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Just a game after all: Violent video game exposure and time spent playing effects on hostile feelings, depression, and visuospatial cognition

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ABSTRACT

Research in the domain of video game violence continues to be contentious and debated. Scholars have examined both positive and negative effects of violent games, although results thus far have been inconclusive and systematic internal validity problems have been identified with past research. The current study adds to this growing literature by examining the effects of video game violence exposure and time spent playing on depression, hostility, and visuospatial cognition. This study improves upon previous research by matching game conditions carefully on confounding variables identified as problems by other scholars. In a laboratory setting, 100 participants were randomly assigned into one of six conditions based on two independent variables (time spent playing and type of video game). Results indicated that neither randomized video game play nor time spent playing a video game had any effect on depression, hostility, or, visuospatial cognition. Effect size estimates were below levels for practical significance. These results suggest that both positive and negative influences of violence in video games may be limited in scope.

1. Introduction

The effects of violent video game exposure, both positive and negative, on various behaviors are still highly contested within academia and the general public. At present, the debate has carried over into policy-making as the state of California attempted to restrict the sale of violent video games in a case which went to the US Supreme Court (Brown v. EMA, 2011; Ferguson & Olson, 2010). This case ended with the dismissal of the California law as unconstitutional and a brief but thorough repudiation of the research cited by California in support of its law as unpersuasive. As video games became increasingly more sophisticated and readily available, expressions of alarm among some scholars led to the publication of several policy statements by professional groups expressing concern about the content of violent games and their potential influence on children (e.g., American Academy of Pediatrics, 2000; American Psychological Association, 2005). These policy statements are limited however, as they were written largely by scholars already heavily invested in claims that violent games were harmful, and did not constitute independent reviews by neutral scholars. More recently, independent reviews from the Australian Government (2010) and Mayo Clinic (Hall, Day, & Hall, 2011) have concluded instead that the data on video game violence is, at best, inconclusive and that scholars and professional societies have expended considerable capital in needlessly worrying society about alleged harmful effects. Additionally, some researchers have cited limitations in video game research methodologies that may have compromised the internal validity of experimental studies in particular (Adachi & Willoughby, 2011; Ferguson, 2009a; Ferguson, Smith, Miller-Stratton, Fritz, & Heinrich, 2008; Freedman, 2002; Kutner & Olson, 2008; Przybylski, Rigby, & Ryan, 2010). The current study will attempt to add to the growing literature by examining the effects of violent video game exposure on aggressive affect (i.e. hostile feelings), depression, and visuospatial cognition. Methodological improvements suggested by other scholars (Adachi & Willoughby, 2011; Przybylski et al., 2010) will be implemented in hopes of further clarifying continuing issues within the violent video game literature.

1.1. Recent trends in video gaming

According to the Entertainment Software Association (ESA, 2010a), the average video game player is 34 years old and has been playing for more than a decade. Of American households, 67% own and play computer and video games. In a series of studies on media use, the Kaiser Family Foundation (KSF, 2010) found that, on average, 73 min per day were spent playing video games among 8- to 18-year-olds. When looking at gender differences, boys spend more time playing video games on cell phones, handheld players,

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and game consoles than girls (Lenhart et al., 2008). On a typical day, boys spent 56 min using video games on consoles, while girls spent only 14 (KSF, 2010; see also Kutner & Olson, 2008). The availability of multiple mediums (e.g., cell phone apps) and the sophistication of video game software have also increased.

Amidst a noticeable economic downturn, video game sales have remained relatively strong. According to the NPD Group (2011), the US video game industry amassed more than $15 billion (USD) in sales for the 2010 fiscal year, with $10 billion coming directly from the sales of physical software. The ESA (2010b) reported a slight decline in sales from 2008 to 2009. However, the video game industry sold 298 million units in the US in 2008, the largest amount in the video game era, which most likely accounts for the slight drop off from the following year. Video game sales, in general, have increased at a progressive rate since the mid-1990s (NPD, 2011).

These simple statistics show not only the staying power of video games, but their ever-growing presence in the daily lives of multiple age groups. Given the popularity of video games as a new entertainment medium, it is worthwhile to consider their potential impact on consumers.

1.2. Aggression

The majority of research on violent video games has focused on potential effects regarding aggression. Although aggression is generally conceptualized as involving intentional harming or humiliating behaviors toward another that the other person seeks to avoid (Baron & Richardson, 1994), developing a working operational definition of aggression particularly for experimental studies has been a significant challenge (Ferguson, 2010a; Ritter & Eslea, 2005; Tedeschi & Quigley, 2000). Because it would be ethically irresponsible to allow participants to act aggressively towards others, laboratory studies are often limited in regards to external validity.

As indicated above, concerns about aggressive responses to playing video games have prompted several professional organizations to put form resolutions suggesting playing violent games may "harm" youth (e.g., American Academy of Pediatrics, 2000; American Psychological Association, 2005) a position which underlay the Brown v. EMA case. Despite the well understood difficulties in measuring aggression in laboratory studies, a number of experiments have attempted to find causal links between violent video game exposure and aggressiveness. For example, in a randomized experiment, Irwin and Gross (1995) assessed differences in physical aggression between boys subjected to either a violent or nonviolent game playing condition, with behaviors such as hitting, pushing, and kicking being observed. Results showed that boys who played the violent video game were significantly more physically aggressive towards peers (effect size approximately $r = .31$). Other research has come to similar conclusion (Bluemke, Friedrich, & Zumbach, 2010; Calvert & Tan, 1994; Kirsh, 1998; Krcmar, Farrar, & McGloin, 2010). However other experimental studies have failed to find clear links between violent video game exposure and aggressiveness (Baldaro et al., 2004; Bösche, 2010; Ferguson & Rueda, 2010; Ferguson et al., 2008; Teng, Chong, Siew, & Skoric, 2011; Unsworth, Devilly, & Ward, 2007; Williams & Skoric, 2005). As such, research on aggressive outcomes remains inconsistent. An inverse relationship between video game sales and youth violence in society has raised some further doubts about the link between video games and serious aggressiveness (Ferguson, 2010a).

One issue that has been raised that may potentially account for the inconsistencies in findings is the potential that video game exemplars may have been poorly matched on variables other than simply violent content (Adachi & Willoughby, 2011; Przybylski et al., 2010). Poor matching of video game conditions on variables ranging from difficulty, pace of action, competitiveness, and complexity of the controls may have introduced confounds into some studies. However this issue will be explored in greater depth later in this manuscript.

1.3. Depression

Given previous evidence for a relationship between depression and violence (Ferguson, San Miguel, & Hartley, 2009), it would appear sensible to suggest a possible link between violent video game exposure and increased depression. However, research dealing with violent video game effects on depression, unlike the heavy focus on aggression, is relatively sparse.

Some evidence supports the existence of such a link. Weaver and colleagues (2009), in a cross-sectional survey of over 500 adults, found that female video game players reported greater depression than non-player females, but no link existed for males. Williams, Yee, and Caplan (2008) similarly found links between exposure to on-line video games with violent content and depressive symptoms.

However, other studies have found more complex results. In a cross-sectional study of Iranian youth, Allahverdipour, Bazargan, Farhadinasab, and Moeini (2010) reported an interesting curvilinear relationship between video game playing and mental health outcomes, with non-gamers and excessive gamers showing increases in problematic behaviors and poorer mental health. Moderate players (1–10 h of game playing per week) fared best, showing the best mental health. Worst mental health outcomes of all were among non-gamers.

Desai, Krishnan-Sarin, Cavallo, and Potenza (2010), in a clinical study of health correlates and video gaming among high school students, found no significant health correlates among boys, but did find that girl gamers were more likely to report lower levels of depression. Additionally, problematic gaming (i.e. gaming with patterns of addiction) was associated with depression, but not associated with grade averages and extracurricular activities.

Ferguson, Colwell, Mlacic, Milas, and Milousic (2011) concluded that media violence use and depression do not appear to be related in three samples of Mexican–American, English, and Croatian adults. Instead, they noted that personality factors such as high neuroticism and trait aggression were predictive of depression.

Presently, the only experimental study directly looking at the effects of violent video game playing on depression found non-significant results (Ferguson & Rueda, 2010). By measuring levels of depression before and after violent video game play, Ferguson and Rueda (2010) found no link between the two variables. Furthermore, these researchers found a post hoc correlation between real-life violent video game exposure and depression, but in the opposite direction. That is, individuals more experienced with violent video games were better able to avoid depression following a stressful experience.

The literature on violent video games and their effects on depression are limited and like most other variables, in disagreement. Despite the widespread prevalence of depression in the United States and most other countries (World Health Organization, 2011), its relationship with violent video game is still relatively unknown.

1.4. Visuospatial cognition

Visuospatial cognition refers to a cluster of related abilities involving the manipulation and processing of visual stimuli including, but not limited to, visual attention, pattern recognition, mental rotation and visual processing (Ferguson, 2007). Although controversial, studies within cognitive and evolutionary psychology suggest that males and females differ slightly in their cognitive abilities (Buss, 2011; Friedenberg & Silverman, 2006; Kutner & Olson, 2008). Research further suggests that males in particular are slightly better at visuospatial tasks, including mental rotation of three-dimensional objects and object trajectory (Sherry, 2004). Some psychologists have begun to examine this phenomenon, proposing that males are more attracted to video games because of their inclination to these cognitive skills (Kutner & Olson, 2008). Regardless of the apparent gender differences within video game preferences, the potential for improvements in cognitive abilities has become an area of interest.

One of the earliest studies on the brain's adjustment due to video game play was executed by Green and Bavelier (2003). These researchers found that action games (e.g., Grand Theft Auto, Half-Life, and Halo) improved habitual video game players' ability to process visual information and focus visual attention. To ascertain if the effects could be taught to non-gamers, Green and Bavelier introduced game play to both males and females with little previous experience. After only 10 days of training on an action game, these participants showed increases in their capacity for visual attention, spatial distribution and temporal resolution.

In a series of experiments, Castel, Pratt, and Drummond (2005) examined the effects of action video games on visual search. Video game players were shown to have faster reaction times than non-video game players on a fixation task, suggesting they are quicker at detecting and responding to the presence of novel stimuli in the visual environment that involves the external capture of attention. Additionally, experienced video game players had faster reaction times in a visual search task. Of interest in these experiments was the finding that video game players and non-players rely on the same mechanisms to guide their visual attention. However, video game players have faster access to the encoding of and responding to targets in easy and more difficult visual searches than their non-playing counterparts.

Examination of gender differences in regards to spatial cognition in a further study yielded interesting results (Feng, Spence, & Pratt, 2007). Males, on average, made more correct responses than females in a spatial attention task requiring participants to detect, localize, identify a target, and assess spatial distribution. After introducing a training period of 10 h on violent action games, Feng, Spence, and Pratt reported that males' and females' performance on spatial tasks improved. Moreover, females in particular showed larger improvements in mental rotation and useful-field-of-view tasks than males. The authors go onto suggest that because action and violent video games require certain abilities that more placid games may not exercise, non-action games may be less beneficial to players in terms of activating visuospatial cognition (Feng et al., 2007; Spence & Feng, 2010).

A recent meta-analysis on the effects of video games on visuospatial cognition sheds light on possible positive outcomes (Ferguson, 2007). Out of a sample of seven published studies, it was shown that a 24% overlap in variance existed between violent video game exposure and visuospatial cognition. This overlap was over 10 times the variance overlap witnessed for violent video games and aggression, a considerable difference. The author concluded that video game violence effects on aggression were negligible but that current research supported potential positive effects for visuospatial cognition.

1.5. Methodological issues within video game research

Recent scholarship has begun to address the issue of systematic confounds introduced in much of the past experimental work on video game violence (Adachi & Willoughby, 2011; Kutner & Olson, 2008). The main issues include the equating (or lack thereof) of video games, short game-playing periods for experiments, and the overuse of measures with poor validity.

The first limitation with experimental research is the failure of many studies to adequately equate video game conditions on confounding variables such as competitiveness, difficulty, and pace of action (Adachi & Willoughby, 2011; Przybylski et al., 2010). As Adachi and Willoughby point out, heightened levels of aggression within previous experiments may not be directly attributed to the violent content alone, but may share some variance with the aforementioned variables due to failure to adequately control these confounds. More simply put, it may be the difficulty of a certain violent game that causes a participant to become angrier and frustrated, not the explicit and violent content. Given that violent video games are, on average, more competitive than nonviolent games, it is impossible to say whether previous studies which failed to equate their video game exemplars on competitiveness actually measured aggression (Adachi & Willoughby, 2011). The same issue arises with other video game dimensions such as pace of action and difficulty. For example, first-person shooters (FPSs), such as *Wolfenstein 3D*, *Doom*, *Medal of Honor*, *Halo*, and *Call of Duty*, are normally fast-paced games that require players to react quickly to enemies and have been used in past experiments. Previous studies that have suggested such games have effects on aggression often compared them to games that were much less competitive, slower in pace of action, and often less difficult (see Adachi & Willoughby, 2011 for discussion). As such the violence variable of video games has not been isolated from other confounding variables, limiting internal validity of these studies. Several past studies that have addressed this issue, by including more rigorous controls for these potential confounds, find that differences in aggression are no longer apparent (Ferguson & Rueda, 2010; Przybylski et al., 2010).

A second limitation with previous experimental research is the preponderance of limited game playing times. It is often difficult to expect participants to take part in a study that involves large time expenditures. As a consequence much of the past research has subjected participants to short game playing times, often between 5 and 20 min, seldom enough time to master complex controls. Of the most recent and highly cited experiments in violent video game research, only two (i.e. Ferguson & Rueda, 2010; Ferguson et al., 2008) allow participants to play more than the 5–20 min norm. Przybylski et al. (2010) suggest that this short time frame does not allow participants to meet their needs for competency and mastery of controls, which in turn leads to higher levels of aggression. These suggestions echo those of Adachi and Willoughby (2011) in that they recognize video game players need to feel successful and autonomous when playing. Allowing participants to familiarize themselves with the video game (i.e. playing more than 20 min) should reduce frustration as they become more competent with controls and general gameplay. This would also mirror real-life situations, in which video game players play more frequently and at greater length.

One final limitation of importance to this study is that of the overuse of invalid measures and underuse of valid ones. Several critics have noted the lack of highly valid measures for aggression and their inability to generalize to real-life aggression or violent behaviors (Ferguson, 2010b; Ferguson & Rueda, 2009; Ferguson, Smith, Miller-Stratton, Fritz, & Heinrich, 2008; Ritter & Eslea, 2005). The lack of standardization and clinical cutoffs for these measures makes interpretation of results murky. As Ferguson (2010a) points out, the lack of sensitivity and specificity for novel scales makes it difficult to detect true differences in constructs, be it aggression, depression or visuospatial cognition.

Most of the limitations noted above have been discussed in the context of aggression outcome research. However it is fair to note that they easily apply to other fields including depression and mental health outcomes and visuospatial cognition. Just as poor condition matching and poorly validated outcome measures may bias aggression research, they may equally bias outcome research for these other issues.

1.6. Current study

The current study sought to address several gaps in the previous literature. First, issues related to video game violence effects have been applied very broadly to include both positive effects on visual spatial cognition, as well as negative effects such as depression and visuospatial cognition (Ferguson, 2010a, 2010b). However no studies have considered positive and negative influences in conjunction. As such outcomes of the present study include both potential negative effects (depression, hostility) as well as positive outcomes (visuospatial cognition). Secondly, this study has taken greater care to match video game conditions on potential confounds than has often been the case in previous research. Third, the issue of video game playing time is considered. And finally, outcome measures were selected for clinical utility and validity given how often research in this field is generalized to clinically related outcomes (such as youth violence) whether or not outcome measures are actually clinically valid (Ferguson, 2010a, 2010b).

2. Pilot study

Several video game exemplars were chosen by the researchers for their theoretical similarity on potential confounds that have limited the internal validity of previous work. Of course the perception of the researchers regarding their similarity is not sufficient to ensure confounding variables were adequately controlled. As such, a pilot test was conducted in order to examine whether the violent and nonviolent video game exemplars chosen were equated on difficulty, pace of action, and competitiveness. This was examined with a 3 × 2 (Condition × Gender) Factorial design. Along with gender, the independent variable was randomly assigned video game condition (violent, non-violent, and non-violent within a violent game; see below for descriptions) and the dependent variables were difficulty, pace of action, and competitiveness,

2.1. Participants

A total of 40 (22 male, 18 female) undergraduate students from a Hispanic-serving university in the southern United States participated in the pilot study. Mean age for this sample was 22.4 years (SD = 3.34) and mean education level was equivalent to a college sophomore standing.

2.2. Materials

A video game review questionnaire was created in order to assess levels of difficulty, pace of action, and competitiveness in the video game exemplars. The questionnaire consisted of 14 Likert-type items with the three respective scales previously mentioned. The difficulty scale was composed of four items: "how difficult was the game", "to what extent did you feel like you could win this game", "how difficult was it to understand the rules and purpose of this game", and "how hard was it to learn the game controls". The pace of action scale was created from five items: "how exciting was this video game", "how fast was the pace of action for this video game", "how boring was this video game", "how often did you feel like you were doing the same, repetitive actions", and "to what extent did this video game have exciting, 'action-packed' moments". The competitiveness scale was composed of five items: "how challenging did you feel the game was", "how important did you feel it was to succeed at the game", "how tough was this video game", "to what extent did you feel like you accomplished something during the game", and "how much did you feel like you were competing against the video game". All items were appropriately reverse-scored where appropriate. Alpha reliabilities for the three scales were all above .7.

2.3. Method

Three levels of game-play were implemented within this experiment: violent game-play, non-violent game-play, and non-violent game-play within an otherwise violent game. Two video games, *Red Dead Redemption* (Rockstar Games, 2010) and *FIFA 10* (EA Sports, 2010), were used when administering the game-playing portion. Participants randomly assigned into the violent game-play condition played *Red Dead Redemption* from a predetermined save point with approximately 30% of the game already completed. Participants randomly assigned to the non-violent game-play condition played *FIFA 10*. Participants randomly assigned to the non-violent game-play within a violent game condition played *Red Dead Redemption* from the beginning of the game, when human vs. human violence has not yet entered the storyline. Thus, during this last condition, participants played a relatively non-violent game before the actual violence ensues.

Justification for this type of video game-play is based on the equation of games across various dimensions. Adachi and Willoughby (2011) propose various dimensions (e.g., pace of action and difficulty) that could possibly influence predictor variables. To our knowledge, this is the first experimental study that has attempted to use the same video game for both violent and nonviolent exemplars without modifying any existing content, but rather using the game's original storyline to allow for the dictating of violent content. Therefore, various dimensions remain constant and nearly identical while violent content is controlled for.

As previously mentioned, the violent exemplar was *Red Dead Redemption* which is rated M (Mature) by the Entertainment Software Ratings Board (ESRB) due to its intense violent content in which players can murder using various real-world weapons (e.g., guns, knives, bombs, etc.). The game follows an open-world format, much like its predecessor *Grand Theft Auto*, in which players can roam an expansive map and interact with practically every surrounding (e.g., animals and strangers). More specifically, *Read Dead* is a third-person shooter in which players assume the role of the protagonist John Marston, an outlaw seeking to redeem his honor by capturing members of his old gang.

The nonviolent exemplar was *FIFA 10* which is rated E (Everyone) by the ESRB. This sports game involves playing soccer where individuals can choose between numerous club and national teams and compete against a computer opponent. Inherent in the game of soccer is the slide tackling tactic that involves "person on person" contact. However, considering that this move is not intended to injure other players (but rather dispossess them of the ball) and follows the rules of the game, this action does not meet commonly accepted definitions of violence within video games (Ferguson & Rueda, 2010; Thompson & Haninger, 2001).

Participants were notified at the time of signing up that each experiment was scheduled for a 1-h time slot. After completing the consent procedures and demographic questionnaire, participants were given instructions on how to play their respective video game exemplar as well as a scripted overview of the video game controller, which lasted approximately 5 min. Participants then played their randomly assigned video game for 30 min alone in the laboratory. The video game review questionnaire was then administered upon completion of the video game playing portion.

2.4. Results

Means and standard deviations for responses to the video game review questionnaire are presented in Table 1 for each condition. Participants rated the video game exemplars as equal on dimen-

Table 1
Means and standard deviations for video game exemplars on potentially confounding variables.

	N	Difficulty	Pace of action	Competitiveness
Condition 1	15	11.5 (3.31)	12.0 (3.38)	8.53 (3.50)
Condition 2	10	9.60 (1.89)	10.4 (2.71)	5.60 (1.17)
Condition 3	15	13.2 (3.01)	14.3 (2.89)	8.47 (3.42)

Note. Condition 1 = violent exemplar, condition 2 = non-violent within violent exemplar, condition 3 = non-violent exemplar.

sions of difficulty, $F(2,40) = 2.36$, $p > .05$, and competitiveness, $F(2,40) = 3.09$, $p > .05$. Differences in pace of action ratings for the video game exemplars, however, were significant, $F(2,40) = 4.27$, $p = .02$. Bonferroni post hoc analyses of the pace of action dimension elucidate the difference was between the two control conditions condition 2 ($M = 10.4$, SD = 2.71) and condition 3 ($M = 14.3$, SD = 14.3) but neither differed from the target violent condition.

Results of the pilot study show the chosen video game exemplars are more than reasonably adequate for both violent and non-violent conditions across the difficulty and competitiveness dimensions. In terms of pace of action, there exists a difference between the non-violent within a violent game control exemplar (Red Dead Redemption) and non-violent control exemplar (FIFA 10). However the intent was to match controls well with the target condition. In this case no differences were revealed between the target condition and either of the controls, although the control conditions differed from one another. Given these results, we are confident that the target and control conditions are reasonably equated in terms of these relevant potentially confounding variables. Even if we were to ignore the issue of statistical significance, as evidenced by the means in Table 1, it is evident that the target violent condition is evenly spaced in outcomes between the two control conditions on most outcomes. Thus, any limitations of one control condition should be addressed by the other.

3. Experimental study

As noted above, the current study exposed participants to one of three video game exemplars (violent, non-violent, non-violent within a violent game) and one of two time playing conditions (15 vs. 45 min) in an experimental setting. Participants were first frustrated to induce irritation and test whether violent video games increased or decreased this irritated state. Levels of aggressive affect (hostile feelings), depression, and visuospatial cognition were measured before and after game play.

The limitations described in the literature review were addressed in this experiment. First, both the violent and nonviolent exemplars were equated on competitiveness, difficulty, and pace of action. To further equate violent and nonviolent games, a novel exemplar was created in which the same game (i.e. *Red Dead Redemption*) was used for both violent and nonviolent conditions. As noted earlier this was done by allowing participants to play the game at points with relatively little to no violent content (non-violent exemplar) and with the mature, violent content normally experienced within the game (violent exemplar). Also, different playing time conditions were created in order to see if the limited amount of game play in previous experiments possibly account for higher frustration and aggression. By allowing some participants to play the video games for either 15 or 45 min, it could be possible to find differences between experimental groups due to frustration resulting from limited time exposure. Lastly, the outcome measures used for the dependent variables were of high quality. Each scale and inventory have been widely used and validated within psychological and clinical research.

For the current research, it is hypothesized that exposure to video game violence in a laboratory setting will result in increased levels of hostility and depression. Counterintuitive to negative effects, it is also hypothesized that exposure to video game violence in a laboratory setting will result in increased levels of visuospatial cognition. Lastly, it is hypothesized that more exposure (i.e. 45 min of game play vs. 15 min of game play) to video game violence in a laboratory setting will result in amplified effects from the aforementioned hypotheses. More simply put, it is expected that those participants playing for longer periods will record higher levels of hostility, depression, and visuospatial cognition than their shorter game-playing counterparts.

4. Method

4.1. Participants

A total of 100 young adult students from a Hispanic serving regional comprehensive university in the south participated in the present study. Participants were recruited from various undergraduate courses and were given course credit for their time by their respective instructors. The sample consisted of 49 females and 51 males, ranging in age from 18 to 45 years with a mean age of 19.9 (SD = 3.92). In regards to ethnicity, 93 (90.3%) were Hispanic, 5 (4.9%) were Caucasian (non-Hispanic), and 2 (1.9%) declined to report. The sample presented for this study is representative of the ethnic distribution for the university student body. The average education level was equivalent to a college sophomore in the United States (2nd year of postsecondary education).

4.2. Experimental design

The design for this study was a $3 \times 2 \times 2$ mixed factorial design. The between-subjects independent variables were the type of video game-play, which had three levels (violent, non-violent, and non-violence within a violent game), and the time spent playing the video game, which had two levels (15 or 45 min). Thus, this design rendered six experimental conditions: violent video game exposure for 15 min, violent video game exposure for 45 min, non-violent video game exposure for 15 min, non-violent video game exposure for 45 min, non-violent video game exposure within a violent game for 15 min, and non-violent video game exposure within a violent game for 45 min. Because the present study has a pre-post design, the within-subjects independent variable is time and has 2 levels (pretest score and posttest score). This design also avoids limitations of using change scores (Cronbach & Furby, 1970; Field, 2009).

4.3. Dependent variables

4.3.1. Hostile feelings

Feelings of hostility were operationally defined as the total score on the State Hostility Scale. Developed by Anderson, Deuser, and DeNeve (1995), the State Hostility Scale (SHS) is a 35-item, 5-point Likert-type scale in which respondents are asked to report their current mood. A series of adjectives are presented to the respondent and they are asked to rate how strongly they disagree or agree (i.e. 1 for "strongly disagree" and 5 for "strongly agree") with each word. In this study, the SHS was highly reliable at pretest (Cronbach's $\alpha = .92$) and posttest (Cronbach's $\alpha = .93$). All 35 items were used for this study. Justification for use of the SHS is predicated on the introduction of frustration within the experimental procedure (see Frustration Task below).

4.3.2. Depression

Participants' severity of depressive symptoms was operationally defined as the total score on the Beck Depression Inventory-

II. The Beck Depression Inventory-II (BDI; Beck, 1996) was used to measure depression symptoms in respondents. The BDI is a 21-item assessment of the severity of depressive symptoms for use in people ages 13 and over. Scores on these 21 items range from 0 to 3. In our study, the BDI had high internal consistency at both the pretest and posttest (Cronbach's $\alpha = .83$ and .86, respectively). The BDI has been found to be sensitive to frustration tasks in previous research (Ferguson & Rueda, 2010) and is included here given societal interest in this outcome variable.

4.3.3. Visuospatial cognition

Visuospatial cognition was operationally defined as the standardized score of the matrices subscale on the Kaufman Brief Intelligence Test-II. The Kaufman Brief Intelligence Test-II (KBIT; Kaufman & Kaufman, 2004) was used to measure visuospatial cognitive skills in participants. The KBIT is composed of three subtests, two of which are classified as verbal subtests and the other as a nonverbal subtest. For this study, only the nonverbal subtest (i.e. matrices) was used in order to assess cognitive abilities in fluid reasoning and visual processing (Bain & Jaspers, 2010). The matrices subtest consists of 46 multiple-choice type items. Participants must choose which of six possible answer choices best completes a 2×2, 2×3, or 3×3 matrix. These tasks involve mental imagery, visual attention and pattern recognition and visual manipulation and thus are a reliable index of visuospatial intelligence. Raw scores are produced by deducting incorrect responses from all correct responses, with a maximum possible raw score of 46. Raw scores are then standardized across relevant age groups. Testing was consistent with the standardization guidelines provided by Kaufman and Kaufman (2004).

Assessing for psychometric quality has shown the KBIT matrices subtest to have adequate validity and reliability (see Bain & Jaspers, 2010 for review). The nonverbal subtest has shown to have high internal consistency reliability ranges from .78 to .93 ($M = .88$). Kaufman and Kaufman (2004) report mean reliabilities of .86 and .91 across the age groups of 4–18 and 19–90, respectively. Reported test–retest reliability was also high ($r = .83$), but not optimal due to the novel problems presented by the matrices subtest that diminish practice effects. Additionally, the KBIT's nonverbal subtest was shown to correlate highly ($r = .83$) with the Wechsler Adult Intelligence Scale's (Wechsler, 1997) perceptual organization index, which also measures the spatial cognition construct. This outcome here was included to provide a clinically valid indices of visuospatial cognition and thus extent previous work in this domain.

4.4. Frustration task

The paced auditory serial-addition task (PASAT; Gronwall, 1977) was used to increase frustration in all participants, regardless of the experimental condition, to examine the degree to which different games reduced (or increased) frustration. The PASAT is a computer-based program in which participants must add numbers from 1 to 20 in a sequential order. At the beginning of the sequence, two numbers (e.g., "1" and "2") are presented and the participant must add these numbers and click on the corresponding sum (e.g., "3"). After clicking on this total, another number (e.g., "5") is presented on the screen and participants are instructed to add this new number to the last number shown (e.g., "5 + 2") and, again, click on the corresponding sum (e.g., "7"). The presentation of this sequence gradually increases with time, making the task more difficult. The PASAT has been shown to create an interference effect, since it is a participant's intuition to add the last number presented with the last sum entered. This interference has been shown to elicit frustration, irritation, and anxiety (Ferguson & Rueda, 2010; Tombaugh, 2006), although it was originally intended to measure cognitive processing speed.

4.5. Video game habits

A video game playing habits questionnaire was used in order for participants to disclose what games they play and how often they play them. The VGH asked participants to list their three favorite video games as well as indicate how often they play these games using a 5-point Likert-type scale (i.e. 0 = almost never play, 5 = very often). To avoid variable estimates between respondents (Ferguson, 2011), video games listed by participants were coded using the Entertainment Software Ratings Board (ESRB) rating system. ESRB ratings were obtained for each game reported by the participant and ordinally coded (a minimal score of 1 for "Everyone", 2 for "E 10+", 3 for "Teens 13+", and a maximal score of 4 for "Mature"). Since few games in existence are rated "Adults Only" and were not reported by participants in this study, the scoring ended at the "Mature" rating.

Composite scores were obtained by multiplying the ESRB ratings of the three games listed by participants by the time spent playing each respective game, then summed across the three games. This allowed for a general measure of real life video game-playing habits in participants (Ferguson, 2011; Olson et al., 2009).

4.6. Procedure

Data collection occurred over a 6-month period from late 2010 to early 2011. All procedures were approved by the local Institutional Review Board and designed to meet the ethical standards of the American Psychological Association.

Randomization of the conditions occurred via an online randomizer. Participants signed up for a 2-h appointment time and were run individually within the laboratory. Upon arrival, participants were greeted by an experimenter who followed a script for the experiment. Participants were escorted to 1 of 3 stations and were asked to take a seat in front of the first station. They were then given a short description of the experiment and procedure under the cover story suggesting that this was a study regarding visual perception and learning. Participants were then asked to sign an informed consent form after reading the form carefully. Any questions or concerns were addressed at this point.

After completing the informed consent, participants were given a demographic questionnaire and video game habits questionnaire. They then completed the pretest KBIT after being told it was a pattern recognition task. Participants then moved to the second computer station where the PASAT was administered by computer under the impression that they were attempting a memory task. After partaking in the task for 10 min, participants were instructed to move back to the original station and were then given the SHS and BDI (pretests). Following the completion of both pretest measures, participants were instructed to take a seat in front of the third station. At this station, participants were given information about the game they were about to play depending on their condition. They were then shown two figures that displayed the X-Box 360 controller layout and the basic game controls for both the violent and nonviolent exemplars. Full descriptions of controls were made to each participant regardless of video gaming experience. After a thorough 5–10 min explanation of game controls, participants were instructed to play either the violent or nonviolent game for either 15 or 45 min depending on random assignment.

Following the video game playing period, participants were instructed to move back to the starting station and were given the SHS and BDI posttests. Upon completion of these measures, participants were administered the KBIT task again (posttest). Finally, all participants were debriefed, and invited to ask any questions. Participants were also informed of the deception with the PASAT task and asked if they considered it frustrating. Additionally, participants were subtly questioned for demand characteristics and suspicion of hypotheses. All participants denied suspiciousness regarding the nature of the study and all considered the PASAT annoying and frustrating. Before leaving the laboratory, participants were reminded to keep information regarding the study to themselves as it was likely that fellow classmates would question the experiment's purpose. Participants were then given their copy of the consent form and were allowed to leave the laboratory.

5. Results

All analyses were conducted using PASW Version 18 (formerly SPSS) Software. In terms of familiarity with video games, participants in the present study were relatively fluent. Among females, 71.4% ($N = 35$) had at least some experience with video games over the past month. Only 20.4% ($N = 10$), however, played video games more than 5 h per week within the past month. Among males, 94.1% ($N = 48$) had at least some experience with video games over the past month. Regarding regular video game play, 58.8% ($N = 30$) of males reported playing more than 5 h per week within the past month. Of the males in our sample, 29.4% ($N = 15$) reported playing between 15 and 30 h per week within the past month. Within the past month, females averaged 3.48 h (SD = 6.34) per week of video game play and males averaged 9.26 (SD = 8.21) hours per week of video game play.

Randomized group equivalency data for each of the six experimental conditions is shown in Table 2. One-way ANOVAs were used to assure randomly assigned video game-playing group equivalence between the six groups in relation to age, real-life video game violence exposure, and pretests and posttests for KBIT, SHS, and BDI measures. Chi-squared analyses were used to reassure group equivalence for gender and ethnicity. No significant differences were found in all cases, supporting successful implementation of random assignment in all experimental groups.

The impact of video game group on hostile feelings (SHS) was tested using a mixed ANCOVA design. Violent content and playing time were the between-subjects independent variables, while the pretest and posttest time periods on the SHS (i.e. time) were used as the within-subjects independent variable. Gender was used as a covariate. A significant interaction between time (i.e. pretest and posttest scores) and group would support game-playing condition having an effect on hostile feelings. However, in this study, the interaction effect of time and group on hostile feelings was not significant $F(1,94) = 3.11$, $p = .09$, $r = .17$, $-.03 \leqslant r \leqslant .36$. Furthermore there was no trend indicating increased hostility in violent conditions as the most post-test hostility was experienced in the non-violent long-exposure *Red Dead Redemption* condition. Thus the effect size noted above is not supportive of the socialization view. A main effect for time was noted in which hostility decreased over time in all conditions $F(1,94) = 8.15$, $p = .01$, $r = .28$, $.08 \leqslant r \leqslant .47$. No other main effects or interactions were significant.

To test the impact of video game group on depression-related symptoms (BDI), a mixed ANCOVA design was implemented. Violent content and playing time were the between-subjects independent variable, while pretest and posttest time periods on the BDI (i.e. time) were used as the within-subjects dependent variable. Gender was used as a covariate. A significant interaction between time and group would have been supportive of game-playing condition having an effect on depression. Once again, the interaction effect between time and group was not significant $F(1,94) = 2.59$, $p = .62$, $r = .16$, $-.04 \leqslant r \leqslant .35$. A main effect for time was noted in which depression decreased over time in all conditions $F(1,94) = 6.63$, $p = .01$, $r = .26$, $.06 \leqslant r \leqslant .45$. No other main effects or interactions were significant.

Lastly, to test the impact of video game group on visuospatial cognition (KBIT) a mixed ANCOVA design was implemented. Violent content and playing time were the between-subjects independent variable, while differences from pretest to posttest time periods on the KBIT (i.e. time) were used as the within-subjects dependent variable. Gender was used as a covariate. A significant interaction between time and group would have been supportive of game-playing condition having an effect on visuospatial cognition. The interaction effect between time and group was not significant $F(1,94) = .06$, $p = .76$, $r = .03$, $-.17 \leqslant r \leqslant .22$. No other main effects or interactions were significant.

5.1. Interpreting null results

One difficulty, traditionally with null results is that it can be difficult to interpret these. On one hand, null effects may reflect low power and the failure to detect small but real effects. On the other hand, very large samples may produce spurious statistically significant results that are of no practical value and which prove unreliable across studies (Smith & Ebrahim, 2001). We do note that all results in the current study are below Ferguson's (2009b) recommendations for practical significance, and are near to Cohen's (1992) level for trivial effects. To aid in the interpretation of effect sizes, the APA Wilkinson Task Force (1999) recommended the reporting of effect size confidence intervals as well as power analyses. As noted above, all effect size confidence intervals (95%) cross over zero into null effects, giving further weight to the interpretation of null effects as "true." All effect sizes witnessed are below Ferguson's (2009b) recommendations for practical insignificance. Further the effect sizes are not representative of clear and distinct patterns among the groups and thus represent little more than random "noise." On balance, we find that the results reported here are consistent with the conclusion that video game violence effects on both positive and negative outcomes examined here are negligible.

Table 2
Group equivalency means for randomized video game groups.

	Red dead redemption (V, 15)	Red dead redemption (NV, 15)	FIFA 10 (NV, 15)	Red dead redemption (V, 45)	Red dead redemption (NV, 45)	FIFA 10 (NV, 45)
N	18	14	14	15	21	18
Age	19.5 (2.5)	19.3 (1.6)	21.9 (7.8)	21.1 (5.3)	18.6 (1.0)	19.9 (3.9)
Violent game exposure	8.52 (6.3)	6.23 (4.8)	5.26 (3.0)	5.96 (3.4)	7.13 (4.5)	7.92 (4.1)
KBIT pretest	94.7 (12.8)	94.7 (9.8)	99.9 (12.1)	94.2 (12.1)	94.1 (16.2)	95.1 (18.7)
KBIT posttest	99.7 (15.3)	98.2 (14.1)	101.6 (10.6)	96.0 (13.3)	98.9 (14.5)	96.8 (16.4)
SHS pretest	80.0 (23.1)	81.2 (23.0)	91.6 (20.4)	79.9 (21.5)	86.4 (20.3)	81.8 (22.2)
SHS posttest	74.3 (23.0)	69.7 (21.1)	66.4 (7.81)	72.1 (21.4)	77.8 (17.9)	69.2 (17.7)
BDI pretest	11.4 (7.3)	9.79 (4.2)	8.57 (6.1)	11.9 (6.5)	9.57 (6.9)	9.11 (6.8)
BDI posttest	8.89 (7.2)	7.21 (5.2)	4.57 (4.9)	7.67 (6.3)	6.33 (4.9)	7.38 (1.7)

Note. Standard deviations are in parentheses. All group differences were not statistically significant. V = violent, NV = non-violent, 15 = 15 min of game-play, 45 = 45 min of game-play.

6. Discussion

Contrary to what was hypothesized, the current study does not provide any evidence that exposure to violent video games causes increases or decreases in aggressive affect (i.e. hostile feelings) or depression in a laboratory setting. Additionally, the current study did not find evidence for a causal link between violent video game exposure and visuospatial cognition. The use of effect sizes and effect size confidence intervals further eliminate the possibility of Type II error particularly given there were no trends in favor of the violent games. Thus, this study adds to recent research (Bösche, 2010; Ferguson, 2010a, 2010b; Ferguson & Rueda, 2010; Kutner & Olson, 2008; Unsworth et al., 2007) suggesting the causal link between violent video games and aggression is nonexistent to weak, at best, under the strictest methodologies. Of perhaps more interest is the novel finding that no differences were seen between video game conditions on visuospatial cognition. This differs from much of the previous work on visuospatial cognition. Rather than necessarily contradicting past work, the current study may elucidate some of the limits of the results on visuospatial cognition. We speculate that previous work may have examined relatively limited easily trainable abilities. It is possible that the relatively narrow measurements used in previous work may not generalize to visuospatial cognition in a broader sense, as measured by the more general visuospatial intelligence measure used in the current study. As such it may be premature to imply that action games are able to promote visuospatial intelligence in a broad sense, although more research is necessarily to fully elucidate these matters.

In regards to time spent playing video games, this study did not find statistical differences in hostile feelings, depression, or visuospatial cognition between short- and long-term playing experimental groups (i.e. 15 and 45 min, respectively). Two possibilities for this are that no real-life differences between playing a video game for either of these two time frames exist or the time span between the two experimental groups was not large enough or representative of average game play. While the first option is possible, it seems more likely that the second option is at play for this lack of group contrast. If violent video games decrease hostility and depression, as some researchers have suggested (Ferguson & Rueda, 2010), it is most likely that this occurs after longer, rather than shorter, game play periods. Additionally, if participants with little gaming experience are given more time to master novel controls, it may allow for a more pleasurable experience and lower frustration levels (Przybylski et al., 2010). Future research looking at potential differences with time spent playing should vary game play periods and make sessions longer than the 45 min used in the present study. However, we caution researchers from overgeneralizing the results of short experimental sessions to real life game play.

It is worth noting that negative psychological states (hostility, depression) decreased over time in all game playing conditions. Unfortunately most previous experimental designs do not use a pre-post design. Our results suggest that video games of all kinds, whether violent or non-violent relax players and reduce negative mood states. It may be that previous experimental results, failing to include pre-post designs, mistakenly ascribed differentials in a reduction in hostility to a hostility increase. This is a potentially serious mistake that bears further analysis.

As with all studies, the present research does have limitations. Although we used gender as a covariate in the current analysis, the lack of other known covariates within this study is one limitation that could be addressed in the future. Secondly, although we sought to use well-validated outcome measures, measuring aggression adequately has been difficult in experimental research (Ferguson, 2010a; Kutner & Olson, 2008). Thus we remain particularly cautious in the generalization of the hostility measure to real world aggression. Lastly, the use of a convenience sample does not represent a common demographic for video game playing. Caution should be used when trying to generalize these findings to other populations and ethnic groups. Lastly although our exposure duration was long for aggression research, our exposure duration was not as long as in some experiments of visuospatial cognition (e.g., Feng et al., 2007; Green & Bavelier, 2003) which may explain the difference in findings.

The present study suggests that violent video games may just be that: games. Although they are sophisticated in design, they may not hold the (positive or negative) effects that some believe exist definitively, however logical they may seem. It could be that other variables not examined here are of more importance regarding video game play, such as the intrinsic value of playing games and the social aspects behind multiplayer games (Kutner & Olson, 2008; Lenhart et al., 2008).

References

Adachi, P. J. C., & Willoughby, T. (2011). The effect of violent video games on aggression: Is it more than just the violence? *Aggression and Violent Behavior, 16*, 55–62. doi:10.1016/j.avb.2010.12.002.

Allahverdipour, H., Bazargan, M., Farhadinasab, A., & Moeini, B. (2010). Correlates of video games playing among adolescents in an Islamic country. *BMC Public Health, 10*(286), 1–7.

American Academy of Pediatrics (2000). *Joint statement on the impact of entertainment violence on children*. <http://www.aap.org/advocacy/releases/jstmtevc.htm> Retrieved 08.02.10.

American Psychological Association (2005). *Resolution on violence in video games and interactive media*. <http://www.apa.org/releases/resolutiononvideoviolence.pdf> Retrieved 30.09.08.

Anderson, C. A., Deuser, W., & DeNeve, K. (1995). Hot temperatures, hostile affect, hostile cognition and arousal: Tests of a general model of affective aggression. *Personality and Social Psychology Bulletin, 21*, 434–448.

Australian Government, 2010. Attorney General's Department. Literature Review on the Impact of Playing Violent Video Games on Aggression. Commonwealth of Australia.

Bain, S. K., & Jaspers, K. E. (2010). Review of Kaufman brief intelligence test, second edition. *Journal of Psychoeducational Assessment, 28*(2), 167–174.

Baldaro, B., Tuozzi, G., Codispoti, M., Montebarocci, O., Barbagli, F., Trombini, E., et al. (2004). Aggressive and non-violent videogames: Short-term psychological and cardiovascular effects on habitual players. *Stress and Health, 20*, 203–208. doi:10.1002/smi.1015.

Baron, R., & Richardson, D. (1994). *Human aggression*. New York, NY: Plenum Press.

Beck, A. (1996). *Beck depression inventory II – Manual*. San Antonio, TX: Psychological Corporation.

Bluemke, M., Friedrich, M., & Zumbach, J. (2010). The influence of violent and nonviolent computer games on implicit measures of aggressiveness. *Aggressive Behavior, 36*(1), 1–13.

Bösche, W. (2010). Violent video games prime both aggressive and positive cognitions. *Journal of Media Psychology: Theories, Methods, and Applications, 22*(4), 139–146. doi:10.1027/1864-1105/a000019.

Brown v. EMA (2011). <http://www.supremecourt.gov/opinions/10pdf/08-1448.pdf>. Retrieved 07.01.11.

Buss, D. M. (2011). *Evolutionary psychology: A new science of the mind*. Boston, MA: Wiley.

Calvert, S. L., & Tan, S. (1994). Impact of virtual reality on young adults' physiological arousal and aggressive thoughts: Interaction versus observation. *Journal of Applied Developmental Psychology, 15*(1), 125–139.

Castel, A., Pratt, J., & Drummond, E. (2005). The effect of action video game experience on time course of inhibition of return and efficiency of visual search. *Acta Psychologica, 119*, 217–230.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155–159. doi:10.1037/0033-2909.112.1.155.

Cronbach, L. J., & Furby, L. (1970). How we should measure "change" – Or should we? *Psychological Bulletin, 74*(1), 68–80.

Desai, R. A., Krishnan-Sarin, S., Cavallo, D., & Potenza, M. N. (2010). Video-gaming among high school students: Health correlates, gender differences, and problematic gaming. *Pediatrics, 126*, e1414–e1424. doi:10.1542/peds.2009-2706.

Entertainment Software Association (2010a). *2010 Essential facts about the computer and video game industry*. <http://www.theesa.com/facts/pdfs/ESA_EF_Violence_2010.pdf>.

Entertainment Software Association (2010b). *Video games in the 21st century: The 2010 report*. <http://www.theesa.com/facts/pdfs/VideoGames21stCentury_2010.pdf>.

Feng, J., Spence, I., & Pratt, J. (2007). Playing an action video game reduces gender differences in spatial cognition. *Psychological Science, 18*(10), 850–855.

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

Ferguson, C. J. (2009a). An effect size primer: A guide for clinicians and researchers. *Professional Psychology: Research and Practice, 40*(5), 532–538.

Ferguson, C. J. (2009b). Media violence effects: Confirmed truth, or just another X-File? *Journal of Forensic Psychology Practice, 9*(2), 103–126.

Ferguson, C. J. (2010a). Blazing angels or resident evil? Can violent video games be a force for good? *Review of General Psychology, 14*(2), 92–104.

Ferguson, C. J. (2010b). The wild west of assessment: Measuring aggression and violence in video games. In L. Annetta & S. Bronack (Eds.), *Serious educational game assessment: Practical methods and models for educational games, simulations and virtual worlds* (pp. 31–44). Rotterdam: Sense Publishers.

Ferguson, C. J. (2011). Video games and youth violence. A prospective analysis in adolescents. *Journal of Youth Adolescence, 40*(4), 377–391.

Ferguson, C. J., Colwell, J., Mlacic, B., Milas, G., & Milousic, I. (2011). Personality and media influences on violence and depression in a cross-national sample of young adults: Data from Mexican–Americans, English and Croatians. *Computers in Human Behavior, 27*, 1195–1200. doi:10.1016/j.chb2010.12015.

Ferguson, C. J., & Olson, C. K. (2010). The Supreme Court and video game violence. Will regulation be worth the costs to the first amendment? *The Criminologist, 35*(4), 18–21.

Ferguson, C. J., & Rueda, S. M. (2009). Examining the validity of the Modified Taylor Competitive Reaction Time Test of aggression. *Journal of Experimental Criminology, 5*(2), 121–137.

Ferguson, C. J., & Rueda, S. M. (2010). The hitman study: Violent video game exposure effects on aggressive behavior, hostile feelings, and depression. *European Psychologist, 15*(2), 99–108. doi:10.1027/1016-9040/a000010.

Ferguson, C. J., Rueda, S. M., Cruz, A. M., Ferguson, D. E., Fritz, S., & Smith, S. M. (2008). Violent video games and aggression: Causal relationship or byproduct of family violence and intrinsic violence motivation? *Criminal Justice and Behavior, 35*(3), 311–332. doi:10.1177/0093854807311719.

Ferguson, C. J., San Miguel, C., & Hartley, R. D. (2009). A multivariate analysis of youth aggression and violence. The influence of family, peers, depression and media violence. *Journal of Pediatrics, 155*(6), 904–908.

Ferguson, C. J., Smith, S., Miller-Stratton, S., Fritz, S., & Heinrich, E. (2008). Aggression in the laboratory: Problems with the validity of the modified Taylor Competitive Reaction Time Test as a measure of aggression in media violence studies. *Journal of Aggression, Maltreatment, and Trauma, 17*, 118–132.

Field, A. (2009). *Discovering statistics using SPSS*. Thousand Oaks, CA: Sage.

Freedman, J. L. (2002). *Media violence and its effect on aggression: Assessing the scientific evidence*. Toronto: University of Toronto Press.

Friedenberg, J., & Silverman, G. (2006). *Cognitive science. An introduction to the study of the mind*. Thousand Oaks, CA: Sage.

Green, C. S., & Bavelier, D. (2003). Action video games modify visual selective attention. *Nature, 423*, 534–537.

Gronwall, D. M. A. (1977). Paced auditory serial-addition task: A measure of recovery from concussion. *Perceptual and Motor Skills, 44*, 367–373.

Hall, R., Day, T., & Hall, R. (2011). A plea for caution: Violent video games, the supreme court, and the role of science. *Mayo Clinic Proceedings, 86*(4), 315–321.

Irwin, A. R., & Gross, A. M. (1995). Cognitive tempo, violent video games, and aggressive behavior in young boys. *Journal of Family Violence, 10*, 337–350.

Kaiser Family Foundation (2010). Generation M^2: Media in the lives of 8- to 18-year-olds. <http://www.kff.org/entmedia/upload/mh012010presentL.pdf>.

Kaufman, A. S., & Kaufman, N. L. (2004). *Kaufman brief intelligence test* (2nd ed.). Bloomington, MN: Pearson.

Kirsh, S. J. (1998). Seeing the world through Mortal Kombat-colored glasses: Violent video games and the development of a short-term hostile attribution bias. *Childhood, 5*, 177–184.

Krcmar, M., Farrar, K., & McGloin, R. (2010). The effects of video game realism on attention, retention and aggressive outcomes. *Computers In Human Behavior, 27*(1), 432–439. doi:10.1016/j.chb.2010.09.005.

Kutner, L., & Olson, C. K. (2008). *Grand theft childhood: The surprising truth about video games and what parents can do*. New York, NY: Simon & Schuster.

Lenhart, A., Kahne, J., Middaugh, E., MacGill, A., Evans, C., & Mitak, J. (2008). *Teens, video games and civics: Teens gaming experiences are diverse and include significant social interaction and civic engagement*. <http://www.pewinternet.org/PPF/r/263/report_display.asp> Retrieved 10.02.08.

NPD Group (2011). *2010 total consumer spend on all games content in the US estimated between $15.4 to $15.6 billion*. <http://www.npd.com/press/releases/press_110113.html>.

Olson, C. K., Kutner, L., Baer, L., Beresin, E., Warner, D., & Nicholi, A. (2009). M-rated video games and aggressive problem behavior among young adolescents. *Applied Developmental Science, 13*(4), 1–11.

Przybylski, A. K., Rigby, C. S., & Ryan, R. M. (2010). A motivational model of video game engagement. *Review of General Psychology, 14*(2), 154–166.

Ritter, D., & Eslea, M. (2005). Hot sauce, toy guns and graffiti: A critical account of current laboratory aggression paradigms. *Aggressive Behavior, 31*, 407–419.

Sherry, J. L. (2004). Flow and media enjoyment. *Communication Theory, 14*, 328–347.

Smith, G., & Ebrahim, S. (2001). Epidemiology – Is it time to call it a day? *International Journal of Epidemiology, 30*(1), 1–11.

Spence, I., & Feng, J. (2010). Video games and spatial cognition. *Review of General Psychology, 14*(2), 92–104.

Tedeschi, J., & Quigley, B. (2000). A further comment on the construct validity of laboratory aggression paradigms: A response to Giancola and Chermack. *Aggression & Violent Behavior, 5*, 127–136.

Teng, S., Chong, G., Siew, A., & Skoric, M. (2011). Grand theft auto IV comes to Singapore: Effects of repeated exposure to violent video games on aggression. *Cyberpsychology, Behavior and Social Networking, 14*(10), 597–602.

Thompson, K., & Haninger, K. (2001). Violence in E-rated video games. *Journal of the American Medical Association, 286*, 591–598.

Tombaugh, T. (2006). A comprehensive review of the Paced Auditory Serial Addition Task (PASAT). *Archives of Clinical Neuropsychology, 21*, 53–76.

Unsworth, G., Devilly, G., & Ward, T. (2007). The effect of playing violent videogames on adolescents: Should parents be quaking in their boots? *Psychology, Crime and Law, 13*, 383–394. doi:10.1080/10683160601060655.

Weaver, J. B., Mays, D., Weaver, S. S., Kannenberg, W., Hopkins, G. L., Eroglu, D., et al. (2009). Health-risk correlates of video-game playing among adults. *American Journal of Preventive Medicine, 37*(4), 299–305.

Wechsler, D. (1997). *Wechsler adult intelligence scale* (3rd ed.). San Antonio, TX: Harcourt Assessment.

Wilkinson & Task Force on Statistical Inference (1999). Statistical methods in psychological journals: Guidelines and explanations. *American Psychologist, 54*(8), 594–604. doi:10.1037/0003-066X.54.8.594.

Williams, D., & Skoric, M. (2005). Internet fantasy violence. A test of aggression in an online game. *Communication Monographs, 72*(2), 217–233.

Williams, D., Yee, N., & Caplan, S. E. (2008). Who plays, how much, and why? Debunking the stereotypical gamer profile. *Journal of Computer-Mediated Communication, 13*(4), 993–1018. doi:10.1111/j.1083-6101.2008.00428.x.

World Health Organization (2011). *Mental health: Depression*. <http://www.who.int/mental_health/management/depression/definition/en/index.html>.