TPS; the *Call of Duty* series is one of the best-selling FPS (Spence & Feng, 2010). Since its introduction in 2003, a new installment has been released every year since 2005. The two latest versions, *Black Ops* and *Modern Warfare 3*, have set records for the most copies sold in 24 hours with 5.6 million and 6.5 million in November of 2010 and 2011, respectively (Gilbert, 2010) and (McElroy, 2011).

Many studies in the realm of action video games have been targeted at the negative social and behavioral aspects associated with playing such games. Following the shooting at Columbine High School in 1999, many parents and politicians blamed action video games as the reason for the shooters' mental instability (Anderson, 2003). Both the shooters of Columbine were avid gamers of *Doom* and *Wolfenstein 3D*, two popular FPS games released in the early 1990s. While there are many theories trying to explain the killers' rationales, including bullying, mental illnesses, the "Goth" subculture, and music, the fact that the killers played violent video games has become a hot debate over whether playing these games could lead to certain violent acts. The majority of research has focused on violence in action video games, television, and films; research has shown that there is a correlation between playing these games and its effects on behavior such as increased aggression, risk taking, and antisocial behavior (Anderson, 2003). Anderson (2003) also points out that this problem doesn't just exist in the United States; various industrial nations, such as Germany and Japan, have had violent crimes associated with playing video games as well.

In 2003, Green and Bavelier conducted a series of experiments that tested the visual attention skills of action video game players (AVGPs) compared to non-action video game players (NAVGPs). The four tasks used were the flanker compatibility task, enumeration, useful field of view which measures attention over space, and attentional blink task which measures attention over time (Green & Bavelier, 2003). The flanker compatibility task examined the difference in target processing speed between compatible (same shapes) and incompatible (different shapes) trials. The enumeration test measured a participant's ability to detect the number of squares flashed on the screen for a specific amount of time. The useful field of view and attentional blink tests measured the participant's ability to focus attention across space and

time, respectively. For the useful field of view test, participants had to "indicate the spoke on which the small target appeared" (Green & Bavelier, 2003, p. 534). For the attentional blink test, participants were presented with a series of black letters fixated in the center. At a random time, a white letter was presented and 50% of the time, an "X" was presented right after. Participants were then asked to identify the white letter and whether an "X" appeared after the letter. AVGPs performed faster and had fewer errors on all four tasks compared to NAVGPs.

A fifth experiment examined whether training in an action video game compared to a non-action video game would confirm the effects of visual attention demonstrated by the previous four experiments. Green and Bavelier (2003) were concerned with whether the attentional differences between AVGPs and NAVGPs were due to their inherent abilities and whether having a better natural visual attention led them to play these types of games. Green and Bavelier (2003) split participants who didn't play action video games into those who played a FPS action video game (Medal of Honor: Allied Assault) and those who played a non-action video game (Tetris). They conducted the enumeration, useful field of view, and attentional blink tests before and after training in Medal of Honor or Tetris and found that all participants improved their scores (Green & Bavelier, 2003). However, action video game training led to an even greater improvement in performance than the control game (Tetris) across all three tasks. With these results, Green and Bavelier concluded that playing action video games can significantly impact an individual's visual attentional processing.

In 2006, Green and Bavelier followed up their previous research with a similar set of experiments looking at whether improvements in visual attention were related to their visual periphery and whether it came at the cost of central vision. The authors used a perceptual load paradigm, a search task similar to the flanker compatibility task used in their previous series of

experiments. They also used a useful field of view (UFOV) test that tested different target eccentricities (10°, 20°, and 30°). Green and Bavelier (2006) found that AVGPs displayed enhanced abilities to locate the target at all three eccentricities which demonstrated how playing video games could enhance visual processing across a large portion of the visual field. Furthermore, the fact that AVGPs performed better at 30° indicated that action video game play can be generalized to untrained areas within the visual field. Green and Bavelier (2006) also conducted a training session in which half the participants trained in an action video game (Unreal Tournament 2004) and the other half in a non-action video game (Tetris). Their results indicated that playing action video games can modify visuospatial attention. Because their study showed that participants who trained in playing an action video game performed better than those who played the control game, a causal link can be established between action video game play and attentional capacities.

Castel, Pratt, and Drummond (2005) performed a similar search task which involved searching for a single target letter under easy or hard search conditions. In both search conditions, participants had to search for a "b" or "d" amongst other distracter letters. The easy search distracters consisted of only the letter "k" while the hard search conditions included the letters "p", "y", "g", "j", "l", and "h". Likewise, they reached the same conclusion as Green and Bavelier that action video game players had faster response times and fewer errors compared to non action video game players.

In most first person shooters (FPS), players must use the graphical representation of the visual field of their character in first person, any heads-up displays (HUDs) such as mini-map, and weapons and ammunition, as well as any other auditory or visual information received from teammates or the game. Appendix A shows what players see on their display in the popular game

Call of Duty: Modern Warfare 3. The player must use this visual information and process it in a way that will help the player succeed. Good FPS players are those who can store and process this information efficiently, and quickly perform the necessary game controls. FPS players are constantly engaging in tasks associated with the maintenance and processing of visual information. While the aforementioned studies have looked at the effects of action video game play on certain attentional skills, it has not addressed how playing action video games, such as FPS, affect inhibition control.

Posner, Nissen, and Ogden (1978) conducted a series of experiments that examined how individuals process and shift their attention towards a specified location. They identified this concept as a "set". Individuals constantly take in information from their visual field. In turn, they attend to this information by performing a motor control such as shifting their gaze towards that location (Posner et al., 1978). Their third experiment can be used to help explain the improved attentional capabilities of FPS players. Posner et al. (1978) wrote that participants can choose to attend to a specific pathway when given a visual input. FPS players are more likely to shift their attention and saccade towards the target faster compared to non-FPS players (Green & Bavelier, 2003, 2006). However, if the cue misrepresents the direction in which the target actually is, FPS players are predicted to not perform as well as non-FPS players since their attention is most likely going to be directed towards where they think the target will appear.

Another task that measures one's inhibition control is the Stroop test (Stroop, 1935). For this test, participants are asked to name the color in which the word is printed in. When the color and word match, it is easy. However, if the color does not match the word, both reaction times and the number of errors increase. While this task does not involve shifting attention and eye movements towards a location, it is nevertheless still a strong attention-based task because it is

easy for participants to perform the task by reading the word instead of correctly naming the color the word is in.

In summary, research has shown that action video game players do better on visuospatial cognition tasks. Their ability to conduct faster searches within their visual field means that they have an enhanced attentional system and faster saccades. However, the question being asked here is how playing FPS video games affect inhibition control. Participants will be self-identified as either FPS players or non-FPS players. They will participate in a spatial cueing task and a Stroop test. Performance in these two tasks will be compared between the two conditions to determine whether playing FPS games has an impact on one's inhibition control. It is hypothesized that FPS players will perform better on the spatial cueing task when the cue has indicated a location in which the target will most likely be present. On the other hand, it is hypothesized that non-FPS players will perform better when the cue does not predict the location of the target as likely. Additionally, it is predicted that non-FPS players will do better on the Stroop test as compared to FPS players.

Method

Participants

The participants of this study consisted of Allegheny College students who volunteered to take part in this study. Volunteers received either class credit or extra credit at the professor's discretion. The total number of participants was N=24 with 13 male participants and 11 female participants. FPS players were defined as participants who indicated on the questionnaire that they played a type of FPS game similar to *Call of Duty*. Non-FPS players were participants who did not self-identify as having played FPS video games. Twelve FPS players and 12 non-FPS

players participated in this study. The age of the participants ranged from 18 to 22 with a mean of 20.42.

Figures 1, 2, and 3 depict the gender, age, and year in school of participants who were identified as FPS players or non-FPS players. Both age and year in school of participants in both conditions were relatively the same. However, the gender of participants for FPS players compared to non-FPS players varied. Self-identified FPS players consisted of 10 males and two females, while non-FPS players consisted of three males and nine females. All guidelines relating to human research, including confidentiality, informed consent, and debriefing were observed.

Apparatus

Computers and monitors in Carnegie Rooms 214, 215, and 216, during the Spring 2012 semester, were used for administering both the spatial cueing task and Stroop test. E-prime was used to program and administer both tasks.

Design

The independent variable was the self-identified condition. The two levels were FPS player or non-FPS player. FPS players were participants who indicated on the questionnaire whether they played a FPS game similar to *Call of Duty*. Those who didn't indicate that they played FPS games were classified as non-FPS players. The dependent variables were the Stroop effect reaction time, the non-informative cue reaction time, and the informative cue reaction time. Reaction times were measured in milliseconds (ms). The Stroop effect reaction time is the difference in reaction times between the two conditions, when participants responded to congruent versus incongruent trials. The order of the Stroop test and spatial cueing task was counterbalanced between participants.

Procedure

Participants were asked to fill out a short questionnaire asking them about demographic information and video game play habits. A copy of the questionnaire is shown in Appendix B.

Participants engaged in a modified spatial cueing task similar to the set of cueing tasks used by Posner et al. (1978). The program, E-prime, was used to program and administer this task. The experiment was conducted in a well-lit room. Participants were asked to sit in front of the monitor at a distance they were comfortable with. All items were black and presented on a white screen. They were asked to fixate their eyes on the "+" at the center of the display. Directions before each testing block indicated one of three possible situations. The first situation informed participants the most likely position the target would appear with a visual cue of "+". The second situation informed participants that all four of the positions were equally likely for the target to appear with a visual cue of "+". The third situation informed participants where the target was most likely to appear with a visual cue that indicated the position. Participants were informed that some trials did not actually have a stimulus. The four locations were numbered "1" through "4", with "1" being the most left, "2" just left of the fixation, "3" just right of the fixation, and "4" being the most right. Participants were asked to press any key after they had successfully moved their eyes and attention towards the target. Reaction times were measured and recorded for each trial. There were a total of 160 trials. Appendix C shows a sample trial.

In addition, participants were asked to complete a Stroop test. E-Prime was also used to program and administer this task. Participants were presented with an instruction screen with the colors that they will see. The colors used in this task were red, blue, brown, green, and purple. Participants were instructed to follow the instructions on the screen for each trial block. The two possible scenarios were "Read the name of the color and ignore other information" and "Name

the color of the item displayed, ignoring other information". They were also asked to say the appropriate thing aloud and then press the space key. Reaction times were measured and recorded for each trial. There were a total of 4 blocks with 20 trials each. Participants were randomly assigned to take either the spatial cueing task or Stroop test first followed by the other test immediately after completing the first task.

Results

The sample consisted of N=24 Allegheny students of which 12 were identified as FPS players and 12 identified as non-FPS players. Figures 1, 2 and 3 show the descriptive statistics of gender, age, and year in school for both conditions. Table 2 depicts the average amount of FPS and non-FPS video game play per week for the past three months for both groups. Table 1 displays the results for each of the three dependent variables measured: Stroop effect, non-informative cue, and informative cue reaction times measured in milliseconds (ms).

The data of two participants, one self-identified FPS player and one self-identified non-FPS player, were removed from analysis. This was because the FPS player recorded a Stroop effect of 2985.65 ms, a standard deviation of 21.78 above the mean. The non-FPS player recorded an informative cue reaction time of 1952.04 ms, a standard deviation of 4.03 above the mean. In addition, this participant averaged a negative difference between the non-informative cue and the informative cue reaction times. No other participant averaged a slower reaction time in the informative cue trials compared to the non-informative cue trials. Another participant also reported colorblindness. As a result, this participant's Stroop effect score was removed from analysis. The data presented in Table 1 does not include the already mentioned outliers or the colorblind participant's Stroop effect score.

Three independent t-tests were conducted to determine if there was a difference between those who played FPS video games and those who do not play FPS video games for the three dependent variables. There was a significant effect of those who play FPS video games (M = 319.29, SD = 60.21) on the performance of the spatial cueing task when given an informative cue compared to those who do not play FPS video games (M = 559.20, SD = 345.95), $t(11.67) = 2.37$, $p = .036$. Figure 4 illustrates this data. There were no other significant differences of those who play FPS video games on the performance of the Stroop effect or the non-informative cue reaction time compared to those who do not play FPS video games.

Discussion

This study revealed that there was a significant effect of those who play FPS video games on the performance of the spatial cueing task when presented with an informative cue compared to those who do not play FPS video games. FPS players had a faster reaction time than non-FPS players when they were given an informative cue as to where the target will be located. This finding confirms previous research by authors such as Green & Bavelier (2003), Green & Bavelier (2006), and Castel et al. (2005) that FPS players have an enhanced attentional system that allows them to process targets even faster when they know where the target will be located. There were no other significant effects.

The lack of a significant difference for the Stroop effect is interesting because the hypothesis was that non-FPS players would perform better on the Stroop test compared to FPS players. It was predicted that FPS players would do worse because they are more used to making a natural and fast attention shift towards a specific area of their visual field and that this tendency to shift attention would make it harder for them to inhibit a natural response. The Stroop effect determines the difference between performance on the congruent (when the color and word

matched) and incongruent (when the color and word do not match) trials. A higher Stroop effect means that participants had a greater difference between the mean reaction times for the incongruent and congruent trials. The fact that non-FPS players did not perform better suggests that the Stroop test was equally difficult for both non-FPS players and FPS players. This could mean that the increased visual attention that FPS players have may not transfer to apply to non visuospatial attention tasks.

There was also a lack of a significant difference for the non-informative cue reaction times between the two conditions. The hypothesis of this study predicted that non-FPS players would perform better than FPS players. It was predicted that if FPS players were likely to draw their attention towards a predetermined target faster, that they would not be able to attend to a target if the cue was misleading. Because there was no significance, FPS players and non-FPS players had a similar reaction time to the non-informative cues.

Instead of the spatial cueing task, an antisaccade task would be a better alternative to measure inhibition control. The antisaccade task (Hallett, P.E., 1978) is an attention-heavy task in which individuals must be able to inhibit the natural orienting response towards a stimulus with the task goal of directing attention towards the opposite side of the stimulus (Unsworth, Heitz, Engle, 2005). For this task, eye movements would be recorded to determine whether participants had successfully antisaccade or whether they had made an error by incorrectly moving their eyes and attention towards the stimulus. Most antisaccade tasks incorporate prosaccade (saccades towards the intended target) and antisaccade trials much like the spatial cueing task used in this experiment. However, instead of indicating the condition by trial blocks, each trial would be randomly assigned to either a prosaccade or antisaccade condition.

Crawford, Parker, Solis-Trapala, Mayes (2011) conducted a study that determined that there was a relationship between the reaction time of a prosaccade and antisaccade errors. FPS players had a faster reaction time to the informative cue trials than non-FPS players. Therefore, according to the research done by Crawford et al. (2011), FPS players should have more antisaccade errors since they were able to draw their attention and prosaccade to the intended target faster than non-FPS players. An extension to this study would be to have self-identified FPS players and non-FPS players take part in an antisaccade task. An eye tracking system would be used to measure eye saccades and determine the reaction times for prosaccades and antisaccades, as well as any antisaccade errors made. Using such a system to measure eye movements would have produced a more precise measurement of where participants were focusing their eyes and attention.

It is possible that there was not enough control over the way participants completed the Stroop test. Even though the directions clearly stated to only press the space key once the participant had said their correct response, there was no way to determine whether the participant had actually responded correctly. One participant even asked if the responses to each trial were being recorded. In addition, more trials could have been programmed per block in order to increase the effectiveness of the measurement and reduce standard deviations. Another possibility would be to increase the number of practice trials so the participant could get used to the flow of the task. The standard deviations for each of the three dependent variables were relatively consistent between the two conditions with the exception of the informative cue reaction times. FPS players had a standard deviation of 60.21 ms compared to non-FPS players who had a standard deviation of 345.95 ms. Another way is to increase the number of

participants in the independent variable condition by recruiting more participants who play FPS video games and more who do not play FPS video games.

There is such a broad range of research on video games (Spence & Feng, 2010). These include researching how players interact with the game, the different cognitive benefits of video games, as well as whether playing violent video games have an effect on increased aggression, risk taking, and antisocial behavior. This study aimed to examine whether there was an effect of playing FPS video games on inhibition skills. While the study did not determine a significant difference between FPS players and non-FPS players, further research can be done to look into whether there is a correlation. A follow-up to this study could be done by implementing the antisaccade task, recruiting more participants, or ensuring that there is a significant difference in the levels of the independent variable. Research into inhibition control can be used to determine whether there are certain psychological aspects of FPS video game play that are not desirable.

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Table 1.
Stroop effect, non-informative cue, and informative cue reaction times (in milliseconds)

	Stroop effect		Non-informative cue		Informative cue	
Condition	M	Standard Dev.	M	Standard Dev.	M	Standard Dev.
FPS player	55.83	134.49	1235.72	386.42	319.29	60.21
Non-FPS player	71.67	182.50	1477.17	326.61	559.20	345.95

Table 2.

Hours of FPS and non-FPS video games played, on average per week, for the past three months

	FPS video game hours		Non-FPS video game hours	
Condition	M	Standard Deviation	M	Standard Deviation
FPS player	4.50	4.25	7.33	8.15
Non-FPS player	0.00	0.00	1.00	1.41

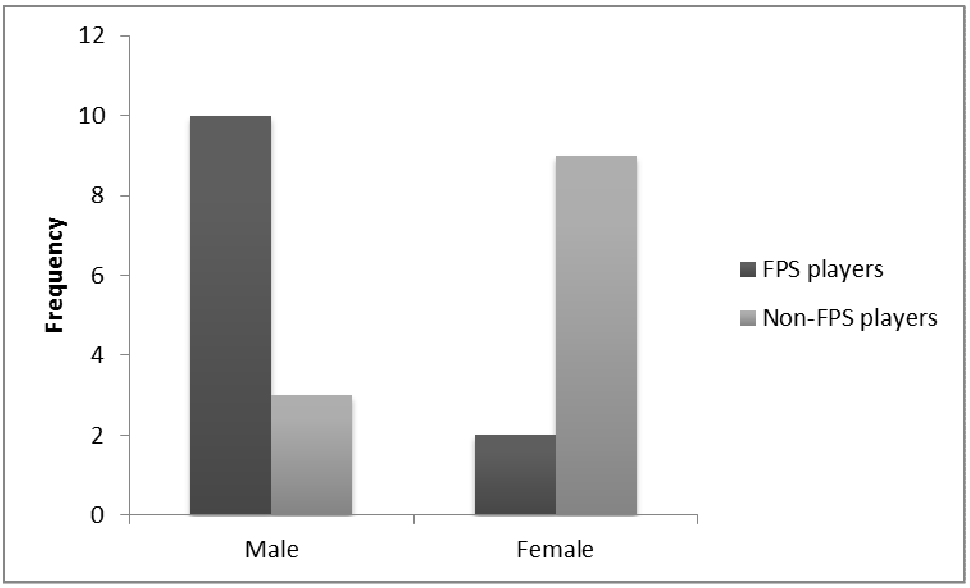


Figure 1. Gender frequency of FPS players and non-FPS players

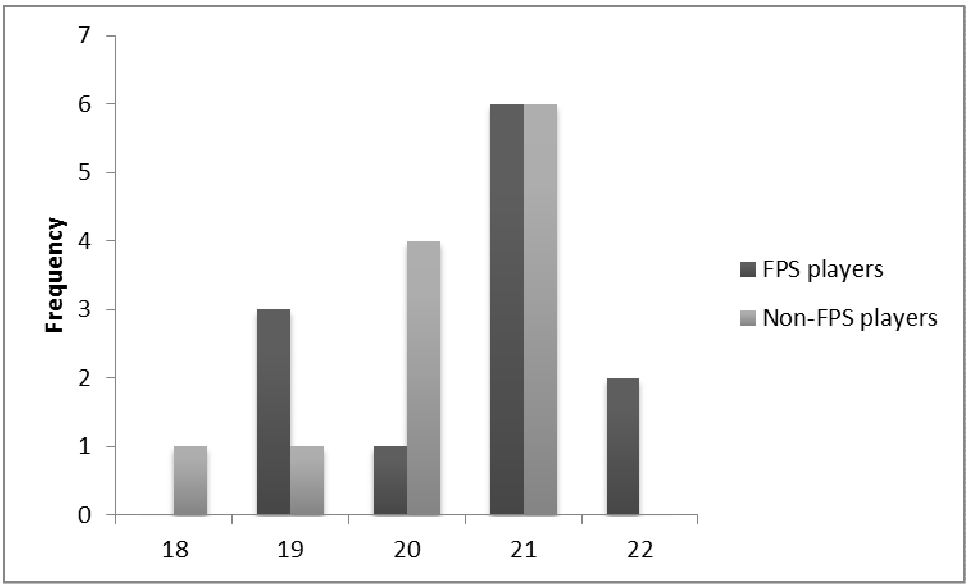


Figure 2. Age frequency of FPS players and non-FPS players

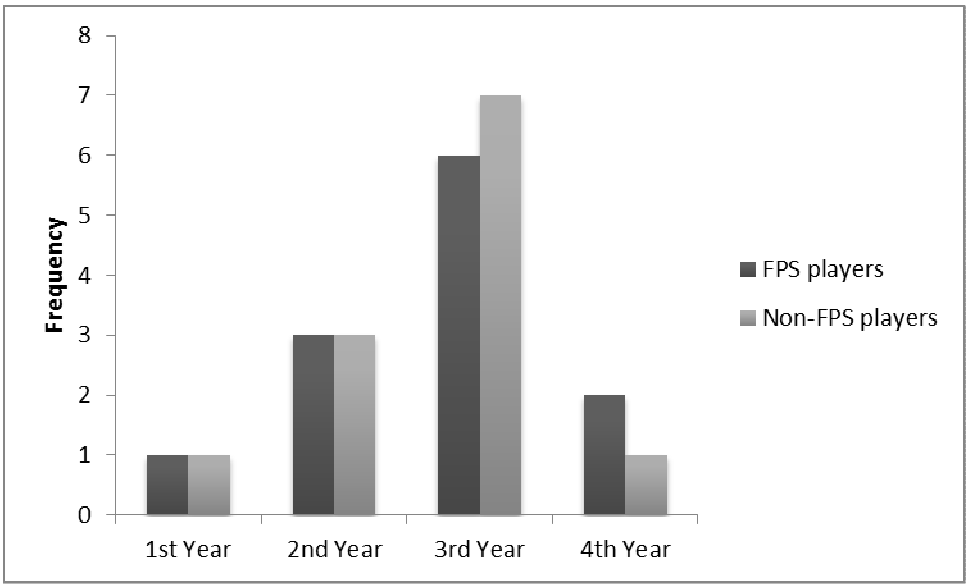


Figure 3. Year in school frequency of FPS players and non-FPS players

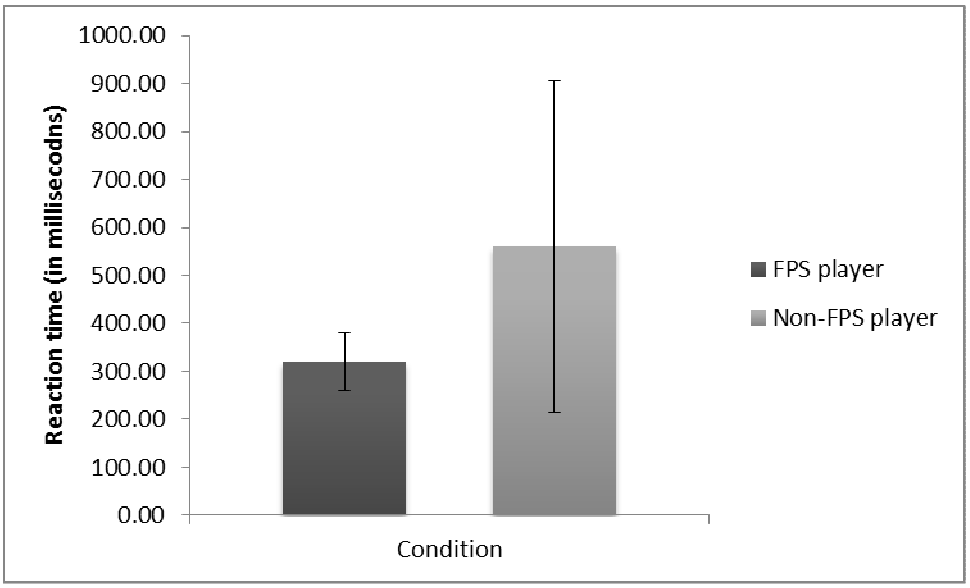


Figure 4. Mean reaction times on informative cue trials for FPS players and non-FPS players. A lower value indicates a faster reaction time (e.g. better performance)

Appendix A: Screenshot from *Call of Duty: Modern Warfare 3*



Image obtained from: http://www.incgamers.com/images/screenshots/30829orig.jpg

Appendix B: Questionnaire

1) How old are you?

_____

2) What is your gender? **[Circle one]**

Male Female Transgender

3) What academic year are you in? **[Circle one]**

Senior Junior Sophomore Freshman

4) Do you play video games (on either Xbox 360, Playstation 3, Wii, PC/Mac, iPad or iOS device, Android device, etc)? **[Circle One]**

Yes No

5) Do you play first person shooter (FPS) video games? Examples include but are not limited to: Call of Duty, Battlefield, Killzone, Crysis, Half-Life, Medal of Honor, Resistance, Far Cry. **[Circle One]**

Yes No

5a) If yes, on average per week, how many hours have you played these types of games in the past 3 months?

_____

6) Do you play non-FPS video games? Examples include but are not limited to: fighting action, adventure, driving, fighting, puzzle, role-playing, strategy, and sports. **[Circle One]**

Yes No

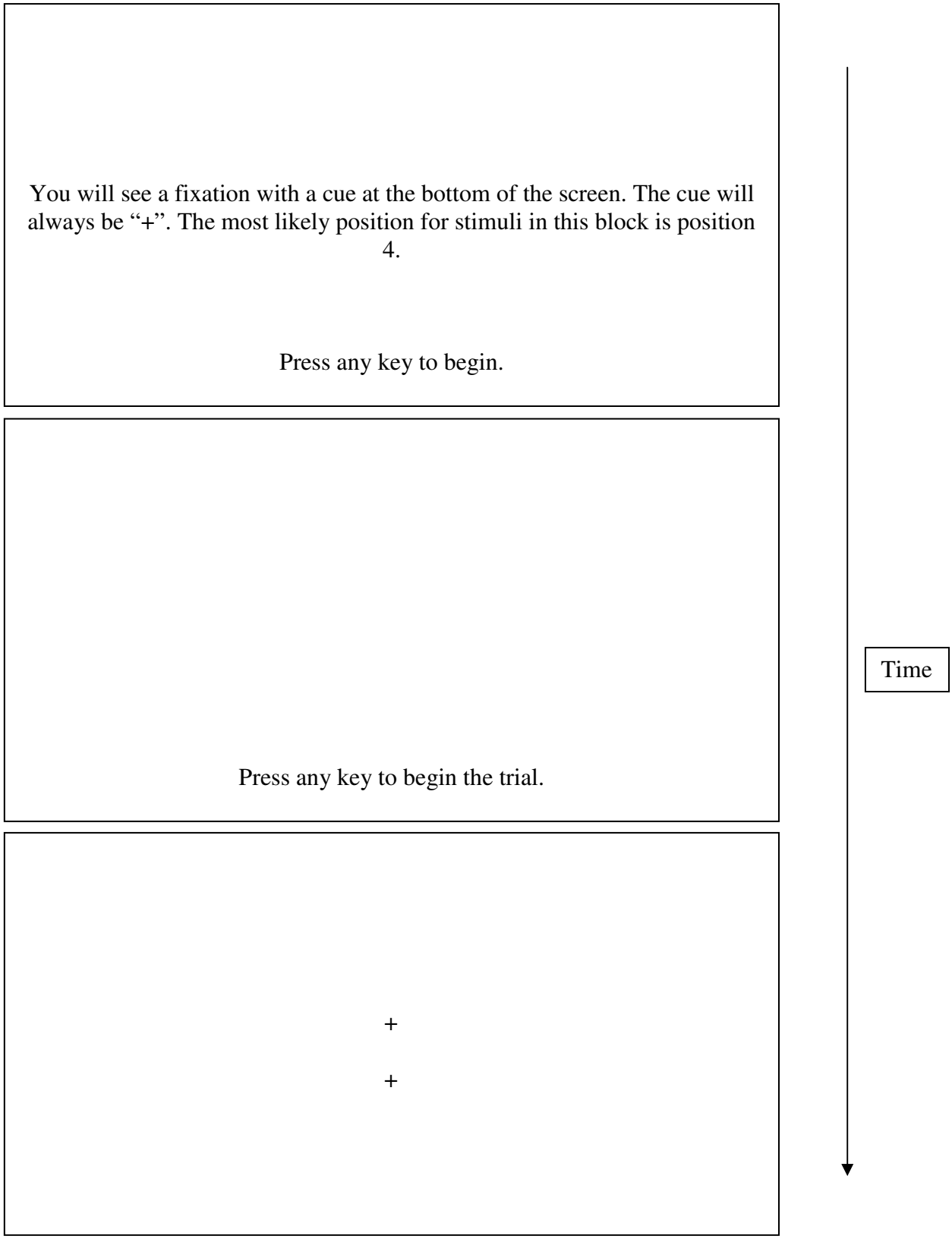
6a) If yes, on average per week, how many hours have you played these types of games in the past 3 months?

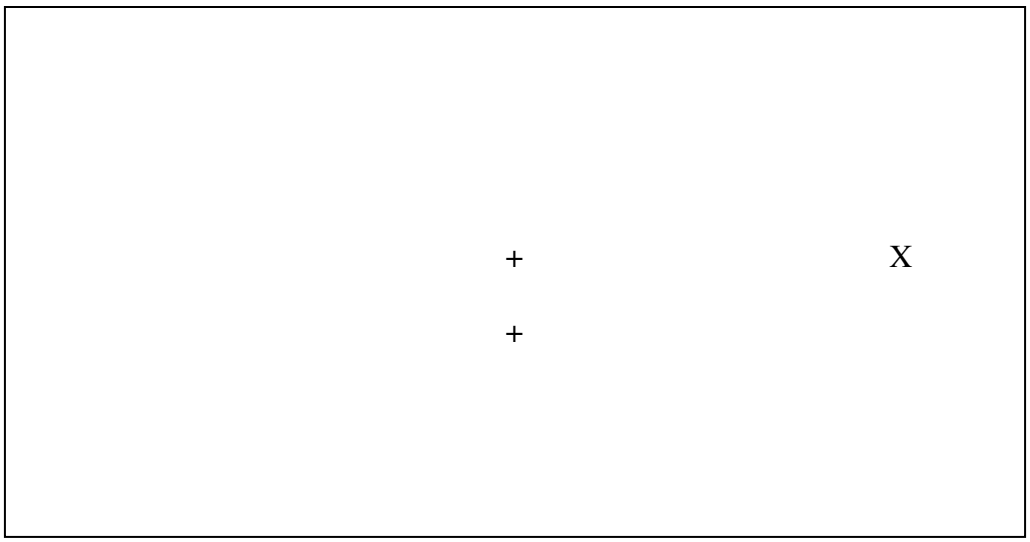
_____

7) Are you color blind? **[Circle One]**

Yes No

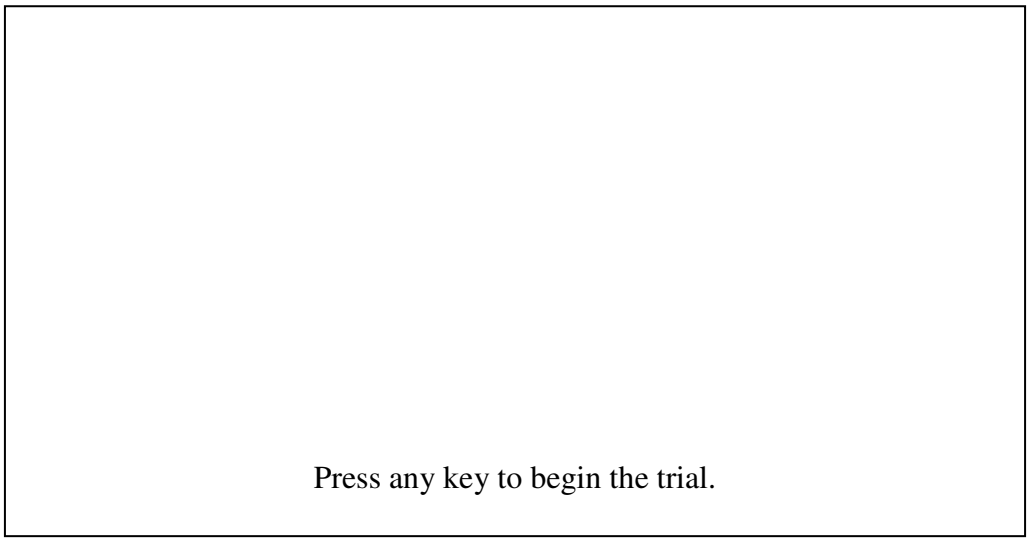
Appendix C: Sample trial of spatial cueing task





Participant's response (pressing space key)

Time



Appendix D: Consent form

RESEARCH PARTICIPANT CONSENT FORM

FPS video games and attention

Yung Yu (Peter) Cheng
Allegheny College
Department of Psychology

Purpose of Research:
The purpose of this research study is to study the affects of playing first person shooter videos games on attentional capabilities.

Specific Procedures:
I understand that I will be asked to complete a short questionnaire about demographic information and video game playing habits. I understand that the tasks I will complete include a pre-cueing task and a Stroop task. I understand that this study will take no more than 30 minutes.

Risks to the Individual:
I understand that the risks of participating in this study are no more than I would experience in everyday life.

Benefits to the Individual or Others:
I understand that the primary potential benefit of this research study will be obtained by other researchers studying the affects of video game play on certain cognitive tasks.

Compensation:
By agreeing to participate in this research study, I understand that I will receive extra credit or credit for research participation in the class in which I was recruited in for this study if approved by my professor.

Confidentiality:
I understand that the data I provide today are completely confidential and that my name never will be associated with the data I provide. I understand that the researcher is not interested in any single person's data and will combine the data I provide with all other participants' data to look for general patterns. Any reports made based on this study's data will focus only on general patterns.

I understand that my data and consent form will be stored separately under lock and key in the Department of Psychology at Allegheny College in Carnegie Room 202. I understand that the data I provide today will be destroyed when they are no longer needed.

Voluntary Nature of Participation:
I understand that I am at NO time required to participate in this study. I understand that if I agree to participate, I may withdraw my participation at any time with no penalty. I understand that I may skip any and all parts of today's procedures that I wish and that I may skip any questions that I wish not to answer.

Contact Information:
For any questions or concerns about this research project, please call **Yung Yu (Peter) Cheng** at **339-222-9657** or email him at **chengy@allegheny.edu**. You also may contact **Dr. Calion Lockridge** at **814-332-3620** or email him at **clockrid@allegheny.edu**. For any questions or concerns about the treatment of research participants, including yourself, please call **Dr. James Lombardi**, Chair of the Allegheny College Institutional Review Board (IRB) at **(814) 332-2975** or email him at **jalombar@allegheny.edu.**

Participant's Name_____ Date_____

Participant's Signature_____ Date_____

Researcher's Signature_____ Date_____

Appendix E: Debriefing form

RESEARCH PARTICIPANT DEBRIEFING FORM

FPS video games and attention
Yung Yu (Peter) Cheng
Allegheny College
Department of Psychology

Thank you very much for your participation in this study!
Your participation is greatly appreciated!

Purpose of Research:
This research's purpose is to study the affects of how playing first person shooter (FPS) video games affect their attentional abilities, especially with regards to inhibition. The pre-cueing task measured participants' reaction time to locate a target when giving a cue informing them of the probability of the location of that target. The Stroop task measured one's performance in saying the color of the text. The hypothesis is that those who played FPS games had a faster reaction time when the cue indicated a location in which the target was most likely to appear. Additionally, it is hypothesized that if the cue didn't predict the location of the target as likely, that non-FPS players would perform better. Furthermore, it is hypothesized that non-FPS players will perform better than FPS players on the Stroop test.

Deception:
This study used minor deception by not fully apprising participants of the purpose of the study. This was done to make sure participants were not influenced or biased by the topic or by any other participants before the study began.

Compensation:
By agreeing to participate in this research study, I understand that I will receive extra credit or credit for research participation in the class in which I was recruited in for this study if approved by my professor.

Confidentiality:
The data provided by all participants are completely confidential and participants' names never will be associated with the data they provide. The data and consent form are stored separately and under lock and key in the Department of Psychology at Allegheny College in Carnegie Room 202. The data will be destroyed when they are no longer needed.

Additional Sources of Information:
Posner, M.I., Nissen, M.J., Ogden, W.C. (1978). Attended and unattended processing modes: The role of set for spatial location. In H. Pick, Jr., & E. Saltzman. (Eds.), *Modes of Perceiving and Processing Information* (pp. 137-158). Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc.

Spence, I., & Feng, J. (2010). Video games and spatial cognition. *Review of General Psychology*, *14*(2), 92-104. doi: 10.1037/a0019491

Green, C.S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature*, *423*(6939), 534-537. doi: 10.1038/nature01647

Contact Information:
Please feel free to contact any of the following people.

- For any questions or concerns about this research project, please call **Yung Yu (Peter) Cheng** at **339-222-9657** or email him at **chengy@allegheny.edu**. You also may call **Dr. Calion Lockridge** at **814-332-3620** or email him at **clockrid@allegheny.edu**.
- For any psychological concerns, please visit or call the Allegheny College Counseling Center at **814-332-4368.**

- For any questions or concerns about the treatment of research participants, including yourself, please call **Dr. James Lombardi**, Chair of the Allegheny College Institutional Review Board (IRB), at **814-332-2975** or email him at **jalombar@allegheny.edu.**
- For any health concerns, please visit or call the Allegheny College Health Center (Winslow Health Center) at **814-332-4355** or visit your personal physician.