

The Relation between Video Game Violence and Aggression

by

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Abstract

Experimental research has shown that playing violent video games produces higher levels of aggressive cognition, aggressive affect, physiological arousal, and aggressive behavior (in the short-term) than non-violent video games (see Anderson, Gentile & Buckley, 2007). However, there are two major limitations with these studies. First, the majority of experimental studies that have compared the effects of violent versus non-violent video games on aggression have failed to equate these games in terms of competitiveness, difficulty, and pace of action. Thus, although the common finding is that violent video games produce higher levels of aggression than non-violent video games, other unmatched factors beyond the actual violent content may be responsible for the elevated levels of aggression. Second, previous experimental studies have tended to use a measure of aggression that may also measure competitiveness, leading to questions about whether violent video games are related to aggression or competitiveness. The present thesis addressed these two issues by first equating a violent and non-violent video game on competitiveness, difficulty and pace of action in Experiment 1, and then comparing the effect of each game on aggressive behavior using an unambiguous measure of aggressive behavior (i.e., the Hot Sauce Paradigm). We found that video game violence was not sufficient to elevate aggressive behavior compared to a non-violent video game. Practical implications and directions for future research are discussed.

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Chapter 1

The Effect of Violent Video Games on Aggression: Is it more than Just the Violence?¹

The horrific shooting sprees by frequent violent video game players at Columbine High School in 1999 and Virginia Tech in 2007, as well as the “Beltway” sniper shootings in 2002 led to increased public scrutiny of the effects of violent video game play. Of course, such accounts are not scientifically grounded and thus cannot provide adequate support for public policy decisions nor links between violent video game play and relevant scientific theories of aggression (Anderson, 2004). Nevertheless, in the past two decades, several correlational studies involving adolescents and young adults have found a small but significant relation between playing violent video games and aggression (see Anderson & Bushman, 2001; Dill & Dill, 1998), with aggression defined as behavior that is intended to harm another individual (Coie & Dodge, 1998). In addition, experimental research examining short-term effects has shown that playing violent video games produces higher levels of aggressive behavior (in the short-term), aggressive cognition, aggressive affect and physiological arousal than non-violent video games (see Anderson, Gentile & Buckley, 2007).

The effect of violent video games on aggression is a relevant issue as video games have become very popular. For example, a nationally representative study of video game play among adolescents in the United States showed that 97% of adolescents aged 12 to 17 years play computer, web, portable or console video games (Lenhart et al., 2008). In terms of frequency, 31% of adolescents play video games every day and another 21% play games three to five days a week. Yet, what may be most concerning is that almost half of the adolescent population plays

¹ This review has been accepted pending revisions in *Aggression and Violent Behavior*

violent video games. In addition, five of the ten most frequently played games are violent. Thus, research is needed to examine the effects of violent video games on aggression.

In spite of the increasing experimental research examining the effects of violent video games on aggression, there are two major limitations with these studies. First, the majority of experimental studies that have compared the effects of violent versus non-violent video games on aggression have failed to equate these games in terms of competitiveness, difficulty, and pace of action. Although the common finding is that violent video games produce higher levels of aggression than non-violent video games, it may be that violent video games are also more competitive, difficult and contain more fast-paced action than non-violent games. Consequently, it is unclear whether the violent content alone is responsible for elevated levels of aggression. Second, previous experimental studies have tended to use a measure of aggression that may also measure competitiveness, leading to questions about whether violent video games are related to aggression or competitiveness. This review elaborates on both of these limitations and starts by outlining a model for how video games might affect aggression.

The General Aggression Model

Anderson and Bushman (2002) developed the General Aggression Model (GAM) in part to account for the effects of violent video games on aggression (see Figure 1; also Anderson & Bushman, 2002; Anderson & Carnagey, 2004 for a detailed description of the model). The model depicts a cyclical relationship between an individual and the environment, in which person variables such as trait hostility, mood, and attitudes toward aggression, as well as situation variables such as exposure to real-world or media violence (e.g., violent video games), interact to influence an individual's present internal state, specifically cognition (aggressive scripts or hostile thoughts), affect (anger and frustration) and arousal (elevated heart rate or

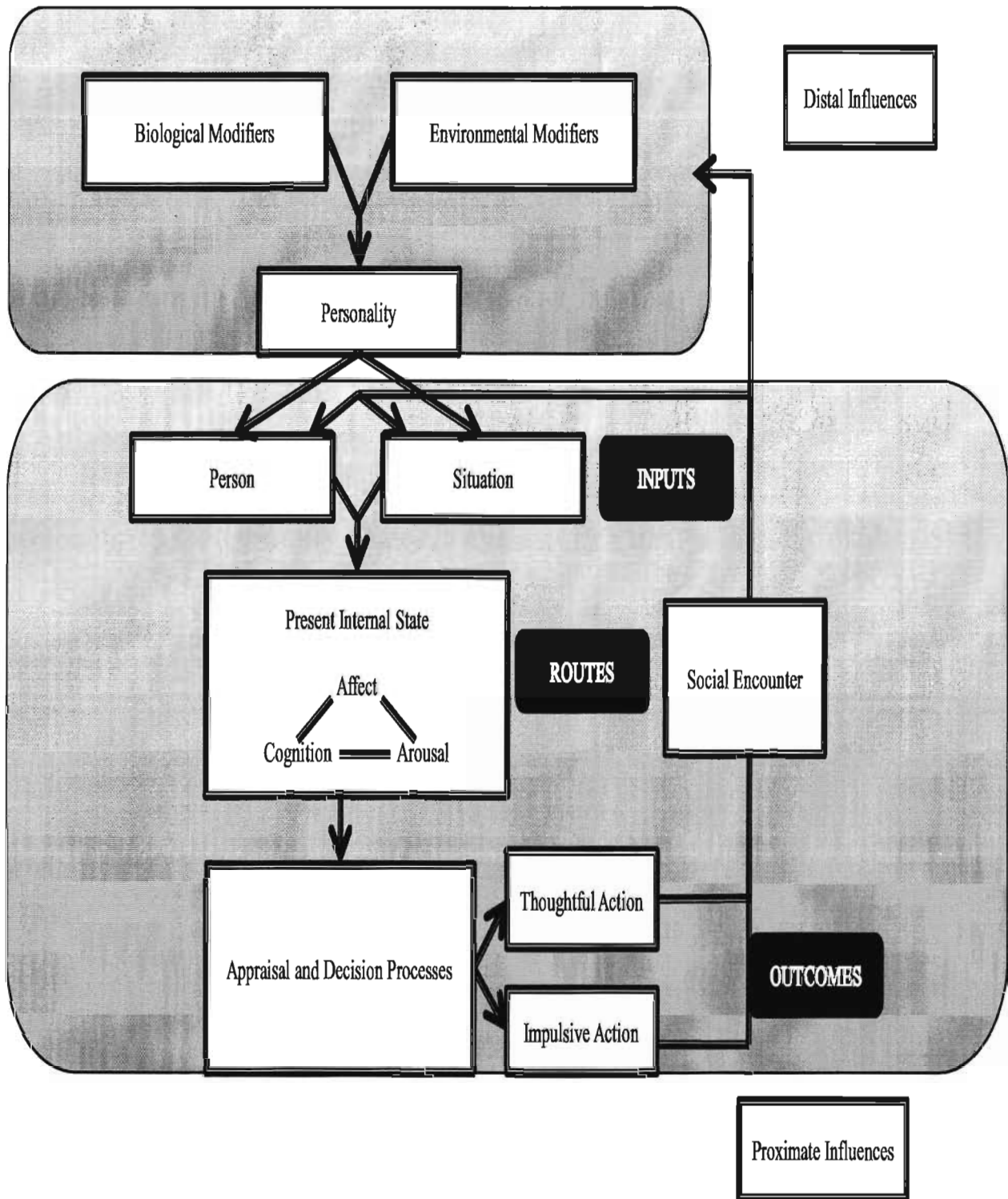


Figure 1. An Overall View of the General Aggression Model. From Anderson & Carnagey (2004).

blood pressure). Cognition, affect, and arousal are the hypothesized mechanisms that interact to influence an individual's appraisal of an aggressive (or ambiguous) act, leading to either thoughtful or impulsive action. For example, if someone bumps into another individual, that individual's internal state will influence whether he or she interprets the person as having hostile intent, or perceives the bump as being accidental. When people's thoughts and feelings are angry or hostile and they are physiologically aroused (e.g., after exposure to a violent video game), they will be more likely to interpret the person as having hostile intent. In contrast, if their affect is positive or they are thinking about how crowded the room is, they will be more likely to believe the bump was accidental. Once an appraisal has been made, decision making processes occur (outcomes). Depending on the individual's internal state and the availability of sufficient cognitive resources, a decision will be made either thoughtfully or impulsively. If he or she interpreted the person as bumping into him or her with hostile intent, he or she may be more likely to aggress than to ignore the bump, especially if this decision was made impulsively (social encounter).

According to Anderson and Bushman (2002), violent video games influence aggression through short-term and long-term effects. In the short-term, violent video games function as a situation variable that can increase aggressive cognition, affect, and arousal, in turn leading to increased aggressive behavior. In the long-term, violent video games can influence aggressive behavior by promoting aggressive beliefs and attitudes, and creating aggressive schema, aggressive behavioral scripts and aggressive expectations; which, in turn, may bias an individual's personality toward aggression. In other words, each violent video game episode may reinforce the notion that aggression is an effective and appropriate way to deal with conflict and anger (Bushman & Anderson, 2002).

Empirical Background

The Influence of Violent versus Non-Violent Video Games on Aggression

Experimental studies examining the short-term effect of violent video games on aggression have typically involved randomly assigning participants to play either a violent or non-violent video game, followed by a measure of aggression (e.g., Bushman & Anderson, 2002; Anderson & Carnagey, 2009). Participants in the violent video game condition have shown more aggression than participants in the non-violent condition for both males and females in a majority of studies (e.g., Anderson et al., 2007 but see Ferguson et al., 2008). For example, Anderson and Dill (2000) conducted an experiment in which they examined the effects of violent video game play on aggressive thoughts and behavior. Participants from an undergraduate sample were randomly assigned to play either a violent or non-violent video game in two laboratory sessions. In the first session, participants completed a measure of aggressive thoughts immediately after playing the video game. The measure was a reading reaction time task in which aggressive words, such as “murder,” were paired with three types of control words (i.e., anxiety, escape, and control). The results indicated that only participants who played the violent video game reacted faster to the aggressive words than the control words. Thus, Anderson and Dill concluded that the violent video game primed aggressive thoughts. Furthermore, consistent with the GAM, priming aggressive knowledge structures is one potential path through which playing violent video games might increase aggressive behavior.

In the second laboratory session, aggressive behavior was measured immediately after playing the video game using a modified version of the Taylor Competitive Reaction Time Test (TCRTT), in which the participant’s goal was to push a button faster than his or her opponent over a number of trials. If the participants lost a trial, they received a noise blast which they

believed was set by their opponent, and if the participants won, they set the level of noise blast to be administered to their opponent. Aggressive behavior was operationally defined as the intensity and duration of noise blasts that the participants chose to deliver to their opponent. The results showed that participants who played the violent video game delivered significantly longer noise blasts (after “loss” trials) than participants who played the non-violent video game.

Similarly, playing violent video games led to increased aggression in an experiment that used a repeated measures design. Barlett, Harris and Baldassarro (2007) took baseline measures of undergraduate participants’ physiological arousal, state hostility, and aggression and then exposed them to a violent video game for 15 minutes. Aggression was measured using story stems in which participants took the point of view of the main character and were asked how they would retaliate after a blatant negative action. After playing the game, physiological arousal, state hostility, and aggression were once again recorded and significant increases from baseline were found in all three measures. Thus, it was concluded that consistent with the GAM, physiological arousal, state hostility and aggression were higher than baseline after playing a violent video game for only 15 minutes. However, since a non-violent video game was not used in this study, it is unclear whether a non-violent video game would have also produced elevated levels of physiological arousal, state hostility and aggression, similar to the violent video game.

Field studies have also supported the relation between violent video games and aggression (see Anderson et al., 2007). For example, Gentile, Lynch, Linder and Walsh (2004) conducted a correlational study with 8th- and 9th-grade students (M age = 14 years) and found that adolescents who played more violent video games reported being more hostile, getting into arguments with teachers more frequently, and being involved in more physical fights than adolescents who played less violent video games. Consistent with the GAM, it was found that

hostility partially mediated the relation between violent video game play and involvement in physical fights, and fully mediated the relation between violent video game play and reported arguments with teachers. In addition, Fling et al. (1992) found that video game play was correlated with both teachers' rating of aggression and self-reported aggression among a sample of sixth through twelfth grade students. Such correlational findings suggest that the short-term effect of violent video game play on aggression found in experimental studies may generalize to the real world. However, due to the correlational design of such studies, it is unclear whether the results indicate that children who played more violent video games then became more aggressive or children who were more aggressive played more violent video games.

Although several studies have found a short-term effect on aggression from violent video game play, only one study has examined the length of these short-term effects (Barlett et al., 2009). In the first of two experiments, the length of short-term violent video game effects on physiological arousal, aggressive thoughts, and hostility was examined using an undergraduate sample. Physiological arousal was measured using heart rate, hostility was measured with a state hostility questionnaire, and aggressive thoughts were measured using a word completion task. Arousal, hostility and cognition were measured immediately after playing the video game, and then again after either a 4-minute or a 9-minute delay.

Participants were told they were in two unrelated studies looking at video game play and food preference. Upon entering the lab, they had their heart rate measured three times to assess baseline heart rate and then completed the state hostility scale and a word completion task. They were then randomly assigned to play either a violent or nonviolent video game for 15 minutes. Immediately after playing the video game, participants again had their heart rate

measured and were given the hostility questionnaire and a different word completion task. They then completed a Hot Sauce Paradigm, designed to measure aggression.

In the Hot Sauce Paradigm, the participant was given an already completed food preference questionnaire and told that another participant down the hall had completed this questionnaire and as indicated by the questionnaire, did not like spicy food. The participant was then brought to a table that had hot sauce, popsicle sticks, cups and a spoon and was informed that his or her job was to mix up some hot sauce for the other participant to drink. The amount of hot sauce in the cup and the degree of hotness was indicative of overt aggressive behavior.

After the participant completed the hot sauce task, the researcher explained that he would be back momentarily. For those assigned to the 4-minute condition, the experimenter left the room, placed the cup of sauce in the hall and then returned immediately, as at this point four minutes had elapsed since the end of the video game. For participants in the 9-minute condition, the experimenter left the room with the cup of sauce and returned without the cup exactly five minutes later, which was nine minutes after the end of the video game. When the experimenter returned, all participants completed a packet of questionnaires including the hostility scale and a new word completion task. Their heart rate was also measured, and participants were told that if they saw the same questionnaires as before, it was because the two studies (video game play and food preference) were looking at similar variables.

Change scores were computed between time 2 (immediately after video game play) and baseline measures of physiological arousal, hostility and aggressive thoughts, and the results showed that these three variables increased more after playing the violent video game than after playing the non-violent video game. Participants who played the violent video game also prepared more of a hotter sauce than those who played the non-violent video game. In terms of

the length of short-term effects, no matter what the delay, by the time the hot sauce paradigm was completed, participants' levels of aggressive thoughts and hostility returned to baseline. Thus, the short-term effect of violent video games on aggressive thoughts and feelings lasted less than 4 minutes. However, there was a significant delay by content interaction for physiological arousal, and further analysis showed higher than baseline average heart rate at the 4 minute delay, and slightly lower than baseline average heart rate at the 9 minute delay. Therefore, the effect on arousal lasted more than 4 minutes but less than 9 minutes.

The second experiment looked specifically at the length of short-term violent video game effects on overt aggressive behavior. The procedure was similar to the first study, except that participants completed the Hot Sauce Paradigm 0, 5, or 10 minutes after violent video game play and aggressive thoughts, feelings and physiological arousal were not measured. A non-violent condition was not included in this study. The results showed that participants in the 0-minute and 5-minute conditions had significantly higher aggressive behavior scores than those in the 10-minute condition. Also, there was no significant difference between the 0- and 5-minute conditions. Thus, the effect of playing a violent video game on aggression lasted between 5 and 10 minutes.

The research findings presented in this literature review appear to offer a clear picture of the short-term relation between violent video games and aggression; however, there are two limitations that have yet to be concurrently addressed in a single study. The first limitation is that dimensions related to aggression other than violence, such as competitiveness, difficulty, and pace of action have not been equated between violent and non-violent video games in the majority of experimental studies examining the effects of violent video games on aggression. The second limitation is that the majority of experimental studies examining the effects of

violent video games on aggression have used an ambiguous measure of aggression that has been used inconsistently across studies. Each of these limitations will be reviewed in turn.

Differences Other than Violence between Violent and Non-Violent Video Games

The first limitation is that in the majority of studies examining the effects of violent video games on aggressive behavior, researchers have not attempted to equate the violent and non-violent games on other dimensions that may be related to aggression, such as competitiveness. For example, violent video games in general tend to be more competitive than non-violent video games (Carnagey & Anderson, 2005). Consequently, studies that have found that violent video games produced more aggression than non-violent video games, but failed to equate the games on competitiveness, cannot conclude that the violent content alone was responsible for the elevated levels of aggression.

Anderson and colleagues also have recognized this issue and have made significant attempts to equate the violent and non-violent games on many dimensions such as physiological arousal, excitement, difficulty, and frustration level (Anderson & Dill, 2000; Anderson et al., 2004; Anderson & Carnagey, 2009). However, recall that according to GAM, video game violence may influence aggressive behavior by elevating physiological arousal, aggressive cognition, and aggressive affect. Thus, some of the video game dimensions that Anderson and colleagues have attempted to match are not actually characteristics of the video games themselves, but instead are variables related to one's internal state. These internal states, according to the GAM, are hypothesized, to be *outcomes* or *consequences* of playing violent video games. For instance, consistent with the GAM, the violent content in a violent video game may produce elevated levels of physiological arousal compared to a non-violent video game, which in turn can influence aggressive behavior. Controlling for physiological arousal level,

therefore, may not make the relation between video game violence and aggression any clearer; instead, it may weaken the relation between the two variables as physiological arousal is a mechanism through which video game violence is thought to impact aggression. In other words, variables related to one's internal state (i.e., physiological arousal, aggressive cognition, and aggressive affect) should not be controlled as they are mechanisms through which video games may influence aggression.

In order to address the issue of whether the violence alone in violent video games produces more aggressive behavior than non-violent video games, it is important to differentiate between 1) characteristics of the video game and 2) internal state variables. We propose that violence, competitiveness, difficulty, and pace of action are four main video game characteristics that may influence aggressive behavior through the mechanisms of internal state variables such as physiological arousal, aggressive cognition, and aggressive affect (see Figure 2).

Competitiveness may influence aggressive cognitions by activating associative links between aggression and competition developed through a variety of past experiences with competitive situations that have resulted in aggressive outcomes (Anderson & Carnagey, 2009; Anderson & Morrow, 1995). Competitiveness may also influence physiological arousal and aggressive affect, such as frustration or hostility. Difficulty may influence physiological arousal, frustration and hostility. For example, games that are more difficult tend to produce more frustration (Anderson and Carnagey, 2009). In addition, pace of action may be linked to physiological arousal, with faster games leading to elevated levels of physiological arousal. To date, no study has equated a violent and non-violent video game on competitiveness, difficulty, and pace of action. Thus, it is unclear whether it is the violence in violent video games that has produced

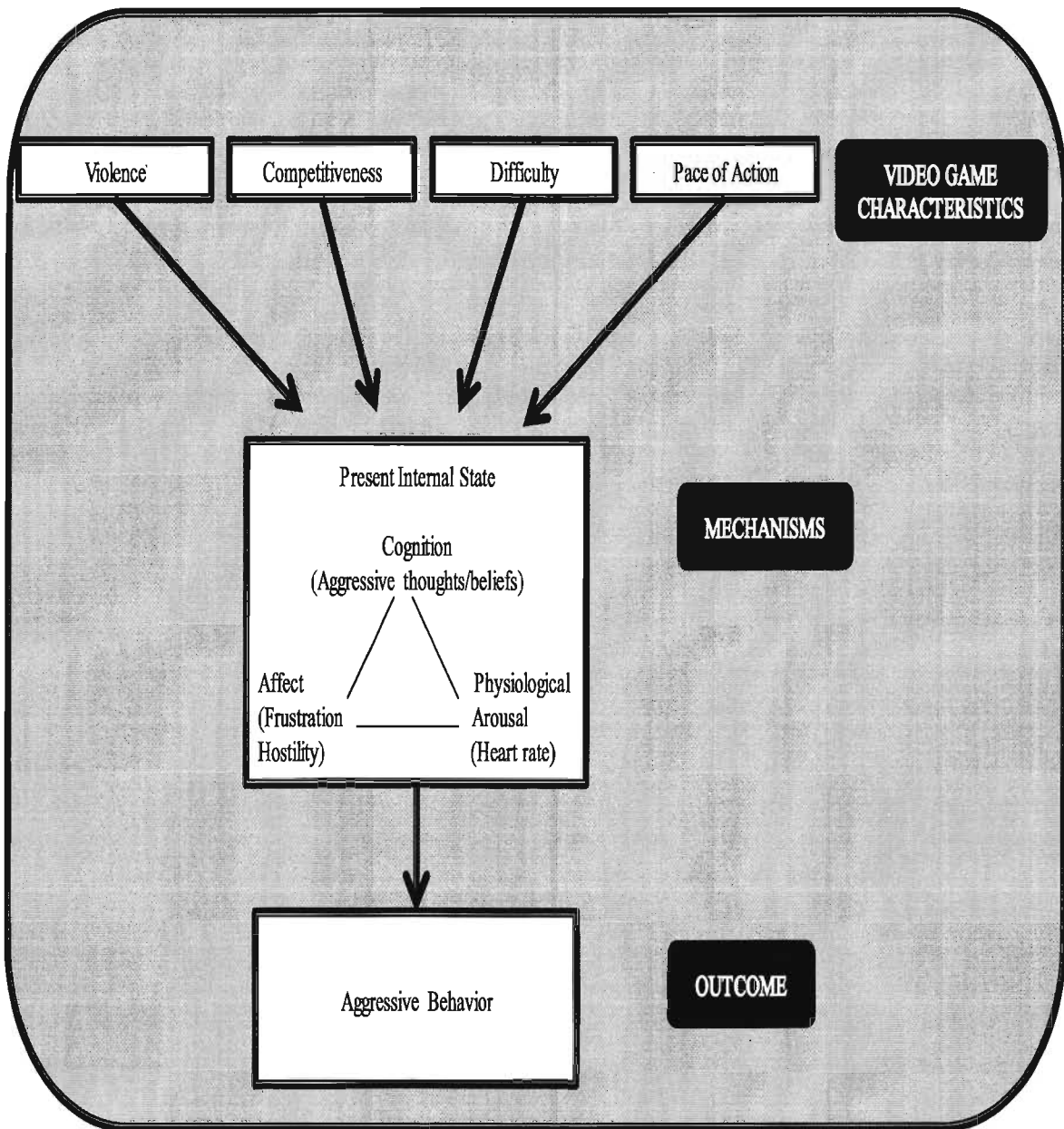


Figure 2. A model of how video game characteristics might influence aggressive behavior in the short-term.

elevated levels of aggression compared to non-violent video games, or whether it is these other game characteristics that may have been responsible.

Only in a few studies have researchers attempted to match the violent and non-violent video games on confounding dimensions. For example, in order to choose video games for their main experiment which was previously described, Anderson and Dill (2000) conducted a pilot study in which they attempted to match a violent and non-violent video game on other dimensions beyond violence that may be relevant to aggressive behavior. The dimensions included blood pressure, heart rate, frustration, difficulty, action pace, enjoyment, and excitement. The best pairing was between the violent video game *Wolfenstein 3D* and the non-violent video game *Myst*, which matched on all of the dimensions except for excitement, with *Wolfenstein 3D* rating higher. Although both difficulty and action pace were matched, Anderson and Dill failed to equate the games on competitiveness. The violent video game *Wolfenstein 3D* is a first-person shooter game that involves shooting and stabbing Nazi soldiers in order to escape from a Nazi prison. The main character must compete with each opponent character in a battle for survival in order to complete the game. However, in the non-violent video game *Myst* the main character does not compete with any other characters in the game, and instead must solve a series of puzzles in order to advance through the levels. Therefore, participants who played *Wolfenstein 3D* may have felt more competitive than participants who played *Myst* and thus, behaved more aggressively. Furthermore, the modified TCRTT which was used to measure aggressive behavior may actually measure competitiveness, which further explains why participants who played *Wolfenstein 3D* administered more intense punishments than those who played *Myst*. This problem with the modified TCRTT will be discussed further in the next section.

Anderson et al. (2004) matched a violent and non-violent video game on physiological arousal (heart rate), enjoyment, action, difficulty and frustration, but failed to equate the games on competitiveness and pace of action. Similar to Anderson and Dill (2000), the violent video game, *Marathon 2*, and the non-violent video game, *Glider Pro*, were quite different in terms of competitiveness. *Marathon 2*, like *Wolfenstein 3D*, is a first-person shooter in which the main character has to compete in battle against many alien creatures in order to complete the levels and succeed in the game. On the contrary, in *Glider Pro*, the player attempts to navigate a paper airplane through a series of obstacles throughout a house with the aid of air currents from floor or ceiling ventilation ducts. Hence, *Marathon 2* involves more competition than *Glider Pro*. Also, the pace of action may have been higher for *Marathon 2*; however, the fact that physiological arousal level was equated between both games makes it unlikely that pace of action influenced aggressive behavior. Consequently, although Anderson et al. found that participants who played *Marathon 2* delivered significantly more intense punishments in a modified version of the TCRTT than those who played *Glider Pro*, it is unclear whether this result was due to the violent content alone, or whether the competitiveness of *Marathon 2* influenced aggressive behavior.

Anderson and Carnagey (2009) was the first study to equate a violent and non-violent video game on competitiveness. Anderson and Carnagey used four sports video games, which included two baseball games and two football games. Of the two baseball games, one was rated as more violent than the other, and one of the football games was rated as more violent than the other football game. The two violent sports video games included unnecessary violence, such as the ability to make a base-runner punch a baseman so that he drops the ball. In contrast, the two non-violent sports games attempted to authentically represent the sport by replicating the actual

rules. Although the games differed in terms of violence, the violent sports video games did not differ from the non-violent games in ratings of competitiveness. The violent sports video games, however, were rated as more difficult than the non-violent games. Consistent with the notion that game difficulty may influence frustration, the violent sports video games were also rated as more frustrating than the non-violent games. Furthermore, pace of action was also rated as higher for the violent games compared to the non-violent games. However, physiological arousal level did not differ between the violent and non-violent games, suggesting that the pace of action may not have had a large enough influence on physiological arousal to produce elevated levels after playing the violent games compared to the non-violent games.

In an attempt to control for the effect of difficulty and pace of action, Anderson and Carnagey included difficulty and pace of action (along with several other video game ratings) as covariates in the model. However, since the violent and non-violent video game differed on ratings of difficulty and pace of action, these variables should not have been used as covariates in an attempt to equate the two games. According to Miller and Chapman (2001), it is invalid to use analysis of covariance for preexisting groups (e.g. violent versus non-violent video game conditions) that do not vary randomly and that differ on the variables which are to be included as the covariates. For example, when the covariate is affected by the treatment (or in our case, the condition), removing the covariate may also remove part of the treatment effect or produce a spurious treatment effect, and thus the grouping variable will be altered in a way that often cannot be specified in a conceptually meaningful way (Miller and Chapman, 2001). Therefore, since difficulty and pace of action were rated higher for the violent video game compared to the non-violent video game, the two games cannot be equated by including difficulty and pace of action as covariates. Instead, a better option would have been to test for an interaction between

difficulty and video game condition, and between pace of action and video game condition, to determine whether difficulty and pace of action predicted aggressive behavior for participants who played the violent video game but not for participants who played the non-violent video game. According to Miller and Chapman, however, the only way to really examine whether the violent content would have produced elevated levels of aggressive behavior compared to the non-violent game would be to match the difficulty and pace of action between the games prior to the experiment. Consequently, although Anderson and Carnagey controlled for competitiveness and still found that the violent sports video games produced more aggressive behavior than the non-violent games in the modified TCRTT, it is unclear whether the violent content alone was responsible for the result. In order to examine whether the violence alone in violent video games produces elevated levels of aggressive behavior, future studies must first equate the violent and non-violent games on competitiveness, difficulty, and pace of action. In addition, there are several problems with the measure of aggressive behavior used in the studies conducted by Anderson and Dill (2000), Anderson et al. (2004), and Anderson and Carnagey, which will be described in the following section.

The Measure of Aggression

The most commonly used measure of aggressive behavior in the violent video game literature is the modified Taylor Competitive Reaction Time Test (TCRTT), in which the participant is told that he or she is competing with another participant (confederate) to see who can push a button faster upon the appearance of a cue (see Table 1). After each trial, the loser receives an aversive punishment (such as a loud noise blast) and the winner chooses the intensity of the punishment. The level of punishment intensity that the participant sets for his or her opponent and the duration of the punishment are indicative of aggressive behavior. Wins and

losses are determined before the task begins, and the participant both receives and delivers punishments.

The first problem with the modified TCRTT is that the participant's motivation to behave aggressively is ambiguous. According to Lieberman et al. (1999), it is unclear whether participants view their behavior as competitive instead of aggressive, in that participants' motivation to give intense punishments may be to slow their opponents' response time on subsequent trials, thus allowing participants to win the competition. Recall that aggression refers to behavior that is intended to harm another individual. If the main intent for participants to deliver intense punishments to their opponents is to gain an advantage in the competition, instead of to actually cause harm to their opponents, then the TCRTT would actually be measuring competitiveness rather than aggression. Furthermore, participants may not even consider the fact that they could be causing harm to their opponents, depending on how immersed they become within the competition.

Why then, have participants who played violent video games been shown to select higher levels of punishment for their opponents than participants who played non-violent video games? The fact that the modified TCRTT may measure competitiveness instead of aggression is especially problematic when used in violent video game studies, as the majority of violent video games involve competition. For instance, the goal of violent video games tends to range from trying to shoot or stab opponent characters (e.g., first-person shooter games such as the *Call of Duty* series or action games such as the *Grand Theft Auto* series) to competing against opponents in a physical battle (e.g., fighting games such as the *Mortal Kombat* series or sports games such as the *Fight Night* series). Although some non-violent video games involve competition, such as racing games (e.g., the *Gran Turismo* series), many non-violent video games do not (e.g., *The*

Sim City series, the *Myst* series, *Tetris*, and *Solitaire*). Consequently, violent video games may prime competitive schemas more than non-violent video games. Thus, when participating in the TCRTT after playing a violent video game, the competitive aspect of the task may become especially salient. A prime example is the aforementioned study by Anderson and Dill (2000). Clearly, *Wolfenstein 3D* involved much greater competition than *Myst*. Therefore, participants who played *Wolfenstein 3D* may have felt more competitive and administered longer punishment durations in order to hinder their opponents' performance in the TCRTT, compared to participants who played *Myst*.

Anderson and Carnagey (2009) examined why participants chose different punishment intensities for their opponents during the modified TCRTT with a questionnaire. Instrumental motivation, which is consistent with competitiveness (e.g., "I wanted to control my opponent's level of responses"), and revenge motivation (e.g., "I wanted to pay back my opponent for the noise levels (s)he set") was measured using 12 items. They found that both instrumental and revenge motivation predicted the average intensity of punishments delivered. Thus, it is evident that some participants view their behavior during the modified TCRTT as competitive rather than aggressive. For high intensity punishments (levels 8-10 on a 10-point scale), only revenge motivation was a significant predictor. However, although revenge motivation appears to measure aggression, it still may not tap into participants' desire to intentionally harm their opponent. For instance, the item "I wanted to pay back my opponent for the noise level (s)he set" may represent participants' desire for retribution in a competitive sense. In other words, because the modified TCRTT is a competitive task, the revenge motivation may be a product of the competition. In order to investigate whether violent video games directly influence

aggressive behavior, future studies must unambiguously assess aggressive behavior by removing the competitive element.

The second problem is that aggression had not been measured in a uniform way in studies using the modified TCRTT to examine the relation between violent video games and aggression (Ferguson, Smith, Mill-Stratton, Fritz, & Heinrich, 2008). For example, Ferguson et al. (2008) described seven different ways in which the TCRTT can be used to measure aggression, such as reporting on the average intensity of punishment selected across all trials versus the average duration of punishment selected across all trials, reporting either average intensity or average duration after either “win” trials only or “loss” trials only, or using some arbitrary cutoff point (such as intensity scores of at least 7 on a 10-point scale). As previously described, Anderson and Dill (2000) found that participants who played a violent video game gave significantly longer durations of punishment than participants who played a non-violent video game after loss trials only. In contrast, Anderson et al. (2004) operationalized aggressive behavior as the intensity of the punishments selected, on a 10-point scale.

The third problem with the modified TCRTT is that consistent with Ferguson et al.’s (2008) findings, it has been shown to lack validity as a measure of aggressive behavior. Ferguson and Rueda (2009) examined the convergent validity of the modified TRCTT with measures of trait aggression, domestic violence, and violent criminal acts. The results indicated that both intensity and duration of the modified TCRTT were not related to trait aggression, domestic violence, or violent criminal acts. To assess whether gender moderated the relation between the modified TCRTT and the three outcome measures, separate analysis were run for males and females. Although aggression and violence are more common among males, their scores on the modified TCRTT were not related to any of the three violent outcome measures.

For females, scores on the modified TCRTT were only related to domestic physical violence. Therefore, Ferguson and Rueda concluded that the modified TCRTT does not appear to measure direct aggression.

In order to assess direct and unambiguous aggressive behavior, Lieberman et al. (1999) created the Hot Sauce Paradigm. As previously described, the Hot Sauce Paradigm involves informing participants that they are to create a hot sauce for a confederate to eat, who does not like hot or spicy food. The level of hotness and the amount of sauce given is indicative of aggressive behavior. There are no competitive benefits gained from administering a hotter sauce to the confederate, so the hot-sauce paradigm unambiguously assesses aggressive behavior with the intent to cause harm to another individual. Furthermore, Lieberman et al. found that scores on this paradigm were positively related to both trait and physical aggression scores on the Buss and Perry (1992) Aggression Questionnaire, supporting the convergent validity of the Hot Sauce Paradigm as a measure of aggressive behavior.

Conclusions: The Importance of Addressing the Limitations

To date, no study has equated the violent and non-violent video games on competitiveness, difficulty, and pace of action (see Table 1). In addition, only one study has used an unambiguous measure of aggressive behavior (Barlett et al., 2009) but the violent and non-violent games were not equated on game characteristics. Thus, in the future, researchers must examine whether a violent video game produces greater levels of aggression than a non-violent video game using an unambiguous measure of aggressive behavior (the Hot Sauce Paradigm), when both games are equated on competitiveness, difficulty, and pace of action. Instead of simply choosing video games that appear to differ in the level of violence but are equal in terms of

Table 1

Limitations with Previous Experiments Examining the Effect of Violent versus Non-violent Video Games on Aggressive Behavior

Author and Date	Limitation(s)
Anderson and Dill (2000)	Games not equated on competitiveness. Used TCRTT.
Anderson and Carnagey (2009)	Games not equated on difficulty and pace of action. Used TCRTT.
Anderson and Murphy (2003)	Games not equated on competitiveness, difficulty, and pace of action. Used TCRTT.
Anderson et al. (2004)	Games not equated on competitiveness and pace of action. TCRTT.
Anderson et al. (2007)	Games not equated on competitiveness, difficulty, and pace of action. Used TCRTT.
Bartholow and Anderson (2002)	Games not equated on competitiveness, difficulty, and pace of action. Used TCRTT.
Bartholow et al. (2005)	Games not equated on competitiveness, difficulty, and pace of action. Used TCRTT.
Barlett et al. (2009)	Games not equated on competitiveness and difficulty.
Cooper and Mackie (1986)	Games not equated on competitiveness, difficulty, and pace of action.
Carnagey and Anderson (2005)	Games not equated on competitiveness and difficulty. Used TCRTT.
Ferguson et al. (2008)	Games not equated on competitiveness, difficulty, and pace of action. Used TCRTT.
Graybill et al. (1987)	Games not equated on competitiveness and pace of action.
Irwin and Gross (1995)	Games not equated on competitiveness, difficulty, and pace of action.

Konijn et al. (2007)	Games not equated on competitiveness, difficulty, and pace of action. Used TCRTT.
Polman et al. (2008)	Games not equated on competitiveness, difficulty, and pace of action.
Schutte et al. (1988)	Games not equated on competitiveness, difficulty, and pace of action.
Silvern and Williamson (1987)	Did not include a non-violent video game condition.
Winkel et al. (1987)	Games not equated on competitiveness, difficulty, and pace of action.

competitiveness, difficulty and pace of action, participant ratings of these video game characteristics on a continuum are necessary. For example, when using a dichotomous violent versus non-violent scale, a video game such as Super Mario in which the main character must jump on other characters in the game in order to defeat them, may be labeled as a violent video game. However, due to the unrealistic and tame nature of Super Mario, ratings of violence would likely be significantly lower compared to a game with more realistic and graphic violence, when evaluated on a continuous scale.

Addressing these limitations has important implications for video game players. First, if a violent and a non-violent video game produce equivalent levels of aggression when they are matched on competitiveness, difficulty and pace of action, then the level of violence in video games may be less influential in promoting aggression than previously believed. Furthermore, this finding would suggest that competitiveness, difficulty and pace of action may have had a larger than expected influence on aggression in previous studies that failed to match the violent and non-violent games on these game characteristics. For example, Barlett et al.'s (2009) finding that the violent video game produced more aggressive behavior than the non-violent video game may be due solely to the fact that the violent game was more competitive and difficult than the non-violent game. In addition, it may be incorrect to assume that all non-violent video games are unrelated to aggression simply because they lack violent content. Instead, it may be that decisions about whether non-violent games influence aggression should be made on a case-by-case basis, based on the degree to which the particular game is competitive, difficult, and fast-paced. In fact, a non-violent video game that is very competitive, difficult, and fast-paced may lead to more aggressive behavior than a violent video game that is rated lower on these video game characteristics. Future research could then investigate the

relative influence of each of these individual video game characteristics on aggressive behavior to determine which characteristics have the greatest impact.

On the other hand, if a violent video game produces more aggression than a non-violent game that is matched on competitiveness, difficulty, and pace of action, it could be concluded with greater confidence than in past studies (i.e., where the games were not matched) that violent video games produce more aggression than non-violent video games because they have greater levels of violent content. Future research could then investigate whether violent video games that are more competitive, difficult and fast-paced lead to more aggressive behavior than violent video games that are rated lower in these game characteristics. Indeed, it may be that there are several video game characteristics that influence aggressive behavior.

Of course, there is always a tradeoff between experimental research and real-world generalizations. The fact that a participant in a lab setting may administer more of a hotter sauce to a confederate after playing a violent video game compared to a non-violent video game does not necessarily mean that people who play violent video games will have physical altercations outside of the lab immediately after playing the game. If this were the case, the rate of day-to-day violence and physical aggression would have dramatically increased in North America due to the recent rise in prevalence rates of violent video game play. However, such findings in controlled laboratory settings do suggest that violent video game play may increase the chance of an individual behaving aggressively if the opportunity arose shortly after exposure to the game. To further investigate the generalizability of this laboratory research to real-life aggression, future research should examine whether the Hot Sauce Paradigm correlates with measures of domestic violence and violent criminal acts, as Ferguson and Rueda (2009) did with the TCRTT. Furthermore, select populations such as people with aggressive tendencies may be more

susceptible than the average person to the effects of violent video games on aggressive behavior. Thus, future research should examine the effects of violent video games on highly aggressive samples and compare these findings to the average population.

Research that examines the role of violent video games in producing aggressive behavior and addresses the limitations outlined in this review is critical. As Barlett et al. (2009) have shown, playing a violent video game for 15 minutes can produce elevated levels of aggressive behavior that lasts between five and ten minutes. Therefore, the fact that many adolescents play violent video games for several hours every day clearly stresses the need for a greater understanding of the effects of violent video games on aggression. It is not until game characteristics are held constant and an unambiguous measure of aggressive behavior is used that the influence of violent content on aggression can be assessed.

Chapter 2

Isolating the Violent Content: Finding Video Games that differ in Violence but are matched in terms of Competitiveness, Difficulty, and Pace of Action²

To date, no study has equated a violent and non-violent video game on competitiveness, difficulty, and pace of action. In addition, only one study has used an unambiguous measure of aggressive behavior (Barlett et al., 2009); however no attempt was made to equate the violent and non-violent games on game characteristics. Thus, it is unclear whether the violent content alone in video games is sufficient to elevate aggressive behavior compared to a non-violent video game. In order to address this issue in the present study, a pilot study and two experiments were conducted. The purpose of the pilot study was to find a violent and non-violent video game that appeared to be matched on competitiveness, difficulty, and pace of action. Experiment 1 then tested whether these two games differed in terms of violence and were matched in terms of competitiveness, difficulty, and pace of action. The two matched games could then be used to examine whether the violent video game would produce more aggression than the matched non-violent video game, when the measure of aggression clearly assessed aggressive behavior without any competitive confounds.

Pilot Study

The goal of the pilot study was to find a violent and non-violent video game that appeared to be equal in terms of competitiveness, difficulty, and pace of action. These two games would then be tested in Experiment 1. Ten participants (4 male, 6 female; *M* age = 24 years 5 months) from a mid-sized university in Ontario, Canada played four video games and the

² Submitted to *Personality and Social Psychology Bulletin* along with Chapter 3 as part of a larger study

order of the four games was counterbalanced across participants. Of the four video games played, two were violent and two were non-violent. The violent games were *Mortal Kombat vs. DC Universe* and *Conan*, and the non-violent games were *FIFA Street 3* and *Fuel*. *Mortal Kombat vs. DC Universe* is a fighting game in which the main character must battle another opponent character in hand-to-hand combat. The goal of the game is to defeat the opponent character so a new opponent can be faced. *Conan* is an action game in which the main character must fight a variety of opponent characters with swords and axes in order to progress through the levels. *FIFA Street 3* is a 4-on-4 soccer game in which the player controls a team (each player on the team can be controlled but only one player can be controlled at a time) and must compete against another team in a game of soccer. Finally, *Fuel* is a racing game in which the main character must race against other characters while driving a variety of vehicles such as motorcycles and ATVs.

Participants played each video game for 10 minutes, and after each game they completed a questionnaire assessing the violence, competitiveness, difficulty, and pace of action of the game. A repeated measures ANOVA revealed that there was a significant game (*Mortal Kombat vs. DC Universe*, *Conan*, *FIFA Street 3*, and *Fuel*) x game characteristics (violence, competitiveness, difficulty, and pace of action) interaction, $F(9,81) = 17.77, p < .001$. Thus, RMANOVAs were conducted to compare each violent video game with each non-violent video game in order to find a matched pair. A significant game x game characteristics interaction was found for *Conan* and *Fuel*, $F(3,27) = 14.40, p < .001$, and univariate analyses demonstrated that *Conan* was rated as more violent than *Fuel* and equal in terms of competitiveness, difficulty, and pace of action (see Table 2). Thus, Experiment 1 was conducted to further test whether *Conan*

and *Fuel* differed in violence and were matched in terms of competitiveness, difficulty, and pace of action.

Experiment 1

The first goal of Experiment 1 was to confirm that *Conan* and *Fuel* were matched on game characteristics, but differed in violence so these games could then be used in Experiment 2. The second goal was to examine whether previous experience with *Conan* and *Fuel* or experience with the relevant video game genres of action (*Conan*) and racing (*Fuel*) influenced how participants rated *Conan* and *Fuel* in terms of game characteristics. Participants completed a questionnaire assessing the violence, competitiveness, difficulty, and pace of action of each game immediately after playing it.

Table 2

Pilot Study Means Ratings (Standard Deviations in Parentheses) of Video Game Characteristics for Conan and Fuel

Game rating	Video game		F^a	Partial η^2
	Conan	Fuel		
Violence	5.10 (1.03)	1.80 (0.99)	160.67***	0.95
Competitiveness	5.02 (0.85)	4.73 (0.89)	.56	0.06
Difficulty	4.8 (1.55)	3.90 (1.20)	2.93	0.25
Pace of Action	4.10 (1.10)	4.80 (1.14)	2.00	0.18

^a $df = 1, 9$.

*** $p < .001$

Method

Participants. Participants consisted of 14 Introductory Psychology students from the same university as in the pilot study (6 males, 8 females; *M* age = 20 years, 1 month). Students were recruited using the psychology participant pool and they earned course credit in exchange for their participation.

Materials. *Video games and equipment.* The violent video game *Conan* and the non-violent video game *Fuel* were selected based on the results of the pilot study described above. In addition to being violent, *Conan* involves competition as each character is an opponent who must be defeated in order to make progress in the game. Similarly, the main character in *Fuel* must compete against the other characters in several different races using vehicles such as motorcycles and ATVs. Although *Fuel* involves competition, violence is not encouraged in the game, as bumping into other characters during a race can cause the main character to lose control of his or her vehicle. The games were played on an XBOX 360 gaming system and 42-inch television screen.

Demographics. A demographic questionnaire was used to assess age and gender. Video game experience was assessed by providing participants with a list of video game genres (e.g. action, sports, etc.) and having them indicate how many hours per weekday and weekend that they played each genre of game. The scale for each genre ranged from 1 (not at all) to 5 (5 or more hours per day). Participants were also asked to indicate how many years they played each genre of video game. In addition, direct experience with *Conan* and *Fuel*, the two video games included in the study, was measured by asking participants how many hours per weekday and weekend that they played each game. The scale for each game ranged from 1 (not at all) to 5 (5

or more hours). These questions were asked in order to examine whether past video game experience was related to video game ratings (see Appendix A).

Ratings of the video game characteristics. A questionnaire was used to measure the violence, competitiveness, difficulty, and pace of action of *Conan* and *Fuel* (see Appendix B). In order to control for differences in participants' experience with these games, the questions were phrased, "Without considering how much experience you have with this video game (pretend this was your first time playing this game), what did you think of this game in terms of...?"

Violence. Violence was measured on a scale from 1 (very low) to 7 (very high) by asking "how violent was the game."

Competitiveness. Competitiveness was assessed on a scale from 1 (very low) to 7 (very high) using Anderson and Carnagey's (2009) four questionnaire items: "to what extent did this video game involve competition" "to what extent did you feel like you were competing with your opponents (i.e., in a battle or in a race)," "how competitive was this video game," and "how hard were you trying to win the game/match/contest." Reliability was acceptable for both *Conan* ($\alpha = .86$) and *Fuel* ($\alpha = .78$).

Difficulty. Difficulty was measured by asking "how difficult was the game" on a scale of 1 (very low) to 7 (very high).

Pace of action. Pace of action was assessed on a scale from 1 (very slow) to 7 (very fast) by asking "how was the pace of the game."

Procedure. Participants were tested individually by the first author. Upon entering the lab, they were seated in front of a 42-inch television and played *Conan* and *Fuel* for approximately 12 minutes each. The order of playing the two games was counterbalanced across

participants. After each video game was played, participants completed the questionnaire assessing the video game characteristics. After the first video game was played, participants also completed the demographic questionnaire. In addition to completing both questionnaires, participants waited ten minutes before playing the next video game in order to control for carry-over effects (Barlett et al., 2009).

Results and Discussion

Experience

In order to include past video game experience as covariates in the main analyses examining video game ratings, we first had to determine that participants' experience did not differ between the two games and genres, as it is invalid to use analysis of covariance for groups (e.g., violent versus non-violent video game conditions) that differ on the variables which are to be included as covariates, such as past video game experience (see Miller and Chapman, 2001). No participants reported having any previous experience with *Conan* or *Fuel*. A repeated measures ANOVA was conducted to examine whether participants differed in their experience with the relevant video game genres racing (*Fuel*) and action (*Conan*), and whether experience with these genres differed between males and females. Participants' experience with racing and action games did not differ, $F(1,12) = .09, p > .05$, nor did experience with the two genres differ between males and females, $F(1,12) = .09, p > .05$. Thus, experience with racing and action games were included as covariates in the analysis comparing participants' ratings of the two games, which allowed us to examine whether previous experience with these genres influenced how participants rated the video game characteristics.

Video Game Ratings

A repeated measures ANOVA was conducted to compare the two video games on the four video game characteristics of violence, competitiveness, difficulty and pace of action. Sex was included as a between-subjects variable and experience with racing and action games were entered as covariates. Only the type of game (i.e., *Conan* and *Fuel*) x game characteristics (i.e., violence, competitiveness, difficulty, and pace of action) interaction was significant, $F(3,6) = 7.72, p < .05$. Thus, participants' ratings of video game characteristics differed between *Conan* and *Fuel* and this was not influenced by their experience with racing and action video games or their sex. To assess this interaction, univariate repeated measures ANOVAs were conducted to compare each of the four video game characteristics between the two games (see Table 3 for mean ratings of the video game characteristics for *Conan* and *Fuel*). *Conan* was rated as significantly more violent than *Fuel*. However, the two games did not differ on competitiveness, difficulty, or pace of action. Therefore, the results suggest that although *Conan* is more violent than *Fuel*, the games do not differ on other video game characteristics related to aggression. Consequently, *Conan* and *Fuel* were used in Experiment 2 to test whether video game violence alone could produce elevations in aggressive behavior.

Table 3

Experiment 1 Means Ratings (Standard Deviations in Parentheses) of Video Game Characteristics for Conan and Fuel

Game rating	Video game		F^a	Partial η^2
	Conan	Fuel		
Violence	5.35 (1.28)	1.50 (0.52)	91.13***	0.88
Competitiveness	5.07 (1.23)	3.71 (1.30)	1.53	0.11
Difficulty	3.93 (1.07)	3.71 (1.44)	0.34	0.03
Pace of Action	5.07 (0.83)	4.93 (1.21)	0.21	0.02

^a $df = 1, 13$.

*** $p < .001$

Chapter 3

Is Violent Content the Main Culprit in the relation between Violent Video Games and Aggression?³

The purpose of the current experiment was to test whether a violent video game produced more aggressive behavior than a non-violent video game that was equated on competitiveness, difficulty, and pace of action, using an unambiguous measure of aggressive behavior. This research has important implications for researchers and the general public. If the violent content alone produces elevations in aggressive behavior compared to the non-violent game, we can confidently conclude that the violent content is the risk factor of interest in the link between violent video games and aggression. However, if the violent and non-violent games fail to produce differences in aggressive behavior, it would be clear that other video game characteristics (i.e., competitiveness, difficulty, and pace of action) may also be important risk factors for aggression, calling for a new focus in research examining video games and aggression.

We examined whether *Conan* and *Fuel* produced differences in aggressive behavior using the Hot Sauce Paradigm to measure aggressive physical behavior. Similar to Barlett et al. (2009), deception was used to disguise the purpose of the Hot Sauce Paradigm so that participants would not be aware that we were assessing the effect of violent video games on aggressive behavior. Specifically, participants were told that they were participating in two unrelated studies looking at 1) video game play and eye-gaze and 2) food preference and personality. For the video game and eye-gaze study, participants were randomly assigned to play either *Conan* or *Fuel* while wearing a piece of eye-tracker head gear (although we did not

³ Submitted to *Personality and Social Psychology Bulletin* along with Chapter 2 as part of a larger study

actually record eye-gaze). Participants then completed the food preference study, in which they were instructed to prepare some hot sauce for another participant to drink who does not like hot sauce. The amount and intensity of hot sauce selected was indicative of aggressive behavior. Thus, deception was used to lead participants to believe that their preparation of hot sauce was not related to their video game play, which was important as studies examining the effects of violent video games on aggression have become increasingly popular. In order to check if the deception was successful, we included a suspiciousness questionnaire at the end of the study to determine whether participants were wise to the deception or to the true purpose of the study.

The assessment of the link between video game violence and aggressive behavior was exploratory, as no study to date has compared the effect of violent and non-violent video games that are equated on competitiveness, difficulty, and pace of action on aggressive behavior. Therefore, no specific hypothesis was made as to whether differences in aggressive behavior would be found between video game conditions. In terms of sex differences, it was predicted that males would give more of a hotter sauce than females, consistent with past literature showing that males are more aggressive than females (e.g., Coie & Dodge, 1998). However, we did not expect to find an interaction between game and sex as past research has shown that the relation between video game play and aggression does not differ for males and females (e.g., Anderson et al., 2010). We also included a measure of trait aggression at the end of the study for half of the sample to test the convergent validity of the Hot Sauce paradigm. Previous studies have found moderate correlations between trait aggression questionnaires and behavioral measures of aggression (e.g., Lieberman et al., 1999, $r = .30$; Ferguson & Rueda, 2009, $r = .25$), so it was hypothesized that hot sauce scores would be moderately related to scores on a trait aggression questionnaire.

Method

Participants. Participants consisted of 42 Introductory Psychology students from the same university as in Experiment 1 (25 males, 17 females; *M* age = 18 years, 6 months). Students were recruited using the psychology participant pool and they earned course credit in exchange for their participation.

Materials. Demographics. An identical demographic questionnaire to Experiment 1 was used to assess age, gender, and experience with *Conan* and *Fuel* and action and racing genres. Questions regarding previous experience were asked in order to examine whether past video game experience was related to video game ratings as well as differences in aggressive behavior.

Video games and equipment. *Conan* and *Fuel* were played using an XBOX 360 console on a 42-inch television screen.

Aggressive behavior. The Hot Sauce Paradigm (Lieberman et al, 1999) was used to measure overt aggressive behavior. Participants were asked to prepare some hot sauce for another participant to drink who does not like hot sauce (note that there actually was no other participant). Participants got to choose the intensity of hot sauce (ranging from 1 = least hot to 4 = most hot) and the amount, knowing the other participant had to drink whatever amount was in the cup. Participants could also taste the sauce in order to see how hot it was. Aggressive behavior was operationalized as the sum of the standardized number of sauce selected and the weight in grams (Barlett et al, 2009). Hot sauce was purchased from a local food establishment that has a ranked system of hotness for the sauces and four sauces were selected that ranked in order from least to most hot. Each sauce was transferred into a plastic squeeze bottle and was given a number from one to four (with one being the least hot and four being the hottest). In

addition, a styrofoam cup to place the hot sauce into, a cup of water, a spoon, popsicle sticks, and white bread (to help ease the hot sensation after tasting the sauce) was used.

Ratings of the video game characteristics. As in Experiment 1, a questionnaire was used to measure the video game characteristics on a scale of 1 = very low to 7 = very high (i.e., violence, competitiveness, difficulty, and pace of action). Alphas for the competitiveness scale were acceptable for both *Conan* ($\alpha = .74$) and *Fuel* ($\alpha = .89$).

Food preference. We assessed food preference of the participants to support the deceptive story that participants were involved in two studies, one of them examining food preference and personality (see Appendix C). Food preference⁴ was assessed by asking “how much do you LIKE the following kinds of foods” for six items (i.e., sweet, savory, spicy, hot, bland, and salty foods) on a 1 (*not at all*) to 5 (*extremely*) scale (Bartlett et al, 2009).

Suspiciousness. Due to the growing popularity of research proposing a relation between violent video games and aggression and the fact that deception was used, a suspiciousness questionnaire was given to assess whether participants knew the true purpose of the study before being debriefed, whether anyone had told them about the study before completing it, and whether they were aware of any deception (Bartlett et al. 2009; see Appendix D). For example, the first item asked “what do you think was the purpose of this study?”

Trait aggression. The Buss-Perry Aggression Questionnaire (Buss & Perry, 1992) was used to measure trait aggression and to examine the convergent validity of the Hot Sauce

⁴ Consistent with Barlett et al. (2009), we confirmed that both the degree of hotness and the amount the hot sauce selected by participants was not a function of liking hot food. Liking hot food did not account for a significant portion of the variability in the degree of hotness $R^2 = .07$, $F(1,40) = 2.78$, $p > .05$, or the amount of sauce $R^2 = .04$, $F(1,40) = 1.44$, $p > .05$.

Paradigm (see Appendix E). The scale consists of 29 items and responses range from 1 (*strongly disagree*) to 7 (*strongly agree*), while higher scores indicate higher trait aggression. For example, one of the items states “once in a while, I can’t control the urge to strike another person.”

Several items were reverse scored. The reliability for this scale was good ($\alpha = .89$).

Procedure. Participants were tested one at a time by the first author. First, they were told that they were participating in two unrelated studies: a video game study examining video games and eye gaze and a study looking at personality and food preference. For the food study, participants were told that they were randomly assigned to the role of “food administrator” and that when the time came their job would be to prepare a certain type of food for another participant who had been assigned to the role of “food taster.” Participants were then given the demographic questionnaire. Participants then completed the food preference questionnaire.

Next, participants were told that they were going to begin the video game and eye-gaze study. Participants were randomly assigned to play either the violent or non-violent video game for 12 minutes while wearing a piece of eye-tracker headgear which they believed was measuring their eye-gaze, although we did not actually record their eye-gaze. Upon completion, participants were then given the questionnaire assessing the video game characteristics and were then told it was time to complete the food preference study. Specifically, the experimenter explained that it was time for the participant to prepare some food for the food taster. Participants were given an already completed food preference questionnaire and were told that the food taster completed this questionnaire. The food preference questionnaire clearly indicated that the food taster did not like hot or spicy food.

The experimenter then provided the participant with the materials for the food preference study (i.e., the hot sauce, a cup, spoon, a cup of water, bread, and popsicle sticks) and explained

that the participant could choose the intensity of hot sauce (ranging from 1 = least hot to 4 = most hot) and the amount, and that the food taster would have to drink whatever amount was in the cup. As in Bartlett et al. (2009), participants were told that they could not mix sauces. Also, if they wished to know how hot the sauces were before choosing one, they could sample the sauces using the popsicle stick. The experimenter left the room and watched from behind a two-way mirror as the task was performed, and then returned to retrieve the cup of hot sauce to allegedly bring to the food taster. The time lapse between the video game play and hot sauce preparation was 2 to 3 minutes, well within the 5- to 10-minute time frame in which the effect of violent video games on aggression has been shown to last (Bartlett et al.). Finally, participants completed the suspiciousness questionnaire to assess whether participants knew the true purpose of the study before being debriefed or whether they were aware of any deception (Bartlett et al. 2009). Also, 26 participants (13 who played *Conan* and 13 who played *Fuel*) completed the Buss and Perry (1992) Trait Aggression Questionnaire to examine the convergent validity of the Hot Sauce Paradigm. The time lapse between the video game play and the completion of the trait aggression questionnaire was over 10 minutes ($M = 11$ minutes).

Results and Discussion

Suspiciousness

Six participants indicated that they knew the true purpose of the study or were aware of the deception and thus, their data was not included in the analysis.

Experience

As in Experiment 1, in order to include past video game experience as covariates in the main analyses (i.e., video game ratings, aggressive behavior, heart rate, frustration, and anger) we first had to determine that participants' experience did not differ between the two games and

genres. No participants reported having any previous experience with *Conan* or *Fuel*. A RMANOVA was conducted to examine whether participants differed in their experience with the relevant video game genres racing (*Fuel*) and action (*Conan*), and whether experience with these genres differed between males and females. Experience with racing and action genres did not differ between video game conditions, $F(1,38) = .54, p > .05$, nor did experience with the two genres differ between males and females, $F(1,38) = .64, p > .05$. Thus, experience with racing and action games were included as covariates in the main analyses.

Video Game Ratings

A MANOVA was conducted to check whether *Conan* and *Fuel* were equated on the three video game characteristics of competitiveness, difficulty, and pace of action, but differed on violence. Experience with racing and action games were included as covariates. There was only a main effect for game, $F(4,31) = 25.97, p < .001$. The video games differed only in ratings of violence, $F(1,7) = 59.48, p < .001$, as *Conan* ($M = 5.14$) was rated as more violent than *Fuel* ($M = 2.05$). Thus, consistent with Experiment 1, participants rated *Conan* as more violent than *Fuel*, and equal in terms of competitiveness, difficulty, and pace of action (see Table 4). Ratings were not influenced by participants' experience with racing or action games, or by their sex. Consequently, we were able to isolate the effect of a video game's violent content on aggressive behavior.

Aggressive Behavior

A univariate ANOVA was conducted with the summation of the standardized amount of hot sauce given and the standardized degree of hotness as the dependent variable, and video game content and sex as the independent variables. Participants who played *Conan* did not differ in hot sauce scores ($M = .09$) compared to participants who played *Fuel* ($M = -.09$), $F(3,38) =$

Table 4

Study 2 Means Ratings (Standard Deviations in Parentheses) of Video Game Characteristics for Conan and Fuel

Game rating	Video game		F^a	Partial η^2
	Conan	Fuel		
Violence	5.14 (1.35)	2.05 (1.20)	59.48***	0.64
Competitiveness	5.00 (0.99)	5.19 (1.19)	0.20	0.00
Difficulty	3.00 (1.14)	3.47 (1.17)	2.29	0.06
Pace of Action	4.74 (1.01)	5.00 (0.89)	2.49	0.07

^a $df = 1, 34$.

*** $p < .001$

.97, $p > .05$, $partial \eta^2 = .001$. As predicted, males ($M = .40$) gave more of a hotter sauce than females ($M = -.59$), $F(1,7) = 5.30$, $p < .05$, $partial \eta^2 = .13$, and the interaction between game and sex was not significant, $F(1,7) = 1.18$, $p > .05$, $partial \eta^2 = .002$. The results suggest that the violent content alone was not sufficient to produce elevations in aggressive behavior compared to a non-violent video game.

Convergent Validity of the Hot Sauce Paradigm

Twenty-six participants completed the trait aggression questionnaire and as predicted, hot sauce scores were positively correlated with trait aggression ($r = .32$). This finding is consistent with previous results (e.g., Lieberman et al, 1999; Ferguson & Rueda, 2009). In addition, a t test confirmed that participants' trait aggression scores did not differ as a function of playing *Conan* ($M = 2.56$) or *Fuel* ($M = 2.54$), $t(24) = -.10$, $p > .05$.

Chapter 4

Tying it all Together: General Discussion and Conclusions

The current thesis began with a review paper in press in *Aggression and Violent Behavior* which served as an introduction to the thesis. In the introduction, the violent video game literature was reviewed and two main limitations in this literature were identified. The first limitation was that no study comparing the effects of a violent and non-violent video game on aggressive behavior has equated the games on other aggression-related game characteristics. In order to address this limitation, a model (see Figure 2) was created in which violence, competitiveness, difficulty and pace of action were proposed to be the four main video game characteristics that may lead to aggressive behavior through the mechanisms of aggression cognition, aggressive affect, and physiological arousal (proposed by the GAM). Thus, in order to isolate the effect of video game violence on aggressive behavior, the games would have to be matched on the other three game characteristics. The second limitation was that the most commonly used measure of aggressive behavior in this literature (the TCRTT) may actually measure competitiveness rather than aggression, and thus, an unambiguous measure of aggressive behavior was needed for the current study.

In the second chapter, the goal was to isolate the violent content by matching a violent and non-violent game in terms of competitiveness, difficulty, and pace of action. The second chapter began with a pilot study in which two video games (*Conan* and *Fuel*) were identified that appeared to differ in terms of violence but were equal in terms of the other video game characteristics. Experiment 1 was then conducted to confirm that *Conan* was in fact rated as more violent than *Fuel* but equal in terms of competitiveness, difficulty and pace of action.

Thus, we had isolated the violent content and *Conan* and *Fuel* could then be used in an experiment examining the effects of video game violence on aggressive behavior.

The third chapter was comprised of a study that examined the effects of *Conan* and *Fuel* on aggressive behavior using the Hot Sauce Paradigm. Specifically, it was the first study in which violent and non-violent video games were equated on competitiveness, difficulty, and pace of action, in order to isolate the effect of the violent content on aggressive behavior. We found that the violent content alone was not sufficient to elevate aggressive behavior using an unambiguous measure of physical aggression (i.e., the Hot Sauce Paradigm) compared to a non-violent video game. This finding suggests that the level of violence in video games may be less influential in elevating aggression than previously believed. Specifically, studies that have failed to equate the violent and non-violent video games on competitiveness, difficulty and pace of action may have mistakenly attributed too much of the variability in aggression to the violent content, instead of these other video game characteristics.

An alternative explanation for this finding may be that neither video game elevated aggressive behavior from baseline because the games may not have been sufficiently violent, competitive, difficult, or contained fast enough action to influence aggression. The inclusion of a control group who played a non-violent video game that was significantly less competitive, less difficult, and contained slower action than *Conan* and *Fuel* would have directly addressed this issue. If hot sauce scores for *Conan* and *Fuel* were elevated compared to the control condition, we could have concluded that competitiveness, difficulty, or pace of action, or some combination of these characteristics, were responsible for the elevations in aggressive behavior. In contrast, if hot sauce scores were equal among all three conditions, the alternative explanation that *Conan* and *Fuel* did not produce elevations in aggression would have been supported.

Although we did not include a control group and therefore could not directly test that alternative explanation, we did compare hot sauce scores for participants who played *Conan* and *Fuel* with hot sauce scores for participants in Barlett et al.'s (2009) violent and non-violent video game conditions (see Table 5). In terms of intensity, scores for both *Conan* and *Fuel* were larger compared to scores found in both violent and non-violent games reported by Barlett et al. In terms of weight, scores for *Conan* and *Fuel* were larger compared to the scores for Barlett et al.'s non-violent video game and slightly smaller than the scores for the violent video game. Thus, hot sauce scores for *Conan* and *Fuel* were very similar to Barlett et al.'s violent video game, and larger than their non-violent video game. The fact that Barlett et al.'s violent video game produced more aggressive behavior than their non-violent video game suggests in our study, *Conan* and *Fuel* may have elevated aggressive behavior from baseline.

Another possible criticism with the current study is that the sample size may have been too small to find a significant effect for video game condition on aggressive behavior. For instance, if the effect size for video game condition in the current study was similar to past studies in which the effect was significant, than the current study may not have had enough power for the effect to reach significance due to an inadequate sample size. However, a comparison of effect sizes with Barlett et al.'s (2009) findings suggests otherwise. Specifically, Barlett et al. found a *partial* $\eta^2 = .12$ for the effect of video game condition on aggressive behavior, compared to *partial* $\eta^2 = .001$ for the current study. The large difference in effect sizes can be explained by examining the mean differences in hot sauce scores for the game conditions. The violent video game in Barlett et al. produced a hot sauce score that was .56 of a standard deviation above the mean, while the non-violent video game produced a hot sauce score that was .66 below the mean. In contrast, the hot sauce score for *Conan* was .09 of a standard deviation

Table 5

Comparing Mean Hot Sauce Scores for Conan and Fuel with Barlett et al.'s (2009) Violent and non-violent Video Games

Video Game	<i>M</i> hotness (intensity)	<i>M</i> weight (ounces)
Barlett et al.'s violent game	2.12	1.27
Barlett et al.'s non-violent game	1.76	0.60
Conan	2.52	1.01
Fuel	2.33	1.01

above the mean, compared to .09 of a standard deviation below the mean for *Fuel*. Therefore, there was not a significant effect for video game condition in the current study because the effect size was very small due to similar aggressive behavior scores in the two video game conditions.

The fact that *Conan* and *Fuel* produced equal levels of aggressive behavior when only one of the games was violent, suggests that the competitiveness, difficulty, pace of action, or some combination of these characteristics, might be responsible for elevating aggression. Research regarding the effects of video game difficulty and pace of action on aggressive behavior is scarce. In contrast, competition has been shown to be related to aggression. For example, a link between competition and aggression has been demonstrated in hormonal research. Bateup et al. (2002) found that the anticipation of a competitive situation led to elevations in the level of the aggression-related hormone testosterone. Similarly, Booth et al. (1989) have shown that among tennis players, winners experienced an increase in testosterone compared to losers. In addition, the relation between competition and testosterone has been demonstrated in the absence of physical exertion. For instance, Mazur, Booth, and Dabbs (1992)

found that the winners of a game of chess had higher testosterone levels than losers. Thus, it appears that competition, especially when one is victorious, is related to elevated levels of testosterone.

Aggression has also been shown to be related to testosterone. For instance, Carre' and McCormick (2008) found that aggressive behavior was positively correlated with elevations in testosterone. In addition, Carre', Putnam, and McCormick (2009) found that elevations in males' testosterone level following a loss in a competitive situation predicted their subsequent aggressive behavior. Similarly, elevations in testosterone level following a win in a competition predicted aggressive behavior, however only among men high in trait dominance. Thus, it appears that competition may influence testosterone, which in turn may influence aggression. According to Carre' et al., this is consistent with the 'Challenge Hypothesis' which states that testosterone levels rise during social challenges such as male-to-male competition for mating partners, which in turn supports territorial and aggressive behavior (Wingfield et al., 1990).

Another important consideration is how competitiveness, difficulty, and pace of action may interact to influence aggressive behavior. For example, if a competitive game is easy, in that people consistently win with minimal effort, it may be less likely that the competition would trigger aggressive thoughts toward the opponent (virtual or real). In addition, feelings of frustration and anger are unlikely when people's efforts to succeed remain relatively unhindered. Under these circumstances aggressive behavior may not be affected. However, a similarly competitive game that is more difficult, i.e., one in which people lose more often and must exert considerable effort in order to succeed may be more likely to trigger aggressive thoughts and feelings toward opponents who they feel are obstructing their performance. In turn, these aggressive thoughts and feelings may then lead to aggressive behavior. This example is

consistent with Anderson and Carnagey's (2009) finding that among several highly competitive video games, those which were more difficult produced greater frustration and aggressive behavior than those which were less difficult. Thus, an interaction between competitiveness and difficulty may be related to elevated aggression. Future research should be directed toward understanding which video game characteristics have the largest impact on aggressive behavior and how these characteristics interact. In addition, according to the GAM video games may influence aggressive behavior through the mechanisms of aggressive cognition, aggressive affect and physiological arousal. Thus, in the future, researchers should investigate *how* certain video game characteristics influence aggressive behavior by determining which mechanisms are affected by the competitiveness, difficulty, and pace of action of a video game and to what extent.

The current study examined video game violence as a situation variable which may influence aggressive behavior. However, according to the GAM, personal variables interact with situation variables to influence one's aggressive behavior. Thus, a limitation of the current study was that the effect of personal variables, such as trait aggression, was not considered. In the future, researchers should also examine how person variables such as trait aggression interact with video game play to influence aggressive behavior. For instance, consistent with the violent television literature (Bushman, 1995), researchers could explore whether people high in trait aggression are more likely to show an effect for video game violence on aggressive behavior, compared to people low in trait aggression.

Another direction for future research is to examine the effect of video games on reactive aggression. For instance, according to the GAM, one's internal state can influence how one appraises an aggressive act (such as someone bumping into him or her), which in turn influences

decision making processes regarding how to behave. Thus, future research should be directed at understanding how video game characteristics influence aggressive behavior if participants are first provoked (e.g., having them taste an aversive concoction chosen by another participant). Furthermore, certain video game characteristics (such as violence) may be more likely to influence participants to view a provocation as a malicious personal attack.

Measuring aggressive behavior in the laboratory is an especially difficult task given numerous ethical constraints. For instance, a researcher cannot simply physically assault a participant to see how they would respond. Although the hot sauce paradigm appears to measure aggressive behavior without any competitive confounds, there are still limitations with this measure. First, there is no option to behave non-aggressively. Although participants may choose the sauce which is the least hot, there is no option to choose a food that is not hot, such as ketchup or barbeque sauce. Thus, it may be beneficial to adapt the hot sauce paradigm to allow participants the option of behaving non-aggressively. Second, participants do not actually get to see the person who will drink the hot sauce, nor do they have to watch the person suffer while doing so. If participants were in the same room as the person that they are preparing hot sauce for, they may be less likely to behave aggressively. Finally, there are demand characteristics that are associated with the hot sauce paradigm that may influence participants to behave aggressively. Since the researcher asks the participants to prepare some hot sauce for another participant to drink, participants may believe they are simply doing what the experimenter has asked in order to help with the study. Furthermore, they may choose to give hot sauce because they believe that is what the experimenter wants them to do. Therefore, it is important to continually evaluate and adapt the hot sauce paradigm in order to accurately assess aggression.

In the current study, we proposed that violence, competitiveness, difficulty, and pace of action are the four main video game characteristics that may influence aggressive behavior. However, another aspect of the violent content that may influence aggressive behavior is the degree of realism. Video games that contain more realistic violence may influence aggressive behavior to a greater extent than games which contain violence that is less realistic. Thus, a measure of how realistic the violent content is should be included in future studies.

In addition to elevating aggressive behavior, violent video games have been shown to decrease prosocial behavior (see Anderson et al., 2010). In the future, researchers should examine whether competitiveness, difficulty, and pace of action also impact decreased prosocial behavior. For example, playing a competitive video game would likely activate competitive schemas, which in turn may suppress thoughts of helping others.

Some researchers believe that they have already shown that violent video games are a risk factor for aggressive behavior (Anderson et al., 2010) and that this effect stems from the violent content in the games (Anderson et al., 2004). On the contrary, the present study has shown that the violent content may not be the only aspect of video games that can elevate aggressive behavior in the short-term. Consequently, decisions about whether video games influence aggression should be made based on the degree to which the games are competitive, difficult, and fast-paced, rather than based only on the violent content. Furthermore, if a non-violent video game is more competitive, difficult, and contains faster action than a violent video game, the non-violent video game may lead to more aggression in the immediate post-game period. Therefore, public policy decisions regarding video games as a “risk factor” for aggression must look beyond the violent content and consider other aggression-related characteristics.

In summary, the present study addressed two important limitations in the violent video game and aggression literature: 1) no study has equated a violent and non-violent video game on competitiveness, difficulty, and pace of action and therefore been able to isolate the effect of the violent content, and 2) most studies have used a measure of aggressive behavior that may measure competitiveness. After controlling for video game characteristics related to aggression and using an unambiguous measure of aggressive behavior, we found that video game violence was not sufficient to elevate aggressive behavior. The present findings have opened a window of exploration regarding video games and aggression and should encourage researchers to continue to critically examine this issue.

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Appendix A: Demographic Questionnaire**Demographic Questionnaire****Participant ID:**

Sex (please circle one): Male Female Age: _____

The following questions focus on your video game experience.

1. On the average WEEKDAY in the past six months, how many hours do you spend playing the following kinds of video/computer games?

Sports (e.g. FIFA soccer 2009, NHL 2009)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Strategy (e.g. Splinter Cell, Rainbow 6)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Role-playing (e.g. World of Warcraft, Final Fantasy)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Puzzles (e.g., Tetris, Solitaire)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Action (e.g. God of War 2, Grand Theft Auto 4)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

First-person Shooters (e.g. Halo, Call of Duty 4)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Racing (e.g. Gran Turismo 4, NASCAR)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Fighting (e.g. Mortal Kombat, Tekken 4)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Adventure (e.g. Harry Potter, Myst III)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours
Quiz/Board games (e.g. Monopoly, Risk)				
1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

2. On the average WEEKEND in the past six months, how many hours to you spend playing the following kinds of video/computer games?

Sports (e.g. FIFA soccer 2009, NHL 2009)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Strategy (e.g. Splinter Cell, Rainbow 6)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Role-playing (e.g. World of Warcraft, Final Fantasy)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Puzzles (e.g. Tetris, Solitaire)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Action (e.g. God of War 2, Grand Theft Auto 4)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

First-person Shooters (e.g. Halo, Call of Duty 4)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Racing (e.g. Gran Turismo 4, NASCAR)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Fighting (e.g. Mortal Kombat, Tekken 4)

1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Adventure (e.g. Harry Potter, Myst III)

1	2	3	4	5
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Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours
Quiz/Board games (e.g. Monopoly, Risk)				
1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

3. How many year(s) have you played the following kinds of games?

Sports (e.g. FIFA soccer 2009, NHL 2009)	_____ year(s)
Strategy (e.g. Splinter Cell, Rainbow 6)	_____ year(s)
Role-playing (e.g. World of Warcraft, Final Fantasy)	_____ year(s)
Puzzles (e.g. Tetris, Solitaire)	_____ year(s)
Action (e.g. God of War 2, Grand Theft Auto 4)	_____ year(s)
First-person Shooters (e.g. Halo, Call of Duty 4)	_____ year(s)
Racing (e.g. Gran Turismo 4, NASCAR)	_____ year(s)
Fighting (e.g. Mortal Kombat, Tekken 4)	_____ year(s)
Adventure (e.g. Harry Potter, Myst III)	_____ year(s)
Quiz/Board games (e.g. Monopoly, Risk)	_____ year(s)

4. On the average WEEKDAY in the past six months, how many hours to you spend playing the following video/computer games?

Fuel				
1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours
Conan				
1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

5. On the average WEEKEND in the past six months, how many hours to you spend playing the following video/computer games?

Fuel				
1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours
Conan				
1	2	3	4	5
Not at all	Less than 1 hour	1-2 hours	3-4 hours	5 or more hours

Appendix B: Ratings of Video Game Characteristics

Qualities of the Video Game Experience

Participant ID:

Without considering how much experience you have with this video game (pretend this was your first time playing this game)...

How was the pace of the action?

1	2	3	4	5	6	7
Very slow	Slow	Somewhat slow	Medium	Somewhat fast	Fast	Very fast

How difficult was the game?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

How violent was the game?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

To what extent did this video game involve competition (i.e., fighting or racing against opponents)?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

To what extent did you view the other characters in the game as opponents?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

To what extent did you feel like you were competing with your opponents (i.e., in a battle or in a race)?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

When you lost or failed, how close were you to winning or succeeding?

1	2	3	4	5	6	7
Very far	Far	Somewhat far	Medium	Somewhat close	Close	Very Close

How much confidence did you have that you would win or succeed?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

How competitive was this video game?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

How hard were you trying to win the game/match/contest?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

How intense was the competition?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

How frustrated were you when you failed or lost?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

How frustrated were you when you succeeded or won?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

How angry were you when you failed or lost?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

How angry were you when you succeeded or won?

1	2	3	4	5	6	7
Very low	Low	Somewhat low	Medium	Somewhat high	High	Very high

Appendix C: Food Preference Questionnaire

How much do you LIKE the following kinds of foods?

Sweet

1	2	3	4	5
Not at all	Somewhat	Neither like nor dislike	Very much	Extremely

Savory

1	2	3	4	5
Not at all	Somewhat	Neither like nor dislike	Very much	Extremely

Spicy

1	2	3	4	5
Not at all	Somewhat	Neither like nor dislike	Very much	Extremely

Hot

1	2	3	4	5
Not at all	Somewhat	Neither like nor dislike	Very much	Extremely

Bland

1	2	3	4	5
Not at all	Somewhat	Neither like nor dislike	Very much	Extremely

Salty

1	2	3	4	5
Not at all	Somewhat	Neither like nor dislike	Very much	Extremely

Appendix D: Suspiciousness Questionnaire

The next few questions focus on your perception of the study.

What do you think was the purpose of this study?

Did anyone tell you about this study before you came today? If so, what did they say?

Did you think anything you were told in the experiment was deceptive? If so, what do you think was deceptive?

Appendix E: Buss & Perry (1992) Trait Aggression Questionnaire (second page)

Fill in the answer that best suits you:

	ALMOST NEVER OR NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS OR ALWAYS
I'm quiet when I'm with a group of other people my age.....○.....○.....○.....○.....
I only talk to other people my age that I know really well.....○.....○.....○.....○.....
I feel that other people my age talk about me behind my back.....○.....○.....○.....○.....
I worry about what other people my age think of me.....○.....○.....○.....○.....
I feel that other people my age are making fun of me.....○.....○.....○.....○.....
I'm afraid that other people my age will not like me.....○.....○.....○.....○.....
If I get into an argument with another person, I worry that he or she won't like me...○.....○.....○.....○.....
I worry about being teased.....○.....○.....○.....○.....
I feel shy with people my age that I don't know.....○.....○.....○.....○.....
I get nervous when I talk to people my age that I don't know very well.....○.....○.....○.....○.....
I worry about doing something new in front of other people my age.....○.....○.....○.....○.....
I feel shy even with other people my age I know well.....○.....○.....○.....○.....
It's hard for me to ask other people my age to hang out with me.....○.....○.....○.....○.....
I'm afraid to invite other people my age to my house because they might say no...○.....○.....○.....○.....

How often do you do each of these things when you have a problem?

	STRONGLY DISAGREE	DISAGRE E	NEUTRAL	AGREE	STRONGL Y AGREE
I get as much information as I can.....○.....○.....○.....○.....○.....
I think hard about what steps to take.....○.....○.....○.....○.....○.....
I think about the choices before I do anything.....○.....○.....○.....○.....○.....
I do something to try to solve the problem.....○.....○.....○.....○.....○.....
I tell myself "Stop and think before you do anything.".....○.....○.....○.....○.....○.....

Fill in the circle that best describes you:

	STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE
If I think something unpleasant is going to happen I usually get pretty worked up.....○.....○.....○.....○.....
I worry about making mistakes.....○.....○.....○.....○.....
Criticism or scolding hurts me quite a bit.....○.....○.....○.....○.....
I feel pretty worried or upset when I think or know somebody is angry at me.....○.....○.....○.....○.....
Even if something bad is about to happen to me, I rarely experience fear.....○.....○.....○.....○.....
I feel worried when I think I have done poorly at something.....○.....○.....○.....○.....
I have very few fears compared to my friend.....○.....○.....○.....○.....
When I get something I want I feel excited and energized.....○.....○.....○.....○.....
When I'm doing well at something, I love to keep at it.....○.....○.....○.....○.....
When good things happen to me, it affects me strongly.....○.....○.....○.....○.....
It would excite me to win a contest.....○.....○.....○.....○.....
When I want something, I usually go all out to get it.....○.....○.....○.....○.....
I go out of my way to get things I want.....○.....○.....○.....○.....
If I see a chance to get something I want, I move on it right away.....○.....○.....○.....○.....
When I go after something I use a "no fear" approach.....○.....○.....○.....○.....
I will often do things for no other reason than that they might be fun.....○.....○.....○.....○.....
I crave excitement and new sensations.....○.....○.....○.....○.....
I'm always willing to try something new if I think it will be fun.....○.....○.....○.....○.....
I often act on the spur of the moment.....○.....○.....○.....○.....

How do the following statements describe you?

Buss & Perry (1992) Trait Aggression Questionnaire

	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
Some of my friends think I am a hothead.....	...○...	...○...	...○...	...○...	...○...
If I have to resort to violence to protect my rights, I will.....	...○...	...○...	...○...	...○...	...○...
When people are especially nice to me, I wonder what they want.....	...○...	...○...	...○...	...○...	...○...
I tell my friends openly when I disagree with them.....	...○...	...○...	...○...	...○...	...○...
I have become so mad that I have broken things.....	...○...	...○...	...○...	...○...	...○...
I can't help getting into arguments when people disagree with me.....	...○...	...○...	...○...	...○...	...○...
I wonder why sometimes I feel so bitter about things.....	...○...	...○...	...○...	...○...	...○...
Once in a while, I can't control the urge to strike another person.....	...○...	...○...	...○...	...○...	...○...
I am an even-tempered person.....	...○...	...○...	...○...	...○...	...○...
I am suspicious of overly friendly strangers.....	...○...	...○...	...○...	...○...	...○...
I have threatened people I know.....	...○...	...○...	...○...	...○...	...○...
I flare up quickly but get over it quickly.....	...○...	...○...	...○...	...○...	...○...
Given enough provocation, I may hit another person.....	...○...	...○...	...○...	...○...	...○...
When people annoy me, I may tell them what I think of them.....	...○...	...○...	...○...	...○...	...○...
I am sometimes eaten up with jealousy.....	...○...	...○...	...○...	...○...	...○...
I can think of no good reason for ever hitting a person.....	...○...	...○...	...○...	...○...	...○...
At times I feel I have gotten a raw deal out of life.....	...○...	...○...	...○...	...○...	...○...
I have trouble controlling my temper.....	...○...	...○...	...○...	...○...	...○...
When frustrated, I let my irritation show.....	...○...	...○...	...○...	...○...	...○...
I sometimes feel that people are laughing at me behind my back.....	...○...	...○...	...○...	...○...	...○...
I often find myself disagreeing with people.....	...○...	...○...	...○...	...○...	...○...
If somebody hits me, I hit back.....	...○...	...○...	...○...	...○...	...○...
I sometimes feel like a powder keg ready to explode.....	...○...	...○...	...○...	...○...	...○...
Other people always seem to get the breaks.....	...○...	...○...	...○...	...○...	...○...
There are people who pushed me so far that we came to blows.....	...○...	...○...	...○...	...○...	...○...
I know that "friends" talk about me behind my back.....	...○...	...○...	...○...	...○...	...○...
My friends say that I'm somewhat argumentative.....	...○...	...○...	...○...	...○...	...○...
Sometimes I fly off the handle for no good reason.....	...○...	...○...	...○...	...○...	...○...
I get into fights a little more than the average person.....	...○...	...○...	...○...	...○...	...○...

	NEVER	RARELY	SOMETIMES	OFTEN	VERY OFTEN
When I really want something I cannot keep my mind off of it.....	...○...	...○...	...○...	...○...	...○...
I have difficulty saving money to buy something several weeks later.....	...○...	...○...	...○...	...○...	...○...
I usually do what I want when I want to.....	...○...	...○...	...○...	...○...	...○...
It's difficult for me to wait my turn for a long time.....	...○...	...○...	...○...	...○...	...○...
My mood is generally cheery.....	...○...	...○...	...○...	...○...	...○...
I do not like changes in routine.....	...○...	...○...	...○...	...○...	...○...
I laugh several times a day.....	...○...	...○...	...○...	...○...	...○...
My first response to anything new is to be interested in it.....	...○...	...○...	...○...	...○...	...○...
No matter when I go to sleep, I wake up at the same time.....	...○...	...○...	...○...	...○...	...○...
Once I start something, I finish it.....	...○...	...○...	...○...	...○...	...○...
I like meeting new people.....	...○...	...○...	...○...	...○...	...○...
I smile often.....	...○...	...○...	...○...	...○...	...○...
I stay with an activity for a long time.....	...○...	...○...	...○...	...○...	...○...
I am happy with my life.....	...○...	...○...	...○...	...○...	...○...
I have trouble getting to sleep at night.....	...○...	...○...	...○...	...○...	...○...
Changes in plans make me restless.....	...○...	...○...	...○...	...○...	...○...
I get the same amount of sleep at night.....	...○...	...○...	...○...	...○...	...○...
To think something over, I want to be alone.....	...○...	...○...	...○...	...○...	...○...
If I have an argument with someone, I want to be alone to think it over.....	...○...	...○...	...○...	...○...	...○...
I get away from others because they disturb me with their noise.....	...○...	...○...	...○...	...○...	...○...
Being alone helps me renew my courage.....	...○...	...○...	...○...	...○...	...○...
I like to do things on my own at home.....	...○...	...○...	...○...	...○...	...○...