The Role of Cognitive Depletion from Playing Video Games in Promoting Aggression

A Psychology Honors Thesis

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Abstract

The present study was intended to examine the effects of cognitively demanding, violent video games, on cognitive depletion, self-control, and aggressive responses. In particular, it aimed to determine if one of the reasons why violent video games stimulate aggression is because they deplete limited cognitive resources, and therefore lower self-control. The short-term effects of playing violent video games on increased aggression have usually been attributed solely to priming and mimicry (Anderson et al. 2010). However, it is possible that playing a cognitively demanding game also depletes cognitive resources, reducing self-control, and increasing the likelihood of aggression in response to provocation (Stucke & Baumeister, 2006). In the current study data was collected from 169 undergraduate students who played a game (violent vs. non-violent and demanding vs. non-demanding) and then engaged in a competitive reaction time task to assess provoked and unprovoked aggression. The results showed that playing a violent game caused increases in aggression but playing a cognitively demanding game neither increased aggression by itself nor increased the effect of playing a violent game on aggression.

Keywords: aggression, cognitive depletion, media violence, video games

The Role of Cognitive Depletion from Playing Video Games in Promoting Aggression

The harmful effects of violent video games have become a controversial issue in recent years. Although many of the corporations who produce these games and even parents whose children play them are reluctant to admit that the facts are true, various studies have illustrated that playing violent video games can increase aggressive behavior not only in the short-term, but in the long run as well (Anderson et al., 2010). A link between aggression and self-control has also been found, and when self-control is weakened aggressive behavior is more likely to exhibit itself (Stucke & Baumeister, 2006). The theory that the brain has limited cognitive resources has also been suggested as a possible factor contributing to the decline of self-control after the expenditure of cognitive effort. As a result, this action contributes to subsequent decreases in self-control and increases in aggression (Baumeister, Heatherton, & Tice, 1994). Research has been done to examine the relationship between self-control and aggression, between self-control and cognitive depletion, and between cognitive depletion and aggression. However, little has been done to examine the role of this process in the relationship between playing violent video games and aggression. The present study intends to examine the effects of cognitively demanding, violent video games, and cognitive depletion on aggressive responses. In particular, it aims to determine if one of the reasons why violent video games stimulate aggression is because they deplete limited cognitive resources, and therefore lower self-control.

Background

The role of a limited cognitive resource in the brain has been examined closely in recent years along with its influence on self-regulation. There has been much debate over what this resource is, and while some have speculated that it may be glucose, others dismiss this theory stating that the findings are minuscule in significance. Some claim that the idea of a resource

model is an incorrect one altogether (Gailliot & Baumeister, 2007) as glucose cannot explain the effects (Kurzban, 2010).

The idea that self-control is an "effortful" mental task that requires cognitive resources was first proposed when a review of multiple studies illustrated diminished self-control on tasks following prior activities that seemed to deplete cognitive resources (Baumeister et al., 1994). Self-control can be defined as the "adjustment" of behavior to fall in line with social norms, expectations and standards. It often involves "inhibiting" impulsive tendencies motivated by emotions or desires, and it is a crucial factor in the lives of humans as they interact with one another daily (Gailliot & Baumeister, 2007). High levels of self-control have also been closely linked to more advantageous interpersonal relationships, reduced prejudice and stereotyping, greater mental health and emotional management skills, control over eating disorders, criminal behaviors, and substance abuse (Duckworth & Seligman, 2005; Finkel & Campbell, 2001; Galliot, Peruche, Plant, & Baumeister, 2009; Galliot, Schmeichel, & Baumeister, 2006; Gottfredson & Hirschi, 1990; Mischel, Shoda, & Peake, 1988; Muraven, Collins, & Nienhaus, 2002; Pratt & Cullen, 2000; Shoda, Mischel, & Peake, 1990; Tangney, Baumeister, & Boone, 2004).

Additionally, it has been shown that cognitive resources can be depleted by certain cognitively demanding tasks, including those that require effortful attention, self-regulation, decision making, or that utilize executive processes (Baumeister, Vohs, & Tice, 2007; Schmeichel, 2007). This can have an effect on future tasks that may utilize these same cognitive resources. Because of the initial cognitive depletion, performance on subsequent self-control tasks has been shown to be greatly diminished, indicating that the same cognitive resource that is compromised during cognitively demanding tasks may also be involved in self-control

(Schmeichel, 2007; Vohs et al., 2006). The term *ego depletion* was created to indicate the exhausted state, or depletion of the limited resource after exercising self-control (Baumeister et al., 2007). Evidence for ego depletion has even been shown to occur in canines, measured by persistence in engagement with a play toy after being instructed to perform extended self-control tasks (Miller et al., 2010). Baumeister et al. (1998) suggested the idea of a strength model, which states that the exertion of self-control depletes a common resource in the body, and can be likened to a muscle that becomes exhausted after strenuous use. This resource can be restored by rest or through the replenishment of fuel (Gailliot & Baumeister, 2007; Tyler & Burns, 2008). A recent meta-analysis of the findings in this area by Hagger et al. (2010) illustrates its current importance in the area of self-regulation research, and proposed several questions to guide experiments in the future. The proposition that an individual's beliefs about self-control and willpower can moderate how they are influenced by cognitive depletion has also been recently explored (Job, Dweck, & Walton, 2010)

Self-control also plays a significant role in the expression of aggression, and is often referred to as a metaphorical inner restraint that prevents aggression from outwardly manifesting itself (Stucke & Baumeister, 2006). When these restraints are weakened or broken, self-control is compromised and aggression is more likely to be exhibited (Stucke & Baumeister, 2006). As stated previously, participating in cognitively demanding or self-regulating tasks can deplete the brain's limited resource, and therefore inhibit self-control in future tasks. This in turn prevents aggression from being inhibited as well (Stucke & Baumeister, 2006). Aggression has been defined as the intent to harm another individual through behavior (Berkowitz, 1993). As a social race, all human beings are confronted by aggressive tendencies, however socialization teaches us to suppress acting upon these impulses. As aggression is often instigated by provocation from

others, self-control is instrumental in facilitating a civilized population (Anderson & Bushman, 2002). Research by Stucke and Baumeister (2006) illustrates how the capacity to suppress aggression is a resource limited by previous actions of self-control and regulation. Therefore, participating in cognitively demanding tasks can increase the chances of one acting out aggressively, as a result of diminished cognitive resources in the brain, and therefore diminished self-control.

The role of video games in the development of aggressive behavior has also been examined closely in recent years. Violent video games have been shown to cause not only short-term effects, such as priming violent thoughts and stimulating aggressive arousal, but also long-term effects, such as the development of violent attitudes and beliefs (Anderson et al., 2003; Huesmann & Kirwil, 2007). Drawing from Bandura's (1963) observational learning theory, Berkowitz's (1993) cognitive neoassociaionism, and Abelson's (1976) script theory, a number of information processing models have been preformed to explain how observing violence causes aggressive behavior (Huesmann, 1988; Dodge, 1980; Anderson & Bushman, 2002). All of these models propose a 'self-control' stage in which scripts for aggressive behavior should be exhibited. All of these models also explain how the effects of environmental factors, along with exposure to violent media and real-world violence, affect an individual's thoughts and beliefs about the world, known as schemas. They additionally explain how these factors influence aggressive tendencies and aggressive arousal.

The effects of video games are of particular concern because of the rate at which violent video games are available and widely used, especially among adolescents. According to Lenhart et al., (2008), of young adults between 12-17 years of age, 97% play some kind of computer or video game, and the majority of these games are violent in nature. Experimental research by

Anderson and Dill (2000) illustrates how violent video games prime aggressive thoughts. Participants in their study were faster at identifying violent words as compared to control words after playing a violent video game. In an additional laboratory experiment they investigated the effects of violent video games using blasts of noise directed at an opponent as a measure for aggression. In this study, participants who played the violent game administered longer blasts of noise to their opponent than those who played the non-violent game (Anderson & Dill, 2000). A field study conducted by Gentile, Lynch, Linder, and Walsh (2004) using populations of students from 8th and 9th grade classes assisted in illustrating that these effects are not just short term. Students who reported playing more video games were also found to be more aggressive, disrespectful to their teachers, and were involved in more physical altercations with other students than those who did not. This specific study, along with a multitude of other studies in this area of research, illuminate a clear connection between the effects of violent video games on aggression, and suggests that priming of aggressive cognitions plays a key role in the short-term effects of violent video games.

The major hypothesis of the current study is that part of the effect on aggression of playing violent video games is also due to the fact that such games deplete cognitive resources and make self-control less likely. Because cognitive depletion is a short-term phenomena, the current study focuses on the short-term effect of violent video games.

Hypothesis

It is expected that subjects who play a violent video game that is cognitively demanding will show much higher levels of aggression and lower levels of sharing than those playing a violent non-cognitively-demanding game, a non-violent cognitively-demanding game or a non-violent non-cognitively demanding video game respectively. In addition, it is expected

that those who play a non-violent, non-cognitively demanding game will show the lowest levels of aggression and the highest levels of sharing compared to the other conditions. This is based on the assumption that cognitively demanding tasks reduce the ability to exert self-control, which increases the risk for aggressive behavior when provoked, and also that violent games prime more aggression than non-violent games.

Method

Participants

For this study 167 undergraduates were recruited from the University of Michigan, and received credit for an introductory psychology course for their participation. Subjects were primarily white (76%) and consisted of 107 female and 60 male students (M_{age} = 18.83 years, age range: 18-27). The students were recruited using the Psychology Subject Pool. This sample size (40or more per condition) was sufficient to detect a moderate effect size of .4 with a power of .75.

Measures

Buss-Perry Trait Aggression Questionnaire. This questionnaire consisted of the physical and verbal sections of the original Buss-Perry Trait Aggression Questionnaire. It required participants to rate 14 items on a 7-point scale (1 = extremely uncharacteristic of me and 7 = extremely characteristic of me; α = .86) Scores were averaged in a way such that higher scores represented more aggressive responses and therefore greater trait aggression, and lower scores indicated less aggressive responses and therefore lower trait aggression.

Competitive Reaction Task (CRT). The CRT consists of a reaction time task completed on a computer that uses aversive stimuli to measure aggression. Participants were led to believe that they were competing against a partner of the same sex, and were trying to click a

button before their partner does. The task consisted of 25 trials and participants were told that whoever hits the button the slowest for each trial will be blasted with aversive noise. Participants were then able to set the volume and duration of the noise for their partner for each of the 25 trials and could view the levels that their partner set for them. Aggression was measured by the level and duration of the blasts of noise the participants assigned to their partners. The blasts of noise were set to levels in increments of 1 (5 decibels), from level 1 (60 decibels) through level 10 (105 decibels). An option of 0 decibels, or no noise, was available as well, and represented a non-aggressive response. In the first trial the participant was programed to lose and receive a level 10 (105 decibels) blast of noise for a duration of 10 seconds, which served as provocation for the participant as it was the loudest and longest assignment possible. The participant was programmed to lose half of the remaining trials, which remained constant across all participants. On each trial the intensity level for the noise blast that the participant chose was multiplied by the duration they chose to represent one measure of aggression. The participant's score on this variable on the first trial was taken as a measure of unprovoked aggression and the participant's average score on trials 2 to 25 was taken as a measure of provoked aggression.

Sharing Task. For the sharing task participants, who were led to believe that they were participating with a partner, had the opportunity to take a reward from their partner. Aggression was measured by how much candy they took versus how much they left for their partner. Immediately after playing the video game participants were asked if they would like a Jolly Rancher candy. If they denied the candy it indicated that they did not like the particular type of candy. If they accepted, the experimented said, “Actually, I shouldn’t give you any now, because you need to complete the rest of the experiment first. But I will set them outside the door and you can take as many as you want when you are done, just make sure to leave some for your

partner." Five Jolly Ranchers were placed in a bowl in a hallway outside of the experiment room, and taking three or more was considered an aggressive act.

Implicit Theories about Willpower Questionnaire. This 6 item questionnaire measured participant's views about strenuous mental activity using a 6-point scale (1 = strongly agree and 6 = strongly disagree; α = .83) Questions assessed if participants felt they needed to rest and replenish fuel after engaging in mentally strenuous tasks, or if they are able to move from one stimulating task to the next without losing concentration or needing to take a break. Scores were averaged in a way such that higher scores represented a belief that strenuous mental activity resulted in a need to refuel cognitive resources and lower scores indicated a belief that they engage in many strenuous mental activities without needing to rest.

Procedure

The experiment was performed using a 2x2 (violent game vs. non-violent game; cognitively demanding game vs. non-cognitively-demanding game) between subjects design with subjects assigned randomly to conditions. The experiment took each participant about an hour to complete.

When participants arrived they were instructed to have a seat in the waiting room until they were called into the experimental room. Once the participant was seated in the experiment room they were told, "Before we begin I would just like to explain the experiment to you. We are studying reaction time, and how it is influenced by playing video games. You will be participating in this experiment with a partner who will be doing things in another room of the lab. There are several parts to the study. First you will be completing a short questionnaire, you will then play a video game for 25 minutes, and finally you will participate in a computer task measuring reaction time." Participants were then given time to read over and sign the consent

form (see Appendix A). A questionnaire containing the physical and verbal sections of the Buss-Perry Trait Aggression Questionnaire was given to the subjects as a covariate in analysis. Participants were then randomly assigned to play a violent-cognitively-depleting game, a violent-non-cognitively-depleting game, a non-violent-cognitively-depleting game, or a non-violent-non-cognitively-depleting game. Participants played the video game for 25 minutes, and played one of two video games assigned to each condition to control for any effects caused by the individual games. Before playing the video game participants were told, "You will now be playing a video game. You will play the game for 25 minutes, and I will come back into the room and let you know when your time is up. If for any reason the game stops before the 25 minutes is over, please let me know and I will get it started for you again."

After playing the video game, the participants were asked if they would like some candy. If the participant accepted, the experimenter then said, "Actually, I shouldn't give you any now, because you need to complete the rest of the experiment first. But I will set them outside the door and you can take as many as you want when you are done, just make sure to leave some for your partner." Subjects then participated in a competitive reaction task on the computer where an imaginary partner provoked them, to measure aggression. Before beginning the competitive reaction task they were told, "I will now explain the reaction time task to you. In this task you will compete with your partner to see who can press a button faster. The slowest person on each trial will hear a noise through a pair of headphones. You will set the noise levels for your partner, and your partner will set the noise levels for you. The noises will NOT harm your ears. The reaction-time task consists of 25 trials. We will get a more accurate perception of the reaction times if you interact 25 times instead of just once." After the experimenter explained the competitive reaction task, they directed the participant to head back to the waiting room when

they complete the task, and to take some candy on their way out being told, "When you are done with the Competitive Reaction Task please head back out to the waiting room. And again, feel free to take some candy on your way out to the waiting room, just make sure to leave some for your partner." Once they completed the competitive reaction task, the subject then left to go back to the waiting room where the experimenter gave them the final questionnaire measuring their implicit theories about willpower, and finally debriefed the participant (see Appendix B).

Materials

PlayStation 3 video game systems were used along with eight video games, two for each condition. Games were considered violent if they received an Entertainment Software Review Board (ESRB) rating of "Teen" or "Mature" for scenes of violence. Games were considered non-violent if the received an ESRB rating of "Everyone", indicating that the game was appropriate for all audiences and does not contain violence. The violent, cognitively demanding video games used were Fight Night Round 4 and Call of Duty 4: Modern Warfare. These games were considered cognitively demanding as they required players to navigate though a three dimensional environment, interact with other characters by aiming and shooting or hitting and punching them. The violent, non-cognitively demanding video games used were Time Crisis: Razing Storm and Tekken 6. There games were considered non-cognitively demanding as they did not require players to move throughout a three dimensional environment, and only required players to engage in a few actions by pressing a few buttons. The non-violent, cognitively demanding video games used were Top Spin 3 and Jigsaw Madness, and these games were considered cognitively demanding as they required participants to assess spatial qualities, position objects in an undefined environment, as well as move through a three dimensional environment. The non-violent, non-cognitively demanding games used were Flower and Flow.

These games were considered non-cognitively demanding, as they required players only to move the controller slightly in order to navigate through their environment.

Results

The participant's average aggression toward their hypothetical partner on trials 2 to 25 of the Competitive Reaction Time task, i.e., their average aggression in response to provocation, was the primary dependent variable analyzed. The theory being tested is that cognitive depletion reduces self-control when one is provoked; so my focus was on provoked aggression.

To see how game type affected provoked aggression, I conducted a 2(video game condition: violent or non-violent) x 2(cognitively demanding or non-cognitively demanding) between subjects analysis of variance of provoked aggression. The mean scores by condition are shown in Figure 1. The interaction between violence level and demanding level of the game was not significant $F(1,163) = 0.3$, $p = .58$. However, as expected, levels of overall aggression were higher for those who played a violent video game than for those who played a non-violent video game $F(1, 163) = 4.2$, $p < .05$, regardless of whether the game was cognitively demanding or not. As for the effect of cognitive depletion on aggression, contrary to my hypothesis, participants who played a video game that was cognitively demanding behaved no more aggressively toward their partners than those who played a video game that was not cognitively demanding $F(1, 163) = 0.4$, $p = .54$. In fact, for violent video games, participants scored non-significantly higher on aggression in response to provocation when the video game was not cognitively demanding.

The alternative assessment of provoked aggression measured by the number of candies the participant took after being told to leave some for the partner did not yield any significant results (Game violence: $F(1,163) = 1.48$, $p = .23$; Game demand: $F(1, 163) = 0.02$, $p = .90$; Violence X Demand: $F(1, 163) = 1.19$, $p = .28$). I also examined the effects of playing the violent

and demanding video games on unprovoked aggression as assessed by aggressiveness on the first trial of the competitive reaction time task. There were no significant effects of the violence of the video game $F(1, 163) = 2.21$, $p = .14$, of the cognitive demands of the video game $F(1, 163) = 0.37$, $p = .54$, or of their interaction $F(1, 163) = 0.06$, $p = .80$.

Participants' scores on the Buss-Perry measure of trait aggression were significantly correlated with their provoked aggression scores on the competitive reaction time task as shown in Figure 2, $r = .19$, $p < .05$. This means that participants who scored higher on the Buss-Perry also scored higher provoked aggression on the CRT. Consequently, I recomputed the analysis of variance for the effects of video game type on provoked aggression with Buss-Perry aggression scores entered as a covariate. The effect of violent video games in stimulating aggression remained significant in this analysis $F(1,162) = 3.8$, $p < .05$ even though trait aggression as measured by the Buss-Perry was significantly related to the provoked aggression scores $F(1,162) = 5.1$, $p < .03$.

Finally, there also did not seem to be a significant relationship between the score on the Theories of Willpower questionnaire and their performance on the CRT.

Discussion

The results from this study did not support the initial hypothesis that cognitively demanding violent video games would produce more aggressive responses in participants than non-cognitively demanding violent video games. In fact the data supported just the opposite, the cognitively demanding violent video games resulted in less aggressive responses than non-cognitively demanding violent video games. Playing violent video games resulted in participants assigning more aggressive responses to their partner during the CRT. This link between violent video games and aggression is supported by previous research in this area illustrating many of

these same effects. There was no interaction between violence level and demanding level of the video games. The Buss-Perry Trait Aggression Questionnaire did have a significant relationship with participant's responses on the CRT, and those with higher trait aggression were more aggressive to their partners on the CRT. No significant results emerged from the Theories about Willpower Questionnaire, and therefore participant's responses on the CRT were not influenced by their views about strenuous mental activity. Additionally, the sharing task did not produce any significant results, as few participants took more than two candies, indicating an aggressive act.

A possible explanation for these results could be that playing the cognitively demanding violent video games could have resulted in increased levels of self-satisfaction in subjects for completing a challenging task, therefore reducing their frustration and likelihood of acting aggressively. Another potential explanation relies on the participant's previous experience playing video games. Certain participants may have found specific video games more challenging than other participants, which could have resulted in less cognitive depletion for these individuals.

The present study does have several limitations, one of the most significant being the limits of the representativeness of the sample. As subjects were undergraduate students recruited from a single large class at a large Midwestern university, the results may not be generalizable to the larger population. Also, while two video games were used in each condition and the video games used were selected on objectively specified criteria, the validity of the experiment could have been improved by using more than two video games in each condition. In addition and as mentioned previously, some of the participants may have played the video games used in the study, resulting in the video game being less demanding for these participants, and more demanding for those with less experience. This would introduce error variance. Finally, there

was no measure taken of how cognitively demanding the video games really were to the participants. The decision about whether a video game was demanding or non-demanding was simply made by the experimenter.

Future research on this topic should include an objective measure of how cognitively demanding each participant finds each video game, as this could result in some variability within the experimental conditions. It should also further examine the process of and theory surrounding cognitive depletion, including investigating the processes that occur within the brain during cognitively depleting tasks. Although this study did not provide evidence that violent video games produce such aggressive responses in those who play them because of cognitive depletion, further research could be done to identify the role that these demanding tasks play in aggressive responses in general.

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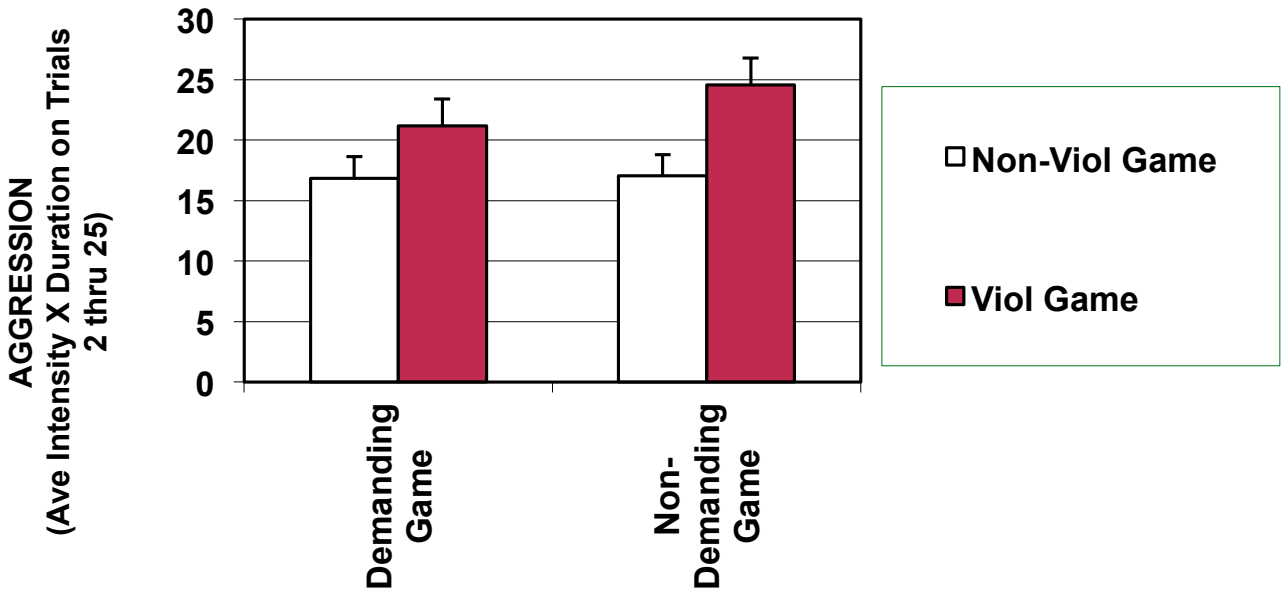

Figure 1. Mean aggression (CRT time x duration) as a function of type of game played

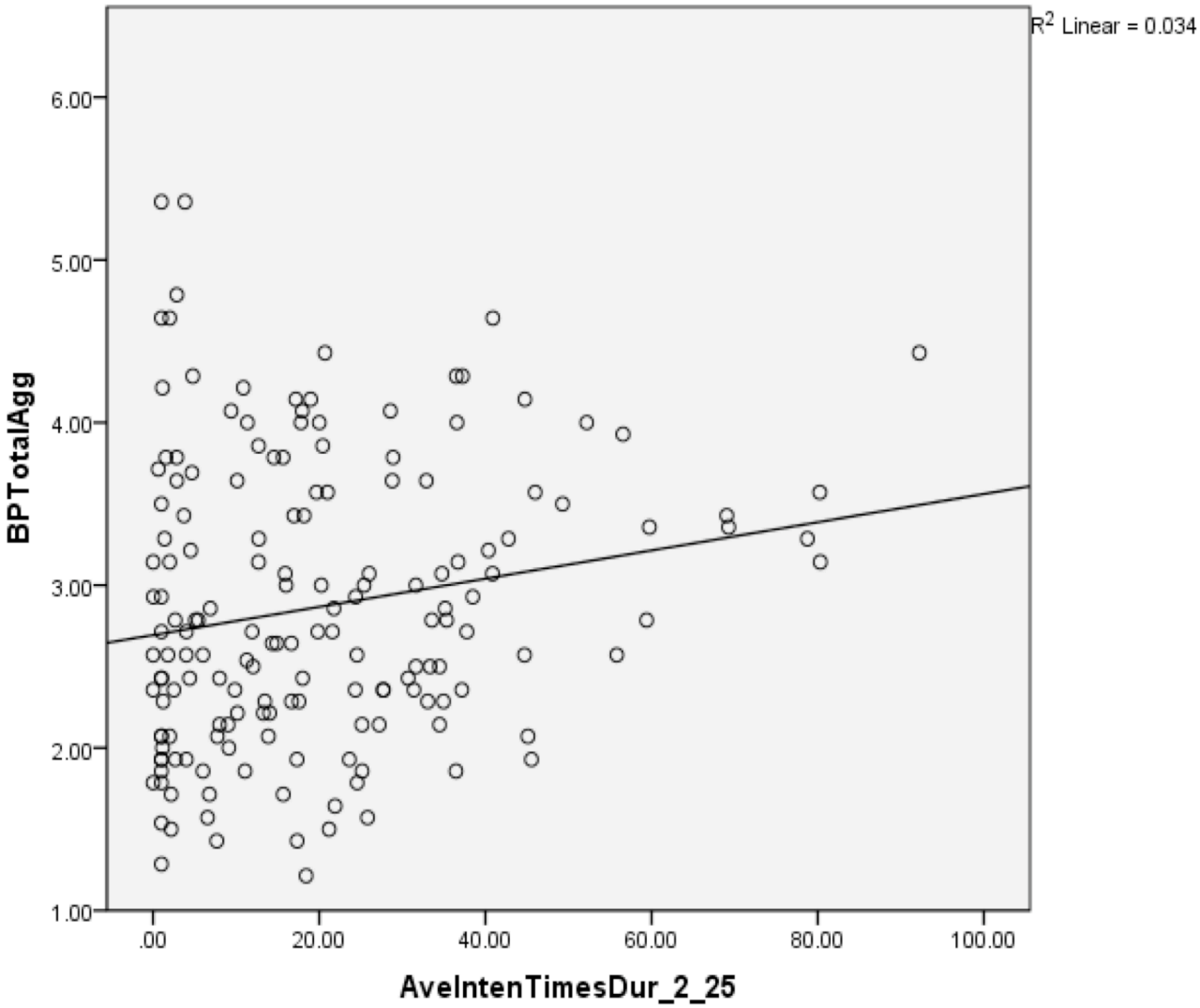

Figure 2: Correlation between aggression on Buss-Perry and provoked aggression.

Appendix A

Consent to Participate in a Research Study
Video Game Playing and Reaction Time

Principle Investigator: Cassandra Pentzien
Faculty Advisor: Rowell Huesmann

Dear Participant,

You are invited to be a part of a research study that examines computer games and how they influence reaction times. This research is conducted by Cassandra Pentzien, for her senior thesis, and her advisor, Dr. Huesmann.

The first part involves playing a video game (rated "T" or teen) by yourself for about 25 minutes. In the second part, you will be participating in a different reaction time task on a computer against another student who will be in a different room. In this second game your goal will be to try to hit a button as fast as you can after a light comes on. In each trial whoever hits the button slower will receive a blast of irritating noise in their earphones. The loudness and duration of the noise one receives will be controlled by the other player. This noise may be loud and uncomfortable, but it is limited so it cannot be harmful. Finally, you will be also asked a few questions about your own behaviors on a short questionnaire. The entire study will take less than one hour.

Participation in research is voluntary and you must be 18 or older to participate in this study. Although there are no foreseeable risks involved in the study, you are free to decline to respond to any question and discontinue the study at any time for any reason. Even if you decide to withdraw from the study, you will still receive course credit. You can meet your introductory psychology methods or introductory communications requirement by completing alternative assignments or other studies within the pool. For more information, please contact subjectpool@umich.edu. While you may not receive a direct benefit from participating in this research, some people find playing a sports game to be an enjoyable experience. You will receive 1 hour of credit toward the Psych 111 or research requirement for your participation in the study. The entire study will take about an hour.

Your performance on these games and everything else you do in the study will be confidential. Your responses will be recorded and stored in a computer that can only be accessed by the research investigators. Your names and all individual identifiers will be deleted from the computer files. Responses from individual participants will not be reported. Instead we will analyze responses from large groups of participants.Your data will be kept for about one year for the analysis purpose but will be erased after publication of the research.

This study has been reviewed by the University of Michigan Institutional Review Board. We expect that the results from this study will benefit American society by providing us with a better understanding of the relationship between playing computer games and how people think and behave. If you have questions about this research, including question about scheduling or your compensation for participating you may contact Cassandra Pentzien, pentzien@umich.edu or Professor Rowell Huesmann, huesmann@umich.edu. If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researcher(s), please contact the University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board, 540 E Liberty St., Ste 202, Ann Arbor, MI 48104-2210, (734) 936-0933 [or toll free, (866) 936-0933], irbhsbs@umich.edu.

CONSENT STATEMENT

I hereby consent to participate in this study. I have been given as much information about the purposes and procedures of this study as is possible to do at the beginning of the study. I understand that my participation is completely voluntary and free to withdraw from the study without losing 1 hour of research credit in Psych111 for participating.

_____ _____

Print and sign name Date

Appendix B

Video Game Playing and Reaction Times – Debriefing Information

Thank you for participating in the study conducted by Cassandra Pentzien and faculty advisor, Dr. Huesmann. As we told you at the beginning, this study is about the relation between playing video games and reaction time. However, what we told you at the beginning of the experiment was not the whole story. Sometimes if we told people what the whole point of the experiment was ahead of time, then some people might do whatever it is they think we want them to do, just to be helpful. Other people might do the exact opposite of what they think we want them to do, to show us that we can't figure them out. When people are trying to second-guess what the experiment really is about, and they behave a certain way because of it, our results gets messed up. That's because they aren't behaving like they naturally would in the real world. The whole point of this experiment is to find out how people would naturally behave.

Now we'd like to explain what we were trying to learn about with this study. In this study, people played a video game that was violent and either cognitively demanding or not cognitively demanding, or a non-violent game that was either cognitively demanding or not cognitively demanding. The reaction time task, which in fact is called a Competitive Reaction Task (CRT), was used to measure your levels of aggression toward your partner after your partner provokes you by giving you a loud noise blast. We expect to find greater levels of aggression among participants who have played a violent video games, and even greater levels among participants who have played a violent video game that was cognitively demanding. This is because tasks that are cognitively demanding have been shown to decrease an individual's ability to exert self control, which in turn leads to a greater likelihood of exhibiting aggressive behavior. But we couldn't tell you about this beforehand because we didn't want you to second-guess what we expected you to do, and then behave differently from how you might naturally react. There was no other way to do the study and get valid results. Another thing we could not tell you was that we were counting how many candies you took as another measure of self-control.

We would like to emphasize that there are no correct responses in this study. We were looking at people's natural responses. Also, your response will be kept completely confidential because your data will be analyzed as part of a group of responses (e.g., all the people who played the violent, cognitively demanding game will be grouped together). If you no longer want your responses recorded because of deception, please notify the researcher. Finally, I would like to ask you not to mention anything about the study to any other students. If a student found out what the study was about and then participated in the study, we would get invalid results. Your efforts and our efforts would be wasted. Therefore, we would appreciate it if you did not tell others about the study. Thanks a lot for your help.

If you have any questions about the study please contact Cassandra Pentzien, pentzien@umich.edu or Professor Rowell Huesmann, huesmann@umich.edu. If you have questions about your rights as a research participant, or wish to obtain information, ask questions or discuss any concerns about this study with someone other than the researcher(s), please contact the University of Michigan Health Sciences and Behavioral Sciences Institutional Review Board, 540 E Liberty St., Ste 202, Ann Arbor, MI 48104-2210, (734) 936-0933 [or toll free, (866) 936-0933], irbhsbs@umich.edu.

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Appendix C – Buss Perry Questionnaire

Questionnaire

Please rate each of the following items in terms of how characteristic they are of you.

1) Once in a while I can't control the urge to strike another person.

1	2	3	4	5	6	7
extremely uncharacteristic of me						extremely characteristic of me

2) Given enough provocation, I may hit another person.

1	2	3	4	5	6	7
extremely uncharacteristic of me						extremely characteristic of me

3) If somebody hits me, I hit back.

1	2	3	4	5	6	7
extremely uncharacteristic of me						extremely characteristic of me

4) I get into fights a little more than the average person.

1	2	3	4	5	6	7
extremely uncharacteristic of me						extremely characteristic of me

5) If I have to resort to violence to protect my rights, I will.

1	2	3	4	5	6	7
extremely uncharacteristic of me						extremely characteristic of me

6) There are people who pushed me so far that we came to blows.

1	2	3	4	5	6	7
extremely uncharacteristic of me						extremely characteristic of me

7) I can think of no good reason for ever hitting a person.

1	2	3	4	5	6	7
extremely						extremely

uncharacteristic of me — characteristic of me

8) I have threatened people I know.

1 2 3 4 5 6 7

extremely uncharacteristic of me — extremely characteristic of me

9) I have become so mad that I have broken things.

1 2 3 4 5 6 7

extremely uncharacteristic of me — extremely characteristic of me

10) I tell my friends openly when I disagree with them.

1 2 3 4 5 6 7

extremely uncharacteristic of me — extremely characteristic of me

11) I often find myself disagreeing with people.

1 2 3 4 5 6 7

extremely uncharacteristic of me — extremely characteristic of me

12) When people annoy me, I may tell them what I think of them.

1 2 3 4 5 6 7

extremely uncharacteristic of me — extremely characteristic of me

13) I can't help getting into arguments when people disagree with me.

1 2 3 4 5 6 7

extremely uncharacteristic of me — extremely characteristic of me

14) My friends say that I'm somewhat argumentative.

1 2 3 4 5 6 7

extremely uncharacteristic of me — extremely characteristic of me

Appendix D

ltems to Measure Implicit Theories about Willpower

Instruction:
This questionnaire has been designed to investigate your ideas about willpower. Willpower is what you use to resist temptations, to stick to your intentions, and to remain in strenuous mental activity. There are no right or wrong answers. We are interested in your ideas.
Using the scale below, please indicate how much you agree or disagree with each of the following statements by writing the number that corresponds to your opinion in the space next to each statement.

1	2	3	4	5	6
strongly agree	moderately agree	slightly agree	slightly disagree	moderately disagree	strongly disagree

Strenuous mental activity: _____

Strenuous mental activity exhausts your resources, which you need to refuel afterwards (e.g. through taking breaks, doing nothing, watching television, eating snacks).

After a strenuous mental activity, your energy is depleted and you must rest to get it refuelled again.

When you have been working on a strenuous mental task, you feel energized and you are able to immediately start with another demanding activity.

Your mental stamina fuels itself. Even after strenuous mental exertion, you can continue doing more of it.

When you have completed a strenuous mental activity, you cannot start another activity immediately with the same concentration because you have to recover your mental energy again.

After a strenuous mental activity, you feel energized for further challenging activities.