

The Impact of a Video Game on Criminal Thinking: Implicit and Explicit Measures

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Abstract

Background. Debate regarding the potential repercussions of engaging with videogames that promote violence and crime has been part of public discourse for decades. The present study seeks to add to the debate by investigating some of the **unexplored links** between **pro-criminal videogames** and **antisocial cognitive processes**.

Aim. This study examined whether **criminal thinking** could be **manipulated** by exposure to common criminal stimuli: a popular North American **news show** and a popular antisocial **videogame** (GRAND THEFT AUTO IV).

Method. Participants ($N = 136$) were assigned to one of **four conditions** (criminal news, non-criminal news, criminal gameplay, noncriminal gameplay) followed by **implicit** (Implicit Association Test) and **explicit** (questionnaires) **measures** of criminal thinking.

Results. Results indicated that engaging in criminal video gameplay had an **immediate effect on implicit measures** of criminal thinking, but not on explicit measures of criminal thinking.

Implications. This study builds on the present literature by examining **sources of criminal thinking** and the **usefulness of virtual crime** methodologies and **implicit measures** for experimental paradigms in this field.

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Keywords

antisocial cognitive processes, crime, criminal depictions, criminal stimuli, criminal news, criminal thinking, explicit, explicit measures, gaming, Grand Theft Auto, IAT, implicit association test, implicit measures, media, **pro-criminal videogames**, simulation, videogame, violence, **virtual crime**

The impact of violent and criminal depictions in the media on criminal behaviour has been the subject of long-standing controversy, particularly with the emergence of increasingly violent videogames. An analysis of popular videogames in 2003 revealed that 68% of all games contained violent interactions and, of games specifically intended for older children and adults, 90% depicted violence (Smith, Lachlan, & Tamborini, 2003; it is possible that these numbers have changed since 2003, but no more recent study was known to the researchers). Public concern over the violent content of media has increased partly due to its association with a number of school shootings in the US - shootings such as the 2012 Newtown Massacre. The Newtown Massacre was the second deadliest mass shooting by a single person in American history and was committed by twenty year-old Adam Lanza who was known to have frequently played violent first-person shooter games (Kleinfield, Rivera, & Kovaleski, 2013). Whether or not playing criminal videogames influenced the shooter's propensity for violence was unclear but widely discussed. In 2013 the world also witnessed the very publicized and extremely successful release of the criminal videogame GRAND THEFT AUTO V which sold over 16 million copies within five days of its release date, making it the fastest selling entertainment product of all time (Duffin, 2013). This release led, once again, to an immediate and heated renewal of the debate regarding whether violent videogames have adverse influences on players beyond the game.

In light of the debate, and to investigate some of the unexplored links between criminal videogames and antisocial cognitive processes, the present study examined the impact of criminal media on criminal thinking. Criminal thinking refers to modes of thought that support the development and maintenance of antisocial behaviour (Taxman, Rhodes, & Dumenci, 2011). This term includes psychological constructs such as entitlement, justification, power orientation, personal irresponsibility, cold heartedness, criminal rationalization (Knight, Garner, Simpson, Morey, & Flynn, 2006), and other antisocial cognitions. The present study used measures that explicitly and implicitly tapped into the broader construct of criminal thinking rather than just examining the more commonly researched sub-categories of aggression and violence. This study found that after playing the game GRAND THEFT AUTO IV in a criminal manner increased implicit criminal thinking, while engaging in the game in a non-criminal way or watching news clips did not. This suggests that something specific to the act of engaging with a criminal videogame may increase criminal thinking.

Effects of Violent Media Consumption

Multiple meta-analyses have been conducted to examine the effect of violent media (including news, movies, print, and videogames) on children and adolescents. In a review of these meta-analyses (also referred to as a meta-meta-analysis), Browne and Hamilton-Giachritsis (2005) found consistent evidence that violent imagery in television, movies, and computer games has significant short-term effects on arousal, cognition, and emotion, which increase the likelihood of aggressive behaviour, especially in young boys. Similarly, in a meta-analysis of 202 studies, Bushman and Anderson (2001) found not only a clear link between the consumption of media violence and aggressive behaviour, but the statistical magnitude of this correlation steadily increased between 1975 and 2000.

In another review, focusing specifically on videogame violence and aggression, Anderson and Bushman (2001) reported a positive and significant overall small effect size (Pearson's $r = .19$) for the correlation between videogame violence and aggression. Videogame violence was positively correlated with aggressive behaviour, cognitions, affect, physiological arousal, and negatively associated with prosocial behaviour. These associations have been supported by a number of other meta-analyses and review articles (e.g., Anderson, 2004; Anderson et al., 2004; Anderson et al., 2010; Barlett, Anderson, & Swing, 2008; Sherry, 2001). Despite these findings, skepticism abounds regarding the nature of the relationship between media violence, antisocial behaviour, and attitudes. In particular, critics cite methodological issues and overwhelmingly correlational research as major limitations (e.g., Ferguson & Kilburn, 2010), and express the need for more experimental manipulations.

Playing a criminal videogame can potentially increase aggression and criminal thinking if it primes aggressive thoughts or scripts (Anderson et al., 2004). This was demonstrated in two experimental studies by Greitemeyer (2014), which showed that playing a violent videogame leads to a fundamental bias in what the player counts as aggressive. Specifically relevant to antisocial video gameplay, the lesson players learn is that aggression and criminal behaviour are effective strategies for achieving goals. Exposure to violent videogames can also lead to neural desensitization. In a study by Engelhardt, Bartholow, Kerr, and Bushman (2011), participants who played a violent videogame were compared to participants who played a nonviolent videogame. Participants who played the violent game showed a reduction in brain areas that were associated with aggression towards other participants. While this kind of aggression may dissipate over time, the constant rehearsal of aggressive cognitions could precipitate enduring changes in, and potentially contribute to, an aggressive personality. This basic mechanism is likely to apply beyond the construct of aggression and also apply to general criminal thinking - where repeated exposure to short-term criminality in media could make criminal cognitive structures more readily accessible, creating a cognitive tendency that facilitates criminal behaviour.

Explicit Measures of Criminal Thinking

To aid the understanding and assessment of criminal thinking and antisocial attitudes, numerous self-report questionnaires have been developed. For example, the Psychological Inventory of Criminal Thinking Styles (PICTS; Walters, 1995), and the Texas Christian University Criminal Thinking Scale (TCU-CTS; Knight et al., 2006), are self-report measures of antisocial thinking; these questionnaires do moderately well at discriminating individuals who have high levels of criminal thinking from those who have low levels (Walters, Hagman, & Cohn, 2011). McCoy and colleagues (2006) demonstrated that self-report criminal thinking scores are significantly higher in individuals reporting violence and aggression.

Criminal thinking patterns often escalate over time, along with criminal behaviour, so low levels of criminal thinking should precede higher levels of criminal thinking (e.g., Palmer, 2007). By extension, these early (low) levels of criminal thinking could be conceptualized as the early origins of criminal behaviour, and are found to some extent in everyone (for example, most people have occasional thoughts of murdering someone, Buss, 2006). For the present study the criminal thinking tool deemed most appropriate was the TCU-CTS. First, the TCU-CTS is arguably the most concise and cost-effective criminal thinking instrument to date (Knight et al., 2006). Second, it was constructed using the most validated components of its predecessor (the PICTS) along with other research-based components, giving it a strong empirical and theoretical foundation. Finally, while original criminal thinking measures were developed for offender populations, results have extended the TCU-CTS to college samples (McCoy et al., 2006).

Although using questionnaires is one way of measuring aggressive and criminal tendencies, the use of such measures of criminal thinking has been heavily criticized. Two criticisms predominate. First, self-report measures primarily rely on introspection to tap into consciously accessible knowledge (Gawronski & Bodenhausen, 2006; Greenwald et al., 2002; Walters, 2002). This necessarily limits the ability of such measures to examine unconscious processes. Second, self-report measures are susceptible to self-presentation biases and faking strategies (Crowne & Marlowe, 1960; Greenwald et al., 2002; Nederhof, 1985), especially for socially sensitive material – sensitive topics such as criminal tendencies. While subcultural theories of crime and deviance may argue that if an antisocial individual associates with antisocial peers their norms and values may normalize their behaviour, in individuals who identify as generally prosocial (such as the university students used in this sample), the topic of criminal tendencies is likely to be remain sensitive.

Implicit Measures of Criminal Thinking

The use of implicit measures helps avoid such methodological deficiencies (Greenwald & Banaji, 1995). In an effort to address these limitations, a computerized task known as the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) was developed to circumvent the possibility that participants may be unaware

of, or unwilling to fully disclose, attitudes of a sensitive nature. Implicit attitudes are theorized to manifest as actions or judgments that are made automatically and without the individual's awareness as to their causation (Fazio & Olson, 2003; Greenwald & Banaji, 1995). This particular property of participants being unaware of the true nature of the test is credited with making IAT scores resistant to faking (Greenwald, Poehlman, Uhlmann, & Banaji, 2009). Results from a meta-analysis comparing explicit and implicit attitudinal measures indicate that while the predictive validity of explicit measures dropped sharply when topics were socially sensitive, the same was not true for implicit measures (Greenwald et al., 2009). Additionally, the IAT has been deemed a useful alternative to explicit measures of criminal thinking specifically, (e.g., cognitive distortions in sex offenders, Mihailides, Devilly, & Ward, 2004; aggressive traits following violent video gameplay, Uhlmann & Swanson, 2004).

Three previous studies have examined the effects of violent videogames on implicit measures of aggression, and resemble the present study. Bluemke, Friedrich, and Zumbach (2010) and Fischer, Aydin, Kastenmüller, Frey, and Fischer (2012) examined the effects of violent videogames on implicit measures, but these two studies implicitly measured only aggressive self-concept, and used atypical gameplay scenarios. The game used in the present study, GRAND THEFT AUTO IV, involves controlling a plain-clothed character on virtual city streets and engaging in criminal activities such as theft and assault. This was intended to simulate real-world crime as much as possible. While GRAND THEFT AUTO IV was also used in another study (Teng, Chong, Siew, & Skoric, 2011), that also measured changes in cognition, the previous study used a longitudinal design, a questionable control condition that involved participants who did not play any game (rather than a similarly arousing nonviolent game), and a Singaporean sample. Instead of this, the present study used a short-term design and employed a North American sample. It also used control conditions – including the use of violent news segments where the viewer is not actively engaging with the material but is still primed to think about violence, and both a nonviolent videogame and nonviolent news condition as neutral conditions.

The Present Study

In the present study we predicted that criminal media could influence criminal thinking in two ways. Hypothesis 1 predicted that short-term exposure to criminal media would increase participant endorsement of explicitly-measured (i.e., self-reported) criminal attitudes on the TCU-CTS measure. However, because of literature regarding the problems associated with explicit measures, we predicted that if Hypothesis 1 were not supported, it could be due to measurement biases rather than a lack of real change. In line with this, Hypothesis 2 predicted that short-term exposure to criminal media would increase participant endorsement of implicitly-measured (IAT) criminal attitudes. By measuring criminal thinking both implicitly and explicitly, we increased our ability to detect change.

Method

Participants

One 136 Canadian undergraduate students (34 in each experimental condition) participated in this study in exchange for course credit. Of these, the majority were women (102 women, 34 men), Caucasian (98 Caucasian, 38 non-Caucasian), in their second year of study (range: year 1-5), majoring in an area other than Psychology (86 non-psychology majors, 50 psychology majors), 20 years of age on average (range: 17-55), and right-handed (117 right handed, 19 left-handed). Three participants were excluded from the final sample due to participant user errors (failure to adequately use the controls and play the videogame).

Materials

Criminal Thinking Scales. The Texas Christian University Criminal Thinking Scale (TCU-CTS) is a 37-item instrument that takes about 15 minutes to complete. This measure was developed in an American sample and has been validated in a number of States (e.g., Taxman et al., 2011), and while no validation in a Canadian sample could be found, the questionnaire items were examined and seen as appropriate for use in a Canadian setting. It includes scales to measure Entitlement, Justification, Personal Irresponsibility, Power Orientation, Cold Heartedness, and Criminal Rationalization. For each of the scales, items are rated using a 5-point Likert scale (1 = disagree strongly, 2 = disagree, 3 = uncertain, 4 = agree, 5 = agree strongly). Scores are obtained by averaging ratings on the items that each scale consists of and multiplying this mean score by 10 (so final scores range from 10 to 50). A study by Knight and colleagues (2006) examined the psychometric properties of the instrument. The authors state that although the instrument was designed to provide a baseline measure of an offender's criminal thinking, items in the TCU-CTS refer to current thinking and behaviors rather than static criminal history. Thus, the TCU-CTS can serve as a measure of change in criminal thinking when administered repeatedly over time. In addition to the TCU-CTS, the Self-Appraisal Questionnaire (SAQ; Loza, Dhaliwal, Kroner, & Loza-Fanous, 2000) was included. The SAQ is a 60-item measure with dichotomous responses (true/false) that provides a general measure of history of crime and risk for future crime. A modified version, modified for a non-offender sample by including a *not applicable* option for items, was administered in the present study to examine potential history of crime because this was seen as a relevant descriptive measure of the sample.

Implicit Association Test. In the IAT procedure, the relative strength of automatic associations in memory between concepts is inferred from the speed with which an individual sorts target words - words which were of interest for examining implicit criminal thinking - into categories (e.g., Nunes, 2009). Participants in this procedure need to sort each target word into one of four categories by pressing one of two keys on a computer keyboard. Two of the categories are indicated by one key (the *left* key) and



Figure 1. Visual representation of modified IAT procedure.

Note. This figure represents examples of trials from the two test phases of the modified IAT, *T1* representing the first, and *T2* representing the second, testing phase that participants completed during each 5-minute IAT session. During *T1*, *Me* and *Bad* are both indicated by the same (right) key, and *Other* and *Good* are both indicated by the same (left) key. The participant needs to correctly classify the example target word *THEM* as belonging to the right category (and press the corresponding right key), and the example target word *Violent* as belonging to the left category (and press the corresponding left key). During *T2*, the categories are switched. Now, *Me* and *Good* are both indicated by the same (right) key, and *Other* and *Bad* are both indicated by the same (left) key. If the participant has a criminal view of themselves (i.e., criminal thinking), the participant will categorize the target criminal words that are presented in the centre of the screen more quickly during *T1*, when the pairing of *Me* and *Bad* means that participants are sorting criminal words into a category linked to the self.

the remaining two categories are indicated by another key (the *right* key). Response time is expected to depend on the extent to which the categories that share one key are associated in the participant's memory. An illustration of the IAT procedure used in the present study presented in Figure 1.

Procedure

During phase one, participants completed an Implicit Association Test (IAT). Participants then were randomly assigned to one of four groups. Group 1 viewed a 20-min *neutral* news compilation depicting neutral inter-personal interactions – for

example a clip on water pollution in the city, dog training, and medical issues. Caution was taken to select clips that were as emotionally neutral as possible. Group 2 viewed a 20-min *criminal* news compilation with various clips involving crime - for example a clip on gun violence in schools, child soldier training, and coverage of imprisonment. All clips were presented by the same news source and newscast (NBC Nightly News). The news compilations were included to control for a possible priming effect. Priming would involve the involuntary activation of associated concepts, wherein simply viewing criminal content could increase implicit and explicit criminal thinking.

Group 3 played a neutral videogame mission (involving only non-criminal activity), and Group 4 played a videogame mission that encouraged virtual criminal activity. To ensure that participant gaming experiences were similar, both groups were given the same game (GRAND THEFT AUTO IV) and a specific set of matched tasks to accomplish during their gameplay. For example, while Group 3 was instructed to go to a specific restaurant and *meet* the blonde waitress, Group 4 was instructed to go to the same restaurant and *assault* the blonde waitress. It was necessary to give participants instructions as to what they had to do for their missions in order to generate consistency in type of gameplay (i.e., violent or nonviolent) for each condition – free-style play would have generated a widely varying experience fraught with confounding variables that would have threatened the explanatory power of the experiment. Participants were given a map of the virtual world that indicated the locations they had to visit; along with specific instructions regarding the activities they had to engage in while playing the game (see Appendix B and C for full instructions). A research assistant was present in the experimental room at all times, monitoring that all participants paid attention to the news compilations and stuck to game protocol, and assisting with potential questions. The research assistants had standardized engagement with participants and most participants asked no or few questions about gameplay or news compilations. Only potentially problematic participant questions or situations (such as having difficulties using the controls to move the character in the game) were noted.

After viewing the news compilation or playing the game, participants then completed a post-test IAT of the same format as the pre-test IAT. Then, the explicit measures of criminal thinking were administered; The TCU-CTS and the SAQ, followed by a brief demographics form. Finally, all participants were debriefed about the nature of this study (see Appendix A for full debriefing handout; for the importance of debriefing in simulation and gaming research see Crookall, 2010).

Results

Explicit Measure

To examine the extent to which participants would endorse criminal thinking after participating in the various conditions, two questionnaires were administered: the TCU-CTS and a modified version of the SAQ. The present sample had an average TCU-CTS total score of 67.5 (range: 41-116) out of a possible 185 points (minimum = 37 points) across conditions, with higher scores indicating higher antisocial thinking.

Table 1. Average Scores for Each Condition on Explicit Measures (With Standard Deviations in Parentheses).

Condition	Criminal Thinking	Cold Heartedness	Criminal Risk	Conduct Disorder
Neutral News	66.2 (12.9)	11.6 (2.9)	9.1 (6.8)	2.2 (1.9)
Criminal News	66.0 (12.9)	10.8 (2.2)	8.1 (5.7)	2.1 (2.2)
Neutral Game	70.5 (14.6)	11.3 (2.5)	7.9 (6.0)	1.9 (1.8)
Criminal Game	67.5 (19)	12.8 (4.1)	7.9 (2.0)	2.3 (2.0)

Note. Criminal Thinking (total score; maximum possible score of 185) and Cold Heartedness (subscale; maximum possible score of 25) were measured by the Texas Christian University Criminal Thinking Scale (Knight, Garner, Simpson, Morey, & Flynn, 2006). Criminal Risk (total score; maximum possible score of 120) and Conduct Disorder (subscale; maximum possible score of 11) were measured by the Revised Self-Appraisal Questionnaire (Loza, Dhaliwal, Kroner, & Loza-Fanous, 2000).

This was broken down by subscale averages across all 136 included participants (conditions were collapsed because no significant differences were found) as follows: entitlement (13.2), justification (10.8), power orientation (16.1), cold heartedness (11.6), criminal rationalization (13.8), and personal irresponsibility (10). A one-way 2x2 between subjects ANOVA (analysis of variance) revealed no significant differences for the four conditions on TCU-CTS total scores, attesting to the difficulty in measuring this construct explicitly. The average score on the SAQ was 8.2 (0-32) out of a possible 120 points, with a mean score of 2.1 (0-9) out of a possible 11 points on the Conduct Disorder subscale. Because scores on the SAQ were so low, other subscales could not be meaningfully examined. As expected for a university (and predominantly female) sample, our sample scored significantly below levels considered to place them at risk for offending on all measures. Again, a one-way 2x2 between subjects ANOVA was conducted and revealed no significant differences for the four conditions on SAQ total scores (for values see Table 1). Overall, these findings do not support hypothesis 1, but are in line with the literature that suggests difficulties with regard to measuring socially sensitive issues with explicit measures.

Implicit Measure

Implicit Association Test outcomes and comparisons were computed in accordance with the guidelines provided by Greenwald, Nosek, and Banaji (2003). Among other things, this meant discarding IAT latencies over 10,000 ms and under 400 ms (6 instances deleted), replacing error latencies with the trial block mean and an added 600 ms "penalty," and computing difference scores with pooled standard deviations. Participants completed both a pre-test and a post-test to evaluate change within participants as well as between participants.

A one-way 2x2 ANOVA was conducted on pre-post difference scores to compare the effect of watching neutral news, watching criminal news, engaging in neutral gameplay, or engaging in criminal gameplay on *me-crime* IAT endorsement. The ANOVA indicated a significant difference for the four conditions, $F(3, 795) = 3.37$,

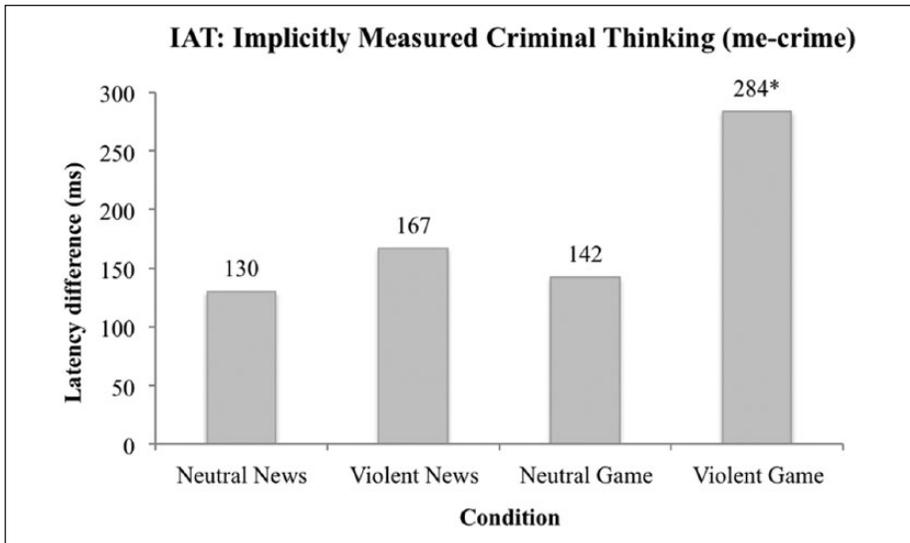


Figure 2. Implicit Association Task: Scores on Implicitly Measured Criminal Thinking Stimuli (me-crime).

Note. Values represent the difference between pre- and post-test latencies on *me-crime* associations. Higher numbers indicate faster response times (smaller response latencies) at post-test.

*This value is significantly larger than each of the values presented at an alpha of < 0.01 .

$p < .05$, $\eta^2 = 0.072$. *Post-hoc* comparisons using the Tukey HSD test indicated that the mean score for the criminal gameplay condition ($M = 284.41$) was significantly different from the neutral news ($M = 129.59$, and a small effect size of Pearson's $r = 0.143$), watching criminal news ($M = 166.77$, $r = 0.112$), and neutral gameplay conditions ($M = 142.11$, $r = 0.125$). In accordance with hypothesis 2, results indicate that participants in the criminal videogame condition were significantly faster at post-test than at pre-test at responding to the *me-crime* association than in the three control conditions (for values see Figure 2).

Discussion

The results of this study indicate that certain forms of criminal media (i.e., criminal video gameplay) change implicitly measured criminal thinking. In accordance with hypothesis 2, participants were faster at attributing criminal adjectives to themselves after playing a criminal version of GRAND THEFT AUTO IV than in control conditions. Because participants in the criminal news compilation control condition did not show this change, the results were considered to be not simply due to a priming effect. Additionally, because participants in the neutral conditions did not show this effect, the difference was considered to not simply be due to playing a videogame or watching a news show *per se*. Overall, these findings support previous research suggesting

that implicit measures may be able to detect changes in criminal thinking that explicit measures cannot. The data suggest that people may begin to form criminal thinking after engaging in criminal video gameplay.

These findings are in line with major cognitive theories and previous studies using similar methodology (Bluemke et al., 2010; Teng et al., 2011). In the violent videogame condition, success was determined through the use of criminal behaviours. In accordance with the General Aggression Model (Bushman & Anderson, 2002), engaging in criminal video gameplay, by nature, requires the activation of antisocial scripts that are conducive to achieving success in the game. These scripts may not be activated, or may be fundamentally different, in those who are merely watching criminal behaviours performed by others. Further, individuals engaging in antisocial video gameplay are not necessarily exposed to the long-term consequences of their in-game criminal actions, whereas criminal activity in television media is often associated with punishment and chastisement. While evidence abounds that this script activation occurs, debate as to how and whether this results in aggression in the real world abounds (e.g., Ferguson & Kilburn, 2010).

In the present study, individuals were engaged in a mere 20 minutes of criminal videogame activity yet demonstrated a significant shift in short-term implicitly measured criminal thinking patterns. This result could be compounded through lengthy and prolonged exposure to criminal videogames. Indeed, Anderson and colleagues (2010) suggested that repeated exposure to violent videogames leads to an overlearning of aggression-related behavioural scripts that are constantly rehearsed while playing violent games, which can lead to increased aggressive behaviour.

Our first hypothesis, that criminal media would alter explicit criminal thinking, was not substantiated. Both criminal news clips and video gameplay did not produce a significant change in self-reported criminal thinking patterns. This is in line with the problems that critics have raised (e.g., Greenwald et al., 2009) with regards to explicit measures of cognitive change. In other words, the lack of change observed in explicitly measured thinking may have been due to participants being unaware of their criminal thinking patterns, or being unwilling to disclose anti-social thought patterns. Finally, it is possible that explicit endorsement of criminal thinking may be a relatively stable phenomenon that is not easily manipulated by brief exposure to criminal stimuli. Future research on how explicit criminal thinking patterns in university students can be manipulated would help shed light on this issue.

While the results of this study are promising, they should be interpreted with a number of limitations in mind. First, this study does not fully test the specificity compared to the generality of the effects of criminal content on criminal thinking. Future studies to fully address this differentiation would require creating an IAT version that includes criminal items as well as violent non-criminal items, and seeing whether a criminal-game specifically influences criminal identification, and whether a violent non-criminal game specifically influences violent self-identification. Note that this will likely be difficult to achieve because of the entanglement of violence and crime in videogames. Second, it is impossible to rule out demand characteristics in most experiments, including in this one. While the nature of the experiment was not overtly disclosed, it is

possible that observed effects for the criminal conditions was due to an experimental artifact where participants interpreted the experiment's true purpose (i.e., manipulating criminal thinking) and unintentionally changed their responses to fit this interpretation - although the use of control conditions was done to try to rule this out.

Third, university samples such as the one used here are typically better educated, of higher socioeconomic status, and more homogenous in age than the general population, making results potentially difficult to generalize. The majority of the sample were young adults who may already have well-formed opinions and beliefs that are not easily swayed by brief exposure to criminal or antisocial stimuli. Younger children may be more vulnerable to the long-term effects of violent and antisocial media than the young adult sample used here (as indicated by Hasan, Bègue, Scharkow, & Bushman, 2013; and Shibuya, Sakamoto, Ihori, & Yukawa, 2008). Fourth, the majority of the sample was female, and violent videogames are typically marketed towards males. Males may have more experience with videogames in general, and antisocial cognitions may be altered in fundamentally different ways in men than in women. Men are also likely to be more familiar with such games, and have already experienced the effects of them prior to commencement of the study - a reality which was not controlled for in the present study. Fifth, while most participants indicated that they were novices at the game (or even indicated "I never play computer games."), the study did not directly assess videogame familiarity before testing.

Finally, subjects were only briefly exposed to criminal content. Given that repeated and prolonged exposure to criminal situations may be required to create more permanent changes in antisocial thinking patterns, perhaps a longitudinal study would be appropriate to elucidate any potentially permanent changes. Future research on the different contributors of criminal news and gameplay for criminal thinking patterns is important given that beliefs, attitudes, and cognitions are important dynamic facilitators of criminal behaviour. Despite these limitations, the effect of the implicit measure of criminal thinking to detect change is encouraging.

The study provides insight on how criminal thinking patterns may emerge as a result of media influences and the findings demonstrate that significant changes in criminal thinking patterns occur after being told to participate in criminal video gameplay, but not after viewing criminal news clips. Individuals who experience an attitudinal shift in criminal thinking due to such violent video gameplay may be primed to participate in criminal conduct more readily than naïve individuals. Further, the findings may help inform public policy regarding the regulation and distribution of pro-criminal videogames, especially for games as realistic as *GRAND THEFT AUTO IV*. Educators who are interested in the learning aspects of simulation and gaming may find the implications of this study of particular interest and could use it to inform their application of videogames to promote or prevent criminal thinking. The marked difference between changes in explicit and implicit measures demonstrate that attitudes and cognitions may not always be easily assessed solely through self-report measures and testify to the usefulness of using implicit measures. Overall, the results build on the literature attesting the usefulness of using simulation and gaming methodologies to examine social phenomena such as the development of crime-relevant attitudes and thinking patterns.

Appendix A: Virtual Crime Debriefing Form

Debriefing Form

An examination of the influence of media exposure on self-concept. The present study examined your criminal self-concept, and whether it changed after viewing criminal or neutral stimuli. Our self-concept, the way we view and perceive ourselves, is important for our identity and behaviour. In fact, we often try to maintain our self-concept and protect our self-perceptions, particularly after we have committed a crime. In other words, although the benefits of criminal behaviours may be tempting, when we commit crime, we may lose a positive view of ourselves. While it is important that we keep a positive self-concept, it is also vital that we can adapt. This may allow new attitudes, such as criminal attitudes, to become part of our identity when we commit crime. In support of this, research has demonstrated that the social identity of offenders changes significantly at the beginning of the criminal career. Once established, the criminal identity promotes criminal behaviours and is reinforced by criminal conduct and the environment.

Criminal self-concept followed by stereotype enactment is probably related to recidivistic (re-offending) behaviour. Although the importance of a criminal identity for recidivism is recognized to some extent, its immediate contribution remains unclear. With offender recidivism carrying such important economic and social consequences for society, and national recidivism rates ranging between 30 and 73%, understanding the underlying psychological factors motivating repeated criminal behaviour would have tremendous benefits.

The present study examines the fragility of criminal self-concept. To do this we will examine the base-rates of criminal identity traits, and evaluate whether criminal self-concept can be manipulated by mere exposure to criminal stimuli. This study will provide valuable base-rates and information on how easily criminal identity can be manipulated that will help contextualize future studies.

Appendix B: Grand Theft Auto Instructions Neutral

Instructions (N):

You have a series of things to do in the next 20 minutes. Please follow the instructions in order, and do not deviate from the plan. **Your sole mode of transportation is walking/running.** You begin in your apartment. If a gun shows up in your hands, press “1” on the keyboard to disarm yourself. If the cops apprehend you at any point, or you die, continue to your next destination from where your game resumes.

1. Program your first destination as a “Waypoint”:
 - a. Press “esc” on the keyboard to bring up the Liberty city map. You are positioned where the flashing orange arrow is.
 - b. Click on the t-shirt icon nearest to the arrow. The name “Modo” will show up. Keep the mouse on this icon (with the name showing), and press “enter”. You will see the term “Waypoint” appear along with a green cross. Press escape twice, to return to the game.
 - c. In the bottom left-hand corner of your screen there is a circle with a map in it. You need to go towards the green cross.
2. Take the elevator to street level.

3. Follow the map to the clothing store “*Modo*”. As much as possible, stay on sidewalks (and crosswalks, etc) as you move towards your destination so that you don’t get hit by cars. Avoid running into other pedestrians.
 - a. Press the arrow keys to move around.
 - b. Use the cursor to change your view.
 - c. Press space while holding the arrow keys to run.
4. Enter the clothing store by walking through either of the doors.
5. In the store: Options will appear as you approach the racks in the store – look through until you find “brown pants”.
 - a. Once you have found the brown pants, press “E” to try them on. Then press “Enter” to buy them.
6. Leave the store and program your next waypoint (like for #1), but this time, click on the knife and fork icon nearest to you (the name “*Restaurant*” will show up). Press enter to create your waypoint. Press “esc” twice to return to game.
7. Follow the map to the restaurant. When you approach it, you will see signs for “Café Superstar” with a star logo. Enter the café.
 - a. Approach the blonde waitress behind the bar. Look at her for 10 seconds.
8. Leave the cafe and program your next waypoint (like for #1), but this time, click on the t-shirt icon nearest to you (the name “*Perseus*” will show up). Press enter to create your waypoint. Press “esc” twice to return to game.
9. Follow the map to the store. Enter it.
10. In the store: Look through the racks until you find “Three button jacket in ebony & vest with charcoal pants”.
 - a. Once you have found the suit, press “E” to try it on. Then press “Enter” to buy it.
11. Leave the store and program your next waypoint (like for #1), this time click on the gun icon at the end of the middle island (the name “*Weapons*” will show up). Press enter to create your waypoint. Press “esc” twice to return to game.
12. Follow the map to the gun store. On your way, **approach someone on the street**.
13. Go down into the gun store.
 - a. “Examine” the guns and look around the store. Do not buy anything (press “E” to pick things up and put them back down).
14. Leave the store and program your next waypoint (like for #1), this time click on the bowling-ball icon on the middle island (the name “*Bowling*” will show up). Press enter to create your waypoint. Press “esc” twice to return to game.
15. Follow the map to the bowling alley by the pier.
 - a. Walk up to the counter by the door. Go bowling (press “E”). Follow the instructions.

You are done!

Checklist:

- Went to *Modo* clothing and bought pants
- Went to Café Superstar and saw blonde waitress
- Went to *Perseus* clothing and bought suit
- Approached someone on the street
- Went to the gun store and looked around
- Went to the bowling alley and went bowling

Appendix C: Grand Theft Auto Instructions Criminal

Instructions (C):

You have a series of things to do in the next 20 minutes. Please follow the instructions in order, and do not deviate from the plan. **Your sole mode of transportation is walking/running.** You begin in your apartment. If a gun shows up in your hands, press “1” on the keyboard to disarm yourself. If the cops apprehend you at any point, or you die, continue to your next destination from where your game resumes.

16. Program your first destination as a “Waypoint”:
 - a. Press “esc” on the keyboard to bring up the Liberty city map. You are positioned where the flashing orange arrow is.
 - b. Click on the t-shirt icon nearest to the arrow. The name “Modo” will show up. Keep the mouse on this icon (with the name showing), and press “enter”. You will see the term “Waypoint” appear along with a green cross. Press escape twice, to return to the game.
 - c. In the bottom left-hand corner of your screen there is a circle with a map in it. You need to go towards the green cross.
17. Take the elevator to street level.
18. Follow the map to the clothing store “Modo”. As much as possible, stay on sidewalks as you move towards your destination so that you don’t get hit by cars. Avoid running into other pedestrians.
 - a. Press the arrow keys to move around.
 - b. Use the cursor to change your view.
 - c. Press space while holding the arrow keys to run.
19. Enter the clothing store by walking through either of the doors.
20. In the store: Options will appear as you approach the racks in the store – look through until you find “brown pants”.
 - a. After you have found the brown pants (do not buy them), go to the cash register and break into it (press “E” to open it).
21. Leave the store and program your next waypoint (like for #1), but this time, click on the knife and fork icon nearest to you (the name “Restaurant” will show up). Press enter to create your waypoint. Press “esc” twice to return to game.
22. Follow the map to the restaurant. When you approach it (the restaurant), you will see signs for “Café Superstar” with a star logo. Enter the café.
 - a. Approach the blonde waitress behind the bar. Go to her (behind the bar) and punch (using the “P” and “R” keys) her repeatedly until she is unconscious.
23. Leave the café and program your next waypoint (like for #1), but this time, click on the t-shirt icon nearest to you (the name “Perseus” will show up). Press enter to create your waypoint. Press “esc” twice to return to game.
24. Follow the map to the store. Enter it.
25. In the store: Look through the racks until you find “Three button jacket in ebony & vest with charcoal pants”.
 - a. Once you have found the suit (do not buy it), go to the large security guard by the door and punch him repeatedly (using the “P” and “R” keys).

26. Leave the store and program your next waypoint (like for #1), this time click on the gun icon at the end of the middle island (the name “*Weapons*” will show up). Press enter to create your waypoint. Press “esc” twice to return to game.
27. Follow the map to the gun store. On your way, assault (using the “P” and “R” keys) someone on the street.
28. Go down into the gun store.
 - a. “Examine” the guns and look around the store. Buy the “Micro SMG”, “30x SMG rounds”, “body armor”, and a “baseball bat” (press “E” to pick things up and “Enter” to buy them).
29. Leave the store and program your next waypoint (like for #1), this time click on the bowling-ball icon on the middle island (the name “*Bowling*” will show up). Press enter to create your waypoint. Press “esc” twice to return to game.
30. Follow the map to the bowling alley by the pier.
 - a. Walk up to the counter by the door. Press “5” to load your gun. Press “A” to shoot. Use the cursor to control what you are shooting at while you hold “A”. If you run out of bullets, use the baseball bat. Kill as many people as you can in the bowling alley.

You are done!

Checklist:

- Went to Modo clothing and stole from register
- Went to Café Superstar and assaulted blonde waitress
- Went to Perseus clothing and assaulted staff
- Attacked someone on the street
- Went to the gun store and bought guns
- Went to the bowling alley, shot and assaulted patrons

Author Contributions

All authors contributed to this article, both substantively and formally. JS conceived and designed the experiment, ran the statistical analyses, wrote the manuscript, and addressed all reviewer comments. KC performed the experiments and helped with initial manuscript preparation. SP made critiques and suggested edits.

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References

- Anderson, C. A. (2004). An update on the effects of violent videogames. *Journal of Adolescence*, 27, 113-122. doi:10.1016/j.adolescence.2003.10.009

- Anderson, C. A., & Bushman, B. J. (2001). Effects of violent videogames on aggressive behavior, aggressive cognition, aggressive affect, physiological arousal, and prosocial behavior: A meta-analytic review of the scientific literature. *Psychological Science, 12*, 353-359. doi:10.1037/a0018251
- Anderson, C. A., Carnagey, N. L., Flanagan, M., Benjamin, A. J., Eubanks, J., & Valentine, J. C. (2004). Violent videogames: Specific effects of violent content on aggressive thoughts and behavior. *Advances in Experimental Social Psychology, 36*, 199-249. doi:10.1016/S0065-2601(04)36004-1
- Anderson, C. A., Shibuya, A., Ihori, N., Swing, E. L., Bushman, B. J., Sakamoto, A., . . . Saleem, M. (2010). Violent videogame effects on aggression, empathy, and prosocial behavior in eastern and western countries: A meta-analytic review. *Psychological Bulletin, 136*, 151-173. doi:10.1037/a0018251;10.1037/a0018251.supp (Supplemental)
- Barlett, C. P., Anderson, C. A., & Swing, E. L. (2008). Video game effects—Confirmed, suspected, and speculative: A review of the evidence. *Simulation & Gaming, 40*, 377-403. doi:10.1177/1046878108327539
- Bluemke, M., Friedrich, M., & Zumbach, J. (2010). The influence of violent and nonviolent computer games on implicit measures of aggressiveness. *Aggressive Behaviour, 36*(1), 1-13. doi:10.1002/ab.20329
- Browne, K. D., & Hamilton-Giachritsis, C. (2005). The influence of violent media on children and adolescents: A public-health approach. *The Lancet, 365*, 702-170. doi:10.1016/S0140-6736(05)66372-6
- Bushman, B. J., & Anderson, C. A. (2001). Media violence and the American public: Scientific facts versus media misinformation. *American Psychologist, 56*, 477-489. doi:10.1037/0003-066X.56.6-7.477
- Bushman, B. J., & Anderson, C. A. (2002). Violent video games and hostile expectations: A test of the general aggression model. *Personality and Social Psychology Bulletin, 28*, 1679-1686. doi:10.1177/014616702237649
- Buss, D. M. (2006). *The murderer next door: Why the mind is designed to kill*. New York, NY: Penguin.
- Crookall, D. (2010). Serious games, debriefing, and simulation/gaming as a discipline. *Simulation & Gaming, 41*, 898-920. doi:10.1177/1046878110390784
- Crowne, D., & Marlowe, D. (1960). A new scale of social desirability independent of psychopathology. *Journal of Consulting and Clinical Psychology, 24*, 349-354. doi:10.1037/h0047358
- Duffin, C. (2013). GTA 5: Fastest-selling entertainment product of all time. *The Telegraph*. Retrieved from telegraph.co.uk/technology/video-games/10324982/GTA-5-Fastest-selling-entertainment-product-of-all-time.html
- Engelhardt, C. R., Bartholow, B. D., Kerr, G. T., & Bushman, B. J. (2011). Your brain on violent videogames: Neural desensitization to violence predicts increased aggression following violent videogame exposure. *Journal of Experimental Social Psychology, 47*, 1033-1036. doi:10.1016/j.jesp.2011.03.027
- Fazio, R. H., & Olson, M. A. (2003). Implicit measures in social cognition research: Their meaning and use. *Annual Review of Psychology, 54*, 297-327. doi:10.1146/annurev.psych.54.101601.145225
- Ferguson, C. J., & Kilburn, J. (2010). Much ado about nothing: The misestimation and over-interpretation of violent videogame effects in Eastern and Western nations: Comment on Anderson et al. (2010). *Psychological Bulletin, 136*, 174-178. doi:10.1037/a0018566

- Fischer, J., Aydin, N., Kastenmüller, A., Frey, D., & Fischer, P. (2012). The delinquent media effect: Delinquency-reinforcing videogames increase players attitudinal and behavioural inclination toward delinquent behaviour. *Psychology of Popular Media Culture, 1*, 201-205. doi:10.1037/a0028114
- Gawronski, B., & Bodenhausen, G. V. (2006). Associative and propositional processes in evaluation: An integrative review of implicit and explicit attitude change. *Psychological Bulletin, 132*, 692-731. doi:10.1037/0033-2909.132.7.74
- GRAND THEFT AUTO IV. (2008). Rockstar Games.
- Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychological Review, 102*, 4-27. doi:10.1037/0033-295X.102.1.4
- Greenwald, A. G., Banaji, M. R., Rudman, L. A., Farnham, S. D., Nosek, B. A., & Mellott, D. S. (2002). A unified theory of implicit attitudes, stereotypes, self-esteem, and self-concept. *Psychological Review, 109*, 3-25. doi:10.1037//0033-295X.109.1.3
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology, 74*, 1464-1480. doi:10.1037/0022-3514.74.6.1464
- Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology, 85*, 197-216. doi:10.1037/0022-3514.85.2.197
- Greenwald, A. G., Poehlman, T., Uhlmann, E., & Banaji, M. R. (2009). Understanding and using the Implicit Association Test: III. Meta-analysis of predictive validity. *Journal of Personality and Social Psychology, 97*, 17-41. doi:10.1037/a0015575
- Greitemeyer, T. (2014). Intense acts of violence during videogame play make daily life aggression appear innocuous: A new mechanism why violent videogames increase aggression. *Journal of Experimental Social Psychology, 50*, 52-56. doi:10.1016/j.jesp.2013.09.004
- Hasan, Y., Bègue, L., Scharnow, M., & Bushman, B. (2013). The more you play, the more aggressive you become: A long-term experimental study of cumulative violent videogame effects on hostile expectations and aggressive behaviour. *Journal of Experimental Social Psychology, 49*, 224-227. doi:10.1016/j.jesp.2012.10.016
- Kleinfield, N. R., Rivera, R., & Kovalski, S. F. (2013). Newton killer's obsessions, in chilling detail. *The New York Times*. Retrieved from http://www.nytimes.com/2013/03/29/nyregion/search-warrants-reveal-items-seized-at-adam-lanzas-home.html?pagewanted=all&_r=0
- Knight, K., Garner, B. R., Simpson, D. D., Morey, J. T., & Flynn, P. M. (2006). An assessment for criminal thinking. *Crime and Delinquency, 52*, 159-177. doi:10.1177/0011128705281749
- Loza, W., Dhaliwal, G., Kroner, D. G., & Loza-Fanous, A. (2000). Reliability, construct, and concurrent validities of the Self-Appraisal Questionnaire: A tool for assessing violent and nonviolent recidivism. *Criminal Justice and Behavior, 27*, 356-374. doi:10.1177/0093854800027003005
- McCoy, K., Fremouw, W., Tyner, E., Clegg, C., Johansson-Love, J., & Strunk, J. (2006). Criminal-thinking styles and illegal behavior among college students: Validation of the PICTS. *Journal of Forensic Science, 51*, 1174-1177. doi:10.1111/j.1556-4029.2006.00216.x
- Mihailides, S., Devilly, G. J., & Ward, T. (2004). Implicit cognitive distortions and sexual offending. *Sexual Abuse: Journal of Research and Treatment, 16*, 333-350. doi:10.1177/107906320401600406
- Nederhof, A. J. (1985). Methods of coping with social desirability bias: A review. *European Journal of Social Psychology, 15*, 263-280. doi:10.1002/ejsp.2420150303
- Nunes, K. (2009). Measuring child molesters' implicit cognitions about self and children. In D. Thornton & R. D. Laws (Eds.), *Cognitive approaches to the assessment of sexual interest in sexual offenders* (pp. 125-144). Hoboken, NJ: Wiley.

- Palmer, E. (2007). Criminal thinking. In D. Carson, B. Milne, F. Pakes, K. Shalev, & A. Shawyer (Eds.), *Applying psychology to criminal justice* (pp.147-166). West Sussex, England: John Wiley & Sons.
- Sherry, J. (2001). The effects of violent videogames on aggression: A meta-analysis. *Human Communication Research*, 27, 409-431. doi:10.1093/hcr/27.3.409
- Shibuya, A., Sakamoto, A., Ihori, N., & Yukawa, S. (2008). The effects of the presence and contexts of video game violence on children: A longitudinal study in Japan. *Simulation & Gaming*, 39, 528-539. doi:10.1177/1046878107306670
- Smith, S. L., Lachlan, K., & Tamborini, R. (2003). Popular videogames: Quantifying the presentation of violence and its context. *Journal of Broadcasting and Electronic Media*, 47, 58-76. doi:10.1207/s15506878jobem4701_4
- Taxman, F. S., Rhodes, A., & Dumenci, L. (2011). Construct and predictive validity of criminal thinking scales. *Criminal Justice and Behaviour*, 38, 174-187. doi:10.1177/0093854810389550
- Teng, S., Chong, G., Siew, A., & Skoric, M. M. (2011). Grand Theft Auto IV comes to Singapore: Effects of repeated exposure to violent videogames on aggression. *Cyberpsychology, Behavior, and Social Networking*, 14, 597-602. doi:10.1089/cyber.2010.0115
- Uhlmann, E., & Swanson, J. (2004). Exposure to violent videogames increases automatic aggressiveness. *Journal of Adolescence*, 27, 41-52. doi:10.1016/j.adolescence.2003.10.004
- Walters, G. D. (1995). The Psychological Inventory of Criminal Thinking Styles: I. reliability and preliminary validity. *Criminal Justice and Behavior*, 22, 307-325. doi:10.1177/0093854895022003008
- Walters, G. D. (2002). The Psychological Inventory of Criminal Thinking Styles (PICTS): A review and meta-analysis. *Assessment*, 9, 278-291. doi:10.1177/1073191102009003007
- Walters, G. D., Hagman, B. T., & Cohn, A. M. (2011). Toward a hierarchical model of criminal thinking: Evidence from item response theory and confirmatory factor analysis. *Psychological Assessment*, 23, 925-936. doi:10.1037/a0024017

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