

01 **Chapter 15**

02 **The Modern Hunter–Gatherer Hunts Aliens**  
03 **and Gathers Power-UPS: The Evolutionary**  
04 **Appeal of Violent Video Games and How They**  
05 **Can Be Beneficial**  
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13 **Abstract** Video game violence has been the focus of much recent concern among  
14 politicians, activists, and some social scientists. Evolutionary psychology can help  
15 explain the origins of fascination of many individuals, particularly males, with vio-  
16 lent games. Interest in violent video games can be viewed as an extension of normal  
17 and adaptive aggression instincts, in which video games provide a safe arena in  
18 which individuals can express aggression and manage mood without actually caus-  
19 ing harm to others. An evolutionary model of violent game interest, the Catalyst  
20 Model, is presented and contrasted with traditional social learning models of video  
21 game violence use. It is argued that the harmful effects of violent game exposure on  
22 the majority of players are negligible whereas violent games may provide a useful  
23 platform for positive development in education, visuospatial cognition, and social  
24 networking.  
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26 **Keywords** Mass media · Computer games · Violence · Aggression ·  
27 Evolutionary psychology  
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31 **1 Introduction**  
32

33 Humankind’s fascination with violent entertainment has been noted during virtually  
34 every historical period (Kutner and Olson 2008; Trend 2007) as well as among most  
35 cultures. Such entertainment has varied in form and intensity, ranging from actual  
36 deaths for entertainment during Roman games or medieval executions to more mod-  
37 ern forms of entertainment such as television and video games, where the injuries  
38 and deaths are largely fictional (excepting those occurring during sporting events  
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perhaps). Media violence has historically had its critics as well ranging from moral philosophers such as Tertullian (200) and Augustine (397) to modern politicians and anti-media lobbyists. However, whatever one's feelings are about media violence, there can be little doubt that such entertainments are ubiquitous, popular, and a constant element of the human condition. As new media have developed quickly in the twentieth and twenty first centuries, cycles of "moral panics" have broken out regarding new media (Kutner and Olson 2008; Trend 2007). In most of these cases, society "elders" who do not use the new media complain that this new media (whether novels, comic books, jazz, rock and roll, movies, television, Elvis Presley, Betty Boop, Harry Potter, etc.) will corrupt or "harm" youth. In retrospect, most of these concerns seem absurd with media that previously caused great alarm now recognized as harmless, yet this does not stop the cycle from continuing with emerging media. In recent years, video games have been at the center of some of the most recent concerns (Anderson 2004; Ferguson 2008). This chapter concerns itself with understanding the use and impact of violent video games from the standpoint of evolutionary psychology. The chapter will be divided into two main parts: first, discussing the appeal of violent video games from an evolutionary standpoint and second, discussing ways in which this appeal can be harnessed to use violent video games for positive outcomes.

## 2 Understanding Aggression

Much of the discussion of aggression in the social sciences began with an assumption that aggression is an inherently bad thing, both for the individual and for society at large. This trickles down into news reports of scientific studies. For instance, when people hear something along the lines of "Scientists conclude that eating pomegranates causes aggression," this is often met with considerable hand-wringing among politicians, activists groups, parents, etc. about the deleterious effects of pomegranates, the moral turpitude of those who dare to farm pomegranates, and self-righteous questions about how anyone, particularly the youth of today, could possibly get any pleasure out of eating pomegranates. Some will call for the restriction of sale of pomegranates, particularly to minors. This all assumes that aggression is necessarily a bad thing. Certainly, in the extreme, when heightened aggression results in extreme violence likely to cause harm to oneself and others, this can be the case (Ferguson and Beaver 2009). However, aggressiveness may also have positive benefits and indeed be evolutionarily adaptive, particularly in moderate amounts. Moderate aggressiveness may aid us in defending ourselves and our family, standing up for our beliefs, seeking high-status positions in society, developing leadership, excelling in sports and many careers, enduring hardships, etc. These are behaviors that increase social status and reproductive success. Indeed, some scholars have recognized that aggressiveness, particularly when allowed to be defined broadly, may have more positive qualities than negative (Hawley and Vaughn 2003; Smith 2007). Aggression measures used in many social science studies do not

91 adequately distinguish between healthy adaptive aggression and extreme violent  
92 behaviors (Ferguson and Rueda 2009; Ritter and Eslea 2005). Thus, much of the  
93 hand-wringing may be premature.

94 Aggression is defined in this paper as a “behavior that is intended to increase  
95 the social dominance of the organism relative to the dominance position of other  
96 organisms” (Ferguson and Beaver 2009). Aggressiveness is a ubiquitous human trait  
97 across societies and historical periods (Ferguson and Beaver 2009). Archeological  
98 evidence from pre-historical human cultures reveals evidence of the use of fatal  
99 violence in these cultures (McCall and Shields 2008). The evolutionary roots  
100 of aggression can be observed by examining humans’ closest genetic relative,  
101 the chimpanzee. Chimpanzees have been observed engaging in mass intergroup  
102 fatal violence (Goodall 1979) and fatal abuse of infants (Goodall 1977). Given  
103 that greater sexual competition exists among males (Gottschalk and Ellis 2009),  
104 and that females are more invested in the care of young (Buss and Duntley  
105 2006), males engage in greater levels of aggression than do females, as is the  
106 case with most other mammalian species (Gottschalk and Ellis 2009; Okami and  
107 Shackelford 2001). This *sexual selection* of male aggression and violence may also  
108 be related to the division of labor between males and females in prehistoric hunter–  
109 gather societies in which males typically undertook the riskier activity of hunting  
110 (Morris 1999).

111 The observation that aggression is an evolutionary adaptation which provides a  
112 selective advantage to those individuals who possess a moderate level of the trait  
113 is at odds with much of the lingo and dogma of the social sciences across the lat-  
114 ter twentieth century. Historically it had been assumed that aggression and violence  
115 were learned behaviors, shaped largely by environmental influences including fam-  
116 ily and peers, but also media effects (e.g., Berkowitz 1993). Increasingly, evidence  
117 has demonstrated that this *tabula rasa* (i.e., blank slate) view of aggression has been  
118 mistaken and that there are strong genetic roots to aggressive and violent behaviors  
119 (Caspi et al. 2002; Ferguson 2010; Rhee and Waldman 2002). Thus too often in the  
120 social sciences, the presumed causal arrow between aggression and its correlates  
121 may have been misdirected.

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### 125 3 Violent Video Games and Aggression

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127 As noted earlier, complaints that various media forms would spark waves of rebel-  
128 liousness, violence, and moral turpitude are nothing unique to the twentieth century.  
129 However the latter half of the twentieth century saw a considerable emphasis  
130 on media violence research guided by the “social learning” theoretical tradition.  
131 Briefly, this tradition, attributed largely to Albert Bandura, suggests that individ-  
132 uals learn through imitating or modeling the behavior of others. Arguably over  
133 time, modeling morphed, in the view of many social scientists, from something that  
134 humans *can* do to something that they *must* do without volition or consideration of  
135 the benefits and costs of doing so.

136 Bandura's "Bobo doll" studies in particular provided much guidance for the  
137 media effects tradition of the latter twentieth century (Bandura et al. 1961, 1963).  
138 There are actually numerous variations on these sets of studies, but in brief they had  
139 children (males and females) watch adults (also males and females) either in real  
140 life or in filmed sequences engage in a series of highly novel acts against a Bobo  
141 doll (an inflatable toy doll which is designed to be boxed or hit). So, for instance,  
142 the models would sit on the Bobo doll and punch it in the nose, or whack it with a  
143 mallet. The researchers then irritated the children by showing them a host of toys  
144 that they were not allowed to play with before bringing them to the test room with  
145 the Bobo doll. Children who had seen an adult model these behaviors (either in real  
146 life or in film) were more likely to engage in similar behaviors. Although the Bobo  
147 doll studies are not media violence studies per se, they purport to demonstrate that  
148 aggression can be imitated by children. Presumably, these results would potentially  
149 be generalizable to television and other media forms.


150 However, there are limitations to the Bobo doll studies that are important to  
151 acknowledge (see Gauntlett 1995). First, the effects appear to be small overall and  
152 evaporate very quickly. Second, the "aggression" in the study was directed at an  
153 object, not another person, and it remains unclear if the studies' results can be gen-  
154 eralized to real-life aggression against people. Related to that is the concern that the  
155 entire situation is contrived; after all, one might ask, what else are you supposed  
156 to do with a Bobo doll other than hit it? Third, it is unclear whether the children  
157 were necessarily more motivated to engage in aggression in general, as opposed  
158 to mimicking *specific* aggressive acts. In other words, overall aggressive behaviors  
159 may not have changed much, but the style of the aggressive behaviors might have  
160 been altered due to the novel kinds of aggressive behaviors presented. Fourth, it is  
161 unclear whether the children were necessarily motivated by aggression, as opposed  
162 to aggressive play or even the desire to please the adult experimenter. Children are  
163 quite used to being given instructions by adults and they may arguably have sim-  
164 ply viewed the models (who were adults) as instructors telling them what to do. In  
165 other words, the children may have even believed that they might be scolded or pun-  
166 ished if they did not follow the model's lead. Lastly, in a subsequent paper, Bandura  
167 (1965) found that showing the model being punished for attacking the Bobo doll  
168 decreased modeled behaviors in child participants. Yet the punishments themselves  
169 appeared to involve considerable aggressive behavior. As described in the original  
170 text:

171 For children in the model-punished condition, the reinforcing agent appeared on the scene  
172 [this occurs after the children watched the model hit the bo-bo doll] shaking his finger  
173 menacingly and commenting reprovingly, "Hey there you big bully. You quit picking on  
174 that clown. I won't tolerate it." As the model drew back he tripped and fell, and the other  
175 adult sat on the model and spanked him with a rolled up magazine while reminding him  
176 of his aggressive behavior. As the model ran off, cowering, the agent forewarned him, "If I  
177 catch you doing that again, you big bully, I'll give you a hard spanking. You quit acting that  
178 way" (Bandura 1965. p. 591).

179 From this description it is reasonable to wonder what we can conclude when it  
180 appears that children are willing to imitate non-violent aggression against an object,

181 but viewing violence against an actual person inhibits their aggression. However  
182 one interprets the meaningfulness of the Bobo doll studies, there is little doubt that  
183 they had considerable impact on the media violence debate.

184 The media effects tradition continued more or less along the same lines, testing  
185 the hypothesis that viewed violence produces increased aggression (although notice  
186 the slip in terms between violence and aggression. . . with the assumption once again  
187 that aggression is inherently pathological). The meaningfulness, and even size of  
188 this body of research, has been debated for decades. For instance, the American  
189 Academy of Pediatrics has infamously claimed upward of 3500 studies on the topic  
190 of media violence, although an actual careful examination of the literature field  
191 found closer to 200 studies with mixed results (Freedman 2002). Like the Bobo doll  
192 studies, studies of media violence have oftentimes been limited by poor method-  
193 ology, inadequate aggression measures, poor control of extraneous variables, and  
194 an almost desperate effort to “prove” the theory rather than to meaningfully test  
195 hypotheses (Ferguson 2009; Olson 2004; Pinker 2002; Savage 2004). Indeed, in  
196 many studies, the study abstracts are worded so as to imply a meaningful connec-  
197 tion between media violence viewing and aggression, whereas a careful perusal of  
198 the results finds non-significant or contradictory results (e.g., Anderson and Dill  
199 2000; Malamuth and Ceniti 1986; see Ferguson 2009 and Savage 2004 for complete  
200 discussions).

201 Not surprisingly, this research tradition has continued  in the advent of video  
202 games. Research on video games began soon after the advent of video games, with  
203 “violent” video games oftentimes represented by games such as *Pac Man*, *Asteroids*,  
204 and *Zaxxon* (e.g., Anderson and Ford 1987; Dominick 1984). That games such as  
205 these are an important source of youth violence today would likely be considered  
206 absurd to most individuals familiar with games (or youth violence for that matter).  
207 Indeed this highlights the very nature of the media violence moral panic cycle. . . that  
208 past panics appear absurd, yet new media continues to incite new panics (Gauntlett  
209 1995). As video game technology has improved, some newer games have “pushed  
210 the envelope” on good taste, including considerable violence and sometimes lewd  
211 sexual content. However, recent meta-analyses have indicated that such content  
212 is unlikely to increase violence risk among players (Ferguson and Kilburn 2009;  
213 Savage and Yancey 2008; Sherry 2007).

214 Although the furor over video game violence effects is unlikely to die down soon,  
215 from a scientific view, it is probably time to reduce our focus on video games as an  
216 important causal contributor to youth violence. Instead of looking at how video  
217 game violence causes an increase in aggression, it may be more fruitful to exam-  
218 ine the reverse. Namely, how aggressiveness among the human species promotes  
219 an interest in violent media including violent video games. Given that players of  
220 violent video games do not randomly stumble upon such games, this causal direc-  
221 tionality arguably makes more sense. Why, though, do many humans find violent  
222 video games enjoyable to play?

223 Humans, perhaps like many other creatures, find violent acts to be intrinsically  
224 rewarding and pleasurable. There are exceptions to this, of course (and perhaps  
225 those exceptions go on to become social scientists wedded to tabula rasa views of

226 aggression); however there is little argument that violent media and violent video  
 227 games are overwhelmingly popular. Recent research on mice has suggested that  
 228 engaging in violent behavior activates reward centers of the brain (Couppis and  
 229 Kennedy 2008) and some have suggested that similar mechanisms may exist among  
 230 humans (Taylor 2009).

231 Although it is hardly a new idea to state it here, rather than humans becoming  
 232 aggressive because of exposure to violent media, it is likely more true that humans  
 233 like violent media because of an inherent aggressive streak in our species (Ferguson  
 234 2002). Thus many individuals, particularly males, may be inclined to enjoy violent  
 235 video games due to natural interests in aggression and competitiveness. Females  
 236 may have used “sex selection” to promote aggressiveness in males (Okami, and  
 237 Shackelford 2001) as such traits are useful for hunting and protection of the fam-  
 238 ily unit (Morris 1999). Thus it should not be surprising to find that young males,  
 239 in particular, almost universally play violent video games (Ferguson et al. 2008a;  
 240 Griffiths and Hunt 1995; Kutner et al. 2007). Violent video game playing among  
 241 females, although certainly not unheard of, is considerably less universally. Play of  
 242 such game may relate to pre-existing needs for and enjoyment of aggressive and  
 243 competitive stimuli. Indeed recent research has suggested that, far from stimulating  
 244 antisocial behavior, video game play may relate to increased social behavior and  
 245 civic engagement (Lenhart et al. 2008). Thus aggressiveness may play an essen-  
 246 tial role in male bonding and dominance hierarchies. Violent game playing, like  
 247 sports and competitive hobbies, may be merely a consequence of such pre-existing  
 248 motivations, not a cause of them.

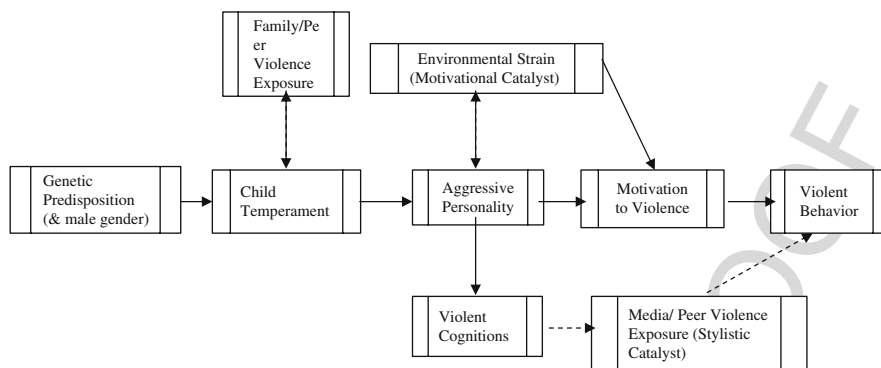
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#### 252 **4 An Evolutionary Model of Violent Video Game Playing**

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254 Ferguson (Ferguson 2009; Ferguson et al. 2008a) has propped a model, called the  
 255 Catalyst Model, to explain the interaction between genes and evolution, environ-  
 256 mental determinants of aggressiveness, and violent video game playing. It should be  
 257 noted that the term “violent video game,” like aggression, is rather broad, encom-  
 258 passing a wide variety of games, not only those such as *Grand Theft Auto* which tend  
 259 to receive the most negative attention. As noted above, games such as *Centipede*,  
 260 *Pac Man*, *Space Invaders*, and *Asteroids* have been labeled as “violent” games.  
 261 Although this is technically accurate (all of those games involve one thing attempt-  
 262 ing to destroy other things), it does point to the degree to which some of this debate  
 263 has become absurd. Such notions are dependent upon the view that the human mind  
 264 is naturally devoid of aggressive inclinations, that humans *must* model behaviors  
 265 that they witness, and that even the slightest hint of violence potentially carries risks  
 266 of deleterious outcomes.

267 The Catalyst Model, presented in Fig. 15.1, approaches the relationship between  
 268 video game playing and aggression from a different view than the traditional tabula  
 269 rasa social science view. Briefly, this model suggests that excessive aggressiveness  
 270 and a proneness to extreme violence (Ferguson and Beaver 2010) are the product of



**Fig. 15.1**

a combination of genetic effects and exposure to violence in the family and among peers. This observation has been supported by existing literature (Beaver et al. 2009; Caspi et al. 2002). The Catalyst Model suggests that aggression (and eventually violence) increases in proportion to the amount of stress that the organism experiences. Increased stress results in increased violence risk. For individuals already prone to acts of extreme violence due to genetic or family of origin influences, the amount of stress required to “catalyze” aggression is less than that for individuals with a normal or healthy genetic profile or background.

Related to violent media and video games, individuals with aggressive tendencies (relatively speaking) may have more aggressive thoughts and may be more prone to seek out violent media than may other individuals. Violent media may, at times, serve as a “stylistic catalyst.” In essence, a stylistic catalyst may influence the form that a violent act takes, but not the motivation to be violent itself. For instance, a criminal who watches *CSI* or plays the video game spin-off may use bleach to destroy evidence of a violent crime where they would not have done so before. However, whether or not the individual watched *CSI* or played a violent video game, the violent act still would have occurred. Thus, exposure to violence in video games may influence the *style* of a violent act, but not the frequency or motivation of violent acts. An offender might repeat a phrase from a game, dress like a character, or reference the game after being caught (offenders blaming video games after being caught is obviously self-serving and should be taken with a large grain of salt). Aside from these minor details, the game had no real influence on the offender’s motivation or intention to commit a violent act in the first place. Initial data on the Catalyst Model have suggested that it is superior to existing social learning-based models in explaining the interaction between video game violence and aggressive behavior (Ferguson et al. 2008a).

A further evolutionary point is worth considering. Namely humans, with some variation and particularly among males, are intrinsically aggressive, and thus, to varying degrees, drawn to aggressive stimuli. It thus follows that humans and males

316 particularly will be drawn to violent stimuli, including those in the media. Although  
317 this issue is often referenced in regard to heinous violent crimes such as mass shoot-  
318 ings (see Ferguson 2008 for a discussion), evidence makes clear that even healthy  
319 non-pathological young males (and some females) enjoy consumption of violent  
320 media (Ferguson et al. 2008a; Griffiths and Hunt 1995; Olson et al. 2007). In con-  
321 demning this reality, which is probably unchangeable no matter how much social  
322 critics might rant against it, are we missing an opportunity to use such media for  
323 positive outcomes?  
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## 327 **5 Using Violent Video Games for Positive Purposes**

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329 In the above sections I have argued that humans are intrinsically aggressive, that  
330 aggressive behavior in moderate doses can be adaptive, and that as an aggressive  
331 species, humans and males in particular are likely to be drawn to violent media.  
332 Further I have argued that the evidence suggests that, for most consumers at least,  
333 violent media does not have a deleterious effect on viewers. I am well aware that  
334 other social scientists have advocated the opposing view, but I feel that such argu-  
335 ments are not based on data, but rather on scientific ideology, politics, and emotion  
336 (see Grimes et al. 2008 for an excellent discussion of this issue).

337 One unfortunate element of this debate, which persists in a vacuum of evidence,  
338 is that the utility of an intrinsically attractive media is being missed. I am not advo-  
339 cating that the most savagely and offensively violent games be employed in these  
340 contexts. However, I do argue that scientists might consider a balance involving  
341 incorporating educational elements into games with a moderate amount of violence  
342 that will be interesting and fun for students to play. Some games have already done  
343 this with considerable success (Kato et al. 2008). One difficulty that educational  
344 games traditionally have is in competing with commercial games. Frequent gamers  
345 might find educational games “lame” in comparison to the sophisticated and action  
346 packed games that they are used to playing. As a related issue, the “shelf life” of  
347 many games, including educational games, can be limited. Some games such as  
348 *World of Warcraft* have exhibited remarkable staying power, however, and individ-  
349 uals interested in designing games for educational purposes would do well to learn  
350 some of the lessons of commercial games rather than trying (and perhaps failing) to  
351 reinvent the wheel.

352 In the following sections I will discuss some of the existing research on the use  
353 of games, both commercial and “serious games” (i.e., games that are specifically  
354 developed for purposes related to human enhancement or development, rather than  
355 as entertainment only), for “positive” purposes. Specifically I focus on the “unin-  
356 tended” consequences of violent video game playing on visuospatial cognition and  
357 the “intended” use of games, including both commercial and educational games  
358 with violent content in education.

359 *Visuospatial cognition.* Put simply, visuospatial cognition refers to a set of intel-  
360 lectual abilities related to the mental manipulation of and memory for objects and




relationships between objects. Such abilities may provide advantage in careers ranging from art to engineering to surgery. Generally it is acknowledged that males tend to perform higher on tasks related to visuospatial cognition than do females (Collaer and Hill 2006; Livesey and Intili 1996; Parsons et al. 2004), although there may be some degree of task specificity in these differences (Ferguson et al. 2008b; Halpern and Collaer 2005). From an evolutionary perspective it is hypothesized that these differences may relate to a division of labor in early human hunter–gatherer societies in which males were involved in the hunting role, which benefited to a greater degree from high visuospatial cognition (Silverman and Eals 1992; Morris 1999).

Just as it makes sense that males who are more aggressive than females may be drawn to violent games, so too males high in visuospatial cognition relative to females (who, by contrast, excel in verbal skills) may be drawn to video games for their involvement with visuospatial cognition. Thus, any relationship between video game playing and gender might only be a gender effect, and thus gender should be carefully controlled in all research on this topic.

Nonetheless, evidence has emerged to suggest that individuals who play video games generally, and violent games specifically, tend to have better visuospatial cognition than do non-gamers. Ferguson et al. (2008b) found that gamers, and those who play violent games specifically, outperformed non-gamers on visual memory tasks, even when gender was controlled. Similar results were found by De Lisi and Wolford (2002), although Sims and Mayer (2002) found that playing non-violent games such as *Tetris* did not translate to better visuospatial performance. As such there may be something particular about *violent* video games that relates to visuospatial cognition. It may not be the violence per se but rather the type of fast action found in such games.

The results described above are largely correlational, however. Even though gender is controlled, it may still be true that those with better inherent visuospatial cognition are more attracted to video games and violent games specifically. However, more recent experimental research has confirmed that a causal pathway exists between violent video game play (these research articles typically refer to such games as “action” games, whereas aggression articles refer to “violent” games, despite that these two groups of scholars use the same games. . . itself an interesting observation in how science is marketed for audiences) and improved visuospatial cognition (Feng et al. 2007; Green and Bavelier 2003 2006). Further research has also suggested that practice with violent video games is even related to improved performance in surgery for medical doctors (Rosser et al. 2007). Lastly, a recent meta-analytic review has noted that the effect size for the relationship between playing violent games and improved visuospatial cognition is many times greater than for that seen between violent game playing and aggression, which was negligible (Ferguson 2007).

This last finding raises the question of why violent games would function reasonably well at improving visuospatial cognition, despite that they do not increase aggression. Isn't all learning the same?  answer, obviously, is “no,” and the question assumes a rather simplistic and naïve version of “learning.” Behaving aggressively (or violently) requires intrinsic motivation. One must “decide” to engage in

406 such behavior. Although innate genetic tendencies influence an individual's level  
407 of aggression, the influence of environment on aggression is correspondingly small  
408 (Ferguson 2010). That is not to say that environment has *no* impact on violence,  
409 but the largest environmental predictors appear to be related to stress, family vio-  
410 lence, and peer delinquency, as predicted by the Catalyst Model (Ferguson et al.  
411 2009). After those factors are controlled, video game violence (or television) has no  
412 impact on violent behavior. Thus individuals are, to varying degrees, predisposed  
413 to violence, but ultimately “decide” to act violence, particularly when under stress.  
414 Violence is an act of volition and a personality trait that is not easily changed by  
415 environmental influences.

416 By contrast, visuospatial cognition is an automatic cognitive task, not a voli-  
417 tional personality trait. Automatic cognitive tasks do not require volition to function  
418 and improve with practice. Thus the difference between visuospatial cognition and  
419 aggression (or violence) is in the nature of the outcome. . . a volitional personal-  
420 ity trait versus an avolitional, automatic cognitive task. Cognitive tasks respond to  
421 practice, while personality traits do not.

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## 425 **6 The Use of Violent Games in Education**

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427 The benefits of violent games on visuospatial abilities are probably not terribly con-  
428 troversial as such influences are *accidental*. In other words, gamers become better  
429 at visuospatial tasks due to practice at those tasks, but that was never their intention.  
430 Violent games were not particularly developed for those tasks. Using violent games  
431 in education may be considerably more controversial as, in many instances, this  
432 would involve purposely designing a violent game for use by children in schools,  
433 a notion that schools and parents may be uneasy about, even as kids are exposed  
434 to violence in the books they read in literature classes. The use of video games  
435 directly in educational settings faces several practical constraints, including time  
436 commitment limitations and teacher prejudices against video games (Rice 2007).  
437 Nonetheless, as such games have inherent appeal to many children, there is potential  
438 for such games to make educational material more appealing.

439 In this context, there are two research sets. One avenue considers the “accidental”  
440 educational value of commercial games, with considerable attention focusing on  
441 *World of Warcraft* in particular. The other focuses on games purposely developed  
442 for educational purposes, games that may be included under the heading of “serious  
443 games.”

444 In regard to commercial games it has been found that the use of violent video  
445 games in informal settings may promote some cognitive development, although this  
446 is usually an unintended element of game play. For instance, research in this area  
447 has typically focused on *World of Warcraft* (WoW), an MMORPG (massively mul-  
448 tiplayer online role-playing game) that has enjoyed an unusually long active life.  
449 WoW is a fantasy role-playing game with violent content, for which many play-  
450 ers actively participate in message boards and blogs related to the game. Some

451 early research has suggested that WoW may promote reading and writing achievement,  
452 including among boys who previously had little interest in such activities  
453 (Steinkuehler, in press; Steinkuehler and Duncan 2009; Steinkuehler and Williams  
454 2006). Similarly VanDeventer and White (2002) found that children who displayed  
455 expertise at mildly violent games were likely to display higher ordered thinking  
456 skills. Durkin et al. (2009) have found that frequent use of video games and other  
457 electronic media is associated with improved social and language development in  
458 children with language disorders.

459 Research on games purposely designed for use in education remains in its  
460 infancy. Some of the most promising research in this regard has come out of health  
461 psychology, where specifically targeted video games have promoted the health of  
462 young medical patients. In one remarkable recent study, researchers found that a  
463 first-person shooter game *Re-Mission* improved self-efficacy, cancer knowledge,  
464 and treatment adherence in teen and young adult cancer patients (Kato et al. 2008).  
465 In the game *Re-Mission*, players play as a microscopic female robot that is injected  
466 into the bodies of cancer patients and blasts cancer cells and infections with a variety  
467 of weapons. Arguably the game succeeds because it presents a lively action-oriented  
468 platform that holds players' attention, allowing the educational components of the  
469 game greater opportunity for impact. *Re-Mission* takes advantage of the existing,  
470 popular first-person shooter format and applies this format for a pro-social purpose.  
471 Both non-violent and mildly violent educational games have demonstrated  
472 short-term efficacy for specific educational goals in controlled settings (Asakawa  
473 and Gilbert 2003; Reiber et al. 1998), yet little research has expanded outcomes to  
474 longer term, global, and ecologically valid results.

475 Research on the use of violent video games in promoting educational agendas  
476 remains in infancy. Yet the promise of *Re-Mission* directly, and *World of Warcraft*  
477 somewhat indirectly, has led to calls for increased use of video games, including  
478 those with violent content, to promote educational agendas. For instance, NASA  
479 has begun development of an MMO to promote science education (NASA 2008).  
480 The adoption of violent games as potential educational tools will naturally need to  
481 take place in the framework of a larger discussion of positive and negative effects of  
482 violent games. Yet, given the appeal and staying power of violent games, it may be  
483 worth having this discussion.

## 484 485 486 487 488 489 490 491 492 493 494 495 References

- 488 Anderson C (2004) An update on the effects of playing violent video games. *J Adolesc* 27(1):  
489 113–122
- 490 Anderson C, Dill K (2000) Video games and aggressive thoughts, feelings and behavior in the  
491 laboratory and in life. *J Pers Soc Psychol* 78(4):772–790
- 492 Anderson C, Ford C (1987) Affect of the game player: short term effects of highly and mildly  
493 aggressive video games. *Pers Soc Psychol Bull* 12(4):390–402
- 494 Asakawa T, Gilbert N (2003) Synthesizing experiences: lessons to be learned from internet  
495 mediated simulation games. *Simul Gaming* 34(1):10–22
- 496 Augustine (397) Confessions. <http://www.ccel.org/ccel/augustine/confessions.toc.html>, Retrieved  
497 10 Jan 2008

- 496 Bandura A (1965) Influence of models' reinforcement contingencies on the acquisition of imitative  
497 response. *J Pers Soc Psychol* 1(6):589–595
- 498 Bandura A, Ross D, Ross SA (1961) Transmission of aggression through imitation of aggressive  
499 models. *J Abnorm Soc Psychol* 63(3):575–582
- 500 Bandura A, Ross D, Ross SA (1963) Imitation of film-mediated aggressive models. *J Abnorm Soc  
501 Psychol* 66(1):3–11
- 502 Beaver KM, Shutt JE, Boutwell BB, Ratchford M, Roberts K, Barnes JC (2009) Genetic and envi-  
503 ronmental influences on levels of self-control and delinquent peer affiliation: results from a  
504 longitudinal sample of adolescent twins. *Crim Justice Behav* 36(1):41–60
- AQ5 504 Berkowitz L (1993) *Aggression: its causes, consequences, and control*. McGraw-Hill, New York
- 505 Buss D, Shackelford T (1997) Human aggression in evolutionary psychological perspective. *Clin  
506 Psychol Rev* 17(6):605–619
- 507 Caspi A, McClay J, Moffitt T, Mill J, Martin J, Craig I, et al (2002) Role of genotype in the cycle  
508 of violence in maltreated children. *Science* 297(5582):851–854
- 509 Collaer M, Hill E (2006) Large sex difference in adolescents on a timed line judgment task:  
510 attentional contributors and task relationship to mathematics. *Perception* 35(4):561–572
- 511 Couppis M, Kennedy C (2008) The rewarding effect of aggression is reduced by nucleus  
512 accumbens dopamine receptor antagonism in mice. *Psychopharmacology* 197(3):449–456
- 513 Dominick J (1984) Videogames, television violence and aggression in teenagers. *J Commun  
514* 34(2):136–147
- 515 Durkin K, Conti-Ramsden G, Walker A, Simkin Z (2009) Educational and interpersonal uses of  
516 home computers by adolescents with and without specific language impairment. *Br J Dev  
517 Psychol* 27(1):197–217 (March)
- 518 Feng J, Spence I, Pratt J (2007) Playing an action video game reduces gender differences in spatial  
519 cognition. *Psychol Sci* 18(10):850–855
- 520 Ferguson CJ (2002) Media violence: miscast causality. *Am Psychol* 57(6–7):446–447
- 521 Ferguson CJ (2007) The good, the bad and the ugly: a meta-analytic review of positive and negative  
522 effects of violent video games. *Psychiatr Q* 78(4):309–316
- 523 Ferguson CJ (2008) The school shooting/violent video game link: causal link or moral panic? *J  
524 Investig Psychol Offender Profiling* 5(1–2):25–37
- 525 Ferguson CJ (2009) Media violence effects: confirmed truth, or just another X-File? *J Forensic  
526 Psychol Practice* 9(2):103–126
- AQ6 527 Ferguson CJ (2010) Genetic contributions to antisocial personality and behavior (APB): a meta-  
528 analytic review (1996–2006) from an evolutionary perspective. *J Soc Psychol* 150(2):160–180
- AQ7 529 Ferguson CJ, Beaver KM (2009) Natural born killers: the genetic origins of extreme violence.  
530 *Aggress Violent Behav* 14(5):286–294
- 531 Ferguson CJ, Kilburn J (2009) The public health risks of media violence: a meta-analytic review. *J  
532 Pediatr* 154(5) 759–763
- 533 Ferguson CJ, Rueda S, Cruz A, Ferguson D, Fritz S, Smith S (2008a) Violent video games  
534 and aggression: causal relationship or byproduct of family violence and intrinsic violence  
535 motivation? *Crim Justice Behav* 35(3):311–332
- 536 Ferguson CJ, Cruz A, Rueda S (2008b) Gender, video game playing habits and visual memory  
537 tasks. *Sex Roles J Res* 58(3–4):279–286
- AQ8 538 Ferguson CJ, San Miguel C, Hartley RD (2009) A multivariate analysis of youth violence and  
539 aggression: the influence of family, peers, depression and media violence. *J Pediatr* 155(6):  
540 904–908
- 541 Freedman J (2002) *Media violence and its effect on aggression: assessing the scientific evidence*.  
University of Toronto Press, Toronto
- 542 Gauntlett D (1995) *Moving experiences: understanding television's influences and effects*. John  
543 Libbey, Luton
- 544 Goodall J (1977) Infant-killing and cannibalism in free-living chimpanzees. *Folia Primatol* 28:  
259–282
- 545 Goodall J (1979) Life and death at Gombe. *Natl Geogr* 155:595–621

- 541 Gottschalk M, Ellis L (2009) Evolutionary and genetic explanations of violent crime. In: Ferguson  
 542 C (ed) *Violent crime: clinical and social implications*. Sage, Thousand Oaks
- 543 Green S, Bavelier D (2003) Action video game modifies visual selective attention. *Nature*  
 544 423(6939):534–537
- 545 Green S, Bavelier D (2006) Enumeration versus multiple object tracking: the case of action video  
 546 game players. *Cognition* 101(1):217–245
- 547 Griffiths M, Hunt N (1995) Computer game playing in adolescence: prevalence and demographic  
 548 indicators. *J Commun Appl Soc Psychol* 5(3):189–193
- 549 Grimes T, Anderson J, Bergen L (2008) *Media violence and aggression: science and ideology*.  
 550 Sage, Thousand Oaks
- 551 Halpern D, Collaer M (2005) Sex differences in visuospatial abilities: more than meets the eyes.  
 552 In: Shah P, Miyake A (eds) *Cambridge University Press*, New York
- 553 Hawley P, Vaughn B (2003) Aggression and adaptive function: the bright side to bad behavior.  
 554 *Merrill Palmer Q* 49(3):239–242
- 555 Kato P, Cole S, Bradlyn A, Pollock B (2008) A video game improves behavioral outcomes  
 556 in adolescents and young adults with cancer: a randomized trial. *Pediatrics* 122:e305–e317,  
 557 <http://pediatrics.aappublications.org/cgi/content/full/122/2/e305>, Retrieved 10 Jun 2008
- 558 Kutner L, Olson C (2008) *Grand theft childhood: the surprising truth about violent video games  
 559 and what parents can do*. Simon & Schuster, New York
- 560 Kutner L, Olson C, Warner D, Hertzog S (2007) Parents' and son's perspectives on video game  
 561 play: a qualitative study. *J Adolesc Res* 23(1):76–96
- 562 Lenhart A, Kahne J, Middaugh E, MacGill A, Evans C, Mitak J (2008) *Teens, video games and  
 563 civics: teens gaming experiences are diverse and include significant social interaction and civic  
 564 engagement*. [http://www.pewinternet.org/PPF/r/263/report\\_display.asp](http://www.pewinternet.org/PPF/r/263/report_display.asp), Retrieved 10 Feb 2008
- 565 Livesey D, Intili D (1996) A gender difference in visual–spatial ability in 4-year-old chil-  
 566 dren: Effects on performance of a kinesthetic acuity task. *J Exp Child Psychol* 63(2):  
 567 436–446
- 568 Malamuth N, Ceniti J (1986) Repeated exposure to violent and nonviolent pornography:  
 569 Likelihood of raping ratings and laboratory aggression against women. *Aggress Behav*  
 570 12(2):129–137
- 571 McCall G, Shields N (2008) Examining the evidence from small-scale societies and early prehis-  
 572 tory and implications for modern theories of aggression and violence. *Aggress Violent Behav*  
 573 13(1):1–9
- 574 Morris D (1999) *The naked ape: A zoologist's study of the human animal*. Delta, New York
- 575 National Aeronautic and Space Association (2008) *NASA MMO game*.  
 576 <http://ipp.gsfc.nasa.gov/MMO>, Retrieved 10 Jul 2008
- 577 Okami P, Shackelford T (2001) Human sex differences in sexual psychology and behavior. *Annu*  
 578 *Rev Sex Res* 12:186–241
- 579 Olson C (2004) Media violence research and youth violence data: why do they conflict? *Acad*  
 580 *Psychiatry* 28(2):144–150
- 581 Olson C, Kutner L, Warner D, Almerigi J, Baer L, Nicholi A, Beresin E (2007) Factors correlated  
 582 with violent video game use by adolescent boys and girls. *J Adolesc Health* 41(1):77–83
- 583 Parsons T, Larson P, Kranz K, Thiebaut M, Bluestein B, Buckwalter G et al (2004) Sex differ-  
 584 ences in mental rotation and spatial rotation in a virtual environment. *Neuropsychologia* 42(4):  
 585 555–562
- 586 Pinker S (2002) *The blank slate: the modern denial of human nature*. Penguin, New York
- 587 Reiber L, Smith L, Noah D (1998). The value of serious play. *Educ Technol* 38(6):29–36
- 588 Rhee S, Waldman I (2002) Genetic and environmental influences on antisocial behavior: a meta-  
 589 analysis of twin and adoption studies. *Psychol Bull* 128(3):490–529
- 590 Rice J (2007) New media resistance: barriers to implementation of computer video games in the  
 591 classroom. *J Educ Multimed Hypermed* 16(3):249–261
- 592 Ritter D, Eslea M (2005) Hot sauce, toy guns and graffiti: a critical account of current laboratory  
 593 aggression paradigms. *Aggress Behav* 31(5):407–419

AQ9

AQ10

- 586 Rosser J, Lynch P, Cuddihy L, Gentile D, Klonsky J, Merrell R (2007) The impact of video games  
587 on training surgeons in the 21st century. *Arch Surg* 142(2):181–186
- 588 Savage J (2004) Does viewing violent media really cause criminal violence? A methodological  
589 review. *Aggress Violent Behav* 10(1):99–128
- 590 Savage J, Yancey C (2008) The effects of media violence exposure on criminal aggression: a meta-  
591 analysis. *Crim Justice Behav* 35(6):1123–1136
- 592 Sherry J (2007) Violent video games and aggression: Why can't we find links? In: Preiss R, Gayle  
593 B, Burrell N, Allen M, Bryant J (eds) *Mass media effects research: advances through meta-  
594 analysis*. L. Erlbaum, Mahwah, pp 231–248
- 595 Silverman I, Eals M (1992) Sex differences in spatial ability: evolutionary theory and data. In:  
596 Barkow J, Cosmides L, Tooby J (eds) *The adapted mind: evolutionary psychology and the  
597 generation of culture*. Oxford Press, New York, pp 531–549
- 598 Smith P (2007) Why has aggression been thought of as maladaptive? In: Hawley P, Little T,  
599 Rodkin P (eds) *Aggression and adaptation: the bright side to bad behavior*. Lawrence Erlbaum,  
600 Mahwah, pp 65–83
- AQ11 601 Steinkuehler CA (in press) Cognition and literacy in massively multiplayer online games. In: Leu  
602 D, Coiro J, Lankshear C, Knobel K (eds) *Handbook of research on new literacies*. Erlbaum,  
603 Mahwah
- 604 Steinkuehler C, Duncan S (2009). Informal scientific reasoning in online virtual worlds. *J Sci Educ  
605 Technol*, DOI: 10.1007/s10956-008-9120-8
- 606 Steinkuehler C, Williams D (2006) Where everybody knows your (screen) name: online games as  
607 “third places”. *J Comput Mediat Commun* 11(4):article 1
- 608 Taylor K (2009). *Cruelty: human evil and the human brain*. Oxford University Press, New York
- 609 Tertullian (200) *De spectaculis*. [http://www.tertullian.org/lfc/LFC10-13\\_de\\_spectaculis.htm](http://www.tertullian.org/lfc/LFC10-13_de_spectaculis.htm),  
610 Retrieved 10 Jan 2008
- 611 Trend D (2007) *The myth of media violence: a critical introduction*. Blackwell, Malden
- 612 VanDeventer S, White J (2002) Expert behavior in children's video game play. *Simul Gaming*  
613 33(1):28–48
- 614
- 615
- 616
- 617
- 618
- 619
- 620
- 621
- 622
- 623
- 624
- 625
- 626
- 627
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