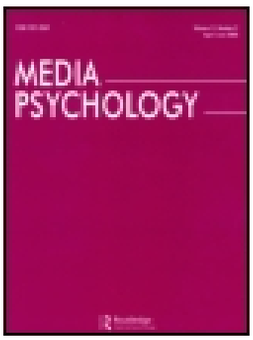

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Repeated Play Reduces Video Games' Ability to Elicit Guilt: Evidence from a Longitudinal Experiment

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Statements supported mostly by correlational and cross-sectional studies suggest that playing violent video games can cause emotional desensitization. A longitudinal experiment examined a) whether repeated violent game play leads to emotional desensitization and b) whether desensitization generalizes to other play and real-life experiences. Participants played alternative versions of the same violent game for the first four days; on these days, the character role was varied between-subjects to be moral (United Nations soldier) or immoral (terrorist soldier). On Day 5, all participants played a novel game as a terrorist. Results indicate two things. First, habituation occurs over repeated game play: Repeated exposure decreased the ability of the original game to elicit guilt. Second, the decreased ability to elicit guilt can generalize to other gameplay experiences: Guilt elicited by the novel game on Day 5 was

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reduced for the immoral character condition compared to the moral character condition. The current study provides causal, longitudinal evidence regarding the potential for video game play to lead to emotional desensitization with regard to future video game-play experiences.

Determining the extent to which video games are capable of eliciting moral emotions has attracted considerable scholarly attention (Grizzard, Tamborini, Lewis, Wang, & Prabhu, 2014; Hartmann, Toz, & Brandon, 2010; Lin, 2011; Schmierbach & Limperos, 2013). Moral emotions serve as "an emotional moral barometer, providing immediate and salient feedback" regarding the social and moral acceptability of an action (Tangney, Stuewig, & Mashek, 2007, p. 347). Research on the ability of video games to elicit moral emotions presents a consistent, replicable finding: Players engaging in unjustified violence in video games feel guilt for their virtual transgressions (e.g., Hartmann et al., 2010). Notably, the findings of this research contrast strongly with gamers' claims that killing virtual characters on a screen is no different than taking pawns in a game of chess, with neither action being particularly relevant to real-world morality (see Hartmann, 2012; Hartmann et al., 2010). The preponderance of evidence clearly shows that engaging in unjustified violence in a video game elicits significantly higher levels of guilt than engaging in justified violence (cf., Grizzard et al., 2014; Hartmann et al., 2010). If virtual violence was indeed morally irrelevant, then both unjustified and justified violence should elicit similar levels of guilt. Thus, current evidence suggests that video game actions are morally relevant.

In a somewhat interesting twist, video game scholars and avid gamers both argue that playing the role of an immoral character in a violent video game is unlikely to lead to antisocial consequences, albeit for different reasons. Gamers tend to claim that virtual behaviors are morally inconsequential, whereas researchers argue that because immoral game play elicits guilt, guilt felt by the player may mitigate antisocial consequences of violent video game play or even lead to prosocial responses (Grizzard et al., 2014; Hartmann et al., 2010; Weaver & Lewis, 2012). This argument is supported by research that shows guilt motivates prosocial behaviors (Boster et al., 1999; de Hooge, Breugelmans, & Zeelenberg, 2008). However, the possibility remains that the ability of games to elicit guilt may be reduced through repeated play. Prior work on moral emotions and video game play examined the ability of games to elicit guilt in single-exposure studies. Thus, it is plausible that the ability of video games to elicit guilt might habituate over time: Initial exposures to virtual moral transgressions elicit guilt, but repeated play leads to habituation of this response. Consequently, game play could lose its capacity to induce a moral response. If such effects become completely habituated, gamers may experience their in-game actions as morally inconsequential.

The current study seeks to examine whether the elicitation of guilt resulting from video game play is reduced with repeated play. Reduction of response intensity associated with repeated stimulus presentation is labeled as *habituation* in the academic literature (Groves & Thompson, 1970; Rankin et al., 2009; Stein, 1966). This study also seeks to establish whether habituation of the guilt response will extend or *generalize* to future play experiences. Habituation coupled with generalization is often described as "desensitization" in the video game aggression literature (cf. Carnagey, Anderson, & Bushman, 2007). This article begins with a discussion of the desensitization hypothesis and its relationship to research on phobia reduction. We then present the current study with a focus on its design and the specific hypotheses related to habituation and generalization. Finally, we present and discuss the findings of an experiment designed to test these hypotheses.

THE DESENSITIZATION HYPOTHESIS AND ITS RELATIONSHIP TO VIDEO GAME THEORY AND RESEARCH

Habituation and generalization are established psychological processes with decades of research characterizing patterns of response (Rankin et al., 2009). Rankin et al. (2009) define habituation as "a behavioral response decrement that results from repeated stimulation and that does not involve sensory adaptation/sensory fatigue or motor fatigue" (p. 136). In the case of media stimuli, viewers would be expected to show diminished psychophysiological response after multiple exposures. Generalization is defined as the extension of the habituation response to new stimuli that are similar in nature to the original stimulus. For example, Faulkender, Wright, and Waldron (1974) habituated toddlers to images of animals and then exposed the toddlers to a mixed set of images of another category (fruit) and images of the same category (other animals). Toddlers spent significantly less time looking at images from the familiar category than from the new category, suggesting that habituation generalized from the initial set of animal images to the new set. Research on habituation and generalization has led video game researchers and theorists to propose that aggressive video game play can lead to increased aggression through desensitization (i.e., the desensitization hypothesis; Bushman & Anderson, 2009; DeWall, Anderson, & Bushman, 2011). The desensitization hypothesis is a combination of habituation and generalization mechanisms with regard to media. Repeated exposure to media aggression is thought to decrease both physiological responses (e.g., heart rate) and emotional responses (e.g., fear, guilt) to similar future experiences, both mediated and non-mediated.

One area where desensitization due to exposure to virtual environments has been studied is for the treatment of phobias (Parsons & Rizzo, 2008).

Treatment for phobias involves repeatedly exposing patients to fear-inducing stimuli in a safe environment. Investigations have shown that this repeated exposure results in both habituation and generalization (Foa & Kozak, 1986). In many cases, repeated exposure can take place in virtual environments. For example, Rizzo et al. (2009) used virtual reality to desensitize returning soldiers with posttraumatic stress disorder. Research on phobia reduction through repeated stimulus exposure is particularly important to the current investigation in two ways. First, it provides a theoretical mechanism for desensitization of guilt by suggesting that desensitization can affect both physiological responses, such as heart rate, as well as emotional responses, such as fear (Lang, Melamed, & Hart, 1970). Second, it shows that virtual environments are capable of eliciting real-world desensitization (Tarr & Warren, 2002). At first glance, research showing that virtual environments are capable of desensitizing emotional responses, such as fear, suggests that this mechanism should work with other emotions, such as guilt. At the same time, it is important to recognize that basic emotions, such as fear, differ from more complex emotional responses, such as moral emotions. Unlike fear and other basic emotions, moral emotions, such as guilt, rely on higher levels of cognitive deliberation (Tangney et al., 2007). To experience guilt, individuals must recognize that their actions have violated a moral or social tenet. Thus, it is unclear whether desensitization will occur with emotions that require more complex cognitive evaluations, such as guilt, or whether the cognitive evaluative structures associated with the elicitation of guilt are so ingrained that desensitization of these complex emotions is impossible.

Although desensitization logic is present in much of the theory on video game violence (see Anderson & Carnagey, 2004) and is applied equally to physiological and emotional responses, it is simply assumed to occur in most investigations. Moreover, when it has been examined, causal claims have been hindered by the cross-sectional nature of the research (see discussion by Grizzard et al., 2015). Most studies examining desensitization are not longitudinal and instead take place within a single laboratory sessions (cf. Anderson et al., 2010; Bartholow, Bushman, & Sestir, 2006).

The current study is distinct from previous research on desensitization to video game violence in key ways. First, unlike previous single-session studies, the present investigation examines desensitization across multiple sessions. Research comparing single-session versus multiple-session desensitization training (Rowe & Craske, 1998) concludes that single-session desensitization is a) less likely to generalize to novel stimuli and b) less likely to be permanent.[1] Second, unlike previous research that focused only on cognitive or physiological desensitization, the current study examines emotional responses. This fact is particularly important as current research in moral psychology focuses on the importance of emotions in guiding cognitions and behaviors. For example, dual-process theories of morality argue that

emotional responses underlie moral judgments and behaviors (for an overview, see Eden, Grizzard, & Lewis, 2013, and Haidt, 2001).

THE CURRENT STUDY

The study reported here was a longitudinal experiment separated into two phases to test the desensitization hypothesis. The habituation phase was designed to test the study's basic hypothesis that the ability of a video game to induce moral emotions will dissipate with repeated play. During the habituation phase, participants played the same game on four sequential occasions. The generalization phase was included to establish that habituation is not limited to the original game, but extends to new game stimuli. During the generalization phase, participants played a new game.

The Habituation Phase

Literature regarding the amount of time necessary for habituation to occur due to media exposure varies greatly. Several studies have demonstrated habituation within a single session (Bartholow et al., 2006; Linz, Donnerstein, & Adams 1989; Popova, 2009; Wilson, 1989). However, longitudinal experiments over multiple days have also demonstrated habituation with regard to violence and pornography (Linz, Donnerstein, & Penrod, 1984; Zillmann & Bryant, 1982). The habituation schedule for the current research consisted of four exposures to the same game across four separate days. This mirrored the habituation schedule of Rowe and Craske's (1998) phobia reduction study. Game play on each day consisted of approximately 10–15 minutes, for a total of 40–60 minutes across all exposures. This schedule should be sufficient for establishing desensitization for several reasons. First, and as previously stated, media research has demonstrated desensitization in single sessions with significantly less exposure time (Wilson, 1989). Second, multiple exposures over a series of days is more likely to lead to desensitization than a single session (Rowe & Craske, 1998).

The current project adopted the stimuli used in the Hartmann et al. (2010) study, a modified version of *Operation Flashpoint*. In their study, participants engaged either in normatively immoral behaviors (i.e., playing as a paramilitary terrorist who kills U.N. soldiers to defend a torture camp; henceforth, referred to as the immoral condition) or in normatively moral behaviors (i.e., playing as a U.N. solider who has to kill paramilitary terrorists to liberate a torture camp; henceforth, referred to as the moral condition). Thus, the current study replicates Hartmann et al.'s first hypothesis.

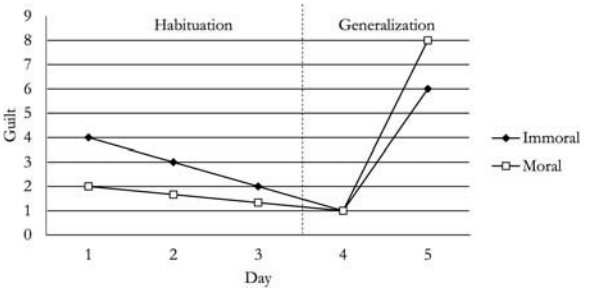

FIGURE 1. Visual depiction of habituation and generalization hypotheses. Days 1–4 represent the habituation phase of the study while Day 5 represents the generalization phase.

H1: Participants in the immoral condition will feel more guilt postgame play than participants in the moral condition on Day 1 of the study.

Next, we hypothesize that the level of guilt elicited by the game should decrease with repeated play in a manner that interacts with condition. Both conditions should experience decreases in guilt over time (previous studies show that even moral violence is capable of eliciting low levels of guilt; Hartmann et al., 2010; Grizzard et al., 2014; Lowinger & Solomon, 2004), but the reduction in guilt should be stronger for the immoral condition, as this group is expected to elicit higher levels of guilt on Day 1 of the study (see Figure 1 for a graphical depiction of the desensitization hypothesis).

H2: There will be an interaction between game condition and time, such that the postgame play guilt difference between the moral and immoral conditions will be smaller on Day 4 of the study than on Day 1 of the study.

The Generalization Phase

The generalization phase tests whether the effect of the immoral game on reducing guilt will generalize to a similar three-dimensional shooter game. The similar game is the "No Russian" level from the game, *Call of Duty: Modern Warfare 2* in which players help a terrorist organization carry out an attack at a crowded airport by walking through the airport and killing any civilians they encounter. The game is graphic and realistic in its depiction of the violence and in the reactions of the civilian characters.

The game was selected for its similarity to the immoral condition of the desensitization phase game. Both games include terrorist groups committing unjust violence, both have identical controls, and both use the first-person perspective. Previous research paradigms on emotional desensitization to media content generally select novel content that is similar, but not identical,

to the desensitizing content (Wilson, 1989; Zillmann & Bryant, 1982), as generalization is a function of the similarity between stimuli (Shepard, 1987). Consistent with previous research on habituation and generalization (Bradley, Lang, & Cuthbert, 1993; Rowe & Craske, 1998; Zillmann & Bryant, 1982), it is expected that participants in both conditions will experience an increase in guilt when they are exposed to the novel stimuli as compared to the original stimuli. However, if habituation of a general-nature occurred and it is lasting, participants in the immoral game condition should experience a smaller increase in guilt to the novel game as compared to the moral game condition, as the immoral game has desensitized the individual to immoral violence specifically. This leads to Hypotheses 3a and 3b, which are displayed graphically in Figure 1. Note that the novel game is expected to be more guilt inducing than the original game. This specificity in the prediction is based on the fact that the novel game had more advanced graphics than the original game, and is supported by past investigations on the influence of advanced graphics on player responses in general (see Ivory & Kalyanaraman, 2007) and on the arousal potential of the two specific games used in this study (see Grizzard et al., 2015).

H3a: There will be an increase in postgame-play guilt for both conditions between Day 4 of the study, when participants play the original game for the last time, and Day 5 of the study, when participants play the novel game for the first time.

H3b: There will be an interaction between game condition and time, such that the increase in postgame-play guilt between Day 4 and Day 5 will be greater for participants in the moral condition as compared with participants in the immoral game condition.

METHOD[2]

Procedure Overview

The study employed a mixed design with a game condition factor and a repeated measures factor. The between-subjects factor was the game condition (moral and immoral). The repeated measures factor was time (Days 1–5). Days 1–4 represented the habituation phase, during which participants played the *Operation Flashpoint* game used by Hartmann et al. (2010). Day 5 represented the generalization phase examining generalization of the habituation response to future game-play experiences, during which participants played the aforementioned, novel *Call of Duty* game.

To account for potential testing effects associated with repeatedly measuring guilt, a separate between-subjects factor was added to the study. This additional, between-subjects factor represented two separate groups of participants (Group A and Group B). During the desensitization phase, both

TABLE 1 Procedure Illustrating Guilt Assessment and Induction by Day

	Desensitization phase				Generalization phase
Condition	Day 1	Day 2	Day 3	Day 4	Day 5
Group A					
Immoral	O	O	O	O	O
Moral	O	O	O	O	O
Group B					
Immoral				O	O
Moral				O	O
Induction	Game	Game	Game	Game	Novel game

Note. O = represents observation of guilt.

groups played *Flashpoint* over the four days. The assessment of guilt, however, differed depending on the group to allow for a modified Solomon four-group design. Group A completed the guilt measure on all six days of the experiment; Group B completed the guilt measure only on Days 4 and 5 (see Table 1). The group between-subjects factor allows for the testing of hypotheses related to desensitization through Group A and hypotheses related to generalization through the combination of Group A and Group B. Participants were randomly assigned to conditions.

Participants

A power analysis based on the effect size observed in Hartmann et al. (2010), Cohen's d = .87, assuming power level of β = .80, and α = .05 (two-tailed) indicated that 22 participants per condition was sufficient to detect a significant effect. A total of 145 university undergraduates were recruited to take part in the experiment. Undergraduates are an appropriate sample for this study because it seems improbable that video game-induced desensitization would affect college students differently than other adult populations. Moreover, it has been noted elsewhere that college students represent a population particularly well suited to studying video game-related psychological processes (Anderson & Dill, 2000). Ninety-five participants (65.54%) identified themselves as female, 49 (33.8%) identified themselves as male, and 1 (0.7%) did not disclose their sex. The majority of participants identified themselves as White or Caucasian (n = 105, 72.4%). Minority races accounted for the following: Asian (n = 12, 8.3%), Black or African American (n = 5, 3.4%), Hispanic (n = 2, 1.4%), Native American (n = 1, 0.7%), and other (n = 4, 2.8%); 16 participants (11.0%) did not disclose their race. The average age of participants was 19.53 years (SD = 1.64, min = 18, max = 27). Seventy participants were randomly assigned to Group A (35 to the immoral condition, 35 to the moral condition), and 75 participants were randomly assigned to Group B (35

to the immoral condition, 40 to the moral condition), who had guilt assessed only after Day 4.

Measures

Guilt. The current project employed similar measures as Hartmann et al. (2010) to replicate their findings. Their scale consisted of three items: "When playing the game, how often did you feel…" (1) "regret," (2) "sorry about something you did," and (3) "like you did something wrong." The current study added three items: guilty, blameworthy, and ashamed, taken from the guilt subscale of the PANAS-X (Watson & Clark, 1994). The prompt was also changed to "What extent do you feel…," to ensure that guilt observed was not simply a demand characteristic (i.e., participants thinking about how they should have felt when playing the game rather than how they felt in the moment). Participants responded on a 0 (*not at all*) to 10 (*extremely*) scale. A confirmatory factor analysis using structural equation modeling conducted on the data from Day 1 indicated a one-factor solution fit the data well after dropping the blameworthy and ashamed items,[3] $\chi^2(2) = 1.86$, $p = .39$, CFI = 1.00, RMSEA = .00, SRMR = .01. The four items were averaged to form a composite for each day, and internal consistency was high across all days (minimum observed $\alpha = .95$).

In addition to guilt, the current study also recorded several covariates thought to be important. These included the participants' sex, video game-play habits, state affect and state arousal, and familiarity with the games used in the study.

Video Game-Play Habits. If the hypothesized relationships regarding desensitization (both habituation and generalization) exist in the population, then participants who are gamers are likely to have experienced desensitization already. Thus, two factors related to video game play were also measured using items created for this study: A five-item attitudes toward video games scale (sample items include "I consider myself to be a gamer" and "I enjoy playing video games"; $\alpha = .86$) and a question regarding the amount of time spent playing video games per week ("On average, how many hours do you spend playing video games each week? Remember to include weekdays and weekends;" Response scale: 1 = *0 hours (I never play);* 2 = *just a few hours a year*; 3 = *1 or 2 hours a month*; 4 = *1 or two hours a week*; 5 = *1 or 2 hours a few days each week*; 6 = *1 or 2 hours every day*; 7 = *more than 2 hours a day*).

State Affect and State Arousal. Guilt is an emotion that has both cognitive (i.e., recognizing that one's action contradicts one's values) and affective components (i.e., feeling negative emotions resulting from recognition). As such, the negative affect associated with guilt is relatively specific in nature (i.e., associated with the recognition, not negative affect in general). To account for the relationship between guilt and generalized negative affect

and to control for such a relationship in hypothesis tests, affect and arousal were measured after game play on each day of the study using the affect grid (Russell, Weiss, & Mendelsohn, 1989). The affect grid is a 9-×-9 table that plots arousal (low to high) from 1 to 9 on the y-axis and affect (unpleasant to pleasant) from 1 to 9 on the x-axis. The midpoint of both factors (5 on each axis) represents neutral affect and arousal.

Game Familiarity. Finally, familiarity with the games used in the study was measured on the final day of the study. Participants were asked how familiar they were with the games in general and more specifically whether they had played or heard of the "No Russian" mission from *Call of Duty: Modern Warfare 2*.

Procedure

The procedure was relatively similar across all days of the study. Upon arrival at the lab, informed consent was gathered. Next, participants' blood pressure was measured through an automatic blood pressure machine as part of a data collection unrelated to the current study (see Grizzard et al. [2015] for a reporting of these data). Next, participants completed the affect grid so that they would become familiar with its use. Following this, participants were informed of the game that they would be playing through the use of recorded instructions, and the controls of the game were described. Next, participants played the game; the *Operation Flashpoint* game play lasted for approximately 7–10 minutes and the novel game, *Call of Duty: Modern Warfare 2* was played for approximately the same amount of time. Immediately following game play, participants completed the guilt measure, followed by another reading of the blood pressure machine, the affect grid, and several questions about perceptions of the game (see Grizzard et al. [2015] for a discussion of these data). The only deviation from these procedures that occurred was on the final day of the study when participants' demographic information and their familiarity of the games were measured at the end of the survey.

RESULTS

Inclusion of Covariates

Prior to hypothesis testing, a correlation matrix of the independent variable (Condition: coded 0 = moral, 1 = immoral), covariates (sex, attitudes toward video games, amount of time playing video games, state affect, state arousal, and game familiarity), and the dependent variable guilt (Day 1) was examined to determine which covariates to include in hypothesis tests. Covariates were included in analyses, if a) they were significantly correlated with the dependent variable across all days of the study and b) they were not

correlated with the independent variable. In addition, if covariates correlated with each other greater than $r \geq .50$, the covariate that correlated most strongly with the dependent variable was included and the others were excluded. This decision was made to ensure that power would not be reduced by the inclusion of multiple covariates with high intercorrelations. Based on these criteria, two covariates were determined to be important for inclusion in analyses: sex and affect. Neither sex (dummy-coded; 0 = female, 1 = male) nor affect correlated significantly with condition ($r = -.05$ and $r = -.09$, respectively), but both correlated significantly with guilt ($r_{sex} = -.36$, $p < .001$, and $r_{affect} = -.60$, $p < .001$). Three potential covariates were not included, despite their positive correlation with guilt, due to their high correlation with sex. These covariates were attitudes toward video games ($r_{sex} = .53$, $r_{guilt} = -.30$), game hours played ($r_{sex} = .75$, $r_{guilt} = -.36$), and familiarity with *Call of Duty: Modern Warfare 2* ($r_{sex} = .58$, $r_{guilt} = -.33$). Notably, sex and game hours played correlated similarly with guilt (both $r = -.36$). The inclusion of both covariates in analyses presented in the paper did not alter the pattern of findings for other predictors, and only reduced the sex effect to zero ($F < 1$), as would be expected for covariates with a high correlation.

Participant Mortality

A manipulation check question was included on each day that asked participants whether the character they controlled during the game was "a terrorist," "a U.N. solider," or "I don't remember," with participants answering incorrectly being removed from analysis. Rolling elimination was used as a method of excluding participants who answered incorrectly. For example, if a participant answered incorrectly on Day 1, he was excluded from all analyses. However, if a participant answered correctly on Day 1 and answered incorrectly on Day 5, she was included in analyses that dealt with Days 1–4, but was excluded from all analyses that dealt with Day 5. Participants were also excluded from analyses if they: a) missed experimental sessions, b) did not complete the guilt measures on all days, or c) did not complete the covariate measures.

Hypothesis 1 examined the difference between conditions on Day 1 for participants in Group A. Sixty eight of the 70 participants recruited into Group A were included in analysis of Hypothesis 1 based on the above criteria (97.1% inclusion rate). Hypothesis 2 examined an interaction between time (Day 1–4) and condition, and Hypothesis 3 examined an interaction between time (Days 4 and 5) and condition. The combined tests of Hypotheses 2 and 3 included 56 participants (80.0% inclusion rate) from Group A. The tests of Hypothesis 3 where Groups A and B were combined included 114 participants in total (Group A, $n = 56$ and Group B, $n = 58$, for 80.0% and 77.3% inclusion rates, respectively).

Hypothesis Testing

Hypothesis 1—Main Effect on Day 1. Hypothesis 1 predicted that guilt would be higher for participants in the immoral game condition than for participants in the moral game condition. An analysis of covariance (ANCOVA) was conducted on participants from Group A with condition (immoral vs. moral) as the between-subjects factor, Guilt as the dependent variable, and affect and sex as the covariates. Results from the test indicated significant effects of both covariates, sex $F(1, 64) = 5.01$, $p = .03$, $\eta^2 = .05$, and affect $F(1, 64) = 23.96.36$, $p < .001$. $\eta^2 = .23$. The direction of the parameter estimates indicates that males felt less guilt than females and positive affect was associated with less guilt. More notably, there was a main effect of condition, $F(1, 64) = 5.59$, $p = .02$, $\eta^2 = .05$. Examination of the estimated marginal means indicate that participants in the immoral condition experienced significantly more guilt than participants in the moral condition ($M_{immoral} = 3.33$, $SD = 2.43$, $M_{moral} = 1.93$, $SD = 2.43$), consistent with the first hypothesis and replicating Hartmann et al. (2010) and Grizzard et al. (2014).

Hypotheses 2 and 3—Interactions Between Condition and Time. Combined together, Hypotheses 2 and 3 predicted a specific pattern across all five days of the study (see Figure 1). To reduce the number of tests and inflation of Type I errors as well as to provide a test of the specified pattern, a focused contrast analysis (see Rosenthal, Rosnow, & Rubin, 2000) was conducted to test these hypotheses in a single statistical test for participants in Group A. A contrast analysis allow for a powerful statistical test of hypothesized patterns in data by examining the extent to which the observed data adhere to a predicted pattern. This approach is particularly preferred in ANOVA designs that incorporate more than two levels of an independent variable (e.g., time in the current study). Contrast analyses require the predicted pattern to be described in contrast coefficients that correspond to the predicted pattern (e.g., a hypothesized positive linear increase in a one-way design with three levels of the independent factor would be –1 0 +1) and sum to zero. Note that this approach is far superior than a simple F test as the F test only tells the researcher that a significant difference exists somewhere between the three levels of the independent factor, and it tells the researcher nothing about the extent to which their data fit the predicted pattern (see Rosenthal et al., 2000).

The contrast coefficients used to test the combined hypotheses were created to represent the pattern found in Figure 1, but recentered so that they would sum to zero (as required for contrasts). These contrast coefficients can be found in Table 2 and are visually depicted in Figure 2. To test the combined hypotheses using a contrast analysis, contrast scores (L scores) were calculated for each participant, and the significance of the contrast was tested using the standard t test approach (see Rosenthal et al., 2000).

TABLE 2 Contrast Coefficients used in Contrast Analysis for Combined Testing of Habituation and Generalization

Condition	Day 1	Day 2	Day 3	Day 4	Day 5	Sum
Immoral	1	0	−1	−2	3	1
Moral	−1	−1.33	−1.67	−2	5	−1
Sum	0	−1.33	−2.67	−4	8	0

Note. Row effects and column effects sum to zero as required for contrast analyses on interactions.

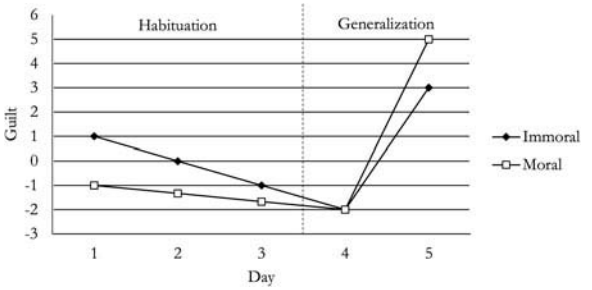

FIGURE 2. Visual depiction of the contrast coefficients used to test Hypotheses 2 and 3.

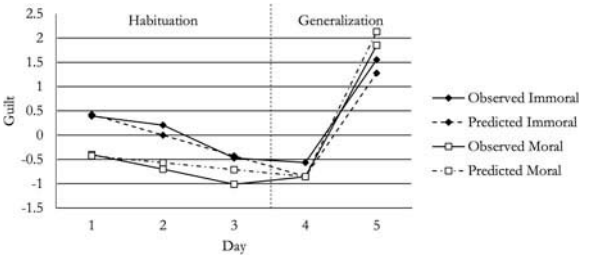

FIGURE 3. Observed and predicted means standardized to be on the same scale.

Results of the *t* test on the contrast score were significant, $t(54) = 5.91$, $p < .001$, Cohen's $d = 1.61$, indicating that the data in the study were consistent with both the habituation and generalization hypotheses. In addition, the pattern of observed means correlates with the pattern of predicted means $r(8) = .98$, $p < .001$ (see Figure 3). Although this analysis is purely for heuristic purposes, the high degree of correlation indicates that the observed data fit the predicted pattern well. We also tested this contrast with the presence of the covariates. This was accomplished through a regression approach whereby guilt on each day was regressed onto condition, sex, and affect for the specific day. The predicted values from these regressions were then used as the outcome variable for the contrast test. The results of this contrast were similarly significant, but with a larger effect size, as would be expected when controlling for additional variance in guilt elicited by the covariates, $t(54) = 11.45$, $p < .001$, Cohen's $d = 3.12$.

Further Analysis of Hypothesis 3. In addition to the contrast analysis, we further examined Hypothesis 3a and 3b. These analyses included participants from Group B, who only provided data on Days 4 and 5 of the study. A mixed ANOVA was conducted with group (Group A vs. Group B) and condition (immoral vs. moral) as between-subjects factors and time (Day 4 and Day 5) as a within-subjects factor. The multivariate tests indicated a significant effect of time, Wilks' $\lambda = .56$, $F(1, 110) = 85.38$, $p < .001$, $\eta^2_p = .44$, indicating that guilt was higher on Day 5 ($M = 5.50$, $SD = 3.60$) than Day 4 ($M = 2.72$, $SD = 2.89$), and a significant interaction of time × condition, Wilks' $\lambda = .95$, $F(1, 110) = 5.27$, $p = .02$, $\eta^2_p = .05$, indicating that while the immoral condition ($M = 3.03$, $SD = 3.10$) experienced more guilt on Day 4 than the moral condition ($M = 2.44$, $SD = 2.68$), the immoral condition ($M = 5.10$, $SD = 3.41$) experienced less guilt on Day 5 than the moral condition ($M = 5.86$, $SD = 3.75$). Both of these effects are consistent with the hypotheses.

Importantly, the Time × Group interaction and the Time × Group × Condition interactions were both nonsignificant indicating that the two-way interaction of Time × Condition did not differ based on group, Wilks' $\lambda = 1.00$, $F(1, 110) = .05$, $p = .83$, $\eta^2_p = .00$, and Wilks' $\lambda = .99$, $F(1, 110) = 1.31$, $p = .26$, $\eta^2_p = .01$, respectively. The between-subjects effect of Condition was nonsignificant, $F(1, 110) = .00$, $p = .97$, $\eta^2_p = .00$, and the interaction of condition with group was also nonsignificant, $F(1, 110) = .002$, $p = .97$, $\eta^2_p = .00$. There was a significant main effect of group, $F(1, 110) = 5.21$, $p = .02$, $\eta^2_p = .05$, with Group B ($M = 4.70$, $SD = 2.83$) scoring significantly higher than Group A ($M = 3.50$, $SD = 2.81$). However, because group did not interact with Time, Condition, or Time × Condition, this main effect simply indicates that the values of the significant effects of time and Time × Condition were higher for Group B as compared to Group A. Overall, the results are consistent with Hypotheses 3a and 3b as indicated by the significant effects of a) Time, b) Time × Condition and the nonsignificant effects of c) Condition, d) Condition × Group, e) Group × Time, and f) Group × Time × Condition. See Figure 4 for a depiction of the interaction with Groups A and B combined.

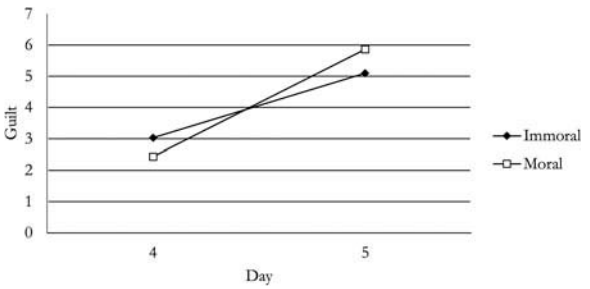

FIGURE 4. Hypothesis 3a and 3b pattern of means for conditions from Day 4 to Day 5.

DISCUSSION

Previous research indicates that engaging in unjust or immoral behaviors in a video game is capable of eliciting the moral emotion of guilt (Grizzard et al., 2014; Hartmann et al., 2010; Lin, 2011; Weaver & Lewis, 2012). Video game scholars have argued that the ability of immoral game play to elicit guilt suggests two important implications. First, video game play is morally consequential (Hartmann et al., 2010; Lin, 2011; Weaver & Lewis, 2012). In other words, the actions undertaken by players in a video game do not occur in a moral vacuum. Instead, virtual behaviors interact with an individual's sense of real-world morality and, thus, are capable of eliciting guilt. Second, because immoral game play induces guilt, assuming the role of an immoral character in a video game should reduce the potential for antisocial consequences associated with violent video games (Grizzard et al., 2014; Hartmann et al., 2010; Weaver & Lewis. 2012). Hartmann and colleagues (2010) argue that guilt should cause players to "enter a more critical and distanced reception mode, which may also serve to diminish the aggressive effects of displayed virtual violence" (p. 357). Weaver and Lewis (2012) echo this theoretical argument: "If a player has moral agency and feels guilty for a certain behavior or choice, a certain level of conscious consideration of the repercussion of one's behavior is implied" (p. 613). Grizzard and colleagues (2010) provided empirical evidence consistent with this logic showing that guilt elicited by video game play led to increased moral sensitivity related to the moral transgression committed during game play. This research indicated potential domain-specific mechanisms related to virtual immoral behavior leading to increased moral sensitivity of moral issues related to the virtual behavior. The findings of the current study support the proposition that video game play is morally consequential but challenge the proposition that routinely assuming an immoral character would mitigate the aggressive effects of violent video game play.

Desensitization to Moral Violations through Repeated Game-Play

Although past research argues that guilt-inducing video games might lead to prosocial responses including increased moral sensitivity (see Grizzard et al., 2014; Hartmann et al., 2010; Weaver & Lewis, 2012), the current findings modify this hypothesis by demonstrating that the ability of game play to elicit guilt decreases over time and that this decreased sensitivity generalizes to future game-play experiences. These findings indicate that if atrocious virtual behaviors increase moral sensitivity (see Grizzard et al., 2014), the increases may be short lived, as the increase in moral sensitivity seems to be dependent on the mediating effect of guilt. Importantly, these findings indicate that desensitization, which has been found for basic emotions, may occur for complex emotions that require cognitive deliberation. At the same time, the question of why this type of desensitization occurs for guilt requires future research.

As stated in the introduction, guilt is a rather complex emotion. It requires an individual to recognize that he or she has done something to violate internal standards of behavior, and it is this recognition that brings about accompanying negative affect. The findings of the current study do not indicate whether it is the recognition that changes with repeated play or whether the resultant affect is less intense. For example, it could be the case that the desensitization observed in the current study was purely the result of players altering the cognitive recognition process of guilt; through repeatedly engaging in virtual behaviors, players came to view their actions as less morally consequential. In this manner, the desensitization observed here may simply reflect the formation of a cognitive schema related to the processing of video game violence. This hypothesis reflects a suggestion made by Raney (2004) when he suggested that media may have its own moral codes that are qualitatively unique from real-world morality (see also Young & Whitty, 2010). This interpretation is similar to the tunnel vision hypothesis (Breuer, Scharkow, & Quandt, 2014).

A second potential explanation regarding our observation of guilt desensitization is that repeated play did not alter the cognitive recognition process, but reduced the amount of negative affect associated with the response. For example, it may be the case that players on Day 4 recognized their actions to be just as immoral as on Day 1, but they did not feel as much negative affect leading to the observed pattern. This explanation would suggest that it was the emotional processes of guilt that were altered rather than the cognitive processes. The data in the current study cannot rule out either of these explanations. Neither would biophysiological data related to arousal, as both explanations would predict reduced arousal. In fact, the only way to rule out one of these explanations may be through functional magnetic resonance imaging (fMRI) data.

If the first explanation is correct and desensitization relates to changes in recognition, fMRI data should indicate time-dependent decreased connectivity between executive prefrontal and subcortical limbic areas. If, on the other hand, desensitization is related purely to changes in strength of emotional responsiveness with no change in recognition, fMRI data should indicate time-dependent decreased activations in limbic areas that are largely independent from activity in executive networks (see Koban & Pourtois, 2014, and Wagner, N'Diaye, Ethofer, & Vuilleumier, 2011). Moreover, this type of research could also determine the relevance of a third explanation related to moral disengagement (see Breuer et al., 2014). It may be the case that the desensitization observed in the current study was the result of post hoc emotion regulation. According to this explanation, players recognize that they did something wrong; guilt and negative affect arise; and the player then uses cognitive strategies to reduce resulting negative affect (see Bandura, 2001, for a discussion of moral disengagement; see also Hartmann, 2012, for a description of how moral disengagement might relate to video game behaviors). If this explanation were

responsible for the underlying pattern, fMRI research should indicate a specific temporal dynamic between subcortical and executive networks such that the upregulation of executive networks moderates or suppresses subcortical activation (see McRae et al., 2012). Finally, a reverse mechanism—that is, some sort of anticipated emotion regulation—may also be possible: Players who engage in violent video game play already know (or have learned through repeated game play) that their behaviors within the game violate social norms and actively suppress the emotional response (guilt, empathy, etc.) in favor of executive control, which is crucial to master the game. This mechanism would be consistent with previous findings in neuroimaging studies on playing violent video games (see Weber, Ritterfeld, & Mathiak, 2006; see also, Mathiak & Weber, 2006) and studies on the elicitation of disgust (see Gallo, McCulloch, & Gollwitzer, 2012). Future research may be able to disentangle these alternative explanations, each associated with specific hypotheses related to connectivity patterns and their dynamics within the brain. At the same time, particularly clever designs may be able to provide evidence of these competing explanations using self-report measures, especially if one could establish expected patterns that are dissociated with one of the proposed mechanisms.

The Moral Consequence of Actions Preformed in Virtual Environments

The findings of the current study add to building evidence that virtual actions are capable of eliciting moral emotions, such as guilt. Thus far, most research of this type has focused on moral emotions elicited by moral transgressions, such as unjust violence. Questions remain as to whether moral upholding in virtual environments (e.g., being kind and compassionate) are equally as capable of eliciting positive moral emotions, such as moral pride and elevation (see Oliver, Hartmann, & Woolley, 2012). Past research (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001) showing greater sensitivity to moral violations than moral upholding indicates that guilt may be an easier moral emotion to elicit than moral pride. Future research should attempt to determine whether this is the case or not. The stimuli used in this study could provide a test of this hypothesis by examining whether the binomial relationship between condition and guilt is similar in magnitude but in the opposite direction for measures of moral pride.

Generalization to Moral Emotions Elicited by Non-mediated Stimuli

Research on habituation and generalization, the mechanisms that underlie desensitization, indicate that two outcomes are possible when habituation occurs: 1) stimulus generalization, the extension of habituation effects to novel stimuli; and 2) stimulus specificity, the failure of generalization to occur (Rankin et al., 2009). Although the findings here indicate some stimulus

generalization (i.e., to future play experiences), generalization to non-mediated stimuli may not occur, as the probability of generalization is negatively related to the sensory intensity of the eliciting stimulus (Rankin et al., 2009). For particularly strong stimuli, such as non-mediated stimuli, generalization may not occur at all. For example, participants may habituate to video game violence, including horrendous acts of virtual torture, rape, and murder, but that habituation may not extend to their viewing the same actions in the real world. Accordingly, we are cautious in describing the ability of video game-induced desensitization to generalize outside of the game until such a finding is demonstrated empirically (see Young & Whitty, 2010, for further discussion).

Limitations

There are several limitations of the current study worthy of mention. First, it is important to note that no other specific emotion was measured in the current study except for guilt. Thus, it is possible that any guilt elicited from game play is simply a demand characteristic. At the same time, there are several reasons that a demand characteristic explanation is unlikely to account for the entirety of the data. Foremost among these is the fact that the study predicted an interaction between condition and time resulting in a very specific pattern of means. It seems unlikely that demand characteristics would lead to such an interaction. In fact, a simple demand-characteristic explanation would suggest a reduction in variance associated with the between-subject factor. Given that most studies on video game violence utilize a violent versus nonviolent comparison, participants in the moral condition would have likely assumed that they were in the violent condition of the study, artificially inflating their guilt responses. Still, future research should include measures of other specific emotions (e.g., sadness, happiness, anger, etc.), which could provide additional discriminant validity regarding the potential for demand characteristics.

Second, the data revealed an unexpected pattern regarding the level of guilt experienced on Day 4 by Group B. Although not statistically significant, Group B participants did report slightly more guilt on Day 4 of the study than Group A participants reported on Day 1 (see Figure 5). Although this finding seems at odds with the desensitization phenomenon, it is important to remember that desensitization is inherently a within-subjects effect. That two between-subjects groups would not represent a pattern expected for desensitization is not problematic, especially when one considers that the interaction contrasts conducted on the within-subjects data were consistent with hypotheses, and the ANOVA conducted demonstrated that group did not significantly interact with condition, time, or the two way interaction of condition and time. Still, this pattern is worthy of mention and demonstrates the notable problems of utilizing between-subjects designs to examine within-subjects effects.

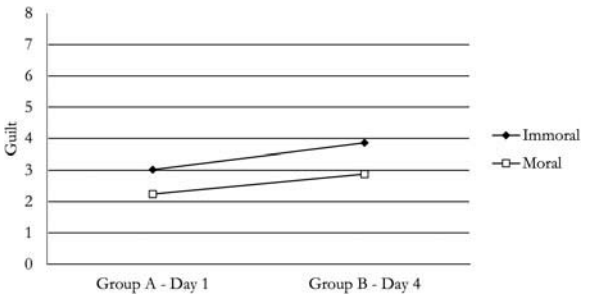

FIGURE 5. Comparison of guilt induced by play on Day 1 for Group A versus Day 4 for Group B.

This idiosyncratic finding also suggests future research questions regarding guilt. It is possible that asking participants about their levels of guilt on each day exacerbated habituation, or that waiting until Day 4 to ask Group B exacerbated the guilt they reported. This post hoc explanation relates to the amount of virtual harm done before the guilt question was asked for both groups. For participants in Group A, the guilt questions were asked after the participants had played the game only once. For participants in Group B, the guilt questions were asked after the participant had played the game four times. This difference resulted in the participants of Group B committing more virtual transgressions than participants in Group A prior to the initial assessment of guilt. Thus, asking the guilt questions on a day-to-day basis could have caused participants in Group A to consider their behaviors with respect to the current day alone while waiting to ask the question until Day 4 could have caused participants in Group B to consider their in-game behaviors with respect to all four previous days. Although this explanation seems plausible, it should be considered speculative until future research can provide a critical test of this hypothesis. Notably, this is another area where the inclusion of measures of other specific emotions might be useful, as they could serve as a masking agent for the effects on guilt.

The third limitation relates to the mortality rate of the participants. All longitudinal studies suffer from participant mortality, and some might consider the rates of mortality here to be moderate, particularly with respect to the test of Hypothesis 4. However, participant mortality is only a concern regarding the internal validity of an experimental study if there is an interaction between mortality and condition such that participants who dropped out of the experiment are systematically different from participants who remained in. A chi-square test crossing participant mortality (remained in vs. dropped out) with the four conditions (moral vs. immoral for Groups A and B) was conducted. The results indicated that mortality was unrelated to experimental condition, $\chi^2(3) = .52$, $p = .92$. Furthermore, correlations between participant mortality and the dependent variables and covariates

were also nonsignificant indicating that participants who dropped out were not significantly different from participants who remained in the study on any of the covariates or dependent variables. In the current case, participant mortality seemed to be random and unassociated with the covariates, independent variables, or dependent variables. Because participant mortality was random, it does not limit or restrict the validity of the current findings; the only effect should be a loss of power.

CONCLUSION

The current article provides evidence regarding potential effects of repeated video game play on the ability of video games to elicit moral emotions. The current research indicates that any mitigating effect of such play (cf. Grizzard et al., 2014) is likely to be short lived, as repeated play desensitizes players to feeling video game-induced guilt. At the same time, it is important to note that there is no evidence of video game-induced desensitization generalizing to real-world behaviors. This proposition requires additional research, as it would be faulty to assume that such generalization is guaranteed to occur. Still, this study is the first to provide experimental evidence of desensitization of moral emotional responses within a video game. This type of longitudinal experimental framework may, thus, be useful for further exploring the complex relationship between video game play and moral emotions.

NOTES

1. In this research (Rowe & Craske, 1998), spider-fearful individuals underwent desensitization training. Some of these participants experienced all of the desensitization training (the duration of which was 1 hour and 45 minutes) in a single session on Day 1 of the experiment; the desensitization training for the other participants was diffused over four days. Researchers held the total amount of desensitization training time constant between the two groups. Notably, the single-session group experienced a reoccurrence of fear to spiders (i.e., evidence that the desensitization they experienced was not permanent), whereas the multi-session group did not.

2. Data were also collected to examine the possibility of generalization of habituation to real-world judgments. On the day following the lab sessions, a novel guilt induction was administered in an online survey. The novel guilt induction asked participants to imagine themselves in a situation in which they had done something to wrong another person (adapted from de Hooge et al., 2008). Subsequent discussion of this induction illuminated several confounds that made us distrust the results, so we decided to not include this induction in this article. We do not believe this has an effect on the other tested hypotheses because it occurred one day subsequent to all other data collection. Please contact the first author if interested in these results.

3. That the blameworthy and ashamed items had a negative effect on the fit of a one factor solution is not surprising. Guilt and shame are similar but distinct moral emotions with the former being associated with actions (i.e., "I *did* something bad") and the latter being associated with the self (i.e., "*I* am bad"; Niedenthal, Tangney, & Gavanski, 1994).

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