Violent content enhances video game performance

Wolfgang Bösche, Technische Universität Darmstadt

E-Mail: boesche@psychologie.tu-darmstadt.de

Telephone: ++49 6151 166571

Abstract

The impact of violent video game content on players' game performance was assessed. According to the desensitization hypothesis (Carnagey, Anderson, & Bushman, 2007), violent content might elicit negative affective responses and inhibitions, which in turn should interfere with performance. On the other hand, the players might understand virtual violent acts as a digital form of rough-and-tumble play, associated with positive emotions and mobilization, which in turn should raise performance. To test these competing hypotheses on game performance, *N*=50 males with no prior violent gaming experience were exposed to three different versions of a custom-made video game in which the actions to be performed were identical, but were audio-visually presented to appear either non-violent, moderately, or extremely violent. The results show no indication of an initial inhibition of aggressive behavior; that is, performance is elevated and remains so if the action is presented audio-visually as being violent. This supports the notion that being involved in violent video game activity is perceived as an essentially harmless acting-out of playful fighting behavior.

Introduction

There are two paradigmatically different mindsets for the investigation of violent video games (*VVGs*), each theoretically and empirically plausible and justified. The first perspective holds that VVGs are terrifying and disgusting, and that their consumption increases violent behavior and decreases empathy both in the short and in the long run. Correlational research reveals habitual, long-term VVG players to be more delinquent and aggressive, to have stronger pro-violence attitudes, to respond less emotionally to violence, and to be generally less empathetic (Anderson & Dill, 2000; Bartholow, Bushman & Sestir, 2006; Weber, Ritterfeld & Mathiak, 2006). Experimental research on the effects of VVGs, as measured in a single laboratory session, reaches similar conclusions (Anderson & Dill, 2000; Kirsh, Olczak & Mounts, 2005; Kirsh & Mounts, 2007; Carnagey, Anderson & Bushman, 2007). These results can be explained using the General Aggression Model and its recent extension to desensitization effects resulting from playing VVGs (Carnagey, Anderson, & Bushman, 2007). According to this model, playing VVGs acts as a desensitization-training procedure such that initially fearful stimuli are presented in a positive emotional context. In this way, fear and anxiety reactions are reduced and empathy for the (virtual) victims is decreased, leading to behavioral (real) outcomes of decreased helping behavior and increased aggression. Note that a *central assumption of this explanation* is that the stimuli presented in VVGs are fearful and should elicit "normal negative reactions to violence" (Carnagey, Anderson, & Bushman, 2007). The "aversive reactions to the sight of blood and gore" that "most people naturally have" (Bartholow, Bushman & Sestir, 2006) are assumed to occur in video games as well. Thus, the inhibition against behaving aggressively, both real and virtual, is thought to operate even for slightly aggressive actions and for aggression

presented in a humorous context. For example, even a rather harmless scenario like jumping on turtles in a video game to make them disappear would be assumed to constitute aggressive behavior (Anderson & Morrow, 1995).

The paradigmatically opposite perspective is that, firstly, VVGs feature fun and excitement, secondly, that interactive violent content is associated with or will raise positive emotions, and finally, that players actually do prefer to have violence in their games due to the positive valence of mock aggression. This view is supported by the historical preference for violence in video games and by the fact that "[t]he popularity of violent video games in particular cannot be overstated" (Kirsh, 2006; p. 228). The prevalence of violent content in current video games is high (Carnagey, Anderson, & Bushman, 2007), and the sales of VVGs typically tend to increase if blood and gore are added. For example, the bloody version of Mortal Kombat has been sold seven times more often than the toned down-version (Goldstein, 1998). The question as to why VVGs can be so enjoyable is highly intriguing, however. On the one hand, it is conceivable that players understand aggressive stimuli as being "not for real" or not really hazardous, but instead as virtual. In fact habitual VVG players often emphasize the idea of a game-reality distinction (Klimmt et al., 2006). The conscious marking of stimuli as virtual in nature may indeed allow for different emotional and behavioral responses than those triggered by real stimuli (Russel, 2003). Weber, Ritterfeld, and Mathiak (2006), caution, however, that such a distinction is metacognitive in nature, and may be suspended during the playing of highly immersive VVGs. Klimmt et al. (2008) support this claim by arguing that emphasis on virtuality is not a viable strategy to make a (morally) disgusting violent video game completely enjoyable, because such cognitions might not come to players' minds given the high levels of presence

77 experienced during the game. Comparative research points to a way of potentially reconciling
78 these opposing perspectives by suggesting that aggressive behavior may indeed be virtual, and
79 may be played, enjoyed, and clearly distinguished from aggressive behavior that is specifically
80 aimed at hurting one's counterpart. A case in point is juvenile mammals, which enjoy engaging
81 in play-fighting (or rough-and-tumble play, or mock aggression) that is not aimed at actually
82 hurting the opponent. Such skills can be considered crucial for the development of social and
83 other competencies (Pellis & Pellis, 2007). Depending on the species, various mimic or vocal
84 intention signals are used to engage in and maintain such play, and are critical for the social
85 control of play bouts and rough play (see Flack, Jeanotte & de Waal, 2004, for chimpanzees).
86 Apparently, play fighting is much more real, physical, and immersing than any VVG could be,
87 but even young mammals have no problem distinguishing it from real fighting.
88 The aim of the present study is to assess these hypotheses about the emotional valence of
89 virtual violence in video games by proposing a behavioral measure that is suited to capturing
90 negative emotional reactions and hesitation (or the opposite), and which can be directly assessed
91 while a video game is played. The basic principle is to use game performance itself as that
92 measure. Performance measures taken directly from action sequences should be sensitive enough
93 to capture emotionally disturbing processes such as fear and disgust, as well as hesitation
94 towards performing the actions themselves. For example, confronting patients with words
95 relevant to their psychological impairment in a Stroop paradigm typically increases reaction time
96 (Williams, Mathews & McLeod, 1996). If an aversive stimulus is expected as a consequence of a
97 certain action, or if there is an inhibition of that action, it will be initiated and executed more
98 slowly, or not at all. In this way, poor performance within a VVG can be considered a simple and

straightforward indicator of inhibition of aggression. Anderson and Morrow (1995), for example, used the proportion of creatures killed in a video game as a measure of aggressive behavior. An additional advantage of such a behavioral measure is that it is less prone to social desirability biases or possible (meta-)cognitive processes than direct questioning.

Overall, if there are negative emotional responses to virtual violence in VVGs initially, then playing a video game that contains violence would be expected to result in inferior game performance compared to a game without violence. However, if novice players perceive VVGs as a digitized version of intrinsically harmless and essentially positively evaluated rough-and-tumble play, the result might be an enhanced level of performance. The experiment described here tested these competing hypotheses by randomly assigning naive participants to one of three versions of a custom-made video game in which the presence of violent content was manipulated by exchanging critical graphics, sounds and instructions. Game performance and its development over time were recorded while the participants played essentially the same game, which differed only in the level of violence depicted. A non-violent game version, a moderately violent one, and - for explorative purposes - a third, extremely violent version were developed.

Method

Participants

Participants were recruited on campus. The recruitment procedure did not involve any course credit, payment, or goods in exchange for participation. A total of 64 male students of various majors volunteered to participate. The data from 14 participants were excluded from the analysis, because they were classified as habitual VVG players (either having played at least one

VVG within the last week, or stating that they had prolonged VVG experience in the past). The age of the remaining participants (N=50) ranged from 20 to 40 years (M=24.34, SD=4.06). They were randomly assigned to either the non-violent (n = 20), the moderately violent (n = 20), or the extremely violent game version (n = 10).

Materials and Apparatus

All game versions were run on an IBM-compatible desktop computer with a Windows XP operating system with desktop speakers connected, at a screen resolution of 800x600 pixels in 32 bit color mode, and were controlled by an optical mouse. The games were programmed using a freeware game development software (PAC-DK version 1.8 by Benjamin Maas, http://www.adventure-creator.com/). The objective of all game versions was to click on targets (rabbits) that emerged from burrows and withdrew again after 1.3 seconds. The targets popped up at five different screen locations with equal probability at an average of about 1 target per second, multiple targets being possible. If the participant clicked on a visible target, 1 point was added to his score, and a gadget was applied to the target, changing the target's appearance, while an appropriate sound was played (details depended on the particular game version, see below). When the participant did not click on the target within 1.3 seconds of its appearance, 1 point was subtracted. If the participant clicked on an empty location, 1 point was subtracted as well, such that the gadget moved with its characteristic sound, but did not change anything. The game automatically logged the number of targets which appeared, targets clicked on and missed, empty locations clicked, and the total score.

All game versions used exactly the same program core; only graphics and sounds were exchanged to produce the three different versions (see Figure 1).

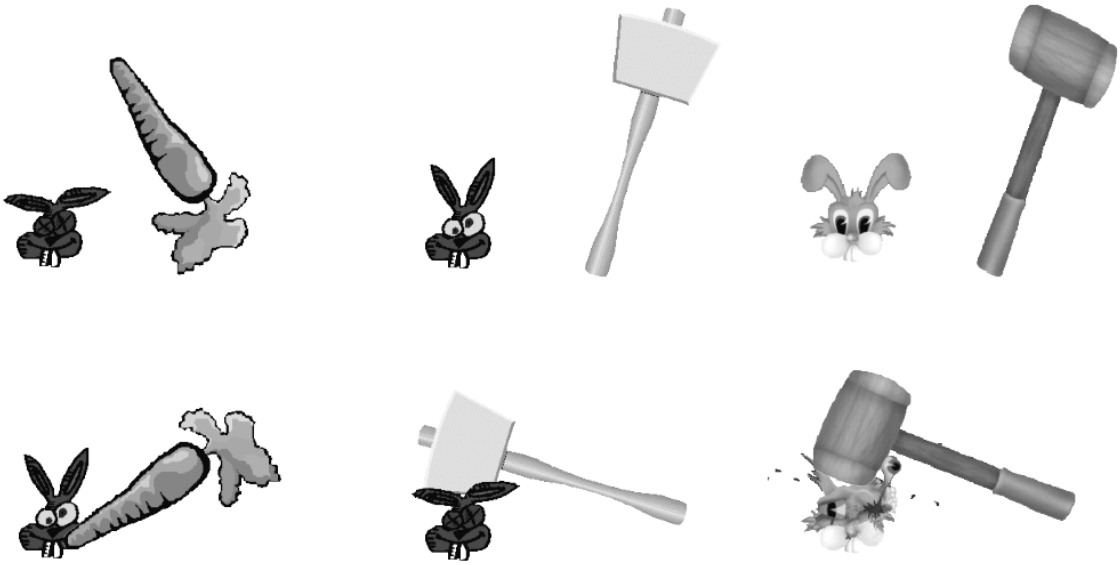

Figure 1. Target objects and gadgets used in the three game versions (on the screen, they were displayed in color on a green background). From left to right: non-violent, moderately violent and extremely violent game visuals. Upper row: Before action. Bottom row: Visualization of successful action.

In the non-violent version, targets were cartoonish rabbits with their ears hanging down, making "heeho" noises when popping up. The gadget used in this version was a big carrot. If a target was clicked, the carrot was moved to the rabbit's mouth, a chewing sound followed by a satisfied "heehee" sound was played, and the rabbit's ears went up (see left-hand column in Figure 1). For the moderately violent version, identical target graphics were used, but in reverse order. The rabbits appeared with their ears up, making "heeho" noises. The gadget, however, was a big hammer. If a target was clicked, the hammer slammed down on the rabbit's head, a clapping sound following cartoonish screaming was played, and the rabbit's ears went down (see

middle column in Figure 1). The extremely violent version used different graphics: A rabbit with somewhat cuddlier features and a hammer with metal-reinforced hitting edges. If a target was clicked, the hammer slammed down on the rabbit's head with a splash, less cartoonish pain noises followed, and the rabbit's head was dismembered: One ear was bloodily ripped off, the eye protruded, and the skull broke, showing a part of the brain (see right-hand column in Figure 1).

All versions used the same mouse pointer, a green meadow as the background picture, and a computerized instrumental version of an Austrian folk music standard ("Zillertaler Hochzeitsmarsch") in the background.

Procedure

All participants were tested individually. Upon arrival, they were informed about their rights, emphasizing that they were being treated anonymously and were free to withdraw from the study at any time without any consequences. Subsequently, all participants received written instructions telling them they were going to practice executing fast and accurate mouse movements, and that for mere entertainment the learning procedure had been built into a video game, in which they should try to score as high as they were able. The instructions referred to the game objects and procedures in an abstract way, using phrases such as "pointing with the mouse cursor", "targets", "clicks" and "score". Only the last paragraph of the instructions contained any explicit reference to the scenario implemented in the particular game version: For the non-violent version, participants were told that their goal was to feed a bunch of hungry, peaky, fluffy rabbits, and that they needed to be given a big bite from a tasty carrot; that for every rabbit fed, one point was added, and rabbits not fed within the critical time interval would lower the score

by one point. For the moderately and extremely violent versions, the instructions referred to a bunch of naughty rabbits that wanted to tease and annoy the player, and that the rabbits had to "taste" the hammer so that they would learn to behave; for every rabbit "disciplined" one point was given, and every rabbit that got away would lower the score by one point.

After reading the instructions, the participants played a first round of their version of the game for 8 minutes, interspersed with short pauses every 2 minutes. Before the second round started, participants worked on a distraction task for about 5 minutes. Then the second and final round was played exactly as the first one was. Finally, the participants filled out a post-experimental questionnaire on their past and present computer and video game use, and were debriefed.

Results

All participants complied with the instructions; no session had to be prematurely terminated due to concerns of the participants, and all N=50 classified as not being habitual VVG players were included in the following analyses.

To assess possible speed-accuracy tradeoffs dependent on the video game version, a preliminary analysis on erroneous clicks was conducted. The number of erroneous clicks on empty locations per participant was rather low (M=14.14, SD=6.53), and there was no hint that these errors might be dependent on the particular video game version, neither for the absolute number of clicks on empty locations, $F(2,47)=0.07$, $p>.20$, nor for the rate of clicks on empty locations per target presented, $F(2,47)=0.12$, $p>.20$.

For the main data analysis, each participant's performance in the video game was computed as the mean score increase per target presented (points per target, *PPT*). This dependent variable has a theoretical maximum of PPT = 1, meaning that every presented target was clicked and that no erroneous clicks on empty locations occurred. Not making any clicks would result in PPT = − 1, because for every target missed the game score is decreased by one point. The theoretical lower limit of PPT is determined by the number of erroneous clicks that a participant can produce within the time limit, theoretically resulting in a large negative PPT, because every erroneous click decreases the game score by one point as well. Figure 2 displays the mean PPT averaged across participants for the three game versions as a function of time.

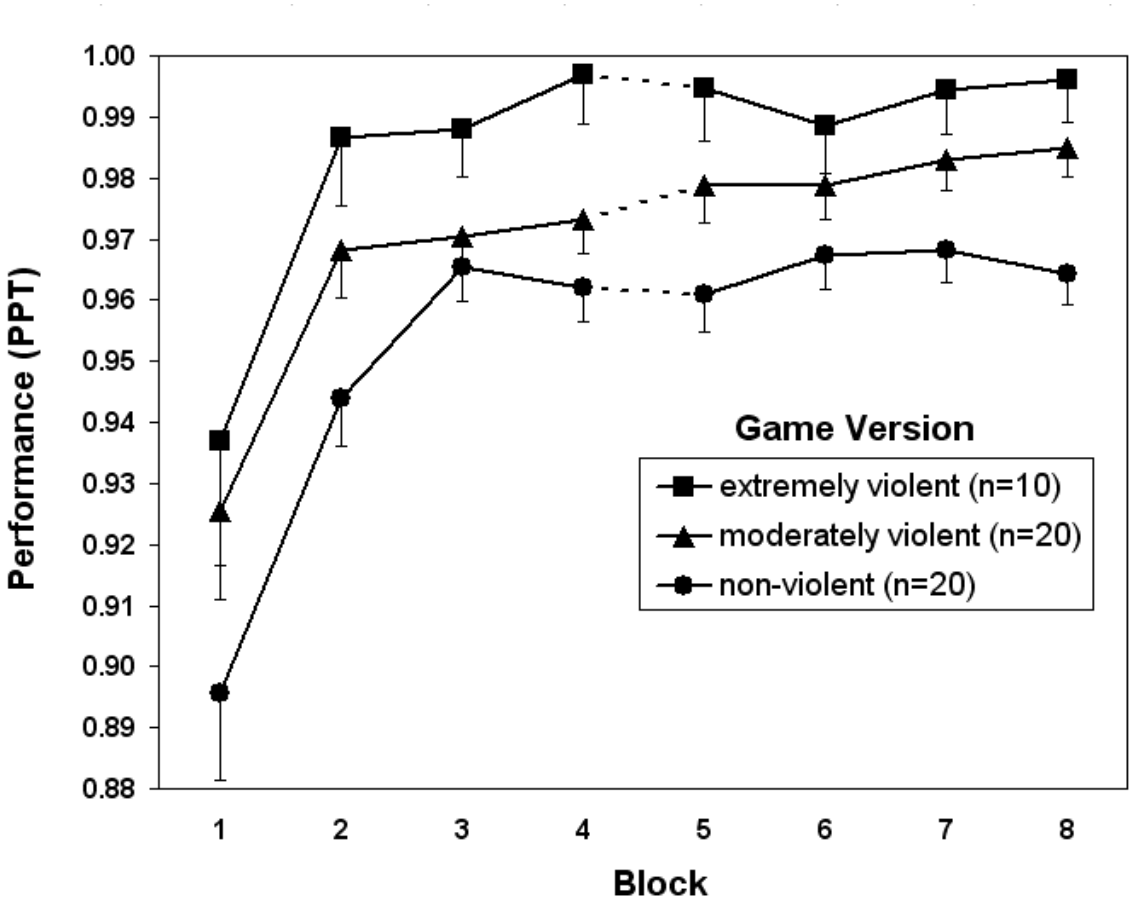

Figure 2. Participants' game performance in points per target (PPT) for the three game versions in blocks of two minutes of game play. Between blocks 4 and 5, a distraction task was administered. Error bars denote s.e.m.

A two-factor, mixed analysis of variance with the video game version constituting a between-participants factor and block number constituting a within-participants factor showed a main effect of the video game version on performance, $F(2,47)=6.13$, $p<.01$. Multiple least-significant-difference tests indicated that the non-violent game version was inferior in performance to both the moderately ($p<.05$) and the strongly violent version ($p<.01$), whilst the

two violent versions did not differ statistically from each other (p=.12). Furthermore, a significant main effect of the block number emerged, $F(7,329)=31.17$, $p<.01$, indicating that there was an overall practice effect, irrespective of the game version. The block number X game version interaction turned out to be insignificant, $F(14,329)=0.68$, $p>.20$, indicating that practice did not affect performance success in the three game versions in different ways.

Discussion

The participants show superior performance in the violent game versions compared to the non-violent one from beginning to end of the game. In other words, the virtual violence or the potentially fearful and disgusting stimuli associated with the game did not harm performance. Rather than a hesitation or inhibition effect, the results show a facilitation of performance by violent acts, lending support to the idea that such violent acts are not perceived as repulsive or disgusting, but rather as exciting and as enhancing the enjoyment of the game. Nevertheless, possible alternative explanations for the results should also be considered:

Firstly, the participants' conceptions of how quickly and accurately the actions need to be performed could have differed depending on the video game version being played: Whilst hitting with a hammer is a quick action by definition, and does not require much accuracy as long as the rabbit's head is hit at least somewhere, feeding is a slower action, because a rabbit does not starve within seconds, and sticking the carrot into its eye would not help matters either. Note that the program core for all three versions used exactly the same screen positions for scoring, meaning that at all locations at which a blow with a hammer could be scored, feeding with a carrot was equally possible. Therefore, the participants could have easily learned within the first

few clicks how accurate or not they had to be in their aim. But even if they realized that they did not have to click on the mouth exactly, this (mis-)conception might still have guided their behavior. Looking at the data for clicks, however, suggests that there is no such speed-accuracy tradeoff. If the participants in the non-violent game version had acted more cautiously in general, fewer erroneous clicks should have been observed in that condition. This was not the case, however.

Secondly, the participants might already have been desensitized to violence beforehand, or the audio-visual game materials might not have been violent and disgusting enough to effectively elicit negative emotions in the participants. However, a possible desensitization occurring before the experiment would not explain why the participants demonstrated superior performance in the violent versions instead of not just equally well. Furthermore, the materials used in this experiment comply with the criteria that Carnagey, Anderson and Bushman (2007) suggest for a positive emotional context, in which desensitization will occur when the violent stimuli are presented repeatedly: Exciting background music, humorous, cartoonish characters, sound effects, and rewards for acting violently. Indeed, some participants' first reaction to the materials in the mildly violent video game version was laughter. The less funny, though still cartoonish extremely violent version did not impair performance either. It is left to future research to identify and define more precisely the properties of game materials that might be capable of eliciting disgust, and thereby to initially impair performance.

Thirdly, the violent content might increase fearful arousal that could be advantageous for performance levels. However, one could easily imagine that such an arousal would instead lead to an increase in erroneous actions which would decrease performance levels. Note that in a

comparable situation, that is, the emotional Stroop task (Williams, Mathews & McLeod, 1996), fear and threat-related stimuli interfered with performance, suggesting that possible advantages of heightened arousal do not play much of a role.

Fourthly, it might be suggested that VVGs typically contain stronger demand characteristics that force the player to act violently ("kill or get killed"). Whilst this argument might hold when comparing commercial VVGs to non-violent ones, it cannot explain the performance differences in the three game versions implemented here. This is because no additional constraints or incentives, such as a player's death, were used in the violent versions as a consequence of inferior performance.

In addition, there is no indication that the participants, who had been randomly selected to play the violent versions of the game, had any major concerns or distress about the game itself, in fact, rather the opposite seemed to be the case. At the end of every experiment, by default, participants were informed that they could drop their E-mail address in a box if they were willing to be contacted for future research. Twenty-five percent of those assigned to play the non-violent game version left their contact address, twenty-five percent did so in the moderately violent condition, and a remarkable ninety percent in the extremely violent version did so, $\chi^2(2)=14.35$, $p<.01$. These high rates of willingness to participate repeatedly in experiments on VVGs mirror the observation made by Weber, Ritterfeld and Mathiak (2006) about habitual VVG players: "[M]ost of the participants even deliberately expressed their will to cooperate in similar studies again" (p. 52).

To conclude, the simple measure of participants' game performance proposed here proved applicable and sensitive enough to successfully capture inhibition or facilitation of virtual

violent behavior. By varying the violent content of essentially the same video game, the present investigation found no evidence that violent stimuli elicited any fear or disgust that could interfere with performance. As real disgust is a prerequisite for desensitization to occur, these results cast some doubt on the hypothesis that playing VVGs can actually desensitize players, and instead suggest that VVGs are perceived as an essentially harmless acting-out of playful fighting behavior. Nevertheless, these results by no means downplay the theoretical possibility of a rise in aggressive behavior as a result of playing VVGs. In fact, it might even endorse this possibility. If players do indeed perceive VVGs as the virtual equivalent of an emotionally positive rough-and-tumble-play situation, and are aware that the aggression is mocked and is not aimed at literally hurting anyone, then perhaps the evolutionary-biological roots for enjoying and engaging in such behavior might be preparation for aggression or combat in real life. The effectiveness of such virtual preparation and training with widely available VVGs must still be assessed more thoroughly, however, because most of today's VVGs typically contain seriously inappropriate mental models of fighting and combat (Bösche & Geserich, 2007).

References

Anderson, C.A., & Dill, K.E. (2000). Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life. *Journal of Personality and Social Psychology*, *78*, 772-790.

Anderson, C.A., & Morrow, M. (1995). Competitive aggression without interaction: Effects of competitive versus cooperative instructions on aggressive behavior in video games. *Personality and Social Psychology Bulletin*, *21*, 1020-1030.

307 Bartholow, B.D., Bushman, B.J., & Sestir, M.A. (2006). Chronic violent video game exposure
308 and desensitization to violence: Behavioral and event-related brain potential data. *Journal*
309 *of Experimental Social Psychology*, *42*, 532-539.
310 Bösche, W. & Geserich, F. (2007). Nutzen und Risiken von Gewaltcomputerspielen:
311 Gefährliches Trainingswerkzeug, harmlose Freizeitbeschäftigung oder sozial
312 verträglicher Aggressionsabbau? *Polizei & Wissenschaft*, *1*, 45-66.
313 Carnagey, N.L., Anderson, C.A., & Bushman, B.J. (2007). The effect of video game violence on
314 physiological desensitization to real-life violence. *Journal of Experimental Social*
315 *Psychology*, *43*, 489-496.
316 Flack, J.C., Jeannotte, L.A., & de Waal, F.B.M. (2004). Play signaling and the perception of
317 social rules by juvenile chimpanzees (pan troglodytes). *Journal of Comparative*
318 *Psychology*, *118*, 149-159.
319 Goldstein, J. (1998). Immortal Kombat: war toys and violent video games. In J. Goldstein (Ed.),
320 *Why we watch: The attractions of violent entertainment* (pp. 53-68). Oxford: Oxford
321 University Press.
322 Kirsh, S.J. (2006). *Children, adolescents, and media violence: A critical look at the research*.
323 Thousand Oaks, CA: Sage Publications.
324 Kirsh, S.J., Olczak, P.V., & Mounts, J.R.W. (2005). Violent video games induce an affect
325 processing bias. *Media Psychology*, *7*, 239-250.
326 Kirsh, S. J., & Mounts, J.R.W. (2007). Violent video game play impacts facial emotion
327 recognition. *Aggressive Behavior*, *33*, 353-358.

328 Klimmt, C., Schmid, H., Nosper, A., Hartmann, T., & Vorderer, P. (2006). How players manage
329 moral concerns to make video game violence enjoyable. *Communications - the European*
330 *Journal of Communication Research*, *31*, 309-328.
331 Klimmt, C., Schmid, H., Nosper, A., Hartmann, T. & Vorderer, P. (2008). ‚Moral management':
332 Dealing with moral concerns to maintain enjoyment of violent video games. In A.
333 Sudmann-Jahn & R. Stockmann (Eds.), *Computer games as a sociocultural phenomenon:*
334 *Games without frontiers – wars without tears* (pp. 108-118). Hampshire, UK: Palgrave.
335 Pellis, S.M. & Pellis, V.C. (2007). Rough-and-Tumble Play and the Development of the Social
336 Brain. *Current Directions in Psychological Science, 16*, 95–98.
337 Russel, J.A. (2003). Core affect and the psychological construction of emotion. *Psychological*
338 *Review*, *110*, 145-172.
339 Weber, R., Ritterfeld, U., & Mathiak, K. (2006). Does playing violent video games induce
340 aggression? Empirical evidence of a functional magnetic resonance imaging study. *Media*
341 *Psychology, 8*, 39-60.
342 Williams, J.M.G., Mathews, A., & MacLeod, C. (1996). The emotional Stroop task and
343 psychopathology. *Psychological Bulletin*, *120*, 3-24.