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Effects of Competition in Violent and Nonviolent Video Games on Aggressive/Prosocial Behavior

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Doctor of Philosophy

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ABSTRACT

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on Aggressive/Prosocial Behavior

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Previous research shows that playing violent video games leads to increases in aggressive feelings, thoughts, and behaviors. However, recent research has questioned the reliability of these findings. Two important variables associated with aggressive outcomes that have yet to be fully explored in the violent video game literature are the competitive aspects of the games and the outcomes of that competition (e.g., winning or losing). The present study was a two (gameplay: violent vs. nonviolent) by two (difficulty: easy vs. hard) by three (competition: no competition vs. competition win vs. competition lose) between-subjects factorial design, with aggressive/prosocial behavior measured as the dependent variable. Results revealed only a significant main effect for competition, such that participants became more aggressive after playing a competitive, as opposed to a noncompetitive game (i.e., regardless as to whether the participant won or lost). Although, there were some violations of the analysis of covariance (ANCOVA) assumptions, additional data examining the reasons why respondents behaved the way they did confirmed the initial finding. The present study supports the assertion that competition in video games has an independent and significant effect on subsequent aggression regardless of the level of violence in a video game.

Keywords: violent media, aggression, competition

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Brief History of Video Games

In 1958, physicist William Higinbotham created what was arguably the world's first video game (Ivory, 2016). Within 14 years, marked by the release of *Pong* in 1972, the first viable commercial market for video games was established (Ivory, 2016). Three years later, the release of *Gun Fight* marked the creation of the first violent video game, depicting human vs. human combat.

Over the past four decades, the video game industry has grown immensely. Long been the leading entertainment industry, the filmed entertainment industry (encompassing motion pictures, television, and videos) has been holding steady at $100 billion, with a worth of $102.3 billion projected for 2020 (Department of Commerce, 2016); the video game industry, on the other hand, currently valued at $100 billion as well (Department of Commerce, 2016), is projected to exceed $118.6 billion by 2019 (Newzoo, 2016). The video game industry has begun to surpass the filmed entertainment industry in terms of profits.

Not only is the video game industry the most lucrative of the entertainment industries, but violent video games are at the top of the video game industry. In the last five years, the top five bestselling games (*Call of Duty: Ghosts*, 19 million copies sold; *Call of Duty: Black Ops II*, 24.2 million; *Overwatch*, 25 million; *Diablo III*, 30 million; *Grand Theft Auto V* [GTA5], 70 million) have all been violent, involving player on player violence. The top grossing video game (GTA5) broke seven world records, including best-selling video game in 24 hours (11.21 million copies sold), highest grossing video game in a 24-hour period, and fastest entertainment property to gross $1 billion (Bora, 2013). The burgeoning video game industry has attracted the attention of

both parents and policy makers who have concerns regarding the effects of playing video games. Therefore, it is not surprising that the effects of playing violent video games have become a major area of research in social psychology, with much of the research finding that exposure to violent video games seems to produce higher levels of aggression (e.g., Anderson et al., 2010). However, more recent research has begun to investigate other aspects of violent video games (competition, winning or losing, etc.), outside of simply the level of violence, with fruitful results.

Definitions

Aggression and violence. It is extremely important to understand that violence and aggression are two different things, as the media and society in general tend to use the terms interchangeably or in ways that differ from the scientific definitions (Allen & Anderson, in press). Therefore, before moving forward, I will define some terms. First, aggression and violence will be defined as follows: "Aggression is behavior intended to harm another individual who is motivated to avoid that harm… Violence refers to extreme forms of aggression, such as physical assault and murder. All violence is aggression, but not all aggression is violence" (Anderson & Bushman, 2001, p. 354). For example, pushing would be considered aggressive, but not violent, if the person doing the pushing intended to cause harm and the person being pushed did not wish to be harmed. Similarly, shooting someone (with the same stipulations as before, intending to cause harm and motivation to avoid said harm) would be both aggressive and violent, as it will likely result in more extreme harm to the recipient (for a more in-depth discussion of violence and aggression, see Allen & Anderson, in press).

Prosocial behavior. On the other end of the continuum, prosocial behavior is defined as behaviors "intended to help others" (Gentile et al., 2009, p. 754). Although most studies

examining the effects of violent video games measure subsequent aggression, a growing body of research has been investigating the effects of video games on prosocial behavior. Specifically, researchers are not only interested in whether violent video games increase aggression, but also whether they equally decrease prosocial behavior (e.g., Anderson & Bushman, 2001), as an increase in one is often seen as an equivalent decrease in the other and vice versa.

Violent video games. Second, the currently accepted definition of violent video games is a game "in which the player can harm other characters in the game" (Gentile & Anderson, 2003, p. 133). However, I would more clearly define violent video games as any activity played via an electronic device with a screen which depicts or allows a player to act out extreme forms of aggression, i.e., violence. Whereas the former definition allows room for ambiguity and games without instances of violence (e.g., tackling in football or impeding a racer's progress), the latter definition restricts the title of violent video game to those games involving true instances of violence (e.g., killing other players).

Therefore, this distinction for extreme forms of aggression would divide previously labeled violent video games into two separate categories: truly violent video games, mentioned and defined above, and aggressive video games. This latter category would encompass those video games, previously called violent video games, that do not actually contain any instances of violence. For the purposes of this study, the violent video game will contain instances of extreme aggression, whereas the nonviolent video game could, at most, be labeled as an aggressive video game, but not a violent video game. These games will be discussed in more detail below.

Competition. Competition involves maximizing one's relative advantage over another party or parties (Van Lange, 2000). In terms of sports, this is usually achieving more, or in some

cases less, points than the other team, or player. This is very similar to the structure of video games as well. The majority of the most popular and bestselling games have what is called a *multiplayer mode*. With the ubiquity of the internet in our society, these multiplayer modes are able to connect players from all over the world for the purpose of competing against one another. Most modern multiplayer modes contain several different objective-based games, like "capture the flag" or "free-for-all." However, one of the most popular game modes is called "team deathmatch," in which two teams compete against each other and attempt to get a higher score than the other by killing members of the other team more often than their own team gets killed. Regardless of the various game types, these games have become immensely popular. For example, according to Microsoft, *Call of Duty: Modern Warfare 3* grossed over $775 million in its first five days of sales, and had 3.3 million unique gamers log over 7 million multiplayer game hours on the day the game was released: November 8, 2011 (Activision, 2011).

Outcome. Although there are several different ways of defining game outcome, the simplest and likely most familiar example would be that of a zero-sum game. In a zero-sum game, the degree that one party wins is equal to the degree the other loses (Von Neumann & Morgenstern, 1944). This is the usual set up for most violent and competitive video games, as well as many other games, such as sporting events and board games. Therefore, for the purposes of this study, I will be referring to the outcome of zero-sum games when I say outcome.

Difficulty. Third, I would like to define what is meant by difficulty. Difficulty has not been defined previously by other media researchers, but refers to the in-game features involving the ease of gameplay. Simply put, the more difficult a game is, the more the game asks of the player. This can include things like inflicting more damage to kill enemies, using in-game resources more efficiently (e.g., healing packs, ammunition, etc.), or suffering less damage

during the game. Thus, difficulty is separate from winning and losing (i.e., outcome) and has more to do with in-game mechanics.

General Effects of Violent Video Games

Since the turn of the century, there have been eight major meta-analyses investigating the effects of violent video games (as currently defined by the field) on aggression (Anderson, 2004; Anderson & Bushman, 2001; Anderson et al., 2010; Ferguson, 2007a, 2007b; Ferguson, 2015; Ferguson & Kilburn, 2009; Sherry, 2001). These eight analyses have compiled over 200 independent studies and analyzed their results to form several general conclusions regarding the effects of violent video games.

The first of these analyses was conducted in 2001 by Sherry. This analysis consisted of 25 independent studies, with a cumulative *N* of 2,722 participants, of which between 1,692 - 1,832 (62% - 67%) were school aged (as one study collected data from both school-aged children and adults without reporting the exact number of each; Gibb, Bailey, Lambirth, & Wilson, 1983). Although Sherry explored several methodologically and theoretically related topics, his overall finding regarding the effects of violent video games on aggression was that there was a small effect (r = .15, d = 0.30; Cohen, 1988), smaller than the effect of television violence on aggression (d = 0.65; Paik & Comstock, 1994).

Two short months later, however, Anderson and Bushman (2001) presented very different findings. With slightly more studies included (35 independent studies) and 1,540 more participants (totaling 4,262), Anderson and Bushman (2001) concluded that exposure to violent video games posed a serious public-health threat to children and youths, including college-age individuals, as they were associated with increased levels of aggression and decreased levels of prosocial behavior. However, the effect sizes found by Anderson and Bushman (r = .19; 2001)

were only slightly larger than those found by Sherry (2001), which led to the main issues addressed by subsequent meta-analyses, namely: How important are these effects? Are they large enough to be meaningful?

Three years later, Anderson (2004) updated his previous meta-analysis with more recent research, bringing the total to 44 independent studies, and found slightly stronger results than before. Specifically, Anderson addressed the first question raised above by reemphasizing the idea that exposure to violent video games is a serious issue. He then addressed the second question by explaining that although the effect size was mathematically small ($d = 0.26$), it was "larger than the effect of condom use on decreased HIV risk, the effect of exposure to passive smoke at work on lung cancer, and the effect of calcium intake on bone mass" (p. 120). Stated another way, the effects of violent video games are larger than the effects of other threats that many people make an explicit effort to avoid or prevent. Therefore, the effects of violent video games should be taken seriously and not disregarded. This is a rather compelling statement as Anderson is saying that the effects of exposure to violent video games on subsequent aggression is as impactful or more impactful than other major health risks.

However, not all researchers share this sentiment. The next three meta-analyses to be published, spearheaded by Ferguson (2007a; 2007b; Ferguson & Kilburn, 2009), made a very different argument than those of years past. Ferguson (2007a) first pointed out a significant publication bias[1] for experimental studies, casting doubt on the idea of a connection between violent video game exposure and aggression. Specifically, he pointed out that a small number of unpublished or suppressed studies could render the results of past meta-analyses trivial, meaning that published meta-analytic results were likely inflated by publication bias (Ferguson, 2007a).

[1] Publication bias is "when articles with positive (i.e., statistically significant) results are selected for publication to a greater proportion than are articles which report negative results" (Ferguson, 2007a, p. 473).

For clarity, Ferguson (2007a) detailed his process for estimating publication bias in his articles, stating that he used several of the methods suggested by Rothstein, Sutton, and Borenstein (2005).[2]

Ferguson brought up publication bias again in his second meta-analytic publication of 2007, in which he conducted a full meta-analysis of the effects of violent video games on aggression, including 17 independent studies with a cumulative total of 3,602 participants, and then corrected it for publication bias. His initial results were fairly similar to the results of previous meta-analyses, although with slightly smaller effect sizes (r = .14); however, after correcting for publication bias, the effect sizes fell below conventional standards for small effects (r = .04). Concordantly, the meta-analysis by Ferguson and Kilburn (2009), including 25 total studies with 12,436 participants, found similar results to the other meta-analyses mentioned, with trivial effect sizes after correcting for publication bias (raw r = .14, corrected r = .08).

The two most recent meta analyses raised the bar with Anderson et al. (2010) including 136 independent articles, with a total of 130,296 participants, and Ferguson (2015) including 101 independent articles, with a total of 106,070 participants. However, except for the major increase in N, they both found similar results to their past analyses. Anderson et al. (2010) found small effect sizes (r = .19) that he and his colleagues felt were significantly serious in light of comparable effect sizes associated with grave public health threats. Ferguson (2015) found trivial effect sizes after correcting for publication bias (raw r = .14, corrected r = .08).

Clearly, the issue is not resolved. Either there is little to no publication bias and violent video games have a serious effect on aggression, or there is a publication bias, and this bias lessens the strength of the overall effect. It is obvious from the above discussion that there is not

[2] Some of the suggested methods included the use of funnel plots, fail-safe N, and Egger's regression. For more information on the specific methods, see Rothstein, Sutton, and Borenstein (2005).

a clear consensus as to the effects of violent video games. However, the more popular opinion is that violent video games do have an effect on subsequent aggression, as is made evident by a review of introductory social psychology textbooks (e.g., Myers & Twenge, 2017), where little to no acknowledgement is given to the Ferguson side of the argument. However, there may be more basic and rudimentary issues at work which may undermine or call into question past findings. Perhaps more important issues are the effects of (1) the competition inherent in most violent video games, (2) the outcome of that competition (e.g., winning or losing, an unavoidable consequence of competition), and (3) the difficulty of the video game being played.

Almost every violent video game is built around competition (e.g., kill or be killed), with some sort of predictable outcome, but the level and emphasis of this competition has not been adequately controlled for in previous research. For example, Polman, de Castro, & van Aken (2008) had participants play either a violent game (*Tekken 3*) or a non-violent game (*Crash Bandicoot 2*), after which they measured participant's levels of aggression using peer nominations. They found that boys were rated as more aggressive by their peers after playing the violent game than after playing the non-violent game. However, there is an alternative explanation for their findings. *Tekken 3* is a violent, fighting game, in which the player controls a character in a one-on-one battle. Due to the nature of a fight, there is a competitive aspect to the game, with the possible outcome of winning or losing the fight. *Crash Bandicoot 2*, on the other hand, involves the player running on a linear path and dodging obstacles. It does not have a competitive aspect or a win/lose outcome inherent in the game play. Therefore, the difference in aggression could have been due to the competition and outcome rather than the violence.

As another example of research conflating competition, outcome, and violence, Ferguson and Rueda (2010) had participants play one of two violent games (*Hitman: Blood Money* or *Call*

of Duty 2), a non-violent video game (*Madden: 2007*), or no video game. They found no significant differences in subsequent aggressive behavior between any of the groups, but this could be explained in terms of competition and outcome rather than level of violence. The actual game play for *Hitman* and *Call of Duty* was not clearly explained in the article, but based on the duration of the gameplay session (45 minutes) it is safe to assume that participants were not playing the variant of the game involving any competition or outcome. In other words, they were likely playing the campaign portion of each game (the part of the game that is played out in a linear fashion and not against any human opponents). On the other hand, *Madden:2007*, being a football game, involves both competition and outcome, as the player has the clear possibility of winning or losing. Therefore, the washing out of the differences between the game conditions could have been due to the inclusion of violent but non-competitive games and a non-violent but competitive game. Thus, a failure to control for two significant variables could account for differences in research findings. Therefore, the present research will investigate the independent effects of these possible confounds employing the standard empirical methods used when studying the immediate effects of playing violent video games on subsequent aggression.

Competition

As stated previously, there have been few studies that have addressed this potential confound, with a thorough search of the literature returning only three studies pertaining specifically to competition in violent video games. In one, Schmierbach (2010) had three groups of participants play a popular violent video game, *Halo*, either solo, cooperatively, or competitively. He found that there were significantly higher levels of aggressive cognition for the participants who played competitively when compared to the solo and cooperative players (Schmierbach, 2010). Similarly, Adachi and Willoughby (2011a) randomly assigned

participants to play a video game that was either high or low in violence and high or low in competition and found higher levels of subsequent aggressive behavior after playing the competitive game, regardless of whether or not it was violent. Based on these two studies, it would appear that the effect of competition on aggression may be independent of the level of violence and may be responsible for aggressive outcomes typically attributed to violence.

In 2013, Adachi and Willoughby examined the long-term effects of playing these competitive video games, irrespective of their levels of violence, and found that greater levels of competitive video gaming predicted higher levels of future aggression. Although suggestive, one major drawback of all of these studies is that they never recorded the results of the competition. In other words, they never addressed the effects of the inevitable consequence of competition: winning or losing. Yet the outcome of the game may be as important as the strategy used to obtain the outcome.

Outcome

Few studies have examined the effects of game outcome, with a thorough search of the literature returning only three that pertain specifically to video games. Shafer (2012), as well as Breuer, Scharkow, and Quandt (2013), found that participants who lost during video game play had significantly higher levels of affective and behavioral aggression, than participants who won. Similarly, Griffiths, Eastin, and Cicchirillo (2016) found that participants who lost a video game had significantly higher levels of hostility than those who won. Thus, there is evidence for differences between outcomes of competition. However, a major drawback of these studies is that none employed a conventionally violent video game (i.e., video games involving clearly violent actions, like killing). All three used sports games, like FIFA soccer or NCAA football, as

these games make it simple and clear who is winning and who is losing. Thus, the effects of winning and losing in a violent video game remain unexplored.

The present study plans to fill in these holes in the literature. Specifically, participants will play either a violent or non-violent game to address the broader question as to the effects of violent and non-violent video games. Additionally, participants will be exposed to either a competitive situation, and randomly assigned to an outcome, or a non-competitive situation, in which outcome is irrelevant. This study will also be the first to examine the effects of outcome with the use of a truly violent video game (e.g., one involving killing).

Difficulty

In-game difficulty has been a relatively unexplored area of research regarding the effects of violent video games on subsequent aggression, with a thorough search of the literature returning no studies in which difficulty was a manipulated variable. However, a study by McCarthy et al. (2016), in which difficulty happened to differ between the violent and non-violent game, found a significant relationship between difficulty and self-reported likelihood to aggress. Most past research has either ignored the issue or attempted to match games on difficulty (e.g., Adachi & Willoughby, 2011a, also see Adachi & Willoughby, 2011b). Matching games on difficulty is an appropriate way to control for differences between games in an experimental study; however, in the real-world games fluctuate widely in terms of difficulty.

As mentioned above, most games, especially violent video games, have a multiplayer component, in which there is no control over in-game difficulty, as the players with whom one is matched will constantly change. However, most video games also come with a campaign component, or story mode. In a campaign mode, the player is usually playing against the game itself and not other players. Thus, the game developer can include preset difficulty levels from

which players can choose. For context, *Halo*, a popular violent video game, has four settings for difficulty in its campaign: easy, normal, heroic, and legendary, with each becoming progressively more difficult. Therefore, controlling for or ignoring in-game difficulty is unwise, as in-game difficulty could have an effect—independent of violence, competition, and outcome—on subsequent aggression, as the player may be more likely to notice or react to the difficulty of the game being played.

Additionally, it is easy to conflate difficulty with outcome, as difficulty and outcome are intuitively seen as causally linked. For example, the player lost because the game was hard, or the player won because the game was easy; however, there are instances where the game can be easy and the player still loses, and vice versa. Therefore, it is important to not only include the variable of difficulty, but also to manipulate it separately from outcome, an issue that took me several iterations[3] to fully understand (Hawk, 2012, 2014, 2016).

The present study will do exactly that, by introducing an independent factor of in-game difficulty: easy or hard (the specific differences will be explained below). This means that I will be able to examine the effects of the difficulty of the game independently of whether the participant won or lost, or competed at all, and therefore will not conflate the two.

Hypotheses

Based on prior research, there were many different results that I hypothesized. First, based on the meta-analytic research mentioned above, I hypothesized that there would be an effect of whether the game played was violent or not, with the violent video game eliciting higher levels of aggression and lower levels of prosocial behavior. Second, based on the

[3] In several of my past studies examining the effects of outcome on aggression, I manipulated outcome through in-game difficulty: using a game on a hard difficult to induce losing, and vice versa. Therefore, all of my past research has conflated difficulty and outcome, which will not be the case in the present study.

research by Schmierbach (2010) and Adachi and Willoughby (2011a, 2013), I hypothesized that there would be an effect between the competition and the no-competition levels, with the competitive level eliciting higher levels of aggression and lower levels of prosocial behavior. Third and finally, based on the research of Shafer (2012), Breuer and colleagues (2013), and Griffiths and colleagues (2016), I hypothesized that there would be an effect for the outcome (winning or losing), with those in the losing condition exhibiting higher levels of aggression and lower levels of prosocial behavior than those in the winning condition.

H1: Participants in the violent game condition would have higher levels of behavioral aggression (or lower levels of prosocial behavior) than participants in the non-violent game condition.

H2: Participants in the competition condition would have higher levels of behavioral aggression (or lower levels of prosocial behavior) than participants in the no-competition conditions.

H3: Participants in the competition lose condition would have higher levels of behavioral aggression (or lower levels of prosocial behavior) than participants in the competition win and no competition conditions.

H4: Participants in the violent game and competition lose condition would have the highest levels of behavioral aggression (or lowest levels of prosocial behavior).

Additionally, as there is so little research on the effects of in-game difficulty, I had a research question regarding its effects. Does difficulty have an independent effect on aggressive/prosocial behavior, and does it have any interactive effects? Specifically, do more difficult games lead to increases in aggression (decreases in prosocial behavior)?

Method

Participants

Four hundred eight college-aged participants were recruited from large universities in the western united states (376 from Brigham Young University and 32 from Utah Valley University). Only male participants were recruited for this study, as males usually have higher aggression levels in violent video game studies (e.g., Bartholow & Anderson, 2002), and females, although often exhibiting lower levels of overall aggression, tend to vary in the same direction and in parallel with males in many studies (e.g., Archer, 2004). All participants self-identified as men.

Participants ranged in age from 18 to 33, with a mean age of 21.29 (SD = 2.01). Participants were predominantly heterosexual (96.32%), unmarried (82.11%), Christian (97.79%), and white (89.46%; see Table 1 for a complete demographic breakdown). Participants were only excluded if they are unable to see or use a computer or unable to fluidly use a keyboard and mouse for gameplay. Participants were compensated monetarily for their time.

Apparatus

A computer program was developed to move participants through the study. The program contained every aspect of the study, including questionnaires, video game stimulus, dependent measure, and all randomization algorithms for random assignment of participants. The entire program was loaded onto multiple USB drives and administered in computer labs to as many as 18 participants at a time. Each computer in the computer lab had one monitor, between 19 and 22 inches diagonally, a Windows-based operating system, a mouse, and a keyboard. All data were saved to each individual USB drive and compiled daily.

Table 1

Demographics

Variable	Frequency	Percentage
Sexual orientation		
Heterosexual	393	96.32
Homosexual	8	1.96
Bisexual	3	0.74
Asexual	3	0.74
Other	1	0.25
Marital status		
Never married	335	82.11
Married	71	17.40
Divorced	1	0.25
Other	1	0.25
Class standing		
Freshman	143	35.05
Sophomore	129	31.62
Junior	89	21.81
Senior	46	11.27
Grad Student	1	0.25
Religious affiliation		
Christianity	399	97.79
Buddhism	1	0.25
Agnostic/Atheist	4	0.98
Spiritual but not religious	2	0.49
Other	2	0.49
Race/ethnicity		
Caucasian/White	365	89.46
African American/Black	5	1.23
Hispanic/Latino	11	2.70
Asian	15	3.68
Pacific Islander	7	1.72
American Indian or Alaskan Native	2	0.49
Other	3	0.74

Note. Percentage refers to the percent of respondents who selected a specific category. Participants could write in a response after selecting other. If their written response coincided with a predetermined category, they were reassigned accordingly. Otherwise, their response was left as other.

Video game. *Doom II: Hell on Earth*, hereafter referred to as Doom 2, developed by id Software, was used in the present study (id Software, 1994). Doom 2 is a first-person shooter, in which a space marine fights against demons to close a portal from hell on the Earth. A first-person shooter is a genre of video game in which the player assumes control of the in-game playable character from the first-person perspective. The player can usually see the playable character's hands and weapon, often a gun. The Doom franchise is well known, and this particular title is its second installment. Due to its widespread popularity and open source code, Doom 2 allows for modifications, or mods, to be created to customize the play experience. The mod used in the present study was the Hilgard Modified Video Game Paradigm (Hilgard, 2014), in which two violence levels, violent and nonviolent, and two difficulties, easy and hard, are offered. The major strengths of this paradigm are that the player played the same levels, with the same number of computer-controlled opponents, or bots, using the same kinds of attacks regardless as to whether the participant was playing the violent, nonviolent, easy, or hard mod. Thus, only the aesthetics and damage dealt by attacks changed between the mods, affording greater control than many other studies.

Study Design

The present study is a two (gameplay: violent vs. nonviolent) by two (difficulty: easy vs. hard) by three (competition: no competition vs. competition win vs. competition lose) between-subjects factorial design (see Table 2).

Gameplay factor. The gameplay factor was built into the Hilgard paradigm. The violent condition had the player playing as a space marine and, using sawed-off shotguns and miniguns, fighting demons from hell. The violence had been increased from the original game with extra blood splatter and screams. The nonviolent condition had the player playing as a

Table 2

Means, Standard Deviations, and Sample Sizes for Each Experimental Condition

	Violent				Non-Violent			
	Easy		Hard		Easy		Hard	
Comp	*M (SD)*	*n*	*M (SD)*	*n*	*M (SD)*	*n*	*M (SD)*	*n*
No comp	-5.14 (5.83)	36	-7.75 (4.10)	32	-4.94 (5.43)	35	-6.81 (4.32)	31
Lose	-0.76 (7.18)	33	0.42 (6.21)	33	-2.43 (8.06)	30	-2.30 (7.87)	33
Win	0.72 (7.65)	36	-1.48 (7.38)	31	-3.88 (7.12)	42	-1.30 (6.24)	33

Note. Comp = Competition condition; Lose = Competition condition where the participant was randomly assigned to lose; Win = Competition condition where the participant was randomly assigned to win.

bounty hunter and, using various teleportation guns, returning escaped aliens to prison, and not killing them. As stated previously, players had the same level layout and number of opponents regardless of the level of the gameplay factor.

Difficulty factor. The difficulty factor was also built into the Hilgard paradigm. The difference between the easy and hard levels was only the damage done by enemy attacks and the health of the opponents. For example, it may take the player three shots to kill each opponent in the hard condition, whereas it may only take one shot to kill each in the easy condition. Therefore, in the hard condition, the player had to spend more time killing opponents, and the opponents had more time alive to do damage to the player. In the easy condition, opponents had less health and did less damage than in the hard condition. Therefore, the game was made harder

because the player had to spend more time killing or teleporting each opponent and each opponent was more likely to kill the player.

Competition factor. The competition factor was comprised of three levels. For both competition win and competition lose, the participants were told that to keep them engaged in the study they would have the opportunity to be entered into a drawing for one of five $100 gift cards if they achieved a higher score than their partner. Pilot testing revealed that including odds made the task feel less competitive, so no odds of winning were given. In reality, participants were not assigned to a partner and were told that they had won or lost based on the competition factor condition to which they were randomly assigned. The final level was no competition; the participant was not prompted with anything competition related. Pilot testing revealed that the competition levels appeared to be significantly more competitive than the no competition level. Finally, regardless as to which condition the participant was assigned, all participants were entered into the drawing.

Measures

Video game exposure. Prior video game exposure was measured using a modified version of the video game questionnaire originally developed by Anderson and Dill (2000), to control for differing levels of violent video game exposure (see Appendix A). The modifications, as detailed in Busching et al. (2015), had participants list their three favorite games. For each game, participants rated how violent the game was, on a 4-point scale ranging from (1) *no violence at all* to (4) *very violent*. Participants also rated how frequently they played each game on a 5-point scale from (1) *almost never* to (5) *almost every day*. Violence and frequency measures were multiplied together, as recommended as a best practice by Busching et al. (2015), and then summed to get an overall violent video game exposure score. The resulting

scale had a range of 61, from 0 indicating no violent media consumption (VMC) to 60 indicating the highest level of VMC. To keep the true nature of the study obscured, distractor items, rated on a similar scale as how violent, were added: how sexual and how educational the game was.

Trait aggression. The short form of the Buss-Perry Aggression Questionnaire (BPAQ-SF), which has been used in many studies and is generally accepted as a reliable and valid measure of trait aggression (Bryant & Smith, 2001; also see Gerevich, Bácskai, & Czobor, 2007), was administered to control for differing levels of trait aggression (see Appendix A). The questionnaire is made up of 12 items, and is broken down into four sub-scales, each consisting of three items added together: physical aggression ($\alpha = .70$; all alphas are from the present study), verbal aggression ($\alpha = .77$), anger ($\alpha = .72$), and hostility ($\alpha = .62$). Each item is rated on a 6-point scale ranging from (1) *completely false for me* to (6) *completely true for me*. The 12 items were averaged to get an overall trait aggression score ($\alpha = .82$). The resulting scale had a range of six, from one indicating the lowest level of trait aggression to six indicating the highest level of trait aggression.

Competitiveness. Competitiveness was measured using a modified version of the competitiveness scale used by McGloin et al. (2016; see Appendix A). The scale consists of 10 items ($\alpha = .87$; alpha is from the present study), with items rated on a 7-point scale ranging from (1) *strongly disagree* to (7) *strongly agree*. However, to better obscure the true nature of the study, the scale was measured using the same scale as the BPAQ-SF. All 10 items were averaged to get an overall competitiveness score. The resulting scale had a range of six, from one indicating the lowest level of trait competitiveness to six indicating the highest level of trait competitiveness.

Distractors and attention checks. In order to obscure the true nature of the study, the Modified Rosenberg Self-Esteem Scale (Zimprich et al., 2005) and the Self-Monitoring Scale (Snyder, 1974) were added because the structure and content of the items were relatively similar to that of the BPAQ-SF and competitiveness measure (see Appendix A). The Modified Rosenberg Self-Esteem Scale consists of 10 items rated on a 4-point scale ranging from (1) *strongly disagree* to (4) *strongly agree* (Zimprich et al., 2005). The Self-Monitoring Scale consists of 25 items rated on a dichotomous scale of (T) *true or mostly true* and (F) *false or not usually true* (Snyder, 1974). Both distractor scales were measured on the same 6-point scale as the BPAQ-SF and competitiveness scale, but were not analyzed.

Two additional attention check items were included to make sure the participants were paying attention to the questions (see Kung, Kwok, & Brown, 2017 for a discussion of the effects of attention check questions on scale validity). These items were also measured on the same 6-point scale as the BPAQ-SF and competitiveness scale. All items from the BPAQ-SF, competitiveness scale, both distractor scales, and attention checks were randomized for each participant.

Aggressive/prosocial behavior. Aggressive/prosocial behavior was measured using a digitized version of the tangram puzzle procedure (Saleem, Anderson, & Barlett, 2015). Tangram puzzles involve a large geometrical outline that needs to be recreated using smaller geometric shapes (e.g., triangles, squares, and trapezoids). Participants were shown 30 different tangram puzzles comprising 10 easy, 10 medium, and 10 hard (see Appendix B). Easy tangram puzzles could be completed using three to four shapes, medium using five to six shapes, and hard using seven shapes. Participants chose 11 puzzles for an ostensible partner to complete. Participants were told that their partner would receive an additional $10 if he was able to

complete all 11 tangrams in 10 minutes, and the partner was choosing the 11 tangram puzzles for the participant to attempt the same. In reality, the participant was not actually asked to complete any tangram puzzles.

If participants chose primarily easy tangram puzzles for their partner, it was assumed that the participants were attempting to help the partner (i.e., were acting prosocially). Conversely, by choosing primarily hard tangram puzzles, the participants would be hurting their partner (i.e., acting aggressively). It is important to note, based on the manipulation present in this study, that there was no competitive component inherent in the tangram puzzle procedure. The participant was told to choose the puzzles for the partner at the same time the partner was ostensibly choosing puzzles for him, and both the participant and the fictitious partner would have 10 minutes to complete the puzzles and receive the reward regardless of the other's performance.

There are two ways of computing the tangram choice variable reported in the literature (e.g., Saleem, Anderson, & Barlett, 2015). The first is to sum the number of difficult tangrams chosen for the ostensible partner (from 0 – 10), indicating the participants degree of aggressiveness, and separately summing the number of easy tangrams chosen for the ostensible partner (from 0 – 10), indicating the degree of prosocialiality. The intention would be to analyze these scales separately, even though they would be somewhat inversely related. The second and preferred method, as will be illustrated below, is to take the number of hard tangrams chosen and subtract from that the number of easy tangrams chosen, ignoring the number of medium tangrams chosen. Thus, the resulting scale is a difference score indicating the degree to which each participant is generally intending to be aggressive or prosocial (medium choices are considered neither hurtful nor helpful). For example, if participant A chose five hard tangrams and participant B chose four hard tangrams, then participant A would be considered more

aggressive than participant B by the former scoring method (five hard to four hard); however, if participant A also chose five easy tangrams and participant B chose zero easy tangrams, then, using the difference score method, participant B (four hard minus 0 easy resulting in four total) was actually being more aggressive than participant A (five hard minus five easy resulting in 0 total), who chose equal numbers of easy and hard tangrams. Therefore, the difference score method gives a better picture of the participants' intentions than using one or the other of the subscales alone. By considering both scales together, we are able to see the full picture of how the various independent variables affected the participants aggressively and prosocially. Finally, the subscales are so closely related that conducting any multivariate analyses using both would result in severe multicollinearity issues.

The latter method was how the variable was computed in the present study. The resulting variable had a range of 21, from -10 to 10, with higher, positive numbers indicating more aggressive behavior, lower, negative numbers indicating more prosocial behavior, and zero indicating equal measures of aggressive and prosocial behavior. As discussed previously in the definitions of aggression and prosocial behavior, aggressive and prosocial behavior are often viewed as on a continuum, indicating that an increase in one is a decrease in the other. For example, if participant A had an overall score of four and participant B had an overall score of eight, one would conclude that participant B was more aggressive—and less prosocial—than A. Therefore, this measure can be interpreted in terms of higher and lower aggression or higher and lower prosocial behavior.

Supplemental questions. After choosing the tangrams for their ostensible partner, participants were asked a series of questions to better understand their intentions behind choosing the tangrams they did. Participants were asked to indicate their agreement, on a 5-point

scale ranging from (1) *not at all* to (5) *a lot*, with five statements meant to better understand their reason for choosing the tangrams they did: provide a range of tangrams, help the other person, make it difficult for the other person, hurt the other person, and give the other person hard tangrams (see Appendix C).

Manipulation checks. Following the collection of the tangram puzzle procedure data, participants were asked several manipulation check questions (see Appendix C). They were asked to rate, on a 6-point scale ranging from (1) *not at all* to (6) *extremely*, how violent and how challenging the game they just played was. Also, for participants assigned to the win or lose conditions, they were asked whether they won or lost. Additionally, participants were asked how much they identified with the in-game character (modified version of Kastenmüller, Greitemeyer, Fairclough, Waite, & Fischer, 2013). These manipulation check questions were used to determine how well participants paid attention during the study.

Procedure

Upon arrival, participants were seated in front of a monitor, keyboard, and mouse. They were prompted to read and sign a consent form. Upon completion, participants read a cover story telling them the reason for the study. They were told that previous research has shown that playing first-person and third-person perspective video games has been shown to affect spatial reasoning and decision making skills, and that they would be randomly assigned to play either a first-person or third-person perspective video game and then complete a task intended to measure their decision making and spatial reasoning abilities. In reality, all participants played a first-person perspective video game, and the task was intended to measure aggressive/prosocial behavior. The participants were not informed of any of the factors—gameplay, difficulty, or

competition—in the study. Pilot testing revealed that the cover story was believable and obscured the true purpose of the study.

Participants were then directed to fill out questionnaires detailing their levels of trait aggression, trait competitiveness, levels of VMC, and general demographics (see Appendix A). After completing the questionnaires, participants were randomly assigned to one of 12 conditions and told to watch a short tutorial which went over what tangrams are and how they were expected to complete the tangram paradigm. This way, the participant could switch from the video game to the measure without having to wait through instructions. Following the tutorial video for the tangram paradigm, participants watched another tutorial video detailing the object of the video game and the controls. The videos were consistent with the gameplay condition they were assigned to, either violent or nonviolent. After the video concluded, if the participant was assigned to a competition condition—either win or lose—he was prompted with the possibility of winning a gift card and connected with an ostensible partner. Participants were told that if they could beat their partner's score, they would be entered into a drawing to win one of five $100 gift cards.

All participants played the video game for 15 minutes. Upon completion, they were immediately switched to the tangram paradigm to measure their levels of behavioral aggression. However, participants in the win or lose condition were told first whether they had beaten or not beaten their partner. Participants were asked to pick the tangrams, as described above, for the same partner they had just played against, or a partner they were just matched with in the case of participants in the no competition group. Participants were reminded that they were not competing with their partner, and they would never actually meet their partner. Once they had chosen, they were shown a screen made to look like the computer was slowly loading the

tangrams for the participant to complete. On the loading screen, the participants were prompted to answer a few short manipulation checks. When finished, the participants were not prompted to complete any actual tangrams. Instead, they were shown a short debriefing video, in which they were told the true nature of the research. Participants were asked not to share the nature of the study with anyone and were told what they should say if asked by others. Then, participants were asked if we may still use their data, paid, and dismissed.

Analysis

A two (gameplay: violent vs. nonviolent) by two (difficulty: easy vs. hard) by three (competition: no competition vs. competition win vs. competition lose) between-subjects factorial analysis of covariance (ANCOVA) was conducted to examine differences in behavioral aggression, controlling for levels of trait aggression, levels of trait competitiveness, and violent media usage. Post hoc tests were conducted following significant ANCOVA results.

In addition to the above analyses, there were several correlational analyses that were also examined. Correlations between trait aggression, competitiveness, and VMC were examined, as few studies to date have examined the relationships of trait aggression and VMC with competitiveness. Finally, a regression was used to examine if trait aggression, competitiveness, or VMC predicted scores on the measure of aggressive/prosocial behavior.

Results

A total of 408 participants took part in the study; however, due to missing data three participants were dropped from the final analysis. Thus, all subsequent analyses utilized the 405 remaining participants. Additionally, all of the 12 different conditions had at least 30 participants and no more than 42 (see Table 2 for sample size per condition, as well as mean and standard deviation of the aggressive/prosocial measure).

Attention and Manipulation Checks

After playing the video game and completing the tangram task, participants were asked a series of questions to confirm that they perceived the manipulations as intended. An independent-samples *t*-test was used to examine differences in how violent the participant felt the game they played was depending on whether they were randomly assigned to the violent or nonviolent video game condition. Results revealed that there was a significant difference in how the participants viewed the video game, with participants assigned to play the violent video game ($M = 5.35$, $SD = 0.83$) rating it as significantly more violent than those assigned to play the nonviolent video game ($M = 2.93$, $SD = 1.22$), $t(402) = -23.26$, $p < .001$, 95% CI [-2.62, -2.21], $d = -2.31$.

A second independent-samples *t*-test was used to examine differences in how challenging the participant felt the game they played was depending on whether they were randomly assigned to the easy or hard video game condition. Results revealed that there was a significant difference in how the participants viewed the video game, with participants assigned to play the hard video game ($M = 2.71$, $SD = 1.31$) rating it as significantly more challenging than those assigned to play the easy video game ($M = 1.39$, $SD = 0.71$), $t(403) = -12.76$, $p < .001$, 95% CI [-1.53, -1.12], $d = -1.27$.

If participants were randomly assigned a competition condition (e.g., win or lose), they were asked to indicate whether they won or lost. After comparing their perception as to how they were assigned, 73.24% assigned to the win condition and 72.87% assigned to the lose condition judged correctly, with 24.65% and 20.93% being unsure, respectively. Very few believed they were assigned to a condition opposite of their actual assignment (3.10% assigned to lose and 0% assigned to win; see Table 3). All subsequent analyses were run both with and

Table 3

Recollections of Competition Condition Assignment

	Recollection							
	Won		Lost		Unsure		No response	
Condition	*n*	%	*n*	%	*n*	%	*n*	%
Win	104	73.24	0	0	35	24.65	3	2.11
Lose	4	3.10	94	72.87	27	20.93	4	3.10

Note. Condition = the condition to which the participant was randomly assigned. Recollection = the manipulation check question asking whether they remembered winning or losing. Participants assigned to the no competition condition were not prompted with this manipulation check question. Percentages were calculated based on the number of participants assigned to the win (n = 142) or lose (n = 129) condition.

without the participants whose response did not match the condition to which they were assigned with no change to the results. Therefore, all participants, not already excluded, were included in all subsequent analyses.

Two attention checking items were included in the lists of items containing the trait aggression and trait competitiveness measures. These items asked participants to indicate how true or not true it was for them that they "…often smell things [that] are not actually there" and "think people are inserting thoughts into [their] head." A total of 77 participants (19.01%) indicated some level of agreement with one of these items, with only six participants (1.48%) indicating agreement with both, indicating either a current psychotic or delusional episode, an

attempt to be funny, or a lack of attention. An inspection of the data from the 77 participants did not appear to show any major difference from the majority of responses. All subsequent analyses were conducted both with and without these participants with no significant differences in the results. Therefore, no additional participants were excluded.

Hypothesis Testing

Assumptions. The data for the dependent variable were not normally distributed (tested via Shapiro–Wilk test). Specifically, the distribution was in the shape of a "U", with higher frequencies at the extremes and lower frequencies in the center. Although ANCOVA is robust to violations of normality, severe violation may produce questionable results. Additionally, due to the non-normal distribution of the data, there was also a violation of the assumption of homoscedasticity (tested via Levene's test of homogeneity), which also may be problematic. Due to the fact that the dependent variable was discrete and there was clumping around a single integer (e.g., 10 or -10), no transformations would correct or help the issue of normality. Nevertheless, ANCOVA has been shown to be relatively robust to serious violations of assumptions (Schmider, Ziegler, Danay, Beyer, & Bühner, 2010): So it was employed here, and the results are interpreted cautiously. [4]

Main analysis. A two (gameplay: violent vs. nonviolent) by two (difficulty: easy vs. hard) by three (competition: no competition vs. competition win vs. competition lose) analysis of covariance (ANCOVA) was conducted, with tangram score entered as the dependent variable to simultaneously test all the hypothesized differences. Additionally, VMC, trait aggression, and trait competitiveness were entered as covariates in the analysis. Results revealed that there was a statistically significant main effect for competition, $F(2, 390) = 24.60$, $p < .001$, $\eta_p^2 = .11$.

[4] A robust regression (robust against violations of regression assumptions) was conducted to investigate the reliability of the results, with results that were not significantly different from those presented here emerging.

Tukey's post hoc test for the competition factor revealed that there was no difference between the winning (M = -1.59, SD = 7.25) and losing (M = -1.23, SD = 7.40) groups. However, there were significant differences between no competition (M = -6.13, SD = 5.09) and winning, as well as no competition and losing, with those who competed, regardless of outcome, exhibiting higher levels of aggression than those who did not compete (see Figure 1).

No significant main effects emerged for gameplay, $F(1, 390) = 2.95$, $p = .09$, $\eta_p^2 = .008$, or difficulty, $F(1, 390) = 0.49$, $p = .49$, $\eta_p^2 = .001$. Concordantly, no significant two-way interactions emerged between gameplay and competition, $F(2, 390) = 1.74$, $p = .18$, $\eta_p^2 = .009$, between gameplay and difficulty, $F(1, 390) = 1.29$, $p = .26$, $\eta_p^2 = .003$, or between competition and difficulty, $F(2, 390) = 1.76$, $p = .17$, $\eta_p^2 = .009$. Finally, no significant three-way interaction between gameplay, competition, and difficulty emerged, $F(2, 390) = 1.72$, $p = .18$, $\eta_p^2 = .009$.

Examination of histograms. As mentioned above, the violations of normality may call the results into question; however, an examination of the data may be informative to help explain what participants were doing. Figure 2 shows the histogram for participants who were not competing while playing the game, and Figure 3 shows the histogram for participants who were competing in the game and who won or lost. In the no competition condition 49.25% of the participants gave all easy tangrams, whereas only 2.24% gave all hard tangrams. However, in the competition conditions, only 26.94% of participants gave all easy tangrams, whereas 13.28% gave all hard tangrams. Therefore, there appears to be a difference between the distributions of the no competition and competition data sets.

Once it became clear that there were extreme violations to the ANCOVA assumptions, I decided to run some tests, that would not be affected by the non-normal shape of the data, in

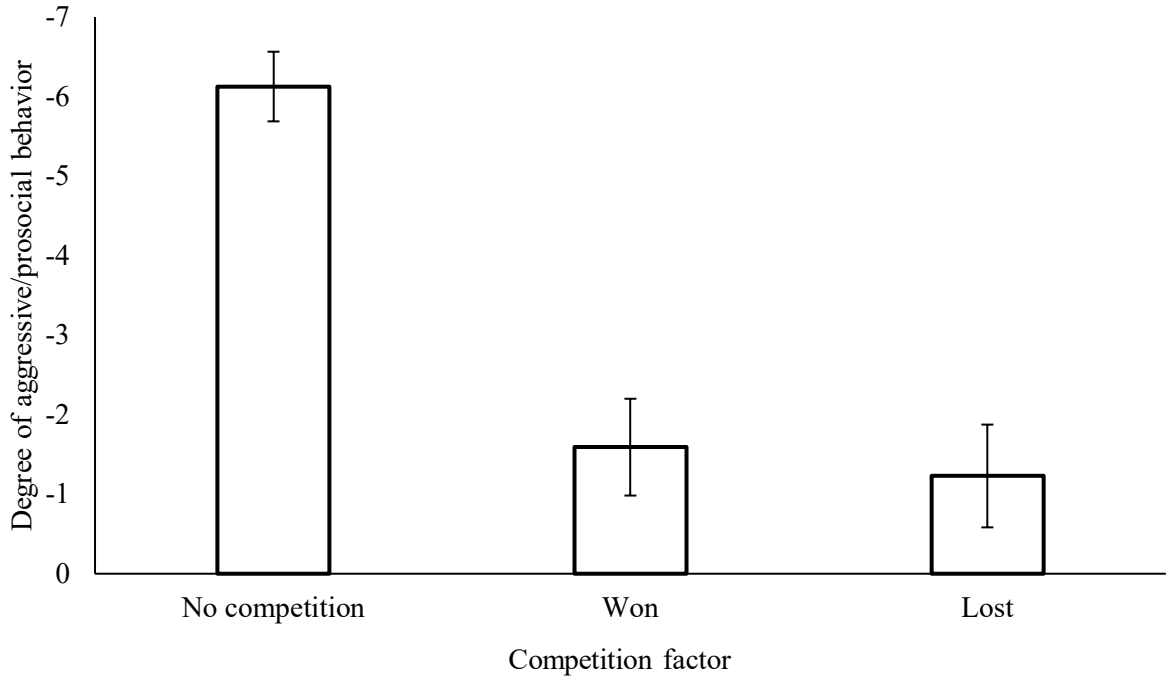

Figure 1. Mean aggressive/prosocial score for each level of the competition factor. There was a significant difference in aggression/prosociality between the no competition and both winning and losing conditions, but there was no significant difference between the winning and losing conditions. The error bars are estimated standard errors. Aggressive/prosocial scores range from -10 to 10, with higher, negative numbers indicating more aggressive behavior.

order to verify a statistically significant difference; thus, two chi-square tests of independence were conducted. The first tested for independence between competition assignment (competition or no competition) and whether the participant chose all easy tangrams (-10 as the tangram score) or all hard tangrams (10 as the tangram score). Participants who chose any other combination were excluded. Results revealed that the two were not independent, χ^2 (1, N = 178) = 20.31, $p < .001$, $\Phi = .34$, with more than the expected number of participants in the no competition group selecting easy tangrams than in the competition group and more than the

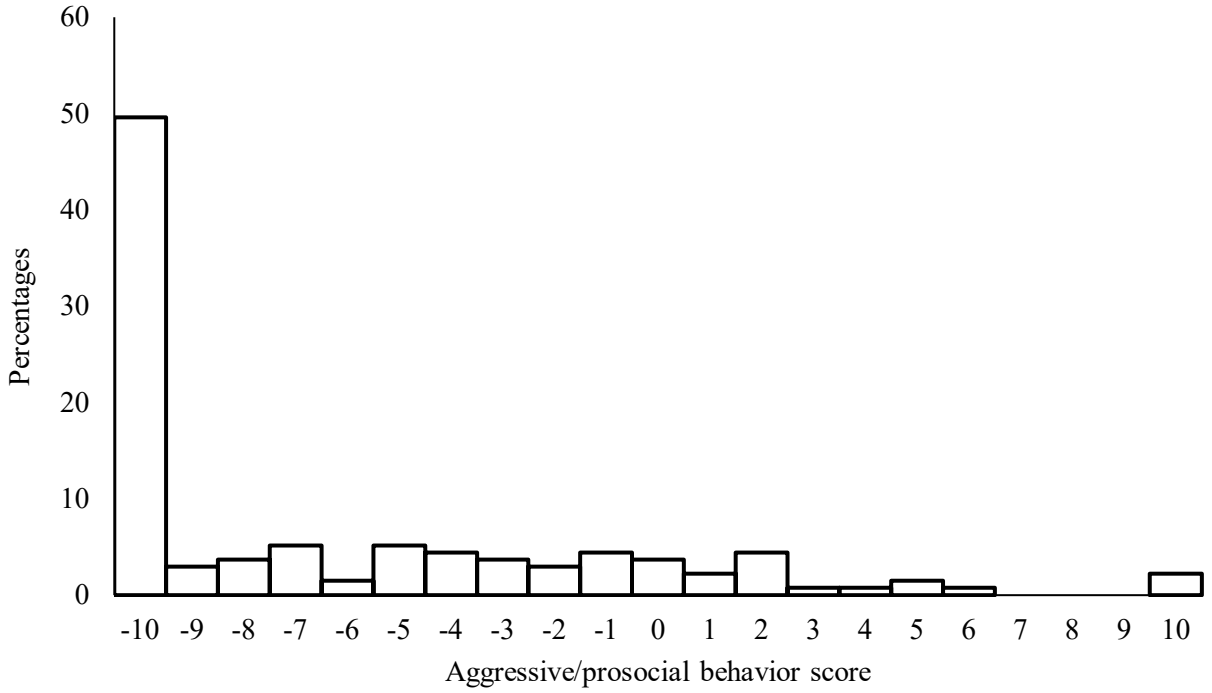

Figure 2. Histogram of aggressive/prosocial behavior scores for participants in the no competition condition (n = 135). This histogram collapses across both gameplay and difficultly conditions. A score of -10 means that the participant gave their partner all easy tangrams (prosocial behavior), whereas a score of 10 means that the subject gave their partner all hard tangrams (aggressive behavior).

expected number of participants in the competition group selecting hard tangrams than in the no competition group.

The second chi-square test of independence further verified the above result by testing for independence between competition assignment and whether the participant was generally prosocial (tangram score less than zero) or aggressive (tangram score greater than zero). Participants whose tangram score equaled zero were excluded. Results revealed that the two were not independent, χ^2 (1, N = 381) = 32.56, p < .001, Φ = .29, with participants in the no competition condition exhibiting a greater propensity for prosociality than those in the

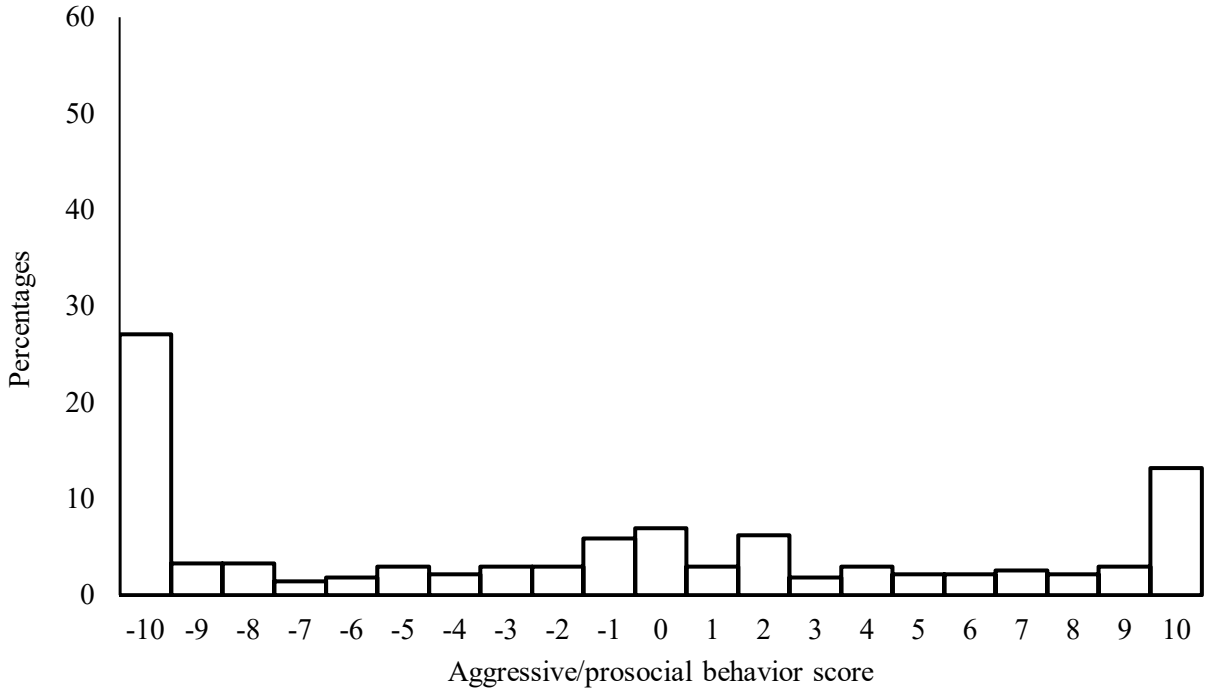

Figure 3. Histogram of aggressive/prosocial behavior scores for participants in the competition conditions (collapsed across the winning and losing conditions as those histograms are relatively identical; $n = 273$). This histogram collapses across both gameplay and difficultly conditions. A score of -10 means that the participant gave their partner all easy tangrams (prosocial behavior), whereas a score of 10 means that the subject gave their partner all hard tangrams (aggressive behavior).

competition condition and participants in the competition condition exhibiting a greater propensity for aggression than those in the no competition condition.

Exploratory Analyses

Reason for choosing the tangrams. After choosing the tangrams for their ostensible partner, participants were asked a series of questions to better understand their intentions behind their choices. As the only significant difference that emerged was competition versus no

competition, the competition factor was collapsed across outcome (i.e., winning and losing) resulting in a dichotomous competition-no competition variable.

Hotelling's T^2 was used to examine an overall difference between the five reasons for choosing the various tangrams (i.e., wanting to give a range of tangrams, help the other person, hurt the other person, make it difficult for the other person, or simply give the other person harder tangrams) and whether the participant was in a competition or no competition condition. Results revealed that there was a significant difference at the multivariate level, $T^2 = 55.76$, $F(5, 398) = 11.04$, $p < .001$, $D^2 = 0.62$, indicating a medium effect (Stevens, 2009). Thus, this test was followed up by the univariate *t*-tests.

Five independent-samples *t*-tests were conducted to examine differences between the five reasons for choosing tangrams based on whether the participant was in a competition group or the no competition group. See Table 4 for the results of the five tests. There was no difference in the participant wanting to give a range of tangrams as a function of whether the participant was in the competition ($M = 2.58$, $SD = 1.59$) or no competition ($M = 2.26$, $SD = 1.51$) groups. However, there were differences in participants wanting to hurt, make hard, or give difficult tangrams to their partner, with participants in the competition group agreeing more that they wanted to hurt, make hard, and give difficult tangrams to their partner than participants in the no competition group (see Table 4 for the specific means and standard deviations). Finally, there was also a difference for participants who wanted to help their partner, with those in the no competition group ($M = 4.14$, $SD = 1.28$) endorsing helping as the reason for giving the tangrams to a greater degree than those in the competition group ($M = 3.11$, $SD = 1.63$).

Identifying with character. Participants were asked to report the degree to which they felt they identified with the playable character. The specific conditions (i.e., gameplay,

Table 4

Differences between Competition and No Competition Groups based on Reasoning for Choosing Tangrams

	No competition		Competition				95 % CI		
Reason	*M*	*SD*	*M*	*SD*	*t*(403)	*p*	*LL*	*UL*	*d*
Hurt	1.23	0.64	2.12	1.47	-6.71	> .001	-1.15	-0.63	-0.71
Difficult	1.49	0.89	2.52	1.55	-7.15	> .001	-1.31	-0.75	-0.76
Hard	1.66	1.03	2.61	1.57	-6.30*	> .001	-1.24	-0.65	-0.67
Range	2.26	1.51	2.58	1.59	-1.95	.052	-0.65	0.002	-0.21
Help	4.14	1.28	3.11	1.63	6.44	> .001	0.72	1.35	0.68

Note. Reason refers to statements with which participants rated agreement; Hurt = "I wanted to hurt the other participants' chances of winning the money"; Difficult = "I wanted to make it difficult for the other participants to win the money"; Hard = "I wanted to give the other participant harder puzzles to complete"; Range = "I wanted to provide a range of tangrams"; Help = "I wanted to help the other participant win the money." Competition refers to both the winning and losing conditions collapsed together. All items were measured on a 5-point Likert-type scale, with one indicating *not at all* and five indicating *a lot*. CI = confidence interval; *LL* = lower limit; *UL* = upper limit; *d* = Cohen's *d*. *df = 402 due to one participant not responding to the item.

difficulty, and competition) did not have an effect on level of identification; however, level of identification was positively correlated with trait aggression, $r = .14$, $p = .004$, revealing that more aggressive participants identified with the character more than less aggressive participants.

Covariates. The three covariates (VMC, trait aggression, and trait competitiveness) were all significantly correlated. VMC and trait aggression, $r = .20$, $p < .001$, as well as trait aggression and trait competitiveness, $r = .33$, $p < .001$, were positively correlated. However, VMC and trait competitiveness were negatively correlated, $r = -.11$, $p = .03$, indicating that more competitive participants tended to consume less violent media than less competitive participants.

Finally, two regressions were run to investigate which of the covariates might predict the tangram choice. The first model contained trait aggression, trait competitiveness, and VMC, entered simultaneously, and the second model broke trait aggression into its four sub-scales. See Table 5 for the results from both analyses. In the first model, VMC was the only significant predictor, and in the second model both VMC and the physical aggression sub-scale were significant predictors.

Discussion

The majority of the research into the effects of playing violent video games on subsequent aggression has mainly focused on the violence in the games (e.g., Anderson et al., 2010; Ferguson, 2015), with evidence generally supporting the link between violent content and increased aggression. However, recent research has begun to show links between competitive video games and increased aggression (e.g., Adachi & Willoughby, 2013), as well as the outcome of that competition and aggression (e.g., Griffiths, Eastin, & Cicchirillo, 2016). The present study is the first to combine all of the above variables in order to test both their individual and interactive effects. Additionally, the present study also included a difficulty variable to investigate the independent and interactive effects of difficulty with violence, competition, and outcome on subsequent aggression.

Table 5

Predictors of Tangram Choice

	Model 1			Model 2		
		95% CI			95% CI	
Variable	β	LL	UL	β	LL	UL
Trait aggression	0.09	-0.16	1.85			
Physical aggression				0.12*	0.03	1.67
Verbal aggression				-0.04	-0.98	0.48
Anger				-0.05	-1.27	0.55
Hostility				0.10	-0.08	1.44
Trait competitiveness	-0.05	-1.25	0.43	-0.04	-1.19	0.49
Violent media consumption	-0.12*	-0.15	-0.01	-0.12*	-0.14	-0.01

Note. $N = 405$. CI = confidence interval; *LL* = lower limit; *UL* = upper limit. * $p < .05$.

In terms of hypothesized effects, which were all tested simultaneously, the present study only found evidence supporting only the assertion made by Adachi and Willoughby (2011a), that it is the competition and not the violence that appears to influence subsequent aggression. There were no significant effects of winning or losing in the competition, only whether or not the participants competed, with those competing exhibiting higher levels of behavioral aggression against an ostensible partner. Although the effect of violence in the game was not significant at

conventional levels of significance, it was trending toward significance; however, this is one of the strengths of the present design, in that it is able to deconstruct the individual effects and partial out variance to the factors most responsible for increased variability, thus, giving greater credence to the idea that competition has a larger effect on aggression than mere violence.

The rest of the hypothesized main effects were not significant. Similarly, there were no significant interactions between violence, competition, or difficulty. Simply put, the only factor that seemed to cause any changes in aggression was the presence or absence of competition, regardless of outcome and violence. This is interesting, as hundreds of studies and eight meta-analyses (Anderson, 2004; Anderson & Bushman, 2001; Anderson et al., 2010; Ferguson, 2007a, 2007b; Ferguson, 2015; Ferguson & Kilburn, 2009; Sherry, 2001) seem to be largely ignoring or overlooking the effects of competition.

The seemingly most parsimonious explanation of the present results would be that competition—which, as discussed previously, is inherent in many violent video games—had an important effect on subsequent aggression because of the antisocial nature of competition (Breuer, Scharkow, & Quandt, 2013). It should be noted that their use of "antisocial" is not necessarily the conventional use of antisocial; it is used as the opposite of prosocial. In other words, competition, particularly a zero-sum game, is inherently selfish. The competitors would have higher regard for themselves and lower regard for their opponents. Thus, this difference in regard would likely carryover to subsequent tasks. Therefore, the lack of regard for one's competitor could lead to higher levels of aggression directed at said competitor. Thus, competitive (antisocial) video gaming tends to lead to antisocial (or aggressive) outcomes, just as prosocial video gaming tends to lead to prosocial outcomes (e.g., Ewoldsen, Eno, Okdie, Velez, Guadagno, & DeCoster, 2012; Velez, Mahood, Ewoldsen, & Moyer-Guse, 2012). Therefore,

after carefully controlling for both violence and competition in video games, competition may more strongly contribute to subsequent aggression than the violence alone. Additionally, based on the results of the present study, it appears that whether a player win or loses (outcome of the competition), competition causes the player to behave more aggressively. This is generally in line with the broader literature on the effect of competition on aggression, with some researcher asserting that aggression developed as a response to competition (Nelson & Trainor, 2007).

Data regarding why participants chose certain tangrams adds further confidence to the assertion above. Participants in the competition conditions were significantly more likely to endorse statements asserting an intention to hurt, make it difficult for, or make it harder for their partner than participants in the no competition conditions, where as participants in the no competition condition were more likely to want to help their partner. Clearly, participants had more aggressive intentions when competing and more prosocial intentions when not competing. Additionally, the manipulation checks all supported the facts that the competitive situation felt more competitive than the non-competitive situation, the violent video game seemed more violent to participants than the non-violent video game, the harder version of the game seemed more challenging than the easier version, and participants were generally able to remember whether they had won or lost. Therefore, it would appear that all the manipulations worked as intended, and the Hilgard video game paradigm offered increased control across all conditions. Thus, it would be difficult to argue that something besides the competition could account for the results reported above.

Ultimately, this could be another indicator, among many others, that the current consensus on the cause of increased aggression after playing video games may not be solely due to the violence in video games. Based on the results of the present study, it would appear that

competition has an equal, if not greater, effect on subsequent aggression than violence. Obviously, more research, especially well controlled empirical studies, needs to be conducted to better understand the true effect of both violence and competition in video games on subsequent aggressive behavior, cognition, and affect.

Importantly, the tangram data did not have a normal distribution, with a substantial proportion of my sample giving only the most prosocial response possible. The non-normal distribution is a violation of the assumption of the ANCOVA, although ANCOVA has been found to be relatively robust to even extreme violations of that assumption assuming sufficient sample sizes (Schmider et al., 2010). After contacting the creators of the tangram paradigm, I was informed that the tangram data tend to be skewed to the prosocial side, but the distribution in the present study, as can be seen clearly in Figure 3, was not simply skewed but had a pronounced "U" shape. Although the data regarding the reason why participants chose certain tangrams seems to support the results of the ANCOVA despite the violated assumptions, this particular distribution has not been reported by any other studies using the tangram paradigm, which could indicate the presence of a confound that better explains the results of the study.

Culture of Honor

The most likely confound that could alternately explain the results of the present study, specifically the odd distribution of the tangram data, would be the culture of honor present in the sample. Previous research has shown that cultures of honor have a greater propensity to use violence and aggression in the face of perceived attacks on one's honor than other cultures (e.g., Nisbett, 1993; also see Nisbett & Cohen, 1996). Although Brigham Young University does have an honor code, which defines how students should act to maintain an honorable lifestyle, the culture of honor to which I am referring likely arises from the historical abuse and

marginalization of the Church of Jesus Christ of Latter-day Saints (i.e., the Mormon or LDS church), as cultures of honor are more likely to arise from sordid pasts (Nisbett, 1993). Leung and Cohen (2011) describe the honor "as a claim to precedence and to virtue, [which] has both an external and an internal quality" (p. 509). Therefore, it could be argued that the competition-against-another-person aspect of the manipulation could be perceived as a challenge to the participant's honor.

The culture of honor would also explain why violence, difficulty, and outcome had no effects. Violence, not directed at the participant by another person, would have no inherent challenge to one's honor. In other words, in the context of the game, the violence directed at the player, via the other computer-controlled opponents, would not inherently threaten the player's honor. Difficulty would also not directly challenge one's honor, as the challenge to one's honor would likely need to come from another person. Again, in the context of the game, the difficulty would not inherently challenge the player's honor, as there is a lack of a salient challenger. Finally, the outcome would likely matter less than the perceived challenge to the participant's honor. Winning or losing is not the threat to the person's honor; the introduction of the competition is. This would be the case for two reasons. One, the competition, by definition, would have to precede the outcome of said competition. Therefore, the threat to the player's honor would be the onset of the competition and not the outcome itself, as can be seen in the results of the present study. The participants who competed behaved more aggressively than the participants who did not compete, regardless of the outcome. Second, previous research indicates that when one feels their honor is threatened, one has a tendency, within a culture of honor, to respond with some kind of retribution (e.g., Somech & Elizur, 2009). The retribution is sought due to the threat, not the outcome of the threat. This would further explain why outcome

had no effect. It was initially hypothesized that losing would cause an increase in aggressive outcomes, as this pattern had been seen previously (e.g., Griffiths, Eastin, and Cicchirillo, 2016). However, in cultures of honor, the threat (competition) dictates the retribution, and not the outcome of the threat, possibly explaining the "U" shaped distribution of the data.

General description of cultures of honor depict them as extremely polite, when treated with respect, and extremely retaliatory when their honor is threatened (Harinck, Shafa, Ellemers, & Beersma, 2013). Unfortunately, a thorough search of the literature returned no studies on the link between competition and cultures of honor. Additionally, the vast majority of the culture of honor literature pertains to homicide rates and acts of violence as being caused by cultures of honor. Therefore, the assertion and speculations made above would be toned-down versions of the supporting literature. Again, the reason I feel this may be an alternative explanation of the results is the extreme change in the distributions of the tangram data between the competition and no competition conditions. Clearly, there is something about the competition condition that has a unique effect in this sample that has not been seen in other samples.

Isolating Competition

Another possible explanation of the strange shape of the data could be the highly controlled isolation of competition and gameplay (i.e., violent vs. non-violent). Most other studies have not had as much control over the gameplay and competition conditions. As stated above, the Hilgard paradigm gives significantly more control over the gameplay condition, and the competition manipulation, as indicated by pilot testing and manipulation checks, appeared to be relatively clear. Therefore, the significant difference seen in both the ANCOVA results and the differences between the competition and no-competition histograms could be due to the separation of the violence from the competition.

Although other studies have investigated the effects of violence and competition separately (see Adachi & Willoughby, 2011a; Schmierbach, 2010), this is the first time it has been done with the tangram procedure as the measure of aggression and with more control of the violent game conditions. It is possible that a clear distinction is made once one parses out variability due to the violence of the gameplay and the inclusion of competition or no competition, which appears to be what happened in the present study. Only in the competition and no-competition conditions do we see a major shift in aggressive response. Therefore, is could be argued that the competition aspect of the game has a stronger or more clearer effect on subsequent aggression than the violence.

Research Implications

The biggest takeaway for researchers from the present study is the need to take into account the competition inherent in violent video games when conducting research. Some studies have begun to do this (e.g., Adachi and Willoughby, 2011a), but far too few have given the effects of competition empirical scrutiny. As detailed above, many violent video games are inherently competitive, making competition a clear confound in most violent video game studies.

With lawmakers and parents using the accumulated body of video game research to make serious decision about video game consumption, especially by young people, it would seem imprudent to not attempt to fully investigate all aspects of video game phenomena, which would include the potential competitive aspects of both violent and non-violent games. As was seen in the present study, the effect of competition was found in subsequent aggression, regardless of violent content of the video game. Thus, although some may feel that the debate over the effects of consuming violent video games has been decided, I would argue that there are still areas of research, not yet adequately investigated, that could potentially change the view that the violence

in video games is the leading cause for increased levels of aggression and decreased levels of prosocial behavior.

Practical Implications

As stated above, lawmakers and parents are using video game research to make important decisions, but they may not have the full picture. Based on the present study, it would be more advisable for parents to limit the amount of competitive play their children partake of, rather than how violent the game is. For example, a parent may not even think twice about giving their child a competitive game, as long as it is not violent. However, in the present study there was no difference in aggression levels for the violent and nonviolent competitive conditions. They both resulted in higher levels of aggression than the violent and nonviolent noncompetitive conditions.

With the perceived increase in interpersonal violence (e.g., mass shooting), there has been increased scrutiny of the role video games play. No study to data has ever made the claim that violent video games lead to increases in violent crimes; however, most studies link violent video game to increases in aggression. However, based on the results of the present study, competition could be just as much at fault as the violence when it comes to increases in aggression. Currently, there are not ways of rating or quantifying how competitive video games are, only ratings that take into account violence. Therefore, if the results of the present study are replicable, it may be advisable to account of the competitive aspects of games when rating them for sale. Based on the results of the present study, competition or no competition would be an important factor parents should consider when purchase a game for their children, as the competition condition produced higher levels of aggression than the no competition condition (see Adachi and Willoughby, 2011a).

Limitations and Future Research

As alluded to above, the foremost limitation is the sample. Previous research has shown that a sample from BYU does not play the same amounts of violent games as other samples in published violent video game research (Hawk, 2014, 2016). Therefore, although I found some of the hypothesized effects, it may be difficult to generalize the results to heterogeneous populations. Additionally, there may have been an extraneous variable with the culture of the sample that could further call the results into question. Finally, although males usually have higher aggression levels in violent video game studies (e.g., Bartholow & Anderson, 2002) and females often exhibiting levels of overall aggression that vary in the same direction and in parallel with males in many studies (e.g., Archer, 2004), the sample was only comprised of males. Thus, as this sample is fairly different from other samples used in published research (i.e., levels of video game play, culture of honor, etc.) the results of the present study may not hold or replicate with more representative samples of the US.

A second limitation is use of the tangram puzzle task to measure aggressive/prosocial behavior. As was mentioned above, there is a tendency for the resulting data to be skewed toward the prosocial side, which could indicate that the measure is fairly insensitive or does a relatively poor job of measuring the aggressive said of the scale. However, the measure has been repeated tested and has been found to be comparable to other accepted measures of behavioral aggression (Saleem, Anderson, & Barlett, 2015). Additionally, there is no further distinction between the various easy, medium, and hard tangrams. Thus, there is no inherent difference between choosing the first of the easy tangrams and the past of the easy tangrams. Possibly, if the tangrams were given difficulty ratings, instead of difficulty categories, a clearer distinction could be made on the aggressive side of the scale.

A third limitation is the use of college-aged students. Although this kind of sample is common for violent video game studies, research has shown larger effects of violent content on aggressive outcomes in younger populations. Therefore, it is possibly that the effects of competition could also be more pronounced in younger players as well. Thus, it would be prudent for future research to investigate the effects of competition in violent and nonviolent video games on subsequent aggression.

A final limitation is that the competition aspect of the study is somewhat different from the common way competition works in most violent video games. While the participants were told they were competing against a partner, the competition was indirect. They were competing on the same task at the same time, with no indication of how the other was doing. A good analogy to explain this difference is that of competition in football versus the competition in track. While both are zero-sum games (i.e., the winner causes the other to lose), the football teams compete to directly overcome and impede the other team. The competition in track is only to see who can complete the task faster or better, with each individual or team on their own, unimpeded by others. Therefore, it is possible that this difference could call into question the generalizability of the results. Nevertheless, to the extent that indirect competition represents a weaker manipulation of the construct than direct competition, it could be argued that the present study provided a stronger test of the hypothesis, as a significant finding would be harder to obtain. Therefore, there is reason to believe that the effect of competition on aggression could be even stronger when players directly compete with each other.

Clearly, future research still needs to parse out the different effects of violence, competition, and outcome in video games on subsequent aggression. The preponderance of evidence for the assertion that it is solely the violence in the video games is only beginning to be

called into question, and more research still needs to be conducted in order to better understand the roles of violence and competition on aggression.

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Appendix A

Demographics

Please answer the following questions.

What is your sex?

Male, Female

What is your current age? (in years)

With which gender do you primarily identify?

Man, Woman, Transgender, Other _____

With which sexual orientation do you primarily identify?

Heterosexual, Homosexual, Bisexual, Asexual, Other _____

What is your current marital status?

Never married, Married, Divorced, Separated, Widowed, Other _____

What is your current class standing?

Freshman, Sophomore, Junior, Senior, Grad Student, Other _____

With which religious affiliation do you primarily identify?

Christianity, Judaism, Islam, Hinduism, Buddhism, Agnostic/Atheist, Spiritual but not religious, Other _____

With which race do you primarily identify?

Caucasian/White, African American/Black, Hispanic/Latino, Asian, Middle Eastern and North African, Pacific Islander, American Indian or Alaskan Native, Other _____

Video Game Exposure

Please enter the names of your three (3) favorite video games. If you have less than three, leave those boxes blank.

1. _____
2. _____
3. _____

How frequently do you play [game 1]? (1 = Almost never – 5 = Almost every day)

How educational is [game 1]? (1 = Not educational at all – 4 = Very educational)

How violent is [game 1]? (1 = Not violent at all – 4 = Very violent)

How sexual is [game 1]? (1 = Not sexual at all – 4 = Very sexual)

How frequently do you play [game 2]? (1 = Almost never – 5 = Almost every day)

How educational is [game 2]? (1 = Not educational at all – 4 = Very educational)

How violent is [game 2]? (1 = Not violent at all – 4 = Very violent)

How sexual is [game 2]? (1 = Not sexual at all – 4 = Very sexual)

How frequently do you play [game 3]? (1 = Almost never – 5 = Almost every day)

How educational is [game 3]? (1 = Not educational at all – 4 = Very educational)

How violent is [game 3]? (1 = Not violent at all – 4 = Very violent)

How sexual is [game 3]? (1 = Not sexual at all – 4 = Very sexual)

Trait Aggression and Competitiveness

Please rate each of the following items in terms of how characteristic they are of you. [Randomized for each participant]

(1 = Completely false for me; 2 = Mostly false for me; 3 = Slightly false for me; 4 = slightly true for me; 5 = Mostly true for me; 6 = Completely true for me)

{Buss-Perry Aggression Questionnaire}

There are people who have pushed me so far that we have come to blows.

Given enough provocation, I may hit a person.

I have threatened people I know.

I often find myself disagreeing with people.

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

My friends say I'm somewhat argumentative.

I have trouble controlling my temper.

Sometimes I fly off the handle for no good reason.

I flare up quickly but get over it quickly.

At times, I feel I have gotten a raw deal out of life.

Other people always seem to get the breaks.

I wonder why sometimes I feel so bitter about things.

{Competitiveness Scale}

I am disappointed when others perform better than me in competitive tasks.

I am envious or jealous when my competitors receive awards for their performance.

I have low tolerance for performing inadequately.

I strive to outperform others, even those I am working with.

I care a lot about winning.

I compete to know where I stand amongst those completing or working on similar tasks.

Whenever I can, I strive to be the best.

I like to be viewed as a winner by my peers.

Sometimes I view contests as an opportunity for me to show that I'm better than others.

I hate losing.

{Modified Rosenberg Self-Esteem Scale}

On the whole, I am satisfied with myself.

I take a positive attitude toward myself.

I can handle the "ups" and "downs" in life quite well.

In my relationships to others, I act self-confidently.

I think that nobody really understands me.

I have the impression that teachers and classmates treat me like an outsider.

I have the impression that behind my back teachers and classmates talk dismissively about me.

I have the impression that many schoolmates tend to avoid contact with me.

I certainly feel useless at times.

Oftentimes, I feel unhappy.

{Self-Monitoring Scale}

I find it hard to imitate the behavior of other people.

My behavior is usually an expression of my true inner feelings, attitudes, and beliefs.

At parties and social gatherings, I do not attempt to do or say things that others will like.

I can only argue for ideas which I already believe.

I can make impromptu speeches even on topics about which I have almost no information.

I guess I put on a show to impress or entertain people.

When I am uncertain how to act in a social situation, I look to the behavior of others for cues.

I would probably make a good actor.

I rarely need the advice of my friends to choose movies, books, or music.

I sometimes appear to others to be experiencing deeper emotions than I actually am.

I laugh more when I watch a comedy with others than when alone.

In a group of people, I am rarely the center of attention.

In different situations and with different people, I often act like very different persons.

I am not particularly good at making other people like me.

Even if I am not enjoying myself, I often pretend to be having a good time.

I'm not always the person I appear to be.

I would not change my opinions (or the way I do things) in order to please someone else or win their favor.

I have considered being an entertainer.

In order to get along and be liked, I tend to be what people expect me to be rather than anything else.

I have never been good at games like charades or improvisational acting.

I have trouble changing my behavior to suit different people and different situations.

At a party, I let others keep the jokes and stories going.

I feel a bit awkward in company and do not show up quite so well as I should.

I can look anyone in the eye and tell a lie with a straight face (if for a right end).

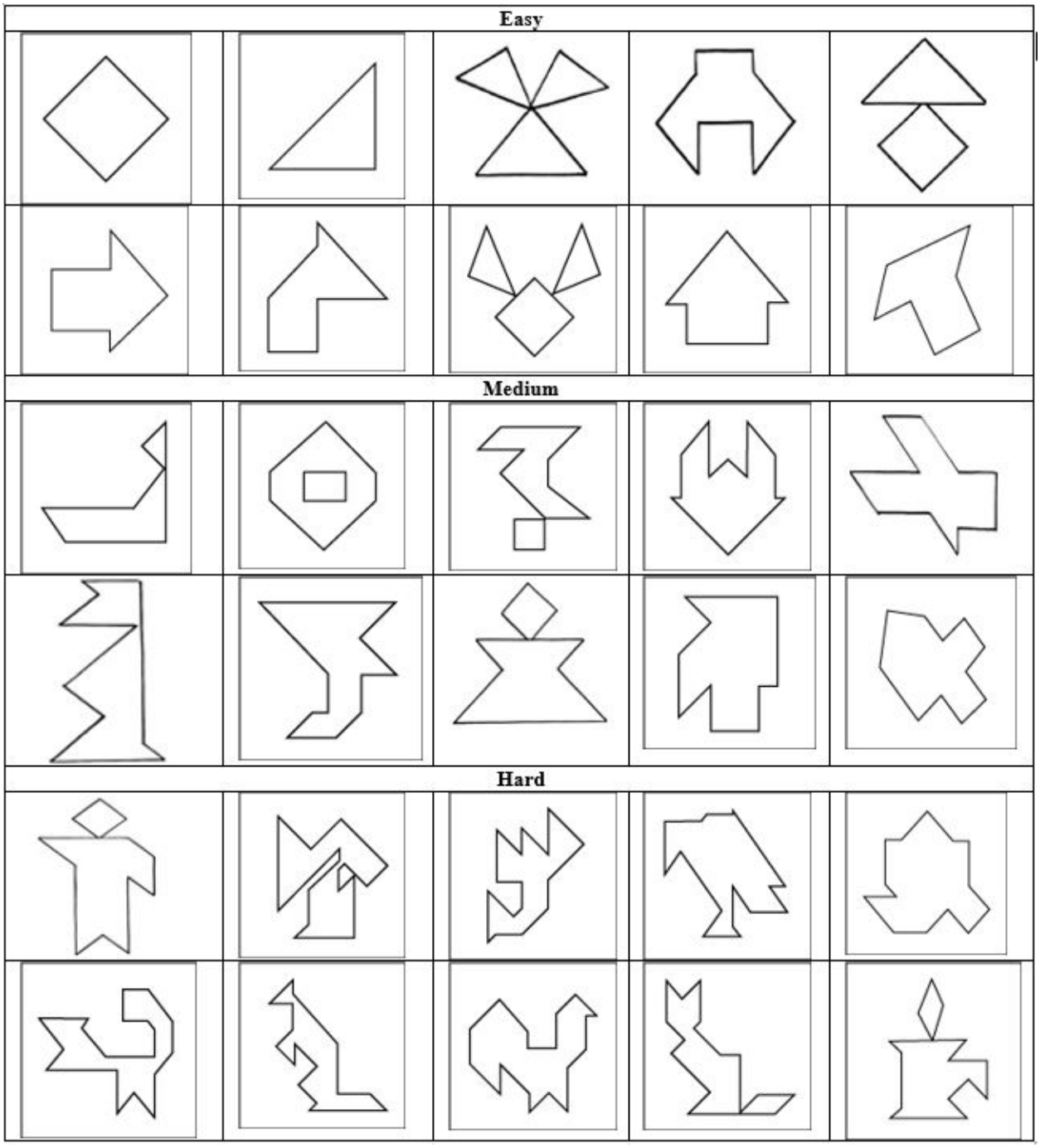
I may deceive people by being friendly when I really dislike them.

{Attention checks}

I often smell things are not actually there.

I think people are inserting thoughts into my mind.

Appendix B



Appendix C

Manipulation Checks

We are getting the tangrams ready for you. Please complete the following questions or items while you wait.

{Motivation questions for Tangram Task}

Please rate the extent to which each of the following reasons influenced your decisions on which tangrams to choose for the other person to solve.

(1 = Not at all; 2 = A little bit; 3 = Somewhat; 4 = Quite a lot; 5 = A lot)

I wanted to provide a range of tangrams.

I wanted to help the other participant win the money.

I wanted to make it difficult for the other participants to win the money.

I wanted to hurt the other participants' chances of winning the money.

I wanted to give the other participant harder puzzles to complete.

How violent was the game you played? (1 = Not violent at all – 6 = Very violent)

How challenging was the game you played? (1 = Not challenging and all – 6 = Very challenging)

[If in competition conditions] Did you win or lose? (Won, Lost, Unsure)

I can identify with the game character I played as. (0 = not at all – 7 = completely)