

Running head: GRAPHICAL QUALITY AND AGGRESSION

The Effect of Graphical Quality
On Aggression in Violent Video Games
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Abstract

Violent video games have been shown to increase the level of aggression at least in some players. One of the factors that has not been studied much is the game's appearance. This experiment tested the effects of the quality of the graphics of a videogame had on the aggression of a participant. The game chosen for this study was Call of Duty 4, which is a violent and realistic video game where the graphics can be easily manipulated. Participants played with either a high or low level of graphics. The low graphical settings were played on a laptop with most of the graphical settings set to a minimum level. The high graphical settings were played on an Xbox 360. Pre-existing levels of aggression were measured with an aggression questionnaire administered before game play. Next the participants played a tutorial level to familiarize the participants with the game, then the participants played a level with real fighting. The aggression of the participants was measured by the competitive reaction time task developed by Bushman and Saults (2007). The researchers hypothesize that the higher graphical setting will produce higher levels of aggression in the participants than in the lower graphical setting. The impact of this study could be viewed as a predictor what effects changing video game technology could have on aggression.

The Effect of Graphical Quality

On Aggression in Violent Video Games

The video game industry is quickly becoming one of the most profitable industries in the world today. From 2002 to 2007 video game sales grew from \$6.9 billion to \$9.5 billion (ESA-Entertainment Software Association, 2008). It has been projected that in 2008, video game sales will outpace sales in the music industry (Reuters, 2007). Video games are becoming a fixture in virtually every home, especially ones with children. One video game prevalence study actually indicated that 98.7% of adolescents play video games to some extent (Ferguson, 2007). There are an extremely wide variety of games being played and each one may have a different affect.

Violent video games are played by the majority of video game users. Fifty seven percent of boys and fifty six percent of girls listed at least one game that had violence against humans as one of their favorite games (Buchman & Funk, 1996). The effect of exposure to this type of violence has been often debated. After the Columbine shootings in 1999, people have become increasingly concerned with the potential damage that violent video games may cause. This is because all of the gunmen were found to have played violent videogames quite frequently. (Giumetti & Markey, 2007). Many other perpetrators

of high school shootings have been found to play violent video games (Anderson & Bushman, 2001). However, with over 98% of adolescents playing video games it is highly unlikely that these children had not played games of some type (Ferguson, 2007). While the people who committed these acts played violent video games it is uncertain that playing these games actually lead to their violence.

Violent videogame's prevalence and recent media attention have become the catalyst for the debate on the possible link between violent video games and aggression. Some researchers claim that there is a positive link between violent video games and aggression.

There have been findings that suggest that violent video games have increased the aggression in the player (Anderson & Bushman, 2001). It has also been found that playing a violent video game will increase the number of aggressive responses when given a story stem (Giumetti & Markey, 2007). On the other hand, other researchers have found that there is not enough evidence to establish a link between violent video game play and increased user aggression. In a meta-analysis of violent video games and aggression Ferguson in 2007 found no relationship between violent video game playing and aggression when corrected for publication bias. However, this research has been so flawed that a conclusive result cannot be obtained yet (Zook, 2008).

Technological confounds, among other things, may be a contributing factor to the conflicting results.

There are many possible confounds that can result in conflicting results. One explanation for the proposed increase in aggression may possibly be the frustration that they feel from a problem in playing the game, such as poor controls. When playing a video game, frustration can bring out aggression in the player thus potentially ruining the results of the study (Barlett, Harris, & Baldassaro, 2007). Whether this frustration comes from the difficulty of the game, poor game design, or unintuitive controls, those that have played video games know the feeling of not being able to beat a certain level and may on occasion through a controller or shout obscenities. Research has found that this is not the only variable that can skew results. It has been found that frustration can increase the levels of aggression in a participant (Baldassaro, Barlett, & Harris, 2007). This would mean that past researchers may have only been frustrating their participants instead of actually causing aggression from the games.

Another factor that has received little consideration when researching the possible link between violent video games and aggression is the technological advancements that have occurred in the gaming industry. From their inception in the mid sixties to the powerful next generation consoles of today, the

technologies that are powering the visual output of video games has expanded obviously grown. However, this increase of graphical processing power may bring about some unexpected side effects in the user. This aggression may indeed be moderated by the advancements in video game technology especially graphical advancements. It has been found that as video game technology evolved there is an increase in the aggression of the user (Ivory & Kalyananaraman, 2007). In fact a positive correlation has been found between the year of publication and the effect size of violent video game play. The more graphic games that have been recently developed may help to explain this trend (Ivory & Kalyananaraman, 2007). These increases in aggression can be explained using the general aggression model.

The general aggression model provides a useful explanation for the development of aggression (Anderson & Bushman, 2002). It defines aggression as preexisting ideas that may influence the way a person acts (Ivory & Kalyananaraman, 2007). The exposure to violence, in this case from video games, may lead a person to act more aggressively because of the images that the game exposes a player to. These aggressive behaviors that commonly occur in the game, in turn influence the individual's personal factors, traits and situational factors. Violent video games may well lead a person to internalize the situations that

he or she is presented with and interact on these internalizations in the outside world.

Past studies have cited that they would like to control for possible confounding variables. Ivory and Kalyanaraman, (2007) stated that it would be beneficial to use the same game in different experimental groups in their study. Many other studies use different videogames all together when trying to determine an effect on aggression. (Ivory & Kalyanaraman, 2007; Giumetti & Markey, 2007) It has also been suggested that some future research try to gain a more detailed understanding of the impact of technology by isolating specific features such as graphical resolution (Ivory & Kalyanaraman, 2007).

This study investigated aggression within a specific violent video game that uses both the minimum graphical setting and maximum, thus keeping the participants experiences controlled. While controlling for participant frustration, it is hypothesized that participants experiencing maximum graphical settings will show the higher levels of aggression than those in the minimum who will show lower levels. The researchers believe this because the higher settings will lead to a heightened sense of presence and involvement which has been found to increase hostility and aggressive intentions (Farar, Krcmar & Nowak, 2006). Also it is predicted that a preexisting disposition for

violence will also have an effect of increase aggression in the player.

METHOD

Participants

There were 27 participants taken from a sample of undergraduates from a small Midwestern liberal arts college psychology department. Participants were randomly assigned to the two conditions, with 14 in the low and 13 in the high graphical conditions. Of those 13 in the high 10 were males and 3 were females. In the low setting there were seven males and seven females. The average age of the participants was 19.6. There were 17 males and 10 females in this study. The students were offered extra credit for participating in the experiment in some of their psychology classes.

Equipment

The projector used in this study was a sharp notevision projector, model XG-M865X. A Compaq laptop running Windows Vista basic with an Intel Centrino Duo processor and an Nvidia GeForce Go 7300 video card was also used to play the game on the low graphical settings. The computer had 2 GB of RAM and 110 GB of total memory. An Xbox 360 was also used to generate the high graphical settings. The participants used a standard Xbox 360 game controller to play the game. Maxell NC-II noise cancellation headphones were used to generate the sound blasts

for the competitive reaction time task. A copy of the instruction manual provided by the manufacturer explaining the controls of the game was given to the participants before they began playing the game.

Game

The video game Call of Duty 4: Modern Warfare was played by the participants in this study. It is a first person shooter video game. In this game you take the role of a present day operative fighting a variety of other militant groups in a variety of locales. It uses a standard first person shooter control set up. It is rated M-for mature by the Entertainment Software Ratings Board for blood and gore, intense violence, and strong language.

Measures

The participants were asked to run the Competitive reaction time task developed by Bushman and Saults, 2007. The participants were be allowed to set the level and intensity of the sound blasts that will be given to a fictional participant that will be described as playing against them from another school. A Likert scale measuring for frustration for after the experiment was created by the researchers (See Appendix A). Participants can rate themselves from one to five on factors such as "How frustrated did you feel while playing the game?" or "How frustrating were the controls of the game?" The aggression

questionnaire, developed by Buss & Perry (1992) was used to determine the participant's aggression levels before game play and after game play (See Appendix B). It broke aggression down into four subcategories, anger, hostility, verbal aggression, and physical aggression. This questionnaire has an overall Cronbach's alpha of 0.92 (Archer, Frederick, & O'Connor, 2001). A Demographics questionnaire that asks for age, gender, class year in school, race, and various questions related to how often the participant plays video games and their familiarity with the game *Call of Duty 4*, was used.

Graphical Settings

To generate the low graphical settings for this study, *Call of Duty 4* was played on the laptop. The Anti-aliasing was turned off. The model quality and texture quality was set to the minimum. All lighting and shadow effects were turned off. Finally, the brightness was turned up to full. For the maximum settings the standard output of the Xbox 360 was used.

Procedure

The participants took part in the experiment one at a time in a large room with stadium style seating. They were randomly assigned to either the maximum or minimum graphical settings group. They will sit in the front row of the room. Informed consent was obtained first. Next, the participants were given the aggression questionnaire for the first time. The

participants were then given a pamphlet with brief instructions on how to play the game. Each participant then played the built in tutorial level until they completed it, a ten minute time limit ran out, or they ran out of ammo. If the time limit ran out or their ammunition ran out they were counted as failing the training but were still allowed to continue. The participants then played the final level, entitled Game Over, until completion. Next the participants completed the aggression questionnaire a second time followed by the frustration scale. During this time one of the researchers would leave the room in order to call the other college to see if they were ready to increase the believability of the cover story. The participants will then be asked to complete the competitive reaction time task developed by Bushman and Saults, 2006. Each participant experienced 17 trials of the task. The demographics and video game exposure questionnaire was administered after that. Finally, the participant will be given a debriefing form and thanked for time spent participating in the experiment.

Results

Men had a significantly higher level of aggression ($M=2.71$) than women ($M=2.09$), $t(25) = 2.801$, $p=.01$ (See Figure 1). Since the proportion of men in the high graphical condition was greater than the proportion of men in the lower, creating a

possible confounding variable, the women were removed the rest of the analyses.

Figure 1. the difference in the aggression average between men and women

A 2 x 2 ANOVA was run with independent factors of when (before and after the game play) and graphical condition (high and low) on the following dependent variables: physical aggression, verbal aggression, anger, hostility, and the average of the scores from the Aggression Questionnaire. Given the number of results only the significant findings will be mentioned. There was an interaction between when the test for anger was taken and the high and low graphical settings, such that participants in the low graphical settings got less angry, while those in the high got angrier $F(1,15)=3.833$, $p=0.069$ (See Figure 2). The main effects were not significant.

Figure 2. The difference in the anger measure in the high and low graphical settings before and after game play.

There was also a significant interaction between when the test for hostility was taken and the graphical level such that participants in the low graphical settings got less hostile after game play while those in the high got more hostile $F(1,15)=7.492$, $p=0.015$ (See Figure 3). The main effects were not significant.

Figure 3. The difference in the hostility measure in the high and low graphical settings before and after game play.

A significant interaction was also found between when the measure of overall aggression was administered and the graphical level such that participants in the low graphical settings got less aggressive after game play while those in the high got more aggressive $F(1,15)=4.212, p=0.058$ (See Figure 4). The main effects were not significant.

Figure 4. The difference in the average aggression measure in the high and low graphical settings before and after game play.

An independent T-test was used to determine differences between the high and low graphical settings. Differences in frustration, intensity of the noise blast, and duration of the noise blast were not found to be significant. These results can be found in Table 1.

Table 1.

Intensity	Duration	Frustration
$T(15)=0.69, p=0.5$	$t(15)=0.53, p=0.6$	$t(15)=0.098, p=0.92$

Table 1. The insignificant findings of intensity, duration, and

frustration.

Discussion

In this study men were significantly more aggressive in all measures than were women. Also, unfortunately there were only three females in the high graphical setting, so there originally appeared that there was a difference between the two conditions. However, once the women were removed the difference was negated. Unfortunately these results can no longer be generalized to women. Since the frustration levels of the two graphical settings were so similar (See Figure 1), it can be argued that any differences in aggression in the two groups were not caused by the participant's frustration. This helps to lend more weight to the further results of this study. Also, much of the past research failed to control for the frustration of the participants.

The graphical settings didn't show an impact on the competitive reaction time task. Also, the competitive reaction time task didn't show any significant findings. This is due in part to the fact that many of the participants didn't take the task seriously. Much of the data is the participant randomly choosing all 10's or all 1's for the whole task. Also, many of the participants reported that they simply didn't believe that they were playing it against the other person from another college. Perhaps if the researchers had had another person visible to the participants than the measure may have proven to be more useful than it was. It would be very important for

future research in the field of aggression and violent video games to either find a better way of implementing the competitive reaction time task, or find an objective measure of aggression that would be easier to implement. This would help researchers to better understand what affects the game play may have on their participants.

The most interesting findings in this study are the interactions found among hostility, anger, and the overall aggression average. In all three of these measures game play on the low graphical setting actually made the participants less aggressive while on the high graphical setting it made them more so. This finding may mean that the images in the low setting weren't strong enough to get the participants to be engaged in what they saw. They simply dismissed it. While in the high graphical setting the violent images that the participants saw helped to activate the angry and hostile thoughts that were produced. This may mean that games that have more powerful graphics do indeed have a much more intense affect on the user than those that do not, which is in support of the researcher's hypothesis. The participants may also be used to better graphics. The participants would then need higher graphics to get involved in the game to produce the angry and hostile thoughts than lower graphics that are in older games.

Another interesting finding is that truly only hostility and anger were affected by the game play. This may be due in part to the fact that the participants were acting out the physical aggression by what their avatar was doing on screen. Also, many of the participants tended to shout at the screen while playing which may have given some catharsis to their verbal aggression. Being hostile and indeed angry would help the players to better survive in the combat situations that are simulated in the game. Therefore, these types of aggression may well be more prevalent in persons playing violent video games. This shows that while a person who plays a violent video game, at least a game with sufficient graphics to involve the player, may have more access to violent thoughts. However with out a sufficient objective measure of aggression this study can't say whether or not they are likely to act out on those thoughts. That would be something that future researchers may want to look at. If future researchers found that there was an increase in aggressive actions than that would be more cause for an alarm. Also, it may be interesting to look at how long the effects on a participant's thoughts would last.

This research is important because it looks at the possible effects that an ever evolving industry may have on its user. It can also help researchers to better understand what types of aggression are being affected by playing violent video games.

It may help the ESRB to better rate games in the future as well. This research brings into light the idea that maybe violent games with poor graphics could potentially deserve a lower rating than those with better graphics.

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Appendix B**Aggression Questionnaire** (Buss & Perry, 1992)

Instructions:

Using the 5 point scale shown below, indicate how uncharacteristic or characteristic each of the following statements is in describing you. Place your rating in the box to the right of the statement.

1 = extremely uncharacteristic of me

2 = somewhat uncharacteristic of me

3 = neither uncharacteristic nor characteristic of me

4 = somewhat characteristic of me

5 = extremely characteristic of me

- | | | |
|---|---|----|
| 1 | Some of my friends think I am a hothead | A |
| . | | |
| 2 | If I have to resort to violence to protect my rights, I will. | PA |
| . | | |
| 3 | When people are especially nice to me, I wonder what they want. | H |
| . | | |
| 4 | I tell my friends openly when I disagree with them. | VA |
| . | | |
| 5 | I have become so mad that I have broken things. | PA |
| . | | |
| 6 | I can't help getting into arguments when people disagree with me. | VA |
| . | | |
| 7 | I wonder why sometimes I feel so bitter about things. | H |
| . | | |
| 8 | Once in a while, I can't control the urge to strike another person. | PA |
| . | | |
| 9 | I am an even-tempered person. | A |

- .*
- 10 I am suspicious of overly friendly strangers. H
- .
- 11 I have threatened people I know. PA
- .
- 12 I flare up quickly but get over it quickly. A
- .
- 13 Given enough provocation, I may hit another PA
person.
- 14 When people annoy me, I may tell them what I VA
think of them.
- 15 I am sometimes eaten up with jealousy. H
- .
- 16 I can think of no good reason for ever hitting a PA
person.
- 17 At times I feel I have gotten a raw deal out of H
life.
- 18 I have trouble controlling my temper. A
- .
- 19 When frustrated, I let my irritation show. A
- .
- 20 I sometimes feel that people are laughing at me H
behind my back.
- 21 I often find myself disagreeing with people. VA
- .
- 22 If somebody hits me, I hit back. PA
- .
- 23 I sometimes feel like a powder keg ready to A
explode.
- 24 Other people always seem to get the breaks. H
- .
- 25 There are people who pushed me so far that we PA
came to blows.
- 26 I know that "friends" talk about me behind my H
back.
- 27 My friends say that I'm somewhat argumentative. VA
- .

28 Sometimes I fly off the handle for no good
. reason. A

9. I get into fights a little more than the average
person. PA

Appendix C

Demographics/Video game familiarity

Gender: _____

Age: _____

Race: _____

Class Year: _____

How many hours do you play video games on average per week? _____

What percentage of this time is spent playing violent video games? _____

How well versed are you in playing first person shooters?

(circle one)

Beginner Intermediate Advanced

Have you played *Call of Duty 4* before? _____If so, how many hours have you played *Call of Duty 4*? _____