# Technological Advancement of Video Games and Their Effects on Players' Aggression




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Technological Advancement of Video Games and Their Effects on Players' Aggression

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## Abstract

Aggression, immersion, and arousal levels were examined in relation to participants who were assigned to play either an older violent, older non-violent, new violent, or new non-violent video game. Participants completed a word completion task (Anderson et al., 2004) as well as the Game Immersion Questionnaire (Jennett et al, 2008), and had their blood pressure and heart rate recorded throughout the study. The hypotheses were not confirmed, but the results suggest that there could be a possible relationship between the technological advancement of violent video game content and heightened levels of aggression. The results of this study mainly suggest that there is an increasing need to determine any and all relationships between video games and aggression. Due to the constantly increasing realism the players experience during video game play, it is possible that gamers could be subjected to greater effects.

# Advancements in Violent Video Game Technology and Effects on Player Aggression

Video games are popular in the United States with over 67% of households playing some type of video game according to the Entertainment Software Ratings Board (2010). The Entertainment Software Ratings Board is responsible for giving appropriate content ratings to video games, where the ratings range from E (Everyone) to M (Mature). Worldwide, 3 billion hours of video games are played each week (Sydell, 2011). Video games have become such a staple in modern life that the average person who plays racks up 10,000 hours of video game play by the time they turn 21, which is only 24 hours less than the amount of time spent in class during both middle school and high school with perfect attendance (Sydell, 2011). This is especially important because multiple studies since the 1990's have found associations between the exposure to violent video games and aggression (Griffiths, 1999; Anderson and Bushman, 2001; Sherry, 2001; Uhlmann and Swanson, 2004; Carnagey and Anderson, 2005).

Violent video games are games that earn any of the following content descriptors in their rating from the ESRB: violence (aggressive conflict), blood, or gore. While often overlooked as a harmless way for people of all ages to pass the time, Anderson (2004) points out that the effect size of violent video games on aggression is estimated at 0.26, which is larger than the effect size of condom use to decreased HIV risk, exposure to passive smoke at work and lung cancer, and the effect of calcium intake on bone mass. These significant medical effects are taken very seriously by the general public and great measures are taken to educate the public about their impact. However, there are practically no measures taken to educate about the larger effects of playing video

games that are considered violent, even though it has been shown that habitually playing violent video games leads to increased physical aggression some months later in children and adolescents (Anderson et. al, 2008) and brief exposure to violent video games can lead to immediate increases in aggressive behavior (Anderson, Carnagey, Flanagan,...et. al, 2004).

In the last half-century, the quality of the user experience during gaming has increased dramatically (Calvert and Tan, 1994; Anderson and Dill, 2000). However, video games have come under heavy scrutiny in the last few decades for causing adverse effects in players (Griffiths, 1999; Anderson and Bushman, 2001; Sherry, 2001; Uhlmann and Swanson, 2004; Carnagey and Anderson, 2005). There have been dozens of studies that documented a relationship between violent video games and aggression.

However, almost no studies have focused on the tremendous advances that video game-technology has taken and their effects on players' aggression (Anderson, 2004). Video game graphics have reached a point of photorealism. The next generation of video game consoles has become available with the recent release of Sony's PlayStation 4 and Microsoft's Xbox One with the potential to draw in even more players. This new generation will increase the realism of each game experience, immersing players into new worlds and situations like never before. It has been documented that the advanced technology is leading to greater immersion (Ivory and Kalyanaraman, 2007) and for violent video games this could lead to greater effects on aggression than have previously been observed in older, lower tech, and less immersive games.

# Literature Review

## *Neurological Effects on Players*

Chou et al. (2012) used single photon emission computed tomography to measure cerebral blood flow in the brains of participants playing a violent video game. The authors concluded that video game play may induce hypoperfusion of the dorsolateral prefrontal cortex, a brain area involved in memory, trust and relationships, mood, and decision making. Significant hypoperfusion was also observed in the anterior cingulate cortex (ACC) of players who had higher scores of killing characters during their game session. The ACC plays a role in conflict and emotional reactivity; Chou et al. (2012) suggest that the ACC also plays a role in mediating violent behavior. This study suggests that violent video game play causes players' to be less able to mediate violent behaviors while also having blunted emotional reactivity to these violent behaviors.

Using fMRI, Montag et al. (2011) measured brain activity of young adolescents with a history of playing violent video games every day. When processing negative emotions in response to being presented unpleasant stimuli, gamers showed decreased brain activity in the left lateral medial frontal lobe, an area involved in the integration of emotion and cognition. Montag also found an increase in activity of the lateral prefrontal cortex when shown screenshots from a popular violent video game, which they hypothesized as being a protection mechanism against experiencing negative emotions by down-regulating limbic brain activity. Chou and Montag suggest that due to the constant emotional and mental stress brought on by violent games, players' brains

diminish activity involving emotional response and elevate activity protecting the player from emotional harm.

*Violent Video Games and Arousal*

Violent video games also influence players' autonomic nervous systems (ANS) during play session (Hasan, Begue, and Bushman, 2012). The induced stress results in increased oxygen consumption, systolic and diastolic blood pressure (Segal and Dietz, 1991), and increased heart rate (Segal and Dietz, 1991; Subhani, Xia, and Malik, 2013). The metabolic rate and cardiovascular stimulation was similar in magnitude to mild-intensity exercise (Segal and Dietz, 1991). These results show that playing violent video games can cause several forms of physiological stress in the body.

*Sleep Deprivation and Aggression*

Several recent studies have been conducted that also attribute aggressive behavior to poor sleep quality (Kamphius et al., 2012; Kamphius et al., 2014; Orzel-Gryglewska, 2010; Lindberg et al., 2009). These researchers also found increased impulsivity aggression, described as any aggression directed towards others, self-mutilation, suicide attempts, domestic violence, substance use, and property destruction (Lindberg et al., 2009). Kamphius et al. (2014) found that not only were sleep problems correlated with higher self-rated aggression and impulsive aggression scores but also with clinician-rated scores. These increased aggression scores have been shown to be reduced with the treatment of sleep disturbances and the effects observed may be attributed to the negative effect of sleep loss on prefrontal cortical functioning; these

effects contribute to loss of control over emotions, including loss of regulation of aggressive impulses (Kemphius et al., 2012). Thus, eliminating any and all sleep disturbances in order illicit healthy sleep can help keep aggressive impulses under control.

*Video Games and Desensitization*

The relationship between video games and desensitization to violence has been the subject of several studies. While some of these studies report that over-exposure to violent video games causes desensitization (Funk, Baldacci, Pasold, and Baumgardner, 2004; Funk, Buchman, Jenks, and Bechtoldt, 2003; Carnagey, Anderson, and Bushman, 2007), Bartholow, Bushman, and Sestir, (2006) reported that *over-exposure* to video games in general is what contributes to the desensitization. Desensitization refers to a blunted response to a stimulus at either the cognitive, emotional, or behavioral level. Cognitive desensitization is apparent when a participant believes that violence is more mundane and inevitable, while emotional desensitization is apparent when there is a blunting of emotional reactions in response to an event that would typically elicit a strong emotional response such as violence (Funk et al, 2004). Behavioral desensitization is apparent when the participant doesn't physically or physiologically act in a typical manner when subjected to a violent situation.

A number of studies support the notion of increased playtime of violent video games leading to blunted responses to violence. Desensitization was measured using blood pressure (physiological), empathy scores (emotional), violence ratings (cognitive), and galvanic skin response (physiological). Carnagey et al (2007) reported that both

blood pressure and galvanic skin response to a video of real-world violence were lower in participants who had just played a violent video game in comparison to those who had played a non-violent video game. This study shows that there may be a causal relationship between violent video games and desensitization to violence where the more a player is exposed to the violent game in question, the more blunted the reaction to violent situations. Undergraduates who had the most exposure to violent video games (relative to the other participants) rated pictures as less violent when exposed to pictures from the Affective Picture System and also reported being less aroused, showing clear desensitization (Lang, Bradley, & Cuthbert, 1999; Bartholow et al, 2006). It has also been showed that empathy scores are lower in children who had longer exposure to violent video games (Funk et al, 2003). These studies have shown that there are effects of desensitization when exposed to violent video games both immediately and over time.

If desensitization is occurring, then decisions and attitudes regarding violence are made less serious by violent video game play, possibly leading to an increase in aggression, both behaviorally and cognitively. An avid player of violent video games could view situations that would be normally considered violent as “normal” and would therefore not react in the standard predicted way. It is important that these results are acknowledged, as aggression response to violent video games has been a heavily researched topic of the last few decades (Anderson, 2004).

*Video Games and Aggression*

Empirical studies increasingly examined the relationship between video gamingand aggression (Griffiths, 1999; Ferguson, 2007). The majority of these studies have come to show that there is relationship between violent video games and the so called Big Five characteristics of aggression, where aggression is measured as aggressive behavior, aggressive cognition, aggressive affect, helping behavior, and physiological arousal (Anderson and Bushman, 2001). With the exception of helping behavior, the Big Five characteristics have positively correlated relationships with violent video game play; helping behavior has an inverse relationship with violent video game play (Anderson, 2004; Ferguson, 2007; Anderson and Bushman, 2001; Kirsh, 2003; Anderson et al., 2004). However, not all studies make use of the Big Five model, others were based off of the General Aggression Model (Kirsh, 2003), Implicit Association Tests (Uhlmann and Swanson, 2004), and Taylor Competitive Reaction Time tasks (Bartholow and Anderson, 2002). The different ways that researchers have measured violent video game effects on aggression show similar results, being that there is a relationship between violent content in video games and heightened levels of aggression (Griffiths, 1999; Ferguson, 2007; Anderson, 2004; Ferguson, 2007; Anderson and Bushman, 2001; Kirsh, 2003; Anderson et al., 2004).

` Immediate changes in aggression caused by violent video game play have also been observed. Studies where participants played a violent video game for 10-20 minutes showed an immediate increase in aggression measured using a modified Competitive Reaction Test(Bartholow and Anderson, 2002; Anderson et al., 2004). One immediate effect shown in these participants was that they were significantly more hurtful when selecting the difficulty (easy, medium, or hard) of puzzles for their partners

when compared to the participants who had played a non-violent game (Gentile et al. 2009). When violence is rewarded in a video game (i.e. more points for killing pedestrians in a racing game, more points for destructive behavior), aggressive cognition also immediately increases (Carnagey and Anderson, 2005). These immediate effects could become long term effects, especially if violent video game play is an everyday part of a player's life (Anderson et. al, 2008).

Due to the negative effects observed, it can be concluded that there is a need to further study violent video games and their effects on players. The act of controlling a video game character that performs an aggressive or violent action is having a significant effect on players. It can be speculated that this is due to the immersion that players experience while playing video games, where immersion is the degree to which involved the player feels in the virtual world they are experiencing. As video game technology and graphics continue to make advances in realism, the immersion that players feel may likely increase if it will require less effort and imagination to embrace a world that looks so similar to reality.

*Technological Advancement*

From their arrival into consumers' homes in 1967, video games have rapidly been changing and advancing. Their technologies have increased exponentially, increasing the quality of play and the entertainment of the players. Most importantly, the graphics of games have become so realistic that they could almost be confused with live-action movies/television. These increased graphics have led to increased

immersion, with players feeling higher levels of presence and involvement (Ivory and Kalyanaraman, 2007).

### *Hypotheses*

As video games are becoming increasingly life-like, research is needed to determine if the higher levels of immersion will lead to different effects on players than past video games. Given that players feel more involved and immersed in the increasingly realistic games they are playing, it would be expected that there would be a greater effect on the players' aggression after playing a modern violent video game as opposed to an older violent video game as well as having a greater effect after playing a violent game compared to a non-violent game in general. It would also be hypothesized that the players' level of arousal (measured by blood pressure and heart rate) during gameplay would be greater when playing newer games as opposed to older games as well as when playing a violent game compared to a non-violent game.

## Method

### *Participants*

The participants (N = 26, 69.2% male) were undergraduate students aged 18-22 primarily from the psychology department at Allegheny College. Students participated on a volunteer basis by signing up on Allegheny's SONA research database. They received participation points or extra credit at the discretion of their professors.

### *Questionnaires and Tests*

The Pittsburgh Sleep Quality Index (PSQI) examines self-reported sleep quality as well as disturbances over a 1-month span (Buysse, Reynolds III, Monk, Berman, and Kupfer, 1989). There are 19 individual items to generate seven component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction with each component weighted equally on a 0-3 scale. The sum of these 7 scores yields one global score on a range of 0-21, with higher scores meaning worse sleep quality. This questionnaire will be used to determine if a participant's aggression could be attributed to poor sleep quality, as lower sleep quality can lead to higher levels of aggression (Kamphuis, Meerlo, Koolhaas, and Lancel, 2012).

The Word Completion Task (WCT) consists of 98 uncompleted words used to measure aggression, with each word having the capability to be completed as a non-aggressive word, aggressive word, or non-word (Anderson et al., 2004). Participants will be asked to complete the task and will be scored by dividing the number of aggressively completed words by total words completed for an "aggression percentage".

The Game Immersion Questionnaire (GIQ) is a 31 item questionnaire that determines players' level of immersion while playing a video game. The GIQ is scores range from 0-124 with 0 representing no immersion whatsoever and 124 representing the highest level of immersion (Jennett et al, 2008).

*Procedure*

After being given and signing the consent form (see Appendix A), each participant will be randomly assigned to one of four groups based on the type of video game they will be playing: Older Non-Violent (ONV) - Sonic The Hedgehog (1991),

Older Violent (OV) - Ultimate Mortal Kombat 3 (1992), Newer Non-Violent (NNV) – Forza 5 (2013), and Newer Violent (NV) – Ryse: Son of Rome (2013). Using a stationary monitor, participants' blood pressure and heart rate will be measured 3 times 10 minutes before their play session in order to determine their baseline numbers (Critikon Dinamap Oscillometric Stationary monitor, 1846 SX, Tampa, FL). The baseline reading will be 3 minutes apart. Before their play session, participants will complete a survey for demographic information and past video game exposure (see Appendix B) while their blood pressure and heart rate is recorded for the first time. They will also complete the PSQI (see Appendix C). Blood pressure and heart rate will be recorded for a second time while the PSQI is completed. The participant will then be instructed on how to play the video game they have been assigned to while their heart rate and blood pressure is recorded for a third time.

Participants will then be asked to play the assigned game for approximately 20 minutes while their blood pressure and pulse are taken 3 times: at minute 6, at minute 12, and at minute 18. Immediately following the gameplay session, participants will be asked to complete the WCT to measure for aggression (See Appendix D). After the WCT is completed, participants will be asked to complete the GIQ (See Appendix E). Participants will then be debriefed (see Appendix F) and thanked for their participation. The study will take approximately 35-50 minutes to complete.

## Results

Analysis were conducted on N = 26. Table 1 represents the participants' demographics and past video game exposure. A series of two-way between-subject ANOVAs were conducted on aggression, immersion, and arousal to the video game group the participants were assigned to. Alpha was set at 0.05 for each ANOVA conducted. The dependent variable, aggression, was from the Word Completion Task. The dependent variable, immersion, was from the Game Immersion Questionnaire. The dependent variable, arousal, was from heart rate and blood pressure recordings.

Table 1

*Demographics and Past Videogame Exposure (N=26)*

| | Percent | Standard Deviation |
|---|---|---|
| Sex | 69.2 (Male) | |
| Mean Age | 20.08 | 1.23 |
| Hours Played | | |
| 0 | 19.20 | |
| <1 | 23.10 | |
| 2-3 | 34.60 | |
| 4-6 | 15.40 | |
| 7-9 | 3.80 | |
| 10+ | 3.80 | |
| Types Played | | |
| None | 7.00 | |
| Sports | 38.46 | |
| Action | 26.92 | |
| Role Playing | 7.69 | |
| Adventure | 11.54 | |
| Arcade | 7.69 | |
| Ratings of Games Typically Played | | |
| E (Everyone) | 26.92 | |
| T (Teen) | 26.92 | |
| M (Mature) | 46.15 | |
| Online Gaming | | |
| No | 46.15 | |
| Yes: Competitively | 19.23 | |
| Yes: Cooperatively | 3.85 | |
| Yes: Both | 30.77 | |

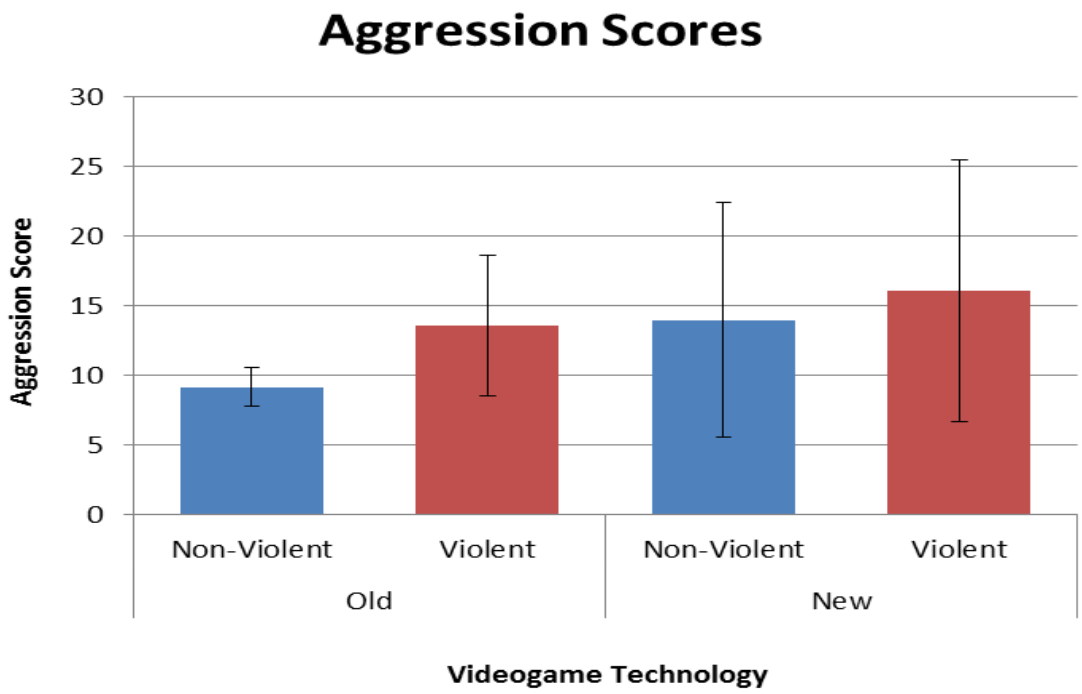



*Figure 1*. Two-way between-subjects ANOVA of aggression scores as a function of video game group (n = 26)

The means and standard deviations for aggression are reported in Table 1. There was not a statistically significant interaction effect ($F = .190$, $p > .05$) or main effect for video game technology ($F = 1.909$, $p > .05$). There was not a main effect for video game violence ($F = 1.518$, $p > .05$).

Table 2

*Aggression Scores Means and Standard Deviations for Video Game Technology and Violence*

| Video Game Technology | Violence | Mean | Standard Deviation | N |
|---|---|---|---|---|
| Old | Non-Violent | 9.15 | 1.38 | 7 |
| | Violent | 13.56 | 5.03 | 7 |
| | Total | 11.35 | 4.22 | 14 |
| New | Non-Violent | 13.96 | 8.43 | 5 |
| | Violent | 16.06 | 9.43 | 7 |
| | Total | 15.19 | 8.69 | 12 |

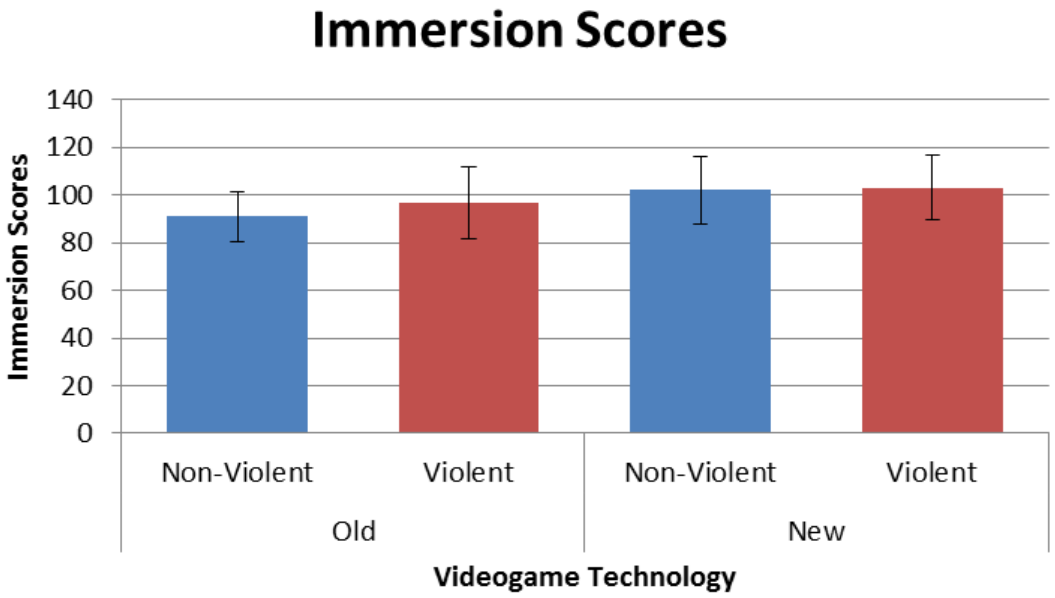



*Figure 2.* Two-way between-subjects ANOVA of immersion scores as a function of video game group (N = 26)

The means and standard deviations for immersion are reported in Table 2. There was not a statistically significant interaction effect (F = .185, p > .05) or main effect for video game technology (F = 2.69, p > .05). There was not a main effect for video game violence (F = .416, p > .05).

Table 3

*Immersion Scores Means and Standard Deviations for Video Game Technology and Violence*

| Video Game Technology | Violence | Mean | Standard Deviation | N |
|---|---|---|---|---|
| Old | Non-Violent | 91.00 | 10.57 | 7 |
| | Violent | 96.71 | 15.06 | 7 |
| | Total | 93.86 | 12.85 | 14 |
| New | Non-Violent | 102.00 | 14.37 | 5 |
| | Violent | 103.14 | 13.56 | 7 |
| | Total | 102.67 | 13.26 | 12 |

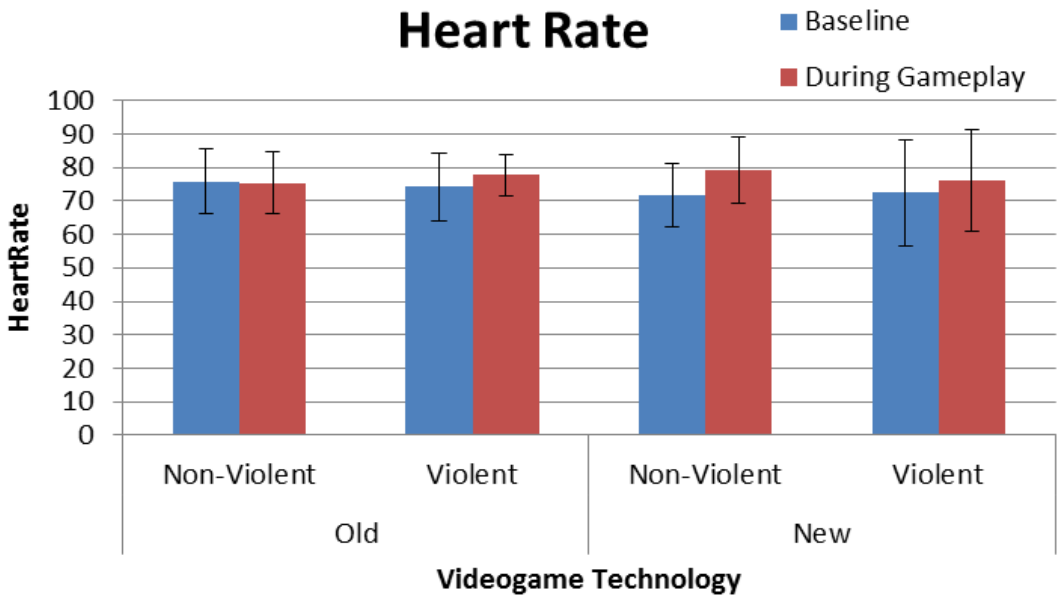



*Figure 3.* Two-way between-subjects ANOVA of heart rate as a function of video game group (N = 26)

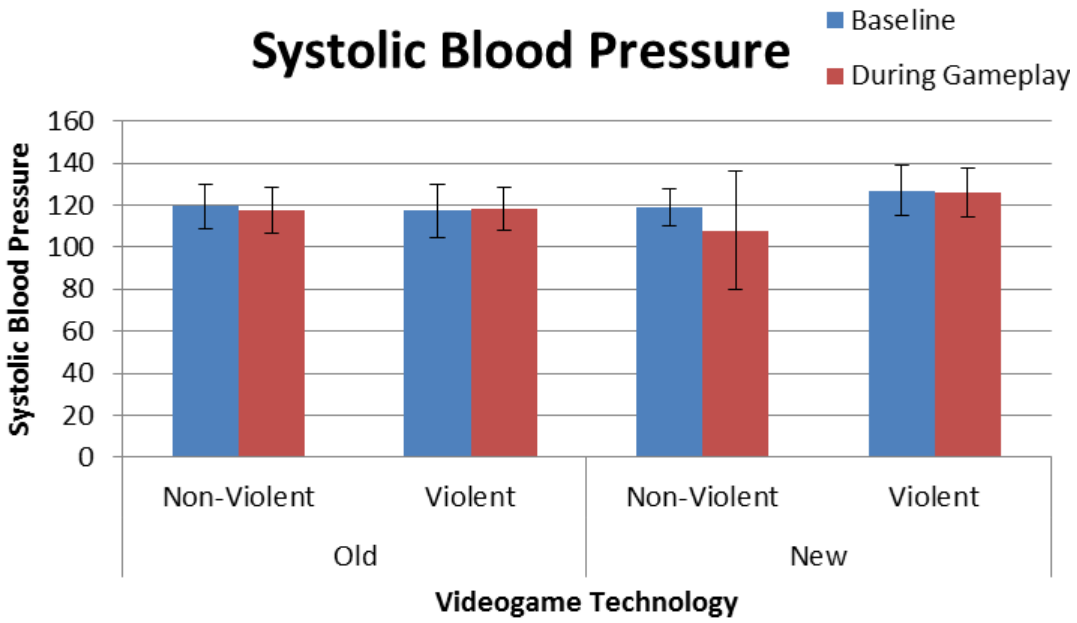



*Figure 4.* Two-way between-subjects ANOVA of systolic blood pressure as a function of video game group (N = 26)

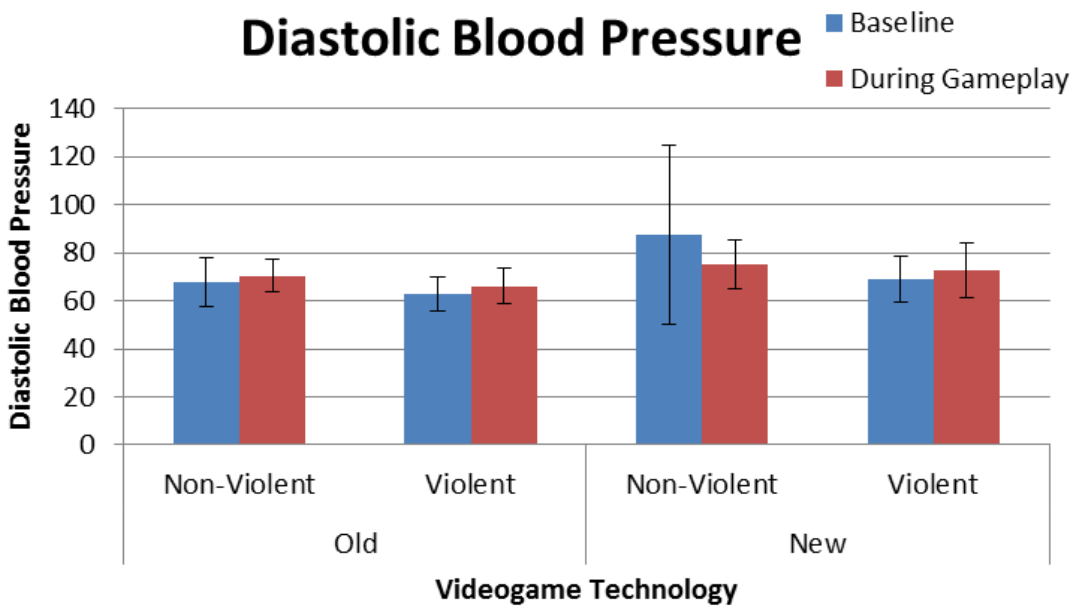



*Figure 5.* Two-way between-subjects ANOVA of diastolic blood pressure as a function of video game group (N = 26)

The means and standard deviations for differences in heart rate are reported in Table 3. There was not a statistically significant interaction effect ($F = 1.81$, $p > .05$) or main effect for video game technology ($F = 1.811$, $p > .05$). There was not a main effect for video game violence ($F = .00$, $p > .05$).

Table 4

*Differences in Heart Rate Means and Standard Deviations for Video Game Technology and Violence*

| Video Game Technology | Violence | Mean | Standard Deviation | N |
|---|---|---|---|---|
| Old | Non-Violent | -0.43 | 3.69 | 7 |
| | Violent | 3.57 | 8.83 | 7 |
| | Total | 1.57 | 6.82 | 14 |
| New | Non-Violent | 7.50 | 11.90 | 4 |
| | Violent | 3.57 | 4.08 | 7 |
| | Total | 5.00 | 7.5 | 11 |

Notes: Differences were determined by subtracting the baseline heart rate scores from the stressed heart rate scores.

The means and standard deviations for differences in systolic blood pressure are reported in Table 4. There was not a statistically significant interaction effect ($F = 3.13$, $p > .05$) or main effect for video game technology ($F = 2.74$, $p > .05$). There was not a main effect for video game violence ($F = 2.21$, $p > .05$).

Table 5

*Differences in Systolic Blood Pressure Means and Standard Deviations for Video Game Technology and Violence*

| Video Game Technology | Violence | Mean | Standard Deviation | N |
|---|---|---|---|---|
| Old | Non-Violent | -1.86 | 2.55 | 7 |
| | Violent | -0.43 | 11.25 | 7 |
| | Total | -1.14 | 7.87 | 14 |
| New | Non-Violent | 15.5 | 25.17 | 4 |
| | Violent | -1.00 | 8.98 | 7 |
| | Total | 5.00 | 17.54 | 11 |

Notes: Differences were determined by subtracting the baseline systolic scores from the stressed systolic scores.

The means and standard deviations for differences in diastolic blood pressure are reported in Table 5. There was not a statistically significant interaction effect ($F = 1.31$, $p > .05$) or main effect for video game technology ($F = 1.97$, $p > .05$). There was not a main effect for video game violence ($F = 1.31$, $p > .05$).

Table 6

*Differences in Diastolic Blood Pressure Means and Standard Deviations for Video Game Technology and Violence*

| Video Game Technology | Violence | Mean | Standard Deviation | N |
|---|---|---|---|---|
| Old | Non-Violent | 2.57 | 5.53 | 7 |
| | Violent | 3.57 | 8.14 | 7 |
| | Total | 3.07 | 6.71 | 14 |
| New | Non-Violent | 16.25 | 27.34 | 4 |
| | Violent | 3.86 | 6.28 | 7 |
| | Total | 8.36 | 19.94 | 11 |

Notes: Differences were determined by subtracting the baseline diastolic scores from the stressed diastolic scores.

## Discussion

### *Summary of Results and Implications*

The hypothesis that there would be a greater effect on players' aggression after playing a modern violent video game as opposed to playing an older violent video game was not supported. Although the group assigned to play a modern violent video game had noticeably higher aggression scores as opposed to the older violent video game group (as expected), the mean difference between the groups were not significant. The hypothesis that there would be a greater effect on players' aggression after playing a violent video game as opposed to playing a non-violent game was also not supported. There was also a noticeably higher aggression score for the violent groups than the non-violent groups; however the difference was not significant.

It is suspected that the lack of significance is largely due to a low number of participants for each group. The low number of participants led to a wider range of scores and also a large standard deviation for the scores. One reason for this could be

that the task required of the participants was moderately time consuming, making it unappealing for participation. Another reason for lack of significance could be the extent of each participant's vocabulary. Not having a firm grasp of the English language or expanded vocabulary would make the WCT extremely difficult and the participant would have a hard time completing many words before the time limit was up. This would then yield aggression percentages that are unrepresentative of the participant.

The hypothesis that immersion levels would be higher for the new video game groups than the older video game groups was not supported. Although there was a noticeable mean difference between the groups, the results were insignificant.

It is suspected that the lack of significance is largely attributed to lack of participants, as with the first two hypotheses. As before, the low number of participants led to a wider range of scores along with a larger standard deviation for the scores.

The hypothesis that arousal levels (measured by blood pressure and heart rate) would be higher for new video game groups as opposed to the older video game groups was not supported. For blood pressure and heart rate, there was a noticeably larger difference from baseline scores to scores during gameplay, but the differences were not significant. The hypothesis that arousal levels would be higher for the violent video game groups compared to the non-violent video game groups was also not supported. Once again, a noticeable difference is present, but there is a lack of significance.

Lack of participants could have had implications on these hypotheses as well. It is also suspected that the lack of significance is a result of not having a resting period before baseline scores were recorded. It is possible that upon arrival, participants had elevated blood pressure and heart rate from walking to the study's location. Having

participants sit for a short period of time before running the baseline tests would have helped to avoid that problem.

*Directions for Future Research*

The findings of this study suggest all of the initial hypotheses are valid. The trends observed are promising; however more conclusive research is still required as the results were all insignificant. The most important change that would need to be made is to obtain a much higher number of participants, with at least N = 25 per group. This change would lead to a smaller standard deviation of the scores and the possibility of significant results. This would simply require better planning on the part of the researcher.

Because this study only used young-adult undergraduates, a further study could be conducted using the general public in order to obtain a truer sample of gaming population. While this study's participants' mean age of 20 falls under the 49% majority of the gaming population between the ages of 18-49, it fails to represent the 25% of gamers under the age of 18 and the 26% of games over the age of 50 (ESRB, 2010). This leaves gamers as a whole fairly unrepresented. Also, because the age range of the participants in the study was only 18-23 years old, gamers between the ages of 24-49 years were also not represented. This makes the results of the study, however insignificant, only related to a very specific population.

Future research could also exclude any and all participants for whom English is not their first language. This would make the results of the WCT much more conclusive. Removing the time limit from the task and having all participants fully complete the WCT would also alleviate the problem of non-representative aggression scores.

As mentioned above, the study could have been improved by having participants sit down for a short period of time before collecting baseline arousal data. Doing so would help return all levels to actual baseline numbers, rather than taking measurements of heart rate and blood pressure directly after the participants had walked to the study. However, doing so would also add time length to the study, which could deter possible participants. If the study is proposed to a larger population however, this problem is eradicated.

As a result of this study, no significant findings were made. However, there is much promise for these hypotheses with a better executed research method. With more participants and a few tweaks to the study's design, I am confident that more conclusive evidence will be found to show that there is a relationship between heightened aggression levels in players who had recently played a modern violent video game compared to players who had recently played an older violent video game. I am also confident that there would be a relationship between heightened aggression levels in players who had just played a violent game rather than a non-violent game, heightened levels of immersion in players after having played a modern video game rather than an older one, and heightened arousal in players after playing a modern video game rather than an older game as well as after playing a violent game compared to a non-violent game. Because video games are such a growing popular activity in the United States, there is an increasing need to determine these relationships, especially how violent content in video games contribute to heightened aggression levels and how the increasing realism of video games is increasing this effect.

References

Anderson, C. A., & Bushman, B. J. (2001). Effects of violent video games on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature. *Psychological Science, 12*(5), 353-359.

Anderson, C. A., Carnagey, N. L., Flanagan, M., Benjamin, A. J., Eubanks, J., & Valentine, J. C. (2004). Violent video games: Specific effects of violent content on aggressive thoughts and behavior. *Advances in Experimental Social Psychology, 36*, 199-249.

Anderson, C. A., Sakamoto, A., Gentile, D. A., Ihori, N., Shibuya, A., Yukawa, S., . . . Kobayashi, K. (2008). Longitudinal effects of violent video games on aggression in japan and the united states. *Pediatrics, 122*(5), e1067-e1072.

Anderson, C. C. A. (2004). An update on the effects of playing violent video games. *Journal of Adolescence (London, England), 27*(1), 113-122.

Bartholow, B. D., & Anderson, C. A. (2002). Effects of violent video games on aggressive behavior: Potential sex differences. *Journal of Experimental Social Psychology, 38*(3), 283-290.

Bartholow, B. D., Bushman, B. J., & Sestir, M. A. (2006). Chronic violent video game exposure and desensitization to violence: Behavioral and event-related brain potential data. *Journal of Experimental Social Psychology, 42*(4), 532-539. doi:10.1016/j.jesp.2005.08.006

Boot, W. R., Kramer, A. F., Simons, D. J., Fabiani, M., & Gratton, G. (2008). The effects of video game playing on attention, memory, and executive control. *Acta Psychologica, 129*(3), 387.

Buysse, D. J., Reynolds III, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry research, 28(2), 193-213.

Carnagey, N. L., & Anderson, C. A. (2005). The effects of reward and punishment in violent video games on aggressive affect, cognition, and behavior. *Psychological Science, 16*(11), 882-889.

Carnagey, N. L., Anderson, C. A., & Bushman, B. J. (2007). The effect of video game violence on physiological desensitization to real-life violence. *Journal of Experimental Social Psychology, 43*(3), 489-496. doi:10.1016/j.jesp.2006.05.003

Chou, Y. H., Yang, B. H., Hsu, J. W., Wang, S. J., Lin, C. L., Huang, K. L., ... & Lee, S. M. (2012). Effects of video game playing on cerebral blood flow in young adults: a SPECT study. Psychiatry Research: Neuroimaging.

Entertainment Software Ratings Board. (2010). Video Game Industry Statistics. Retrieved from http://www.esrb.org/about/images/vidGames04.png on 4/29/13

Ferguson, C. J. (2007). The good, the bad and the ugly: A meta-analytic review of positive and negative effects of violent video games. *Psychiatric Quarterly, 78*(4), 309-316.

Funk, J. B., Baldacci, H. B., Pasold, T., & Baumgardner, J. (2004). Violence exposure in real-life, video games, television, movies, and the internet: Is there desensitization? *Journal of Adolescence, 27*(1), 23-39.

Funk, J. B., Buchman, D. D., Jenks, J., & Bechtoldt, H. (2003). Playing violent video games, desensitization, and moral evaluation in children. *Journal of Applied Developmental Psychology, 24*(4), 413-436. doi:10.1016/S0193-3973(03)00073-X

Gentile, D. A., Anderson, C. A., Yukawa, S., Ihori, N., Saleem, M., Ming, L. K., . . . Bushman, B. J. (2009). The effects of prosocial video games on prosocial

behaviors: International evidence from correlational, longitudinal, and experimental studies. *Personality and Social Psychology Bulletin, 35*(6), 752-763.

Gentile, D. A., Lynch, P. J., Linder, J. R., & Walsh, D. A. (2004). The effects of violent video game habits on adolescent hostility, aggressive behaviors, and school performance. *Journal of Adolescence, 27*(1), 5-22.

Griffiths, M. (1999). Violent video games and aggression: A review of the literature. *Aggression and Violent Behavior, 4*(2), 203-212. doi:10.1016/S1359-1789(97)00055-4

Griffiths, M. (2005). Video games and health: Video gaming is safe for most players and can be useful in health care. *BMJ: British Medical Journal, 331*(7509), 122.

Hasan, Y., Bègue, L., & Bushman, B. J. (2013). Violent video games stress people out and make them more aggressive. Aggressive behavior, 39(1), 64-70.

Ivory, J. D., & Kalyanaraman, S. (2007). The effects of technological advancement and violent content in video games on players' feelings of presence, involvement, physiological arousal, and aggression. *Journal of Communication, 57*(3), 532-555.

Kamphuis, J., Dijk, D. J., Spreen, M., & Lancel, M. (2014). The relation between poor sleep, impulsivity and aggression in forensic psychiatric patients.*Physiology & behavior*, *123*, 168-173.

Kamphuis, J., Meerlo, P., Koolhaas, J. M., & Lancel, M. (2012). Poor sleep as a potential causal factor in aggression and violence. *Sleep medicine*, *13*(4), 327-334.

Kamphuis, Jeanine, et al. "Poor sleep as a potential causal factor in aggression and violence." Sleep medicine 13.4 (2012): 327-334.

Kirsh, S. J. (2003). The effects of violent video games on adolescents: The overlooked influence of development. *Aggression and Violent Behavior, 8*(4), 377-389.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1999). International affective picture system (IAPS): Technical manual and affective ratings.

Lindberg, N., Tani, P., Putkonen, H., Sailas, E., Takala, P., Eronen, M., & Virkkunen, M. (2009). Female impulsive aggression: A sleep research perspective. *International journal of law and psychiatry*, *32*(1), 39-42.

Montag, C., Weber, B., Trautner, P., Newport, B., Markett, S., Walter, N. T., ... & Reuter, M. (2012). Does excessive play of violent first-person-shooter-video-games dampen brain activity in response to emotional stimuli?.*Biological psychology*, *89*(1), 107-111.

Orzeł-Gryglewska, J. (2010). Consequences of sleep deprivation. *International journal of occupational medicine and environmental health*, *23*(1), 95-114.

Radloff, L. S. (1977). The CES-D scale A self-report depression scale for research in the general population. *Applied psychological measurement*, *1*(3), 385-401.

Sheese, B. E., & Graziano, W. G. (2005). Deciding to defect the effects of video-game violence on cooperative behavior. *Psychological Science, 16*(5), 354-357.

Sherry, J. L. (2001). The effects of violent video games on aggression. *Human Communication Research, 27*(3), 409-431.

Silvern, S. B., & Williamson, P. A. (1987). The effects of video game play on young children's aggression, fantasy, and prosocial behavior. *Journal of Applied Developmental Psychology, 8*(4), 453-462.

Subhani, A. R., Xia, L., & Malik, A. S. (2013). Association of Electroencephalogram Scalp Potential with Autonomic Nervous System.Advanced Science Letters, 19(5), 1340-1344.

Sydell, Laura. "How To Save The World, One Video Game At A Time." *NPR*. NPR, 11 Apr. 2011. Web. 30 Apr. 2013.

Uhlmann, E., & Swanson, J. (2004). Exposure to violent video games increases automatic aggressiveness. *Journal of Adolescence (London, England), 27*(1), 41-52.

VanEenwyk, J., & Bensley, L. (2001). Video games and real-life aggression: Review of the literature. *J Adolescent Health, 29*, 244-257.

## APPENDIX A

RESEARCH PARTICIPANT CONSENT FORM
The Advancements in the Technology of Violent Video Games and Their Effects on Players' Aggression
Joel DeFelice
Allegheny College
Departments of Psychology and Neuroscience

**Purpose of Research:** The purpose of this research is to increase the scientific understanding of the effects of video games on players' emotions.

**Rationale for Research:** Video games are a popular leisurely activity with approximately 67% of households in the United States play some kind of video game and many studies have been conducted to determine the effects of video games on players' emotions. As video game technology continues to evolve to the point of games being indistinguishable from reality, it is important that we understand the emotional effects that these increasingly immersive and realistic experiences have on players. This research project is designed to test the effects of current-generation video game experiences compared to those of past-generation video game experiences.

**Specific Procedures:** I understand that I will be asked to complete a set of surveys questionnaires (3) and word completion tasks (2). I understand that I will be asked to complete a series of questionnaires about background information, past video game exposure, my emotional status, and my sleep habits. I understand that I will be placed into a randomized video game group where the video game I am asked to play may be considered emotionally disturbing by some individuals. I understand that my blood pressure and pulse will both be taken 3 times during the study. I understand that this study will take approximately 30-50 minutes and some additional time may be needed.

**Risks to the Individual:** I understand that the risks of participating in this study are no more than I would experience in everyday life. I understand that I may be asked to play a video game that some participants may find emotionally disturbing. If any injuries or discomfort arise during your participation in this study, please contact the **Allegheny College Winslow Health Cente**r at **(814) 332-4355** on Monday through Friday, 8 am to 12 noon and 1pm to 4 pm or the **Allegheny College Counseling Center** at **(814) 332-4368**. You can also contact the 24-hour **Mental Health Emergencies** at **(814) 724-2732** or **724-2739**.

**Benefits to the Individual or Others:** I understand that the primary benefit of this study is to contribute to the knowledge of the scientific community surrounding the topic of video games and emotion.

**Compensation:** I understand that as compensation for participation in this study, I may receive extra credit at the discretion of their professor.

**Confidentiality:** I understand that the data I provide today are completely confidential and that my name will never 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. I understand that the data I provide today will be destroyed when they are no longer needed.

**Contact Information:** For any questions or concerns about this research project, please call **Joel DeFelice** at **(724) 205-0207** or email him at **defelicej@allegheny.edu**. You also may contact **Dr. Sarah Conklin** at **(814) 332-2392** or email her at **sarah.conklin@allegheny.edu**. For any questions or concerns about the treatment of research participants, including yourself, please call **Dr. Rich Bowden**, Convener of the Allegheny College Institutional Review Board (IRB) at **(814) 332-2869** or email him at **richard.bowden@allegheny.edu.**

**Voluntary Nature of Participation:** I understand that I am at **NO time** required to participate in this study. I understand that if I feel uncomfortable in ANY way, I have the right to drop out at ANY time. 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.

Participant's Signature_____
Date_____

Researcher's Signature_____
Date_____

## APPENDIX B

Code: _____ Date - _____

BACKGROUND/VIDEO GAME QUESTIONNAIRE SHEET

Please answer the following:

1) Are you male or female? a) Female b) Male

2) What is your age in years? (Must be 18+) _____

3) What is your current class standing? a) Freshman b) Sophomore c) Junior d) Senior

4) How many hours a week do you play video games?

0 <1 2-3 4-6 7-10 10+

5) What types of video games do you usually play?

None Sports Action Role Playing Adventure Arcade

Other (Specify) _____

6) What rating do the games you play typically have?

E (Everyone) T (Teen) M (Mature)

7) Do you play video games online?

No Yes: Competitively Cooperatively Both

## APPENDIX C

Code_____ DATE _____ Pittsburgh Sleep Quality Index

The following questions relate to your usual sleep habits during the past 30 days only. Your answers should indicate the most accurate reply for the majority of days and nights in the past 30 days. Please answer all questions.

1. When have you usually gone to bed at night? _____

2. How long (in minutes) has it usually take you to fall asleep each night? _____

3. When have you usually gotten up in the morning? _____

4. How many hours of actual sleep did you get at night? _____ (This may be different than the number of hours you spend in bed.

*For each of the remaining questions, check the one best response. Please answer all questions.*

5. How often have you had trouble sleeping because you...

| | *Not during the past 30 days* | *Less than once a week* | *Once or twice a week* | *Three or more times a week* |
|---|---|---|---|---|
| (a) Cannot get to sleep within 30 minutes | _____ | _____ | _____ | _____ |
| (b) Wake up in the middle of the night or early morning | _____ | _____ | _____ | _____ |
| (c) Have to get up to use the bathroom | _____ | _____ | _____ | _____ |
| (d) Cannot breathe comfortably | _____ | _____ | _____ | _____ |

| | | | | |
|---|---|---|---|---|
| (e) Cough or snore loudly | _____ | _____ | _____ | _____ |
| (f) Feel too cold . | _____ | _____ | _____ | _____ |
| (g) Feel too hot. | _____ | _____ | _____ | _____ |
| (h) Had bad dreams | _____ | _____ | _____ | _____ |
| (i) Have pain. | _____ | _____ | _____ | _____ |
| (j) Other reason(s), please describe: _____ _ | _____ | _____ | _____ | _____ |

6. How would you rate your sleep quality overall?

___Very good ___Fairly good ___Fairly bad ___Very bad

7. How often have you taken medicine (prescribed or “over the counter”) to help you sleep?

Not during the past 30 days _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

8. How often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

Not during the past 30 days _____ Less than once a week _____ Once or twice a week _____ Three or more times a week _____

9. How much of a problem has it been for you to keep up enough enthusiasm to get things done?

____ No problem ____Slight problem ____Somewhat of a problem ____ Very big problem

## APPENDIX D

Code: _____ Date: _____

**Instructions**: For the following incomplete words, fill in the blanks with the first letters that come to mind to form a real word. If no word comes to mind, circle the incomplete word and move on.

1 b _ h _ _ _

2 i n _ _ r e

3 e x _ e _ _

4 m u _ _ e r

5 p r _ _ e

6 s p e a _

7 f l i _ _ e r

8 e x p l _ _ e

9 w _ _ m

10 k i _ _

11 t _ p _

12 h _ r _

13 a _ t _ r

14 c h o _ e

15 s _ m p _ _

16 a t t _ c _

17 c _ m p _ _ t

18 d e s _ _ _ _

19 s h _ l _

20 s h o _ t

21 r _ p _ _ t

22 s t r _ _ e

23 l _ _ e

24 b _ r n

25 s t _ r _

26 p _ _ s o

27 p _ s t _

28 m _ _ g l

29 b l _ n d

30 s n _ r e

31 b _ e

32 h _ t

33 g _ _ p e

34 s m _ c k

35 s m _ _ e

36 k n _ _ _

37 t _ n e

38 s _ _ b

39 s h _ r _

40 d r _ _ n

41 p _ _ n e

42 a n g _ _

43 f l _ _ t

44 f i _ _ t

45 p _ c k

46 h a _ e

47 a _ t

48 c _ t

49 w _ n

50 a _ e

51 _ r y

52 w a _

53 f _ m _

54 s l _ p

55 b _ _ k

56 r _ p e

57 f o _ e _ t

58 o f f _ _ _

59 l _ _ o n

60 c r _ _ l

61 c _ e _ t e

62 s t _ r _ y

63 m _ t c _

64 f _ r _ _

65 t _ _ t e

66 n _ _ t _

67 w _ _ d _ w

68 w _ _ k e d

69 v i s _ _ n

70 e n _ a g e

71 s c r _ _ n

72 h _ t r _ d

73 t _ l _ p h _ _ _

74 d i s _ _ s _ e d

75 c _ n t _ _ l

76 p r o v _ _ e

77 p _ n b _ l l

78 o u t _ _ e

79 c _ l l

80 r _ d e

81 m _ n _ g e

82 i n s _ _ _

83 s _ d _

84 b _ _ t

85 b r _ _ z e

86 r e v _ _ t

87 c o o _

88 s _ _ y

89 d _ _ r

90 s m _ c k

91 f r _ _ t

92 _ u n c h

93 s h _ r e

94 a _ u s e

95 c l _ _ r

96 h _ n t

97 w _ t _ r

98 s _ a s h

## APPENDIX E

Video game Immersion Questionnaire

Code _____ Date _____

Instructions: For the following questions, circle the **number** that best corresponds to your answer. The phrase to the left of the lowest number represents the lowest meaning of the scale. The phrase to the right of the scale represents the highest meaning of the scale.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| To what extent did the game hold your attention? | Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
| To what extent did you feel you were focused on the game? | Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
| How much effort did you put into playing the game? | Very little | 1 | 2 | 3 | 4 | 5 | A lot |
| Did you feel that you were trying you best? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| To what extent did you lose track of time? | Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
| To what extent did you feel consciously aware of being in the real world whilst playing? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| To what extent did you forget about your everyday concerns? | Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
| To what extent were you aware of yourself in your surroundings? | Not at all | 1 | 2 | 3 | 4 | 5 | Very aware |
| To what extent did you notice events taking place around you? | Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
| Did you feel the urge at any point to stop playing and see what was happening around you? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| To what extent did you feel that you were interacting with the game environment? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| To what extent did you feel as though you were separated from your real-world environment? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| To what extent did you feel that the game was something you were experiencing, rather than something you were just doing? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| To what extent was your sense of being in the game environment stronger than your sense of being in the real world? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| At any point did you find yourself become so involved that you were unaware you were even using controls? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| To what extent did you feel as though you were moving through the game according to you own will? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| To what extent did you find the game challenging? | Not at all | 1 | 2 | 3 | 4 | 5 | Very difficult |
| Were there any times during the game in which you just wanted to give up? | Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
| To what extent did you feel motivated while playing? | Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
| To what extent did you find the game easy? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| To what extent did you feel like you were making progress towards the end of the game? | Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
| How well do you think you performed in the game? | Very poor | 1 | 2 | 3 | 4 | 5 | Very well |
| To what extent did you feel emotionally attached to the game? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| To what extent were you interested in seeing how the game's events would progress? | Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
| How much did you want to “win” the game? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| Were you in suspense about whether or not you would win or lose the game? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| At any point did you find yourself become so involved that you wanted to speak to the game directly? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| To what extent did you enjoy the graphics and the imagery? | Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
| How much would you say you enjoyed playing the game? | Not at all | 1 | 2 | 3 | 4 | 5 | A lot |
| When interrupted, were you disappointed that the game was over? | Not at all | 1 | 2 | 3 | 4 | 5 | Very much so |
| Would you like to play the game again? | Definitely not | 1 | 2 | 3 | 4 | 5 | Definitely yes |

## APPENDIX F

RESEARCH PARTICIPANT DEBRIEFING FORM

The Advancements in the Technology of Violent Video Games and Their Effects on Players' Aggression

Joel DeFelice
Allegheny College
Departments of Psychology and Neuroscience

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

**Purpose of Research:** The purpose of this research study is to increase the scientific understanding of the effects of the technological advancement of violent video games on players' aggression. The hypotheses of this study are that 1) there would be a greater effect on the players aggression after playing a modern violent video game as opposed to an older violent video game and 2) that the players' level of arousal would be greater when playing newer games as opposed to older games. According to a study performed by Ivory and Kalyanaraman (2007), players felt more more involved and felt a higher level of presence in newer games when compared to older games. The word completion tasks that each participant completed will be compared for changes in aggression.

**Deception:** This study used minor deception by withholding the hypotheses 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:** I understand that as compensation for participation in this study, I may receive extra credit at the discretion of their professor.

**Confidentiality:** I understand that the data I provide today are completely confidential and that my name will never 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. I understand that the data I provide today will be destroyed when they are no longer needed.

**Additional Sources of Information:**

Ferguson, C. J. (2007). The good, the bad and the ugly: A meta-analytic review of positive and negative effects of violent video games. *Psychiatric Quarterly, 78*(4), 309-316.

Anderson, C. C. A. (2004). An update on the effects of playing violent video games. *Journal of Adolescence (London, England), 27*(1), 113-122.

Ivory, J. D., & Kalyanaraman, S. (2007). The effects of technological advancement and violent content in video games on players' feelings of presence, involvement, physiological arousal, and aggression. *Journal of Communication, 57*(3), 532-555.
Uhlmann, E., & Swanson, J. (2004). Exposure to violent video games increases automatic aggressiveness. *Journal of Adolescence (London, England), 27*(1), 41-52.

**Contact Information:**

Please feel free to contact any of the following people.

- For any questions or concerns about this research project, please call **Joel DeFelice** at **(724) 205-0207** or email him at **defelicej@allegheny.edu**. You also may contact **Dr. Sarah Conklin** at **(814) 332-2392** or email her at **sarah.conklin@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. Rich Bowden**, Convener of the Allegheny College Institutional Review Board (IRB), at **(814) 332-2869** or email him at **richard.bowden@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.

Would you like to receive the results of this study?

Name _____ Box # _____

**THANK YOU AGAIN FOR YOUR PARTICIPATION.**