Vulnerability to Violent Video Games: A Review and Integration of Personality Research

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In this report, past research is reviewed, which suggests that the personality traits of psychoticism and aggressiveness likely moderate the negative effects of violent video games (VVGs). The Five-Factor Model (FFM) of personality is then used as a taxonomy to integrate these findings and examine why these traits are important moderator variables. Analyses suggest that these traits likely moderate the effects of VVGs because they contain the FFM traits neuroticism (+), agreeableness (−), and conscientiousness (−). A spherical model of personality, derived from these three FFM traits, is presented as a method of predicting aggression and hostility after playing VVGs; archival data confirms the predictions derived from this spherical model. Findings from the current research demonstrate the utility of a three-trait spherical model to examine the moderating effects of VVGs and suggest that only some individuals are adversely affected by VVGs and that those who are affected have preexisting dispositions, which make them susceptible to such violent media.

Keywords: video games, violence, personality, five factor model

Although violent video games (VVGs) have been a cause of concern among activists and laypersons for decades (for a brief review see Ferguson et al., 2008), the Columbine High School shootings in 1999 exacerbated this concern to almost epidemic levels. From this point forward, almost every school shooting was afforded at least a fleeting association with VVGs (Anderson, 2004; Thompson, 2000). Of course, given that 45.7 million American homes have a least one video game console (Nielson Media Research, 2007), it is clear that most children who play these games do not go on to behave in violent or murderous ways. In fact, although many youths who have engaged in violent school rampages were video game players (Anderson, 2004), most also possessed maladaptive personality traits and characteristics. School violence attributed to violent media has involved shooters who were described by themselves and others as extremely angry, mean, depressed, psychotic, unruly, anxious, aggressive, and hateful *before* the shootings occurred (cf. Cornell, 2006; Cullen, 2009; Gibbs & Roche, 1999; Sandler & Alpert, 2000). Although care should be taken when considering these anecdotal observations (Ferguson, 2007a) these descriptions suggest that certain types of individuals may be more adversely affected by VVGs than other individuals. Thus, the direct link from VVGs to school violence that has been highlighted in the media may obscure a large portion of the equation: personality traits.

Over a decade of correlational and experimental research suggests that VVGs are linked to various negative behaviors and cognitions such as aggression, hostility, and aggressive thoughts (e.g., Anderson et al., 2004; Bushman & Anderson, 2002; Gentile, Lynch, Linder, & Walsh, 2004; Sheese & Graziano, 2005; for a

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critique of this research see Ferguson, 2010; Olson, 2004). Although much of previous research is consistent with the notion that VVGs increase aggression, a considerable number of studies have failed to find compelling links between VVGs and aggression (e.g., Ferguson et al., 2008; Weigman & van Schie, 1998; Williams & Skoric, 2005). Possible explanations for these inconsistent findings have ranged from poor research design and invalid measurements to publication biases (Ferguson, 2007a, 2007b). It is also possible that these findings have been less than consistent because the main effect of VVGs these researchers were examining was moderated by personality. That is, because of various preexisting dispositions, not all participants in these studies were likely affected by VVGs in a similar manner. Although there are numerous personality traits which might moderate the effects of VVGs, past research examining VVGs and other forms of media violence suggest that psychoticism and trait aggression are key characteristics to consider.

Psychoticism

Individuals who score high on psychoticism tend to be cold, lacking in sympathy, unfriendly, untrustworthy, odd, unemotional, unhelpful, antisocial, and paranoid. Although psychoticism was proposed as a vulnerability, given certain environmental exposures, to becoming psychotic (Eysenck & Eysenck, 1976), research has since established that this dimension is more accurately conceptualized as akin to antisocial personality (Claridge, 2006). Past research suggests that this trait likely moderates the negative effects of VVGs. Markey and Sherer (2009) found that participants with elevated levels of psychoticism tended to experience higher levels of hostility and had more aggressive cognitions after exposure to VVGs than did individuals with lower levels of psychoticism or individual exposed to non-VVGs. Research examining psychoticism in the context of other forms of violent media has also produced similar results. After viewing violent films, men with elevated levels of psychoticism were much more likely to

accept violence as a means of conflict resolution than other individuals (Zillman & Weaver, 1996). Men with high levels of psychoticism also tend to express greater levels of rape proclivity after repeated exposure to violent and nonviolent pornography (Barnes, Malamuth, & Check, 1984). Consistent with these studies, Lynn, Hampson, and Agahi (1989) present data that are consistent with a genotype-environment correlation and interaction model implying that viewing TV violence only has an affect on aggression in genetically predisposed individuals with high levels of psychoticism.

In an effort to determine why individuals with high levels of psychoticism are more adversely affected by VVGs, Ravaja and colleagues (2008) examined phasic psychophysiological responses, indexing emotional valence and arousal, after playing VVGs and non-VVGs. These researchers found that after "killing" or "wounding" opponents in a VVG both zygomatic and orbicularis oculi electromyography activity was less pronounced among individuals with high levels of psychoticism. Such findings strongly suggest that these individuals experience less anxiety when killing or wounding a virtual opponent than other individuals who do not have high levels of psychoticsim or who are playing non-VVGs. Consistent with this notion, previous studies have found that individuals with elevated levels of psychoticism are often not disturbed by media violence. Individuals with high levels of psychoticism tend to prefer violent films and even find them more comical and enjoyable than individuals with low levels of psychoticism (Bruggemann & Barry, 2002). Participants with high levels of psychoticism also tend to perceive violence on TV as less violent and frightening than persons who do not possess this characteristic (Gunter, 1983).

Trait Aggressiveness

Aggressive individuals are often conceptualized as angry, having the propensity to engage in verbal and physical aggression, and hostile in their cognitive patterns (Anderson & Bushman, 2001; Buss & Perry, 1992). It has been speculated that aggressive individuals are more likely to make hostile attributions, thereby increasing their anger and the likelihood of aggressive behavior (Tiedens, 2001). Consistent with this notion, Giumetti and Markey (2007) found that participants who were angry were more likely to make hostile attributions to the actions of others after playing VVGs than participants who were not angry or those who had played non-VVGs. When aggression has been experimentally primed before playing VVGs, it has been found that participants tend to use more violent actions during game play and report more hostility than participants who are not primed for aggression (Panee & Ballard, 2002). Individuals high on trait aggressiveness are also more hostile after playing VVGs versus non-VVGs, further suggesting that VVGs have distinct effects on people depending on their aggressiveness (Arriaga et al., 2006). Cross-situational research also suggests that aggressive individuals who play VVGs are more likely to express delinquent and aggressive behaviors than individuals who do not play VVGs (Anderson & Dill, 2000).

The above findings concerning the moderating role of aggressiveness on VVGs are consistent with research examining other forms of violent media. In an observational study, Josephson (1987) found that aggressive children who were exposed to violent TV expressed more aggressive behavior after provocation than children who were exposed to nonviolent TV. Similarly, aggressive cartoons shown in a nursery school have been found to increase aggressive behavior more in children who are ranked high in trait aggressiveness than children ranked low on this trait (Friedrich & Stein, 1973). In a laboratory setting, aggressive individuals were also more likely to feel angry and express hostile behaviors after watching violent videotapes than individuals who are low in aggressiveness or those who watched nonviolent videotapes (Bushman, 1995).

Taken together, previous research suggests that the traits that have been found to moderate the effects of violent TV and movies are the same traits that likely moderate the effects of VVGs: psychoticism and trait aggression. The importance of these two traits is not particularly surprising given the conceptual overlap between these constructs. It would seem reasonable to assume that an individual with high levels of psychoticism—who is cold, lacking in sympathy and unfriendly (Eysenck & Eysenck, 1976)—would also be somewhat aggressive and angry. Consistent with this notion, past research has found that these two traits are moderately correlated ($r = .43$) with each other (McCroskey, Heisel, & Richmond, 2001). This modest correlation suggests that there is likely some overlap between these traits, but that they are also characterized by qualities which make them distinct from each other.

The Five-Factor Model: A Taxonomy for Assimilating Past Research

Although the Five-Factor Model (FFM) is arguably the most popular model of personality traits, researchers examining VVGs have not yet examined the importance of its five personality dimensions: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness. In this model, neuroticism is characterized by individuals' susceptibility to worry, anxiety, anger, and general emotional instability. Extraversion encompasses traits such as sociability, dominance, and talkativeness. Openness to experience is characterized by curiosity, imaginativeness, and originality. Agreeableness encompasses traits including friendliness, warmth, and cooperativeness. Conscientiousness includes qualities such as carefulness, self-discipline, and reliability. The dimensions of the FFM have proven robust across cultures (Church & Katigbak, 1989; Kallasmaa, Allik, Realo, & McCrae, 2000), sex (Costa & McCrae, 1992a), age (Markey, Markey, Ericksen, & Tinsley, 2002), methods (McCrae, Costa, & Busch, 1986), and item pools (Costa & McCrae, 1988; Goldberg, 1990).

As noted by Goldberg (1993), the FFM not only provides a list of broad individual difference variables, but is also a structured taxonomy. Because the traits of the FFM are conceptualized as orthogonal, together these five dimensions cover a broad expanse of personality and can summarize almost any personality construct. In this manner, the FFM is a useful coordinate system for categorizing various personality constructs within its five dimensions (Ozer & Reise, 1994). By categorizing seemingly differing traits under a few common dimensional labels, the FFM can be used to assimilate past research (Funder, 2007). For example, organizational research studies have related a multitude of various personality traits (e.g., responsibility, consistency, work ethics, dependability, etc.; see O'Bannon, Goldinger, & Appleby, 1989) to the outcome of job performance. Ones and colleagues (1993)

has demonstrated that most of these traits can be construed as the FFM trait of conscientiousness. This insight allowed for these previous studies, using different trait names, to be integrated—thereby providing a better understanding of job performance. Similarly, by relating the FFM to the traits of psychoticism and aggression, the similarities and dissimilarities between these traits can be clarified, making it easier to assimilate past VVG research.

Research suggests that psychoticism is related to low agreeableness and low conscientiousness (Costa & McCrae, 1995; Costa, McCrae, & Dye, 1991; Goldberg & Rosolack, 1994; McCrae & Costa, 1985). In other words, individuals who have high levels of psychoticism tend to be *both* low in agreeableness and conscientiousness. These relations make sense given that individuals high in psychoticism would have similar characteristics as those low in agreeableness (e.g., little concern for others, indifferent to others feelings, cold, etc.) and low in conscientiousness (e.g., break rules, don't keep promises, act without thinking, etc.). Research also suggests that the trait of aggression is related to high neuroticism and low agreeableness (Sharpe & Desai, 2001). Again, such relations make intuitive sense given that individuals high in trait aggression would possess similar characteristics as those high in neuroticism (e.g., easily upset, angry, depressed, emotional, etc.) and low in agreeableness.

Because both psychoticism (low agreeableness and low conscientiousness) and trait aggressiveness (high neuroticism and low agreeableness) tend to moderate the negative effects of VVGs, it is likely that the FFM trait agreeableness would also moderate this effect (i.e., individuals who are low on agreeableness would be adversely affected by VVGs). However, past findings are a little less clear as to the importance of the FFM traits neuroticism and conscientiousness. It is possible that neuroticism and conscientiousness do not moderate the effects of VVGs and that previous findings regarding psychoticism and trait aggressiveness occurred because these traits both contain elements of agreeableness. It is also possible that the previous findings regarding psychoticism and trait aggressiveness occurred because neuroticism, agreeableness, and conscientiousness are all important elements of personality to consider in this context. In other words, when high neuroticism, low agreeableness, and low conscientiousness coexist within individuals this might render them especially vulnerable to the negative effects of VVGs. This notion implies that when these three traits are merged in an additive manner, the resulting combination would be far more powerful than any individual FFM trait.

A Spherical Model of Personality: When Traits Merge Within the Individual

A multidimensional approach to personality simultaneously examines various traits and provides insight into how traits coexist within an individual (Trapnell & Wiggins, 1990). While the FFM traits of neuroticism, agreeableness, and conscientiousness may be orthogonal to each other when assessed across individuals they are not isolated entities within individuals. This understanding has been an underlying (although sometimes forgotten) theme in the study of personality since Allport (1937) defined personality as ". . . the dynamic organization *within* the individual of those psychophysical systems that determine his unique adjustments to his environment" (p. 48; emphasis added). For example, a person who is high on neuroticism *and* low on agreeableness will likely exhibit different characteristics (e.g., temperamental, easily angered, etc.) than a person who is high on neuroticism and high on agreeableness (e.g., timid, reluctant to express anger, etc.).

Costa and McCrae (1992b) created a circumplex model to illustrate the eight characteristics that are created by combining together the traits of neuroticism and agreeableness (see Figure 1a). As can be seen in this model, neuroticism and agreeableness are represented as orthogonal dimensions in a two-dimensional space. This circumplex structure provides a useful visual display of the ways in which neuroticism and agreeableness may be manifested within different individuals. Such circumplex models have been used extensively to examine how two traits merge together (cf., Ansell & Pincus, 2004; Pincus & Ansell, 2003). For example, Figure 1a indicates that the characteristic of timid (i.e., people who often feel victimized but rarely express anger [Costa & McCrae, 1992b]) is a combination of high neuroticism and high agreeableness; however, temperamental (i.e., people who are easily angered and typically express their anger directly [Costa & McCrae, 1992b]) is a combination of high neuroticism and low agreeableness.

As previously mentioned, it is possible that the trait of conscientiousness also moderates the negative effects of VVGs. By adding conscientiousness to the traits of neuroticism and agreeableness, two additional circumplex models can be created. Figure 1 displays the two circumplex models created by Costa and McCrae (1992b) by combining together agreeableness and conscientiousness (Figure 1b) and neuroticism and conscientiousness (Figure 1c). By applying the three circumplex models to the
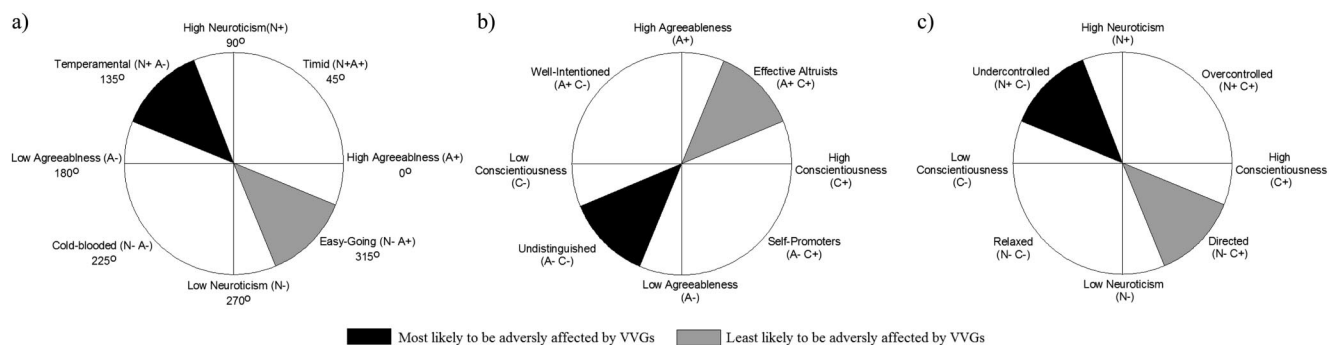

Figure 1. The three cirucmplex models that comprise the sphere. (a) Neuroticism and Agreeableness Circumplex. (b) Agreeableness and Conscientiousness Circumplex. (c) Neuroticism and Conscietiousness Circumplex.

previous discussion regarding the moderating role of neuroticism, agreeableness, and conscientiousness, it is possible to hypothesize which individuals are most and least affected by VVGs. As seen in Figure 1, a person who is temperamental (i.e., people who are easily angered and typically express their anger directly [Costa & McCrae, 1992b]), undercontrolled (i.e., people who lack self-control and are often at the mercy of their own impulses [Costa & McCrae, 1992b]), and undistinguished (i.e., people who are primarily concerned with their own pleasure than with the well-being of others [Costa & McCrae, 1992b]) are most likely affected by VVGs. In contrast, individuals who are easy-going (i.e., people who are slow to anger and typically do not express anger [Costa & McCrae, 1992b]), directed (i.e., people who have clear goals and work toward accomplishing goals [Costa & McCrae, 1992b]), and effective altruists (i.e., people who are self-disciplined and work toward the well-being of others [Costa & McCrae, 1992b]) are least likely to be adversely affected by VVGs.

Although the three circumplex models presented in Figure 1 visually demonstrate the importance of considering how *two* dimensions of personality combine together, they would provide an incomplete picture of who is most affected by VVGs if the *three* FFM dimensions of neuroticism, agreeableness, and conscientiousness are important. By merging these three FFM dimensions into a single, spherical model we gain insight into how these dimensions combine together and also who is most vulnerable to the adverse effects of VVGs. The resulting spherical model, which was created by combining together the primary dimensions of neuroticism, agreeableness, and conscientiousness, is presented in Figure 2. Spherical models of personality are not new and have proven useful tools for understanding the unique combinations of different personality traits (e.g., Markey & Markey, 2006; Tracey, 2002). Although no spherical model has utilized the primary dimensions of neuroticism, agreeableness, and conscientiousness,

the geometric formulas and statistics utilized in past models can be used to better understand the three FFM traits, which appear to be relevant to VVG research.

The spherical structure displayed in Figure 2 implies that personality characteristics or "types" vary along a spherical continuum and can be oriented by the primary dimensions of neuroticism, agreeableness, and conscientiousness. The characteristic names displayed in Figure 2 are the same names of the characteristics presented in the three earlier circumplex models (see Figure 1). The different characteristics on the sphere are also presented in Table 1, along with their theoretical weights on each dimension. These weights represent hypothetical correlations between each characteristic and the dimensions of neuroticism, agreeableness, and conscientiousness (Markey & Markey, 2006).

Each of the characteristics presented in Table 1 and Figure 2 can be cartographically located on the sphere by their longitude and latitude coordinates. Using the neuroticism and agreeableness as the defining location of longitude, a characteristic's location can range from 0° to 359.9°. As seen in Figures 1a and 3 characteristics creating the longitudinal plane are ordered counterclockwise starting at 0° (high agreeableness). To calculate its longitudinal angle, a characteristic's neuroticism and agreeableness weights can be applied to the formula (Markey & Markey, 2006; Wiggins, 1995):

$$\Lambda = \text{arctangent } (N_{\text{Weight}}/A_{\text{Weight}})$$

Where:

Λ is the longitudinal angle of a characteristic

N_{Weight} is the characteristic's weighted relation to Neuroticism
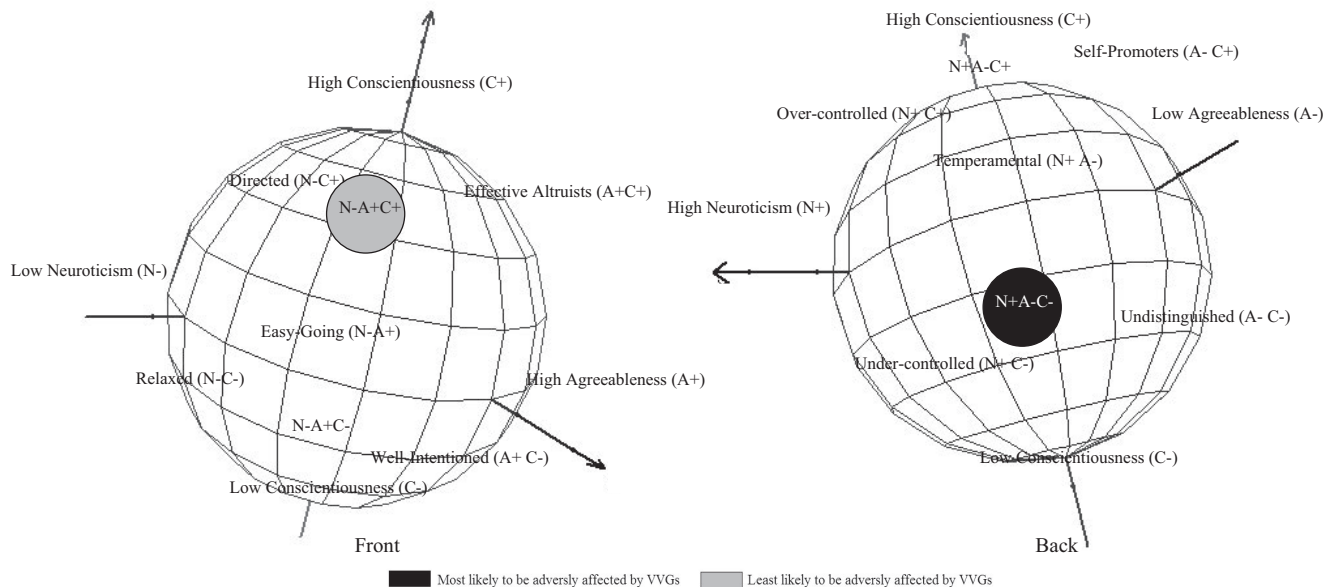

Figure 2. The spherical model created by the primary dimensions of neuroticism, agreeableness, and conscientiousness.

Table 1

Theoretical Location of 26 Characteristics on the Spherical Model and Multiple Regression Analyses Predicting Hostility From a Given Characteristic and the Characteristic's Interaction With VVG Condition

Variable	Λ	Φ	N	A	C	Main Effect of Characteristic (*SE* B)	Characteristic × VVG (*SE* B)
N+ (high neuroticism)	90	0	1.00	0.00	0.00	.17** (.06) **.26**	.19 (.12) **.15**
N + A− (temperamental)	135	0	0.707	−0.707	0.00	.21** (.06) **.33**	.23 (.12) **.18**
A− (low agreeableness)	180	0	0.00	−1.00	0.00	.14* (.06) **.20**	.19 (.12) **.14**
N−A− (cold-blooded)	225	0	−0.707	−0.707	0.00	−.03 (.06) **−.03**	.02 (.13) **.01**
N− (low neuroticism)	90	0	−1.00	0.00	0.00	−.17** (.06) **−.26**	−.19 (.12) **−.15**
N−A+ (easygoing)	135	0	−0.707	0.707	0.00	−.21** (.06) **−.33**	−.23 (.12) **−.18**
A + (high agreeableness)	0	0	0.00	1.00	0.00	−.14* (.06) **−.20**	−.19 (.12) **−.14**
N + A+ (timid)	45	0	0.707	0.707	0.00	.03 (.06) **.03**	−.02 (.13) **−.01**
A + C− (well intentioned)	0	−45	0.00	0.707	−0.707	−.06 (.06) **−.09**	.01 (.13) **.01**
C− (low conscientiousness)	0	−90	0.00	0.00	−1.00	.05 (.06) **.07**	.22 (.12) **.17**
A−C− (undistinguished)	180	−45	0.00	−0.707	−0.707	.13* (.06) **.20**	.20* (.12) **.23**
A−C+ (self-promoters)	180	45	0.00	−0.707	0.707	.06 (.06) **.09**	−.01 (.13) **−.01**
C+ (high conscientiousness)	0	90	0.00	0.00	1.00	−.05 (.06) **−.07**	−.22 (.12) **−.17**
A + C+ (effective altruists)	0	45	0.00	0.707	0.707	−.13* (.06) **−.20**	−.30* (.13) **−.23**
N + C− (undercontrolled)	90	−45	0.707	0.00	−0.707	.16* (.06) **.24**	.26* (.13) **.20**
N−C− (relaxed)	270	−45	−0.707	0.00	−0.707	−.08 (.06) **−.12**	.01 (.13) **.01**
N−C+ (directed)	270	45	−0.707	0.00	0.707	−.16* (.06) **−.24**	−.26* (.13) **−.20**
N + C+ (overcontrolled)	90	45	0.707	0.00	0.707	.08 (.06) **.12**	−.01 (.13) **−.01**
N−A + C+	315	35	−0.577	0.577	0.577	−.21** (.06) **−.31**	−.31** (.12) **−.24**
N−A + C−	315	−35	−0.577	0.577	−0.577	−.14* (.06) **−.22**	−.10 (.12) **−.08**
N−A−C +	225	35	−0.577	−0.577	0.577	−.05 (.06) **−.07**	−.11 (.13) **−.09**
N−A−C−	225	−35	−0.577	−0.577	−0.577	.01 (.06) **.01**	.15 (.13) **.11**
N + A+C +	45	35	0.577	0.577	0.577	−.01 (.06) **−.01**	−.15 (.13) **−.11**
N + A+C−	45	−35	0.577	0.577	−0.577	.05 (.06) **.07**	.11 (.13) **.09**
N + A−C +	135	35	0.577	−0.577	0.577	.14* (.06) **.22**	.10 (.12) **.08**
N + A−C−	135	−35	0.577	−0.577	−0.577	.21** (.06) **.31**	.31** (.12) **.24**

Note. N = neuroticism; A = agreeableness; C = conscientiousness; VVG = violent video games. Bolded values represent the semipartial *r* (effect size) associated with a given main effect or interaction effect. *n* = 118.
* *p* < .05. ** *p* < .01.

A_{Weight} is the characteristic's weighted relation to Agreeableness

For example, the characteristic represented by high neuroticism, high agreeableness, and low conscientiousness would have a longitude location of 45° (45 = arctangent [.577/.577]). In a similar manner, a characteristic's latitude location can be calculated along the dimension of conscientiousness (see Figure 3; Markey & Markey, 2006):

$$\Phi = arctangent \; (C_{Weight}/[(N_{Weight}^2 + A_{Weight}^2)^{1/2}])$$

Where:

Φ is the latitudinal angle of a characteristic

C_{Weight} is the characteristic's weighted relation to conscientiousness

N_{Weight} is the characteristic's weighted relation to neuroticism

W_{Weight} is the characteristic's weighted relation to agreeableness

Therefore a latitudinal angle can range between 90° (high conscientiousness) and −90° (low conscientiousness), with 0°

indicting no relationship to conscientiousness. The characteristic represented by high neuroticism, high agreeableness, and low conscientiousness would have a latitude location of −35° (−35 = arctangent [−.577/{.577² + .577²}^{1/2}]). Table 1 also displays the theoretical longitude and latitude location of each characteristic.

Because past research suggests that neuroticism, agreeableness, and conscientiousness might moderate the negative effects of VVGs, it is possible to use the spherical model to predict the "type" of person who would be most adversely affected by VVGs. Specifically, a person who was high on neuroticism, low on agreeableness and low on conscientiousness would be located at Λ = 135 and Φ = −35 on the sphere. As seen in Figure 2, this location also falls directly between the three locations on the circumplex models presented in Figure 1 predicting who would be most affected by VVGs (temperamental, undistinguished, and undercontrolled). It would also be expected that the more distal a person falls from this location the less he or she would be adversely affected by VVGs. In fact, a person who is located opposite this point on the sphere, at Λ = 315 and Φ = 35, would likely be the least affected by VVGs. As seen on the sphere, this location falls directly between the three locations on the circumplex models that predict who would be least adversely affected by VVGs (easy going, effective altruists, and directed).
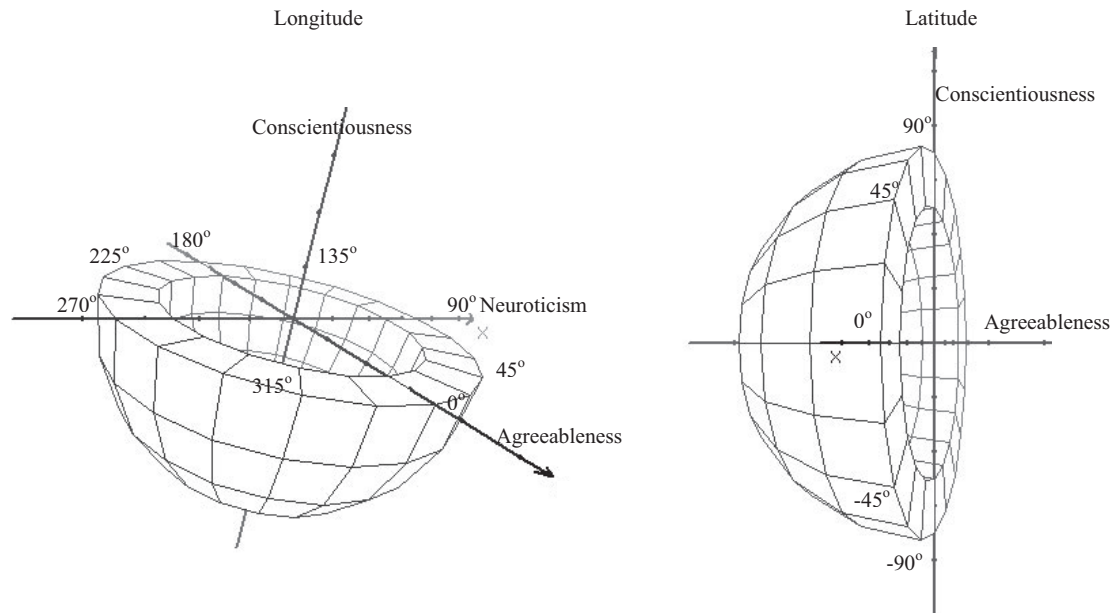
Figure 3. Longitude and latitude locations on the spherical model.

An Example: Using a Spherical Model to Predict the Effects of VVGs

As discussed earlier, two potential explanations can account for past research linking psychoticism and trait aggressiveness to negative outcomes after playing VVGs.

> Explanation 1: The FFM trait agreeableness moderates the negative effects of VVGs.

> Explanation 2: The FFM traits neuroticism, agreeableness, and conscientiousness merge in an additive manner with the resulting combination being more powerful than any individual FFM trait.

The application of the spherical model to the effects of VVGs serves to complement previous research examining psychoticism and trait aggression by suggesting *why* these traits are important moderators. For example, Explanation 1 suggests that psychoticism and trait aggression moderate the negative effects of VVGs simply because they both contain elements of low agreeableness. Explanation 2 implies that psychoticism and trait aggression moderate the effects of VVGs because they both contain elements of low agreeableness *and* they contain high neuroticism (aggressiveness) or low conscientiousness (psychoticism). Therefore, the results from the present report will not only allow for better identification of who is likely to be most adversely affected by VVGs, it will also help integrate previous research linking psychoticism and trait aggressiveness to negative outcomes after playing VVGs.

Archival data were analyzed using the statistical program SPSS 17 to gain insight into which of these two explanations is most valid. Previous research by the first author assessed 118 participants' neuroticism, agreeableness, and conscientiousness using the Big Five Inventory[1] (BFI; John, Donahue, & Kentle,

1991) before playing a VVG (Manhunt 2) or a non-VVG (Tiger Woods Golf). After playing a given video game, participants' hostility was assessed using the State Hostility Scale (SHS; Anderson, Deuser, & DeNeve, 1995). Specifics of this study are presented in Markey & Scherer, 2009; the findings concerning the FMM have not been discussed previously. Table 2 displays the results from the regression analyses in which the centered traits of neuroticism, agreeableness, and conscientiousness, and VVG condition (dummy coded 0 = non-VVG, 1 = VVG) were used to predict hostility.[2] As indicated by the main effects presented in Step 1, neuroticism was positively and agreeableness was negatively related to hostility (i.e., participants high in neuroticism and low in agreeableness tended to be hostile regardless of the VVG condition) and VVGs slightly increased individuals' hostility. In contrast to the first explanation, suggesting only agreeableness would moderate the negative effects of VVGs, these analyses indicate that none of the traits significantly moderated the effect of VVGs. A researcher not considering the importance of the combination of these traits might also incorrectly conclude that the second explanation was also not supported and that none of these

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[1] To utilize the geometric formulas the traits of neuroticism, agreeableness, and conscientiousness were forced to be orthogonal. This was done by submitting these three traits to a principal components analysis and extracting three components with a Varimax rotation. The resulting component scores have the advantage of being highly correlated with their original scales (all *r*s >.90) while being orthogonal.

[2] To be certain that any potential moderating effects were not caused by possible sex differences on a trait, regression analyses were conducted to control for the main effect of sex as well as its interactions with video game condition and a given trait. Results indicated that none of the sex interaction terms were significant and, more importantly, none of the results significantly changed.

Table 2
Multiple Regression Analysis Predicting Hostility

	B	SE B	β	Semipartial r
Step 1				
Violent video game				
(VVG)	.24	.12	.18*	.18
Neuroticism (N)	.17	.06	.26**	.26
Agreeableness (A)	−.14	.06	−.21*	−.21
Conscientiousness (C)	−.05	.06	−.08	−.08
Step 2				
VVG × N	.17	.12	.18	.12
VVG × A	−.17	.12	−.19	−.12
VVG × C	−.19	.12	−.21	−.14

Note. n = 118.
* p < .05.   ** p < .01.

traits are important moderators of VVGs. However, whenever three orthogonal traits (e.g., neuroticism, agreeableness, and conscientiousness) are all important predictors of an outcome (e.g., hostility) the total possible size of their separate effects is severely limited (Cohen & Cohen, 1983; Markey & Markey, 2006). Closer inspection of the interaction effects' signs are suggestive of results occurring in the predicted direction of the second explanation. Specifically, the negative interaction effect of agreeableness and conscientiousness and the positive interaction effect of neuroticism suggest that individuals low in agreeableness and conscientiousness and high in neuroticism were adversely affected by VVGs.

Rather than being limited by the size of the effects three orthogonal traits can produce, a more direct means of examining what occurs when three traits combine together within an individual would be to compute characteristic scores for each of the 26 sphere characteristics presented in Figure 2 and Table 1 for each participant. This is easily accomplished using a participant's neuroticism, agreeableness, and conscientiousness scores and the weighted relations presented in Table 1 and applying them to the formula (Markey & Markey, 2006):

$$\text{Characteristic Score}_j = \sum Z_i W_j$$

Where:

Z_i is the individual's standardized neuroticism, agreeableness, or conscientiousness score

W_j is the weighted relation of jth characteristic to neuroticism, agreeableness, and conscientiousness.

As seen in the above formula, characteristic scores are essentially computed using a simple standardized regression equation. In this manner, each person receives 26 different characteristic scores representing slightly different combinations of the three FFM traits. To examine the potential interaction of these characteristics with VVGs, 26 separate regression analyses were conducted predicting hostility. In each analysis, a given characteristic and VVG condition were entered in the first step and the interaction term between these variables was entered in the second step. The results from these analyses are presented in Table 1. The column labeled "main effect of characteristic" displays the relation between a given characteristic and hostility. More central to the focus of this manuscript are the coefficients displayed in the column labeled "Characteristic × VVG," which lists the interaction effect for a given characteristic. A positive value indicates that people high on a given characteristic were more adversely affected by VVGs than other individuals whereas a negative value indicates that people low on a given characteristic were less adversely affected by VVGs than others. Figure 4 presents a graphical display of these effects by presenting the different interaction effects for different combinations of neuroticism and agreeableness at different levels of conscientiousness. As predicted by the second explanation, Figure 4 and Table 1 show that the individuals most adversely affected by VVGs tended to be high on neuroticism and low on agreeableness and conscientiousness (i.e., $\Lambda = 135$ and $\Phi = -35$). As expected, the effects of the interaction tended to get smaller the more distal to this location, with the people least adversely affected by VVGs being low on neuroticism and high on agreeableness and conscientiousness (i.e., $\Lambda = 315$ and $\Phi = 35$).

The findings from these analyses strongly suggest the importance of considering the cumulative effect of multiple traits within an individual. When the FFM dimensions of neuroticism, agreeableness, and conscientiousness were used to predict hostility, all of the interaction effects were null. However, when these dimensions are combined to measure a single characteristic representing high neuroticism, low agreeableness, and low conscientiousness, significant results emerged from the *exact same data set.* It seems likely that a researcher examining these traits in a one-dimensional manner would fail to realize that these traits are significant moderators of VVGs when they are considered simultaneously. It is important to note that the methodology of combining together three dimensions is both computationally and conceptually different than examining the interaction between the three traits. Such an interaction term would be computed by multiplying the three traits together whereas in the current analyses the combination of the traits was computed by averaging together the FFM traits with various weights.[3] Conceptually a three-way interaction would ex-

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[3] In the current data set the additive method used to combine the three traits together was not strongly related to the nonadditive method of multiplying the three traits together (r = .14) further suggesting the difference between these two methodologies.
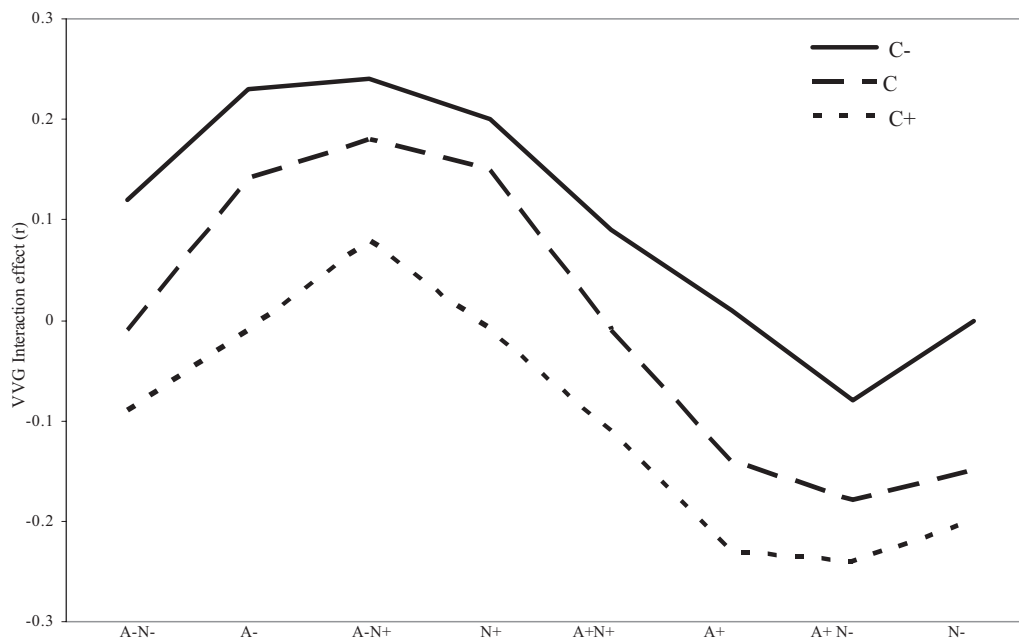
Figure 4. The semi partial correlations indicating how strongly each of the 26 personality characteristics moderated the negative effects of VVGs. Results are presented for the various combinations of neuroticism and agreeableness at different levels of conscientiousness. Note: N = neuroticism; A = agreeableness; C = conscientiousness.

amine whether a two-way interaction (e.g., neuroticism × agreeableness) changed depending on the level of a third variable (e.g., conscientiousness); whereas the methodology employed above allows for different levels of the three traits to be examined when combined together in an additive manner.

Conclusion

Video games are rapidly becoming one of the most popular forms of media consumed by children, adolescents, and adults (Gentile & Anderson, 2003; Olson, 2010). This popularity of video games, combined with the fact that more than half of the games on the market today contain some form of violence (Gentile & Anderson, 2003), has caused many to express concern about the potential negative effects of VVGs. Previous research examining the effects of VVGs suggests that VVGs are linked to various negative behaviors and cognitions such as hostility and aggressive thoughts (e.g., Anderson, 2004; Bushman & Anderson, 2002; Gentile et al., 2004; Sheese & Graziano, 2005). However, more recent research (e.g., Arriage et al., 2006; Giumetti & Markey, 2007; Markey & Sherer, 2009; Panee & Ballard, 2002; Ravaja et al., 2008) suggests that the notion that all, or even most, individuals who play VVGs will inevitably become aggressive may be unwarranted. Instead, it appears that it is crucial to consider various personality traits of the person playing the VVG when predicting whether or not the VVG will have adverse effects.

By using the FFM as a taxonomy, the current report was able to assimilate the findings of past studies, which examined the moderating effects of psychoticism and trait aggressiveness. This integration of past research using the structure provided by the FFM allowed for

a reconceptualization of the traits most salient in VVG research and provided insight into why these traits moderate the negative effects of VVGs. A spherical model of personality was then created to visually demonstrate the resulting personality characteristics associated with different combinations of neuroticism, agreeableness, and conscientiousness. Archival data were then analyzed and confirmed the notion that individuals who were most adversely affected by VVGs tended to be high on neuroticism and low on agreeableness and conscientiousness (i.e., $\Lambda = 135$ and $\Phi = -35$ on the sphere). Additionally, the more distal an individual's personality characteristic on the sphere was from this location, the greater the tendency for VVGs to have less adverse effects. It is important to note that the games used in this study (Manhunt 2 vs. Tiger Woods Golf) likely differ from each other in ways other than their level of violence. However, it seems unlikely that a variable other than violence might account for the moderating effect of personality occurring in the exact manner predicted by previous research, which examined the effects of violence.

The multidimensional view of personality presented in this manuscript helps integrate previous research examining different personality traits as moderators of the adverse effects of VVGs. This model of personality also recognizes that what truly makes an individual different and unique is not a high or low rating on a single trait, but their unique combination of traits. When each of the FFM traits were examined separately, none significantly moderated the effects of VVGs. However, when these traits were combined together, significant moderating effects emerged. These results suggest that it is the simultaneous combination of FFM traits which yield a more powerful moderator of VVGs than any single FFM trait. It appears that the "perfect storm" of FFM traits

in this context is high neuroticism (e.g., easily upset, angry, depressed, emotional, etc.), low agreeableness (e.g., little concern for others, indifferent to others feelings, cold, etc.) and low conscientiousness (e.g., break rules, don't keep promises, act without thinking, etc.).

It is tempting to directly relate the findings presented here to the anecdotal evidence describing the personality characteristics of perpetrators of school violence (e.g., angry, depressed, unruly, anxious, aggressive, hateful, etc.) who also played VVGs. Many of these personality descriptions would certainly be related to high neuroticism, low agreeableness, or low conscientiousness and would probably be located near $\Lambda = 135$ and $\Phi = -35$ on the sphere. However, it should be noted that past experimental research examining VVGs has tended to assess outcomes that were either proxy measures for real world aggression (e.g., questionnaire assessments of hostility or physical aggression) or mild forms of aggression (e.g., loud "sound blasts" delivered to a hypothetical person) and not anything as severe as murder. A direct translation of these findings to a "profiling" of school shooters needs to be done with great caution.

Although the incidences of violence, particularly school violence, linked to video games are alarming, what should perhaps surprise us more is that there are not *more* VVG-driven violent episodes. Given the number of youths who regularly engage in VVG play and the general concern regarding this media, it would seem likely that resulting violent episodes would be a regular occurrence. And yet, daily reports of mass violence are not reported. It appears that the vast majority of individuals exposed to VVGs do not become violent in the "real world." Thus, the questions for researchers, policymakers, and laypersons become "Why do some individuals appear to be affected by VVGs while others are not?" and "Who is most likely to be affected by VVGs?" These questions are somewhat analogous to the questions a medical doctor would ask in trying to determine why the majority of individuals have no adverse effects when exposed to seemingly benign stimuli (e.g., peanuts) while others may experience life-threatening consequences from even minimal exposure. In the case of VVGs, current research suggests that personality moderates individual proclivity to respond adversely to VVGs. It appears that VVGs only adversely affect some individual and those who are affected have a preexisting disposition (i.e., high neuroticism, low agreeableness, and low conscientiousness) which make them susceptible to such violent media.

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