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"Killing Spree": Exploring the Connection Between Competitive Game Play and Aggressive Cognition

Mike Schmierbach[1]

Abstract

Although scholars have repeatedly linked video games to aggression, little research has investigated how specific game characteristics might generate such effects. In this study, we consider how game mode—cooperative, competitive, or solo—shapes aggressive cognition. Using experimental data, we find partial support for the idea that cooperative play modes prompt less aggressive cognition. Further analysis of potential mediating variables along with the influence of gender suggests the effect is primarily explained by social learning rather than frustration.

Keywords

video games, violence, competitiveness, gender, general aggression model, frustration

As video games continue to accrue cultural significance, a growing amount of research assesses their effects on the people who play them. In particular, this research has often focused on the influence of violence in games. Many scholars argue this violence has adverse consequences; those exposed to violent games show an increase in a variety of aggressive outcomes and a decrease in helpful or prosocial behavior (Anderson, 2004; Anderson & Bushman, 2001; Anderson et al., 2004). Although research has improved in recent years, many of these studies needlessly simplify the myriad variables in game characteristics to "violent" versus "nonviolent" (Williams, 2005).

The reality of gaming has grown more complex along with the technology that powers it. Games are now targeted at a variety of age groups and interests. They feature diverse content and visual styles. More important, they are no longer simply solo activities, played in isolation. Instead, games can be played in a variety of social contexts, from consoles that let four people do battle in their living room to massively multiplayer online games that can draw millions of subscribers (Schiesel, 2005). The emergence of such games serves as an important contextual variable, potentially modifying the play experience. Several content analyses

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of games have shown that violence occurs across titles with a great diversity of settings, target audiences, and difficulties (Lachlan, Smith, & Tamborini, 2005; Smith, Lachlan, & Tamborini, 2003). Although these contextual variables may prove irrelevant, it seems doubtful, and several scholars have called for examining them more closely (Southwell & Doyle, 2004; Williams, 2005). By focusing on the question of play mode, and the availability of human opponents or helpers, this study examines one such contextual variable and allows a careful look at how competition and rewards, along with raw exposure to violence, help shape aggression-related responses. Potentially, this might offer insights into the particular characteristics of games that promote aggression and the mechanisms by which this occurs.

This article explores how differences in game-play mode influence aggressive cognition and related variables. The research compares individuals who played the popular Xbox game Halo by themselves with individuals who competed with a partner and those who cooperated with a partner to defeat common foes, testing the expectation that individuals in the competitive context will exhibit more violent thoughts and evaluating two potential theoretical explanations for such an effect.

Games and Aggression

Numerous studies link video game playing to aggressive outcomes. Both Anderson and Bushman (2001; see also Anderson, 2004 and Anderson et al., 2004) and Sherry (2001) have presented meta-analyses showing a fairly consistent pattern of effects. Anderson notes that violent video games prompt aggressive thoughts and feelings as well as aggressive behaviors while inhibiting prosocial behaviors. Sherry too finds the net effect of games is negative, although he is more reserved in judgment, noting (among other things) relatively small effect sizes. These studies do not attempt to balance such findings against potentially positive outcomes of games; they simply illustrate a consistent adverse effect. Games, including multiplayer titles, may have other influences, but given the preponderance of the literature, aggression is a logical place to start.

In this literature, the most prominent approach is the general aggression model developed by Anderson and colleagues, which provides a map of the process whereby stimuli can contribute to aggressive behavior (Buckley & Anderson, 2006; Bushman & Anderson, 2002). In particular, this model has been applied to understanding the effects of media violence. In this model, aggressive emotions and general arousal both help explain why people react aggressively in the short term, as does the priming of violent thoughts. These short-term processes, coupled with long-term learning, explain lasting changes in attitudes and behaviors. Of these paths, researchers have focused heavily on cognition, with studies suggesting it plays a critical role in explaining violent behavior. For example, Anderson and Dill (2000) carried out mediation analyses that suggested cognition, rather than affect or arousal, was primarily responsible for observed effects on behavior. Carnagey and Anderson (2005) also found that the pattern of aggressive behavior in their analyses most clearly mirrored that of aggressive cognition, suggesting that the latter was the primary explanatory factor; however, Sherry's (2001) meta-analysis concludes that arousal may be a more important influence on aggression.

It appears that research into video games that employs the GAM has focused on the cognitive path with the goal of showing that aggression can in part result from conscious, learned behaviors. That is, nothing in this research suggests that "automatic" aggression does not occur as an instinctive response to arousing or frustrating stimuli. Rather, the work attempts to supplement this concepts with the idea that aggressive thoughts and behaviors can be "taught," consistent with social learning theory (Bandura, 1973). For example, the Carnagey and Anderson (2005) study found that such changes in cognition resulted in part from the reward structure of games—when people were given points for killing, both their in-game violence and their subsequent aggressive cognition increased. By showing that particular tactics are rewarded, games teach viewers or players that these tactics are acceptable in other contexts (Anderson & Bushman, 2001).

Overall, then, the GAM is an advancement over other models of aggression that omit learning as a mechanism for the creation of aggression. Thus, it is important to consider the ways in which games fit the social learning model. First, this theory argues in part that individuals may mimic the actions of others, even when those actions are mediated (Bandura, 1973). Thus, if a game shows characters behaving aggressively, players may imitate these acts. More important, the theory posits that individuals learn behaviors for which they are rewarded and avoid those for which they are punished, even if the rewards and punishments are self-administered (Bandura, 1965, 2001). In a game setting, this means that if the game rewards aggressive tactics with advancement or points, or even if the player simply derives satisfaction from aggressive play, this could teach or reinforce such tactics.

In contrast to the heavy emphasis on cognition found in most of the work following the GAM approach, an alternative perspective suggests that aggression is better explained in terms of arousal and frustration. Berkowitz (1989) advocates a frustration-aggression hypothesis. In this approach, individuals who have a reasonable expectation of success but are thwarted in their efforts will exhibit aggression. In the context of games, this suggests that the competition presented by both computer and human opponents would create arousal and subsequent aggressive thoughts and behaviors. Although less explored in the gaming literature as a whole, the frustration hypothesis is put forth as an explanation for the effects of competitive play in the work of Eastin (2006, 2007).[1]

Mode of Play

The question of competition is particularly relevant in light of the growing popularity of multiplayer games. Such games offer the potential to compete with other people in both proximate and distant settings. A handful of scholars have begun to examine the effects of such games. For example, massively multiplayer online games feature thousands of individuals, who might simultaneously be competing with some players and cooperating with others (Chan & Vorderer, 2006; Williams & Skoric, 2005; Yee, 2006). On a more limited scale, most games now feature some kind of multiplayer feature in which one or more additional players can be brought in either as a source of competition or as a partner in play. As such, considering players as isolated individuals misses the way in which many people play.

A handful of studies, mostly focusing on aggression, have evaluated the effects of playing with other people. In most cases, these studies use deception, informing individuals that a distant opponent or partner is a person when in fact a computer is responsible for the other "player's" actions. Eastin (2006; Eastin & Griffiths, 2006) conducted a pair of studies evaluating the effects of competitive play mode. In the first study, Eastin found that female players exhibited an increase in aggression (measured using a word-completion task) against opponents the player was told were human and which were shown as female, regardless of the gender of the player avatar. In addition, players showed greater aggressive cognition toward computer opponents when playing as a female avatar. In a second experiment, players with female avatars showed greater aggressive cognition toward human opponents, although the effect was more pronounced when the opponent was depicted as female. In the second study, Eastin and Griffiths (2006) focused on male players. In this study, players showed no significant differences in hostile expectations, aggressive behaviors, or aggressive feelings between playing against a computer and against a "human" opponent.

Other studies of multiplayer games have used actual human opponents, focusing on competition between players. In a third study, Eastin (2007) assigned players to groups of either 2, 4, or 6 and had those individuals play either competitively or cooperatively. Unlike the prior studies, in this experiment the groups actually existed and interacted, albeit via voice chat (rather than in person). The results showed increased aggression in the six-person groups and slightly (but not significantly) higher aggression among those competing rather than cooperating. In a different study, individuals who played monopoly against a computer had higher self-reported aggression scores than those who played against another person, using the computer software (Williams & Clippinger, 2002), suggesting a reduction in aggression when competing with other people. Another study of differences in play mode used physiological measures to evaluate potential effects (Ravaja et al., 2006). In general, the authors found that playing with another person increased arousal and positive affect, an effect that was heightened when playing with a friend. In this within-subjects design, individuals played two different games, one violent and one relatively nonviolent, both of which featured competitive multiplayer modes. Finally, Anderson and Morrow (1995) looked at the effects of competitive and cooperative play at Super Mario Bros, finding that individuals told to compete with one another at the game were more likely to kill, rather than bypass, enemy characters (although this may partly reflect the ability to score points through enemy kills).

Taken as a whole, the literature provides some weak evidence of heightened aggression, particularly in cognitive terms, resulting from competitive play. This evidence might be stronger or clearer if studies more consistently provided opportunities for direct interaction between players. Certainly, it is logical to expect that competitive play would produce more aggressive cognition compared with cooperative play and that competitive play against other people would amplify this, and the literature presented thus far generally endorses this expectation, leading to the following hypothesis:

Hypothesis 1: Individuals playing a competitive multiplayer game mode will exhibit higher levels of aggressive cognition than those playing a cooperative or solo mode.

In addition to cognition, it is possible that competitive play might act through other channels, including arousal and affect. As noted earlier, although these factors are not as fully explored in existing research, they are an important element of the GAM, and affect is of course central to the frustration model. Thus, although the existing research in this area is less clear, exploring any influence of game mode on these outcomes could help clarify not only whether but also how the contextual variable of mode influences responses to violent game content. Thus, this study poses the following research question:

Research Question 1: Will individuals who play a competitive multiplayer game mode exhibit higher levels of aggressive affect or arousal than those playing a cooperative or solo mode?

Although few would argue with the claim that competitive play can amplify aggression, the literature provides less clarity about the theoretical mechanism behind such effects. This study attempts to evaluate two competing explanations. The first focuses on the rewards competitive play offers for violent interactions. In order to best one's opponent, competitive players must devise effective aggressive tactics. In multiplayer "death match," in particular, there are no rewards for avoiding a fight. Even when playing against the computer, the primary tactics employed are aggressive, but the game is less solely focused on those strategies. However, when playing a cooperative game, individuals benefit from helping their partner (but also from killing computer-controlled adversaries). The study by Carnagey and Anderson (2005) clearly illustrates that when individuals play a game structured to reward them for violent behavior, they will respond more aggressively than when the game punishes or prevents such tactics. This reflects the more general idea of social learning embedded with the GAM. Games may be particularly likely to teach aggression because they not only model violent behavior but also provide direct in-game rewards to players for such behavior. Beyond this, the presence of competition in a game may itself serve as a kind of reward, as competitive play tends to motivate certain types of players and produce enjoyment (Vorderer, Hartmann, & Klimmt, 2003).

An alternative explanation is provided in several of the studies focusing on the effects of competitive multiplayer games. Eastin (2006, 2007) argues that competitive play ought to create greater frustration. This follows the argument put forth in the aggression-frustration hypothesis (Berkowitz, 1989), which suggests that competitive situations foster greater frustration because opponents can hinder success, leading to increased aggression. Deutsch (1993) suggests that, however, cooperative activities (he focuses on learning) can help resolve conflicts and reduce aggression. However, it is not clear that cooperative games necessarily can serve this effect; Wingrove and Bond (1998) detail a study in which a cooperative game fostered aggression toward the supposed partner (actually a computer). Nonetheless, it is at least possible that the increased barriers to success posed by human competitors would foster frustration and aggression.

In short, the literature offers two distinct explanations for increased aggression as a result of competitive versus cooperative play, especially when the competition is

other people. In the social learning/rewards model, competitive play offers greater rewards for aggressive actions and limited models and rewards for nonaggressive tactics. In the frustration-aggression model, competition increases the potential arousal and frustration felt by players, leading to aggressive responses. These are not necessarily mutually exclusive approaches, of course. Thus, this study evaluates two hypotheses that represent these two models, attempting to assess whether either or both explains aggression. In particular, if either model is correct, then the data should show evidence of mediation, such that the competitive play mode causes an increase in the proposed explanatory variable, and that in turn including that explanatory variable in a model predicting the aggressive outcome ought to reduce the size of any measured relationship between play mode and aggression. These competing hypotheses are expressed as follows:

Hypothesis 2a: Individuals playing a competitive multiplayer game mode will feel more rewarded for aggressive play than those in a cooperative or solo mode, and these feelings will mediate any relationship between mode and aggressive cognition.

Hypothesis 2b: Individuals playing a competitive multiplayer game mode will feel more frustrated than those in a cooperative or solo mode, and these feelings will mediate any relationship between mode and aggressive cognition.

An additional test of these models is available in the data as well. A central premise of this study is that the same game content may be experienced in different ways, depending on the context of the experience. This is consistent with, for example, the Southwell and Doyle's (2004) study. One possible moderator, gender, has received significant attention in the literature on games and may be particularly important to understanding how competition shapes aggressive responses to games. Scholars note that women play fewer games (Funk, Buchman, & Germann, 2000; Lucas & Sherry, 2004). Explanations include unappealing content reflecting an absence of female developers (Dietz, 1998), discomfort with computers and mental rotation (Terlecki & Newcombe, 2005), and social factors resulting from women receiving few interpersonal "rewards" for play (Funk & Buchman, 1996; Lucas & Sherry, 2004).

For the purposes of this article, however, the most important explanation put forward is that many games emphasize competition in a way that might not appeal to the majority of female players. Thus, gender provides an important mechanism to explore *why* individuals respond to competitive elements in play.

Some research suggests that many women do not enjoy competition or are less likely to respond favorably to competitive scenarios (e.g., Gneezy, Niederle, & Ristichini, 2003; Lynn, 1993). Potentially, then, if women are less motivated by competition, we would expect them to respond differently to competitive elements in games. Several studies certainly suggest that women are less interested in the competitive or violent aspects of play (Cassell & Jenkins, 1998; Funk & Buchman, 1996; Funk et al.,

2000; Hartmann & Klimmt, 2006; Lucas & Sherry, 2004). In addition, research on massively multiplayer games implies that, although these games do draw significant numbers of female players, those players are often drawn to the cooperative elements (Yee, 2006). More generally, to the extent that competition serves to reward and reinforce aggressive play, then we might predict women will be less vulnerable to the effects of violent games. That is, if women do not like competing and are not motivated to win through violent tactics, then competitive game modes should have a stronger effect on men than women. However, if frustration explains why competitive modes lead to aggressive cognition, then women might be *more* vulnerable. Because they do not enjoy competing with other players and do not respond as well to competitive situations, women would be more frustrated by game situations that require them to compete instead of cooperating, leading to a more aggressive cognitive response.

The literature offers a few studies that evaluate gender as a possible moderator of the link between violent games and aggression, with mixed results. For example, Bartholow and Anderson (2002) compared the effects of violent games on retaliation behavior between men and women, finding stronger effects on men. Deselms and Altman (2003) connected violent games to increased leniency toward violent behavior, but only in men. In fact, in at least one case, playing a violent game actually increased the punishments handed out by women. Tamborini et al. (2004) also found greater hostility from women, although this was linked to viewing, rather than playing, a game. Several other studies have failed to show a significant moderating effect for gender. For example, the meta-analysis by Anderson and Bushman (2001) found no evidence of gender as a moderating factor. However, this work tells us about the effects of game play in general. A more direct test of gender differences comes from the two Eastin studies (Eastin, 2006; Eastin & Griffiths, 2006). In those studies, women showed differences in aggression as a result of game mode, whereas men did not. However, the studies are not entirely comparable as they use different dependent variables. It may simply be that the measure of cognitive aggression using a word-completion task better reflected the kinds of responses that result from competitive play.

In short, the existing literature does not offer a clear reason to predict that women are either more or less influenced by violent competition in games, although a handful of studies actually suggest women might respond more than men. By exploring the role of gender in the context of this specific study, this article offers insight into the mechanism behind any influence of competitive play. Thus, the focus on gender here stems not from a belief that gender is inherently important in explaining or moderating the connection between games and aggression-related variables but that any moderating effect of gender is specifically important to understanding the influence of game mode. This leads to the second main research question for this study:

Research Question 2: Does gender moderate any effect of mode on aggressive outcomes?

Method

Procedure

The researchers recruited study participants from several classes at a midsize southeastern university. Participants received extra credit in their course for completing the study. Recruited individuals completed a 10-minute training session during which they were shown the controls for the Xbox game Halo and allowed to play against an investigator to practice those controls.[2] Participants then signed up for a 1-hour study slot. Participants were assigned slots based on their performance in the practice session and their stated prior experience at video games, such that individuals were placed with other individuals who fit into either an inexperienced or experienced category. These sessions differed only in the skill level of participants. Total *N* was 102.

During the gaming session, pairs of participants were randomly assigned to play the game Halo for 30 minutes in one of three modes. In the *solo mode*, each participant played the second level of the single-player game, in which the player fights a series of battles against a small variety of "alien" opponents (n = 32). In *cooperative mode*, two players worked together to complete this same level (n = 34). In both cases, no participants finished the level in the allotted time. Finally, in *competitive mode,* participants attempted to kill their opponent in a "slayer" or death match game on the "longest" level played on default settings (n = 36). In this mode, most players took part in multiple matches, as a single match ends after one player manages 15 kills. Players simply restarted the level as often as necessary until the 30 minutes were up.

In all three modes, most aspects of the game are similar. Players view the game from a first-person perspective, with an on-screen crosshair that identifies the target and whether it is an opponent. This means players do not see their own avatar except in cut scenes at the moment of death. In such scenes, the player is entirely covered in armor, and when addressed by the computer the player is simply called *Master Chief*, which means that the gender of the player avatar is not explicitly identified. In the multiplayer modes, the screen is split horizontally so that each player has half the display space. In these modes, the two players sat next to one another, viewing the same TV, and were free to interact as they wished. In the solo mode, players were in adjoining rooms, playing on their own system. Although it was possible for them to speak to one another, this was not encouraged, and few players in this condition communicated at all. In the solo and cooperative modes, players restart from fixed save points if they are killed—in cooperative play, they can also restart next to their partner if he or she survives the battle. This meant players often replayed encounters several times, helping ensure a fairly constant pace. In the competitive mode, players respawn at a random point on the map after dying. In general, game play is moderately paced by the standards of the genre; skilled players tended to have somewhat more frequent battles.

Players were observed by at least one investigator and given a reminder of the controller functions if they asked for help. Otherwise, directions for play were minimal. In the solo and cooperative conditions, players were told to kill opponents and pay attention to onscreen text and spoken cues from the in-game narrative. In competitive mode, players

were told to find and kill their opponent. After 30 minutes of play, participants stopped and completed a questionnaire, which was used to construct the key measures in this study.

Measures

Independent variables. In addition to game play condition, two other important independent variables are used in these analyses. The first is *gender*. Roughly 58% of the participants were female. The second is prior game experience. Past research shows that women tend to play fewer games than men. In addition, the play session of more experienced (and thus skillful) game players may have differed from that of less-skilled ones. More experienced players may have been more successful in competitive play and gotten further in cooperative and solo play, even with the matching employed in this study. Thus, experience is included as a covariate in analyses to control for this potential variance and to ensure that any effects of gender are not attributable to skill. Participants were asked six questions about how often they had played Halo, other first-person shooters, other console games, PC games, multiplayer games against people who were physically present, and multiplayer games over the Internet. Options ranged from 0 (*never*) to 7 (*often*); the average of these six items was used as a measure of *gaming experience* ($M = 1.54$, $SD = 1.44$, Cronbach's $\alpha = .83$).

Mediating variables. The study included two potential mediating variables that would provide a theoretical mechanism linking game mode to aggressive responses. The first was the extent to which the individuals engaged in and felt rewarded by *violent strategizing*. Such strategizing indicates that people felt the game encouraged them to adopt violent tactics and that they were rewarded for those tactics. Tendency to engage in and feel rewarded for violent strategizing was measured with four questions, all using a 7-point scale (ranging from *strongly disagree* to *strongly agree*). They asked participants whether they felt killing someone was a great way to get even, whether they really enjoyed getting to kill their opponent, whether they wished there were even more fighting in Halo, and whether they found themselves thinking about how to kill their opponent next. The measure was the average of these four questions ($M = 3.53$, $SD = 1.55$, $\alpha = .80$).

It is also possible that competitive game modes result in higher levels of *frustration*, which would lead to aggressive cognition and other outcomes. To measure this, the study included two questions that were combined into a single index ($M = 3.81$, $SD = 1.80$, $\alpha = .83$). Individuals indicated the degree to which they agreed that playing Halo made them frustrated and reported the extent to which their emotional response to the game included feelings of frustration.[3]

Dependent variables. This study considers three dependent variables to measure precursors of aggression, reflecting the different types of response proposed in the GAM approach. The first is a measure of *aggressive cognition* using a word completion task. Participants were asked to complete six words given the first two letters; these letters were KI, DE, BL, ST, RI, and SL. A single coder than evaluated these words for

whether they represented violent concepts, such as weapons, violent behaviors, or signs of violence or injury. The measure of violent thoughts represents the total number of violent words ($M = 2.10$, $SD = 1.43$). A second coder assessed approximately 20% of the terms, and the calculated numbers of violent terms were compared to evaluate reliability; Krippendorf's alpha was .84. This approach represents a condensed variation of the word completion tasks found in the literature on video games (e.g., Carnagey & Anderson, 2005; Eastin, 2006) as well as others kinds of violent media, in which their association with measures of aggression have been validated (e.g., Anderson, Carnagey, & Eubanks, 2003).

The other dependent variables measure aggressive affect and excitement or arousal. These factors have not proved as important in explaining future violent behavior, and it is less clear whether they would be affected by gaming condition, but by evaluating them the analyses provide a more complete picture of the effects of game mode. *Arousal* was measured using self-report data about whether the individual agreed that their "heart was racing during the game" and that "playing Halo is very exciting" and whether the individual felt the emotions of being "excited" and "anxious" during the game. All items were measured on a 7-point scale and were averaged to from the measure ($M = 3.58$, $SD = 1.32$, $\alpha = .79$).[4] Using self-report data to measure this concept is not ideal, but physiological measurement was not possible within the context of the study, and some prior studies showing gaming effects on arousal have used self-report data. *Aggressive affect* was also measured using self-report data; specifically, individuals were asked using a 7-point scale the extent to which they felt angry while playing the game ($M = 1.82$, $SD = 1.77$).

Results

Unfortunately, the design of this study complicates analysis, because independence of observations cannot be assumed in a dyad-based design (Kenny, 1995; Malloy & Albright, 2001).[5] For these data, a modeling approach recommended by Kenny (2004) is employed. This approach is applicable only to dyad-level data, and it makes certain assumptions. In particular, although the analyses allow for dyad-level effects on the dependent variables, they assume that the effects of the other independent variables are fixed and do not vary by dyad. A mixed linear model is computed, controlling the effects of dyad as well as individual and partner game experience.[6] Condition, gender, and a gender–condition interaction are included as fixed factors in each model.

The initial stage of analysis is to evaluate the extent to which the different game modes influenced both the key dependent variables and the potential mediators. Table 1 lists the estimated marginal means by gender and gaming condition for these variables as generated from the mixed models approach described above. Analysis indicates that condition significantly influenced the number of violent words listed, $F(2, 43.7) = 6.21$, $p < .01$. Competitive players showed the highest level of cognitive violence, whereas cooperative players scored markedly lower. Overall, this provides support for Hypothesis 1.

Two other dependent variables reflect other possible outcomes of violent game content. Although the mechanisms that might cause competitive gaming to lead to increases in

Table 1. Differences in Aggression, Frustration, and Violent Strategizing by Game Mode and Gender

Game mode	Aggressive cognition	Aggressive affect	Arousal	Frustration	Violent strategizing
F, mode	6.26***	2.72*	0.79	2.84*	3.18*
F, sex	0.29	0.92	3.97**	0.99	1.97
F, Mode × Sex	2.65*	0.39	0.69	0.57	1.34
			Men		
Cooperative	1.08 (0.38)	1.67 (0.54)	2.79 (0.40)	3.56 (0.52)	3.07 (0.41)
Competitive	2.81 (0.32)	0.91 (0.47)	3.42 (0.36)	3.10 (0.45)	4.31 (0.36)
Solo	2.08 (0.33)	2.23 (0.49)	3.43 (0.37)	4.11 (0.46)	4.07 (0.37)
			Women		
Cooperative	2.02 (0.27)	1.79 (0.41)	3.81 (0.31)	3.49 (0.38)	3.07 (0.31)
Competitive	2.37 (0.29)	1.75 (0.43)	3.69 (0.32)	3.90 (0.41)	3.26 (0.33)
Solo	2.09 (0.29)	2.51 (0.43)	4.05 (0.33)	4.65 (0.41)	3.69 (0.33)
			Combined		
Cooperative	1.55 (0.21)	1.73 (0.33)	3.30 (0.25)	3.52 (0.31)	3.07 (0.25)
Competitive	2.59 (0.20)	1.33 (0.31)	3.56 (0.24)	3.50 (0.29)	3.78 (0.23)
Solo	2.10 (0.21)	2.37 (0.32)	3.74 (0.25)	4.38 (0.30)	3.88 (0.24)

Note: Values given are estimated mean scores for each group and for both genders combined, calculated using SPSS mixed models and accounting for intercorrelation within dyads, with standard errors in parentheses. Estimated means reflect effects of setting experience variables at mean values. Total $N = 102$.* $p < .1$. ** $p < .05$. *** $p < .01$.

affect or arousal are less clear, the effects are nonetheless worth testing, as per Research Question 1. As the table shows, these variables were not affected in a way consistent with the influence of game mode on aggressive cognition. Mode had no significant effect on arousal, but it did show a marginal effect on affect, $F(2, 44) = 2.72$, $p < .1$. The data show that solo players, male and female, were the most likely to report feeling angry, whereas competitive players, particularly men, actually felt least angry. These results suggest sharp differences in emotional and cognitive responses to game mode; even though this result is only marginally significant, it is a clearly different pattern from the significant influence on aggressive cognition.

Analysis of the two proposed mediators offers some insight into the sources of this difference. The general logic of mediation requires that the independent variable exert a significant influence on the mediator, that the mediator in turn is significantly related to the dependent variable (and in a consistent fashion), and that inclusion of the mediator in subsequent analysis reduces or eliminates the initially significant relationship between the independent variable and dependent variable.[7] Thus, the first step presented here is analyzing the effect of the independent variable of mode on the proposed mediators: frustration

and the use of (and rewards for) violent strategizing. Frustration was marginally affected by game mode, $F(2, 42.5) = 2.84$, $p < .1$, such that solo players were actually the most frustrated. This is consistent with the effects of game mode on anger, not surprisingly. However, it is inconsistent with the effects of mode on violent cognition, often identified as the critical variable in explaining violent behavior and long-term changes. Conversely, violent strategizing was also marginally affected by game mode, $F(2, 45.7) = 3.18$, $p < .1$, and in a way consistent with the pattern of violent cognition. That is, competitive players were the most likely to report feeling motivated to engage in violent strategies and rewarded by those strategies, whereas cooperative players were the least so. Again, although this result is marginal (in fact, p is almost exactly .05), the fact that this pattern is consistent with the aggressive cognition result and clearly distinct from the frustration variable is telling. As an initial "filter" of possible mediators, this step eliminates frustration as an option. If frustration were accounting for the effect of mode on aggressive cognition, it would have to be similarly affected.

Further analyses leave open the prospect that strategizing may partly mediate the relationship between mode and aggressive cognition. In these analyses, the same mixed model predicting aggressive cognition are presented in Table 1, but the proposed mediator is included as an additional covariate. Including strategizing in a model predicting aggressive cognition shows that strategizing is a significant predictor of cognition, $F(1, 78.5) = 14.50$, $p < .001$. In addition, adding this variable reduces the coefficient for game mode, $F(2, 45.1) = 4.65$, $p < .05$). This offers evidence of partial mediation—there is a significant relationship between the independent variable and the mediator and between the mediator and the dependent variable, and including the mediator as a control variable reduces, but does not entirely account for, the relationship between the independent variable and dependent variable. These analyses reinforce the fact that frustration *cannot* be serving as a mediator, as it is not a significant predictor of aggressive cognition, $F(1, 86.2) = .57$, *ns*. The central purpose of these analyses is to compare two competing explanations for any relationship between mode and aggressive cognition: frustration and social learning. Although the results do not formally quantify the degree to which social learning may account for aggressive cognition, they clearly show that only one of these competing hypotheses is viable.

The second research question asked whether the effects of mode would differ depending on gender. As a whole, the data do not provide significant evidence of gender differences. However, for the critical variable of violent cognition, the data show a marginally significant interaction between gender and game mode, $F(2, 63.7) = 2.65$, $p < .1$. Specifically, although both men and women show the same basic pattern of effects, it is much more pronounced for men. Indeed, although not significant, in general women appear to show smaller differences than men across the dependent variables, with the exception of frustration.

Discussion

These data go beyond the question of whether games cause aggressive cognition to evaluate whether a particular dimension of games is relevant to their effects. Games are increasingly played with or against other people, yet the effects of those different contexts are

insufficiently understood. Prior scholarship has called for an increasing focus on these contextual and moderating factors, yet relatively few scholars have answered the call. This study adds to that literature and points to a potentially fruitful direction for further inquiry, considering the social aspects of gaming not only as an aspect of study in their own right but also as a factor shaping how players respond to games. Doing so may help test and improve existing theories of media effects. In this study, the data offer support for the hypothesis that individuals playing competitive games would show greater levels of aggressive cognition than those playing other modes. A careful assessment of the data shows that although competitive play did induce an increase in aggressive thoughts, the true "outlying" group was the cooperative condition, where aggressive cognition was far lower. Interestingly, this same condition actually generated more aggressive affect and frustration.

The data paint a picture of aggression-related outcomes as falling into two distinct categories. The first is more visceral, with aggressive affect and frustration responding most to the solo condition. Although these effects were not the focus of the two models described in the literature, they are intriguing. It appears that playing against the computer can make people frustrated and angry. When watching the game play, the study observers noted that solo play proved especially challenging for some players. These individuals repeatedly encountered the same handful of enemies and struggled with seemingly easy tasks such as walking across a bridge. It may be that solo play in this particular title was frustrating. Competitive play, however, is only as difficult as the skill of the opponent, and in some competitive situations players actually provided feedback to help their opponents get "into the action." Further research would need to explore whether less difficult or differently designed titles would also evoke greater frustration and anger in solo players.

Meanwhile, frustration has been offered as an explanation for other potential precursors of aggression resulting from competition, including aggressive cognition, although this claim has gone largely untested in the literature. Such an explanation was not supported in these data. Frustration did not explain aggressive cognition and did not respond to the manipulations in the same way as that variable. Instead, it appears that aggressive cognition results from social learning. Individuals who embraced the violent strategies necessary to win in competitive play modes were more likely to list violent terms. Meanwhile, those who cooperated with other people expressed the least interest in violent play and the lowest level of aggressive cognition. For these individuals, it was necessary to cooperate with another player, engaging in strategizing that emphasized nonviolent game elements. This may have partly offset any negative effects of the game itself.

The analysis of gender provides an additional test of these competing theories, and the results are somewhat consistent with the above explanation. Men are apparently somewhat more affected by game mode than are women. This result is marginal but directionally consistent with the prediction of social learning theory and inconsistent with what one would expect from the frustration-aggression hypothesis. To the extent that women are less likely to enjoy competition, it makes sense that they would be less likely to learn violence as a response to competitive play. This mode would not offer the same kind of reward for women that it would for men. That said, the data did not show significant

differences in the extent to which women and men embraced violent strategizing, although the basic pattern was the same. The primary reason for considering gender was the extent to which it would serve as a proxy for interest in competition. The relatively weak results for gender—which are consistent with meta-analytic studies that show little evidence of an overall moderating effect—may be due to this indirect measurement. These results generally suggest that more carefully and directly assessing the moderating influence of competitiveness, perhaps drawing on the uses and gratifications literature, might be called for. They do not suggest a clear, strong moderating effect of gender is likely to emerge in other contexts.

In addition, although the data point to social learning as a partial mediator between mode and aggressive cognition, a considerable link between these variables remains even after inclusion of the mediating variable. This may simply reflect the imperfect measure of rewards and learning used, but it may also be that game mode has a priming effect. That is, competitive play may feature more frequent violent interactions, leading violence to be more accessible for players in that mode. This would fit with Huesmann's (1988) model of aggression, which suggests that scripts for aggressive response may be learned from media exposure in a fashion that draws both on social learning and the development of associated mental networks through priming. A priming effect is possible, but it seems unlikely based on observations of Halo and the nature of its game play. For one thing, if competitive play included more frequent combat, this would not explain the differences between cooperative and solo play, which take place in the same areas. The observers noted that players usually made more progress in the cooperative mode, suggesting that they actually encountered more opponents. In addition, the pace of combat in competitive play was not markedly higher, given the low skill level of most players. Furthermore, Eastin (2007) found no connection between the frequency of killing and the amount of state hostility players experienced when experimenting with a similar title, Unreal Tournament. Priming may also have occurred simply as a result of the mode being competitive. Anderson and Morrow (1995) argued that simply instructing participants that they were to compete was adequate to prompt aggressive play, independent of the actual game experience. However, in this study the participants in the competitive condition were not given directions that emphasized competition, although the on-screen cues from the game itself may have had a similar effect.

That said, the violent content of Halo may still have played an important role in explaining these results. Individuals absorbed the lesson that aggressive, violent play was an appropriate strategy in part because the game features that kind of content. A less violent title might not have the same effect. One important direction for future research would compare an equally competitive but less violent title to see how the results differ. In addition, future research should expand beyond college students to look at how other types of game players are affected, and to consider how effects accumulate over time, instead of in a single game session. Expanding the results to other titles would also increase the external validity. Simply increasing the sample size would be beneficial to help clarify some of the marginal results found in this study, as the overall power is rather low. Scholars might also evaluate whether the effects would be different if the two players were not able to interact, as has been the case in some studies where players were told they were playing another

person but simply played a computer. In general, the social interaction made possible in games should be the focus of significant future research, not just in terms of the effects on violence but also on variables like enjoyment and game preference.

Another potential shortcoming is the difficulty of connecting these data to actual aggressive behavior. Although prior research suggests that aggressive cognition is especially important in explaining aggressive behavior (Anderson & Dill, 2000), these data do not directly test such outcomes. Although numerous studies have shown a connection between violent games and actual aggression, these data do not quantify the extent to which Halo players showed increased aggression, if at all.

In short, these data offer insight into the reasons why competitive game play, particularly involving face-to-face interaction, would prompt aggressive cognition. They suggest that players, particularly men, feel more rewarded for aggressive play in competitive situations, and that these rewards—rather than frustration—account for increases in violent cognition. Although prior research has shown some connection between mode and aggression, this study offers new data about why this connection occurs. The findings also hint at the relative importance of frustration and social learning in explaining all aggressive cognition. As sales of competitive and sometimes violent multiplayer games continue to grow, developing our knowledge of this topic remains critical.

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Notes

1. The potential influence of games on arousal is by no means omitted from the GAM. However, most research in this area has focused on understanding cognitive paths and outcomes. One reason may be that if games contribute to aggression primarily by creating frustration and arousal, then nonviolent games may be equally or more "harmful" simply because they are stimulating. Most research into the effects of games has focused on content as the key independent variable, so effects of games not contingent on content would not fit well into such research designs. In this study, the focus is on a contextual factor unrelated to content, so a process such as frustration is important to consider.
2. Using a single title raises obvious concerns about external validity, and it is entirely possible that player experiences in Halo were somehow atypical. However, the title has several strengths as a choice for stimulus materials. First, it not only offered all three selected game modes but also provided a consistent interface and control scheme for all three modes. Released exclusively for the Xbox in 2001 (and later ported to the PC), Halo was a top-seller on the platform and widely credited with helping drive sales for the hardware. Unlike later versions, in the original Halo, multiplayer gaming was only possible through in-person or

private network play, making the laboratory experience more valid than on later titles where most players would have gone online. Finding exact sales figures is difficult, but estimates put worldwide purchases in the neighborhood of 5 million units, and the critical response was strongly favorable; Web site metacritic.com assigns it a score of 97% based on the weighted, standardized average of 68 critical reviews. In short, Halo was widely recognized as an industry leader and was among the most-played first-person shooters, particularly in terms of multiplayer gaming. It features several innovative elements, particularly the use of recharging shields that allow players to recover simply by ducking out of the line of fire. Such elements make the game more deliberately paced than earlier PC shooters like Doom. Exact figures on the rate of aggressive interactions would be difficult to obtain, as they would vary by player and segment, but observation of players suggests that multiple "killings" occurred per minute.

3. For agreement, the scale was again from *strongly disagree* to *strongly agree*. For the measure of frustration as emotion, the scale was from *did not feel* to *felt a great deal*.
4. Once again, two distinct scales were used. The strongly disagree–strongly agree scale was employed for the statements, and the did not feel–felt a great deal scale was used for the measures of emotion.
5. Analysis of the interdependence using the intraclass correlation as calculated by the double-entry method (Griffin & Gonzalez, 1995) shows that coefficients for the mediating and dependent variables ranged from –.24 to .12. Although small, such values suggest sufficient interdependence to bias results from ordinary analyses (Hayes, 2006). Notably, the coefficient of –.24 is significant ($p < .05$) and corresponds to the key dependent variable of aggressive cognition. The negative value is intriguing, in that it suggests aggressive partners may have actually deterred, rather than promoted, aggression.
6. Partner gaming experience is measured using the scale described earlier; the variable is simply that self-reported value for the partner of the player. The analyses show that individual experience predicts some, but not all, of the outcome measures. Those with more experience were more likely to report feeling aroused or excited while playing, $F(1, 93.4) = 9.11$, $p < .01$, more likely to show engaged in violent strategizing, $F(1, 92.6) = 14.93$, $p < .001$, and less likely to feel frustrated, $F(1, 91.9) = 6.10$, $p < .05$. Partner experience was not a significant predictor of any outcome variables.
7. This approach, initially advanced by Baron and Kenny (1986) has been rightly criticized for relatively low power and other issues, including a failure to more precisely quantify the degree of mediation (Preacher & Hayes, 2008). However, it nonetheless presents the *logic* of mediation in a clear fashion, and relationships in which these steps are not even somewhat met clearly cannot represent mediation, eliminating the necessity for more complex analyses.

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