Computers in Human Behavior 50 (2015) 132–140

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

Research Report

Dimensions of video game behavior and their relationships with personality

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ARTICLE INFO

Article history:
Available online 17 April 2015

Keywords:
Video games
Personality
Psychopathy
Aggression
Massively multiplayer online role-playing games
Online

ABSTRACT

As video games become increasingly popular pastimes, it becomes more important to understand how different individuals behave when they play these games. Previous research has focused mainly on behavior in massively multiplayer online role-playing games; therefore, in the current study we sought to extend on this research by examining the connections between personality traits and behaviors in video games more generally. Two hundred and nineteen university students completed measures of personality traits, psychopathic traits, and a questionnaire regarding frequency of different behaviors during video game play. A principal components analysis of the video game behavior questionnaire revealed four factors: Aggressing, Winning, Creating, and Helping. Each behavior subscale was significantly correlated with at least one personality trait. Men reported significantly more Aggressing, Winning, and Helping behavior than women. Controlling for participant sex, Aggressing was negatively correlated with Honesty–Humility, Helping was positively correlated with Agreeableness, and Creating was negatively correlated with Conscientiousness. Aggressing was also positively correlated with all psychopathic traits, while Winning and Creating were correlated with one psychopathic trait each. Frequency of playing video games online was positively correlated with the Aggressing, Winning, and Helping scales, but not with the Creating scale. The results of the current study provide support for previous research on personality and behavior in massively multiplayer online role-playing games.

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1. Introduction

1.1. Video games

Video games are becoming increasingly popular forms of entertainment. Because these games can now be played on a variety of platforms, ranging from dedicated consoles to hand-held devices and smart phones, more people can play more often than ever before. Formerly, there were few video games from which to choose, and these games were quite simple, allowing for only one action or a limited array of actions (Nielsen, Smith, & Tosca, 2008). Now, players can choose how to play, both by selecting from a wide range of video games and by deciding what to do in many of these games. Given that there are video games currently available to appeal to all different play-styles, it should be no surprise that millions of people report playing video games (Entertainment Software Association, 2014) and that many devote considerable time to playing them (Billieux et al., 2013; Griffiths, Davies, & Chappell, 2004; Williams, Yee, & Caplan, 2008; Yee, 2006a).

Individuals who play video games can choose not only which game to play but also, often, what to do while playing a particular game. While some simple games allow only one action or a limited number of actions, many complex games provide multiple paths, choices, and other options. Just as behavior in the real world is influenced by personality characteristics, so too are behaviors in video games likely to be influenced to some degree by personality. If personality and behavior in video games are related much as they are in the real world, one would expect that extraverted individuals would behave more socially, that agreeable individuals would behave more cooperatively, and that conscientious individuals would behave more diligently (in keeping with some of the defining behaviors of these traits; Lee & Ashton, 2008). On the other hand, it may be that the risk-free environment of video games allows to individuals to break free of normal behavioral constraints, thus allowing introverted individuals to be more social and agreeable individuals to express anger.

The primary goal of the current study, therefore, was to examine how personality characteristics are related to different behaviors in video games. More specifically, we addressed the

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http://dx.doi.org/10.1016/j.chb.2015.03.056
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following research problems. First, we investigated the component structure of a questionnaire measuring different behaviors in video games. Second, we investigated the correlations between these components of in-game behavior and broad personality traits (as measured by the HEXACO model of personality; Ashton & Lee, 2007; Ashton et al., 2004; Lee & Ashton, 2008) as well as the correlations between these components of in-game behavior and psychopathic personality traits. Third, we investigated the correlations between frequency of playing video games online, personality traits, and the components of in-game behaviors.

Many video games present unique environments that allow individuals to behave differently than they would in the real world. In many video games, players can perform actions and experience events that are impossible, illegal, or unlikely in the real world. In addition, players' behaviors in video games are generally free of real-world consequences. Video games that allow the player to control an avatar (i.e., a virtual character representing the player in the game world) to interact with the game also allow individuals to potentially experiment with different identities (Ducheneaut, 2010; Turkle, 1995).

In spite of the differences between video game worlds and the real world, some evidence suggests that individuals' behavior in video games is similar to their real-world behavior (e.g., Eastwick & Gardner, 2009). For example, players of the virtual world *Second Life* report doing many of the same things as they do in the real world (Bayraktar & Amca, 2012). Second Life is an online virtual world in which a variety of activities are available, and Bayraktar and Amca (2012) found that correlations between real-world and in-game behavior were generally positive, ranging from .18 for shopping to .48 for entertaining. One exception was found, however: meeting new people was not significantly related between real-world and game contexts, which may simply reflect the fact that it is easy to encounter new people in virtual worlds and other video games that take place online (Bayraktar & Amca, 2012).

However, because Second Life is an online virtual world, which involves less emphasis on "gaming" than most true video games, it is not clear how this finding might apply to other video games. Further, unlike Second Life, many video games do not allow such direct comparisons between in-game and real-world activities, primarily because many in-game activities have no direct real-world equivalent. An examination of the correlations between personality traits and behaviors in video games is therefore needed, to help determine whether players behave in video games much as they do in real life, or quite differently, as compared to other players.

1.2. Personality and behavior in an online video game

Several studies have examined the connections between personality and behavior in a popular video game, the Massively Multiplayer Online Role-playing Game (MMORPG) *World of Warcraft*. World of Warcraft allows players to create an avatar and use this avatar to perform many different activities in a fantasy-type world (What is World of Warcraft?, n.d.). Because the game is played entirely online, players can interact with other players in a variety of ways. For example, players can cooperate with each other to defeat difficult game-generated opponents in *raids*, or attack and kill each others' avatars in player-versus-player activities like *battlegrounds*. World of Warcraft reported a subscriber-base of over 7 million players in 2014, just prior to its 10th anniversary (Makuch, 2014) and allows a diversity of behaviors that has made it ideal for studies of in-game behavior.

Previous research has shown that personality is related to behavior in World of Warcraft, and that many of the correlations are consistent with real-world personality-behavior relationships (e.g., Worth & Book, 2014). For example, player-versus-player behaviors (activities that involve attacking and killing other players' avatars) have been found to be negatively correlated with Honesty–Humility, Agreeableness, and Conscientiousness, and positively correlated with psychopathic traits (Worth & Book, 2014; Yee, Ducheneaut, Nelson, & Likarish, 2011). In addition, behaviors that require persistence and diligence, like collecting pets and working on in-game professions, are positively correlated with Conscientiousness. Behaviors involving exploration and immersion within the game-world were positively correlated with Openness to Experience. Finally, positive social interactions, specifically helping other players and using friendly interactive emotes like /hug and /wave, were associated with high levels of both Agreeableness and Openness to Experience (Worth & Book, 2014; Yee, Ducheneaut, et al., 2011).

The results of the studies by Worth and Book (2014) and Yee, Ducheneaut, et al. (2011) provide some support for research on personality and motivations for playing World of Warcraft. For example, social motivations for playing World of Warcraft were related to Agreeableness and Extraversion, and immersive motivations were related to Openness to Experience (Graham & Gosling, 2013). Thus, in-game behaviors and motivations for play are related to personality traits in predictable ways.

However, another study did not find support for these results. McCreery, Krach, Schrader, and Boone (2012) examined the connections between (player and avatar) personality traits and pre-defined sets of behaviors in World of Warcraft, and found no significant correlations between player personality and behavior. However, it is possible that this study underestimates the true correlations between personality and behavior, due either to issues with the behavioral sets used (i.e., the behavioral sets created for the study may not have been properly reliable or representative of the personality traits they were designed to reflect), or to a relatively small sample size. Nevertheless, it points to the need for further research on personality-behavior connections in video games.

1.3. Personality and behavior in other video games

The need for further research is also indicated by the fact that World of Warcraft and other MMORPGs are not representative of video games more generally. Many video games are not played online and do not offer the range of choices offered in World of Warcraft. It is therefore not clear if the results of the previous studies of behavior in World of Warcraft will generalize to other video games.

Previous research examining the connections between personality and behavior in video games other than World of Warcraft has been rather limited. In a study of behavior in Second Life, Yee, Harris, Jabon, and Bailenson (2011) found that personality traits were correlated with certain exploration behaviors. For example, Conscientiousness was related to walking more often and visiting more zones (Yee, Harris, et al., 2011). However, it is not clear how these particular correlations should be interpreted in terms of correspondence with real-world personality-behavior correlations, or whether these results are likely to be replicated in other video games.

However, some research has suggested that personality and behavior in video games might be related in predictable ways. A study focusing on two violent action video games found that individuals with more aggressive personalities engaged in more aggressive acts in the video games than individuals with less aggressive personalities (Peng, Liu, & Mou, 2008). Similarly, those who are low in Agreeableness play violent video games more often (Chory & Goodboy, 2011), and certainly violent video games permit more aggressive behaviors than less violent video games.

Two studies of the connections between personality and motivations for playing online video games also suggest that personality-behavior correlations may be found in games other than World of Warcraft (Jeng & Teng, 2008; Park, Song, & Teng, 2011). For example, Openness to Experience was positively correlated with discovery motivations (Jeng & Teng, 2008), and Agreeableness was positively related to relationship motivations (Park et al., 2011). Thus, personality may influence what people prefer to do in video games other than World of Warcraft.

1.4. The current study

The current study extends upon the previous research discussed in Sections 1.2 and 1.3 by examining the connections between personality and in-game behavior in video games more generally. For the purposes of the current study, we developed a self-report scale of behaviors that are relevant to many different video games. We therefore proposed the following research question:

RQ1: What is the component-structure of the General Video Game Behavior Questionnaire?

Previous research examining the connections between personality and behavior in video games has primarily involved the Big Five or Five Factor Model of personality (e.g., McCreery et al., 2012; Yee, Ducheneaut, et al., 2011). However, the HEXACO model of personality has demonstrated excellent utility for explaining the different behaviors of individuals in World of Warcraft (Worth & Book, 2014). The HEXACO model of personality was developed from lexical studies of personality-descriptive terms, which have shown that six factors, rather than five, are needed to best describe the variation in personality (Ashton & Lee, 2007). These six factors are similar across many different languages (Ashton et al., 2004; Lee & Ashton, 2008), and are named Honesty–Humility, Emotionality, eXtraversion, Agreeableness, Conscientiousness, and Openness to Experience (hence the acronym HEXACO).

Although the HEXACO model of personality is similar in some ways to the Five Factor model of personality, particularly with regards to the Extraversion, Conscientiousness, and Openness to Experience factors, there are also some important differences (Ashton & Lee, 2007). The HEXACO Emotionality factor describes differences between those who are tough and insensitive (at the low end) and those who are anxious and sentimental (at the high end), and the Agreeableness factor describes differences between those who are angry and inflexible (at the low end) and patient and tolerant (at the high end). The Honesty–Humility factor describes the differences between those who are manipulative and greedy (at the low end) and sincere and fair (at the high end), and individual differences related to Honesty–Humility are not well-represented in the Five Factor Model (e.g., Ashton, Lee, & de Vries, 2014).

It was not practical to develop specific hypotheses for the current study regarding the connections between HEXACO personality traits and behaviors, both because the component-structure of the General Video Game Behavior Questionnaire was not known and because previous studies of the connections between personality and in-game behavior have found conflicting results (e.g., McCreery et al., 2012; Worth & Book, 2014). Accordingly, we proposed instead the following research question:

RQ2: What are the correlations between HEXACO personality traits and dimensions of in-game behavior in video games generally?

In addition to the HEXACO model of personality, the current study included a measure of psychopathic traits. Individuals with high levels of psychopathic traits are callous, manipulative, and impulsive, and they tend to engage in antisocial and criminal behaviors (Hare, 2003; Hare & Neumann, 2008). It is particularly important, therefore, to understand how individuals with high levels of these traits behave in video games, as their behavior may be particularly aggressive and potentially detrimental to other players. We therefore investigated the following research question:

RQ3: What are the correlations between psychopathic traits and dimensions of in-game behavior in video games generally?

Because most previous research has focused on online video games like World of Warcraft, the current study also included a variable measuring frequency of playing video games online. Online video games offer the additional element of player-to-player contact, and it has been suggested that they may, therefore, appeal more to certain individuals than to others (Axelsson & Regan, 2006). Online video games may involve or elicit different behaviors than stand-alone (offline) video games. For example, player-versus-player behaviors are only possible in online video games, and this kind of behavior may be particularly appealing to certain individuals (e.g., Worth & Book, 2014). Therefore, we proposed a fourth research question:

RQ4: What are the correlations between frequency of playing video games online, video game behaviors, and personality traits?

2. Methods

2.1. Participants

The participants for the current study were 220 university students, of which one participant was excluded because she had no score on the General Video Game Behavior Questionnaire. Of the 219 participants included in the analyses, 154 (70.3%) were female. Participants ranged in age from 18 to 32, with a mean age of 20.06 (SD = 2.45; five participants did not report their age). The majority of participants (142; 66.36%) were under the age of 21. The sample was mainly white (169; 77.17%), with 15 (6.85%) reporting South Asian ethnicity, and the remainder (35; 15.98%) reporting other ethnicities.

Frequency of playing video games among participants in the current sample ranged from less than once a month to seven days a week. On average, participants played between once a month and once a week (M = 1.68, SD = 1.99; where 0 = "less than once a month", 1 = between once a month and once a week", and 2 = "about 2 days a week"), with 74 (33.79%) participants reporting that they played less than once a month. Average gaming sessions lasted about 1–2 h (M = 1.63, SD = 1.04; $Mode$ = 2; where 1 = "30 min to 1 h" and 2 = "1–2 h").

2.2. Measures

2.2.1. HEXACO-60 (Ashton & Lee, 2009)

The HEXACO-60 (Ashton & Lee, 2009) contains 10 items for each of the 6 HEXACO factors. Items are rated on a scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Internal consistency reliabilities are generally good; Lee and Ashton (n.d.) report the following values in a college student sample (n = 1126): Honesty–Humility, .76; Emotionality, .80; Extraversion, .80; Agreeableness, .77; Conscientiousness, .76; Openness to Experience, .78. The HEXACO-60 has demonstrated descriptive statistics similar to the longer versions of the scale (i.e., HEXACO-PI-R; Lee & Ashton, 2004; Lee & Ashton, 2006), as well as high levels of self-observer

agreement and appropriate correlations between the HEXACO factors and the factors of the Five Factor model (Ashton & Lee, 2009).

2.2.2. Self-Report Psychopathy Scale – III (SRP-III; Paulhus, Neumann, & Hare, in press)

The Self-Report Psychopathy Scale – III (Paulhus et al., in press) contains 16 items for each of four factors: Interpersonal Manipulation, Callous Affect, Erratic Lifestyle, and Criminal Tendencies. The scale was designed to reflect the 4-factor structure of the Psychopathy Checklist – Revised (Hare, 2003; Williams, Paulhus, & Hare, 2007). Items are rated on a scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Neal and Sellbom (2012) report internal consistency reliabilities as follows: total score, .92; Interpersonal Manipulation, .82; Callous Affect, .78; Erratic Lifestyle, .79; Criminal Tendencies, .75. The full scale and the four individual factors are appropriately correlated with other measures of psychopathy, indicating good convergent validity (Neal & Sellbom, 2012). This scale is also related to relevant external criteria, including criminal behaviors and various forms of aggression (Neal & Sellbom, 2012).

2.2.3. General video game behavior questionnaire

This questionnaire was created for the purposes of the current study (please see Appendix A). The questionnaire includes 34 items that were written so as to reflect many of the various activities that are common in video games. Items were generated so as to reflect a wide range of possible activities in many different video games, and each item was intended to be sufficiently general so as to be relevant to many different video games. Items included in the questionnaire were partly influenced by the kinds of activities that Bartle (1996) suggested would be preferred by different "types" of players (*Explorers*, *Achievers*, *Killers,* and *Socializers*). Inclusion of items in the questionnaire was also partly influenced by previously identified motivations for play in online video games (e.g., Yee, 2006b) and dimensions of behavior identified in a study of World of Warcraft (Worth & Book, 2014). Participants were asked to respond to the question "In the video games that you play, how often do you…" using a scale ranging from *Never* (coded 1) to *Almost all of the time* (coded 7). Participants were also given the option to answer N/A (Not Applicable) if the behavior was impossible to do in any of the games that they had played; this response was also coded 1.[1]

2.2.4. Additional variables

Frequency of online play was measured with the item: "How often do you play video games with or against other players online?" The response scale ranged from 1 (*Never*) to 7 (*Almost all of the time*). Participants were also asked to write-in the name of their favorite video game with the following item: "What is your favorite video game?"

2.3. Procedure

Participants were recruited through a posting on the Brock University psychology department participant recruitment site. In order to be eligible for the study, participants were required to have played at least one video game and to be at least 16 years of age. A link to the study webpage was provided in the study posting; individuals who were interested in participating could click the link to enter the study website, where they viewed a consent and information form that explained the purpose and nature of the study. Participants who chose to participate clicked on a link at the bottom of the consent form in order to indicate agreement to participate in the study and to start the study. Participants then completed a demographic information page, several items regarding their experience with video games (including frequency of playing video games in the past six months, length of typical video game playing session, favorite video game, and frequency of playing video games online), the General Video Game Behavior Questionnaire, the HEXACO-60 and the SRP-III. All participants completed the questionnaires in the same order.

3. Results

3.1. Principal components analysis of the video game behavior Questionnaire

First, we conducted an initial principal components analysis of the General Video Game Behavior Questionnaire, extracting all components with eigenvalues greater than one. Next, a parallel analysis (with $n = 219$ and 34 variables) was performed in order to determine the appropriate number of components to extract. The first 4 eigenvalues from the actual data exceeded the 95th percentile eigenvalues from the parallel analysis, suggesting that 4 components should be retained.

Next, we conducted a principal components analysis with promax rotation, extracting four components. Items loading above .40 on a component were retained. Table 1 shows the proposed component names and item lists for each of the four components. The first component was named *Aggressing*, as top-loading items referred to activities involving aggressive actions. The second component was named *Winning*, as the items referred to efforts to succeed at the game or to beat an opponent. The third component was named *Creating*, as the top-loading items referred to activities involving building or creating things. The fourth component was named *Helping*, as the items referred to activities involving assisting others with aspects of the games.

Only one item had a secondary loading greater than .40. Item 32 – "Talk to or communicate with other players in the game" – loaded at .495 on Aggression and .454 on Helping. Two additional items had secondary loadings greater than .35. Item 7 – "Work on acquiring new, better, or more items" – loaded at .429 on Aggressing and .399 on Creating; item 14 – " Try to prevent an opponent (player or game character) from winning or completing a task" – loaded at .416 on Winning and at .384 on Aggressing. Six items did not load above .40 on any component and were discarded. These items were "Try to finish the game as quickly as possible" (item 34), "Try to make the game more difficult for an opponent (player or game character)" (item 17), "View the game action from the point of view of one character" (item 12), "Try something that is not usually done" (item 9), "Take on a leadership role" (item 33), and "Try a new character, strategy, direction, course, etc." (item 26).

3.2. Sample characteristics and data management

The Winning behavior scale was significantly negatively skewed ($z_{skew} = -4.74$). To correct for moderate negative skew, we therefore reflected and applied a square-root transformation of the variable, as recommended by Tabachnick and Fidell (2007). The variable was then re-reflected in order to preserve the original orientation of the variable. Following transformation, the Winning scale was no longer significantly skewed ($z_{skew} = -1.77$).

Two outliers were observed on the Criminal Tendencies subscale of the SRP-III ($z = 3.48$ and $z = 4.83$, respectively) and the scale

[1] Instructions at the top of the questionnaire stated: "If an action is impossible to do in any of the games you play, please select N/A (Not Applicable). If an action is possible, but you never do it, please select Never." As both the "Never" response and the "N/A" response indicate a frequency of 0, it was deemed appropriate to give the two responses the same value in the analyses.

Table 1
General video game behavior scale component names and items.

Component name	Item no.	Item list
Aggressing	15.	Use a weapon (e.g., a gun, knife, sword, etc.)?
	28.	Damage, injure, kill, or destroy game characters (controlled by the game)?
	3.	Participate in a fight, battle, or war?
	10.	Damage, injure, kill, or destroy other players (controlled by other people)?
	6.	Destroy objects, buildings, cars, or other inanimate (non-living) things?
	32.	Talk to or communicate with other players in the game?
	7.	Work on acquiring new, better, or more items?
Winning	16.	Work on achieving a high score?
	24.	Try to win (the race/the match/the game/etc.)?
	20.	Try to beat an opponent's (player or game character) score or rank?
	1.	Try to improve your own previous score or record?
	29.	Work on improving your playing skills or technique?
	8.	Try to do better than an opponent (player or game character)?
	31.	Work on advancing to the next level/stage/part of the game?
	22.	Try different strategies for playing the game?
	21.	Work on finishing the game or completing all parts of the game?
	14.	Try to prevent an opponent (player or game character) from winning or completing a task)?
Creating	13.	Build objects, items, or structures?
	2.	Create or design something in the game?
	23.	Create a character to represent you in the game?
	30.	Explore?
	19.	Organize, sort, or categorize objects?
	5.	Select a game character to play as?
Helping	27.	Show or tell another (player or game character) how to do something in the game?
	11.	Give advice to another (player or game character) about the game?
	4.	Help another (player or game character) get better at the game?
	25.	Give items/loot/objects to another (player or game character)?
	18	Work with another (player or game character) on a task?

Note. Items are listed in order of highest to lowest loading within each component. Items 9, 12, 17, 26, 33, and 34 did not load above .40 on any component and were discarded.

was significantly positively skewed ($z_{skew} = 9.05$). Tabachnick and Fidell (2007) advise reducing the scores of outliers to the next highest values on the scale (while maintaining their rank order) in order to reduce the potential influence on the results. However, after modifying scores in this way, the two modified scores were still significant outliers and one additional score also became a significant outlier, for a new total of three outlying values. Therefore, the decision was made to retain the scores in their unmodified state. Many of the behaviors listed in the Criminal Tendencies scale are rare and would not be expected to be normally distributed in the general population; therefore, the scale was not transformed.

One outlier was observed on the Honesty–Humility scale ($z = -3.36$). As this outlier was not far removed from the rest of the data and the variable was normally distributed, no modifications were made.

All other scales were normally distributed and had no outliers. Means, standard deviations, and Cronbach's alpha reliabilities of the primary variables of interest are presented in Table 2. Reliabilities ranged from .72 for the Openness to Experience scale to .94 for the SRP-III total score.

Table 2
Means, standard deviations, and Cronbach's alpha reliabilities for general video game behavior scales, online frequency, and personality scales.

	M	*SD*	Alpha
Aggressing	4.11	1.60	.91
Winning (sqrt)[a]	6.33	0.31	.87
Creating	3.86	1.15	.74
Helping	3.63	1.26	.83
Online frequency[b]	2.92	2.08	—
Honesty–Humility	3.23	.63	.77
Emotionality	3.24	.66	.78
Extraversion	3.47	.56	.76
Agreeableness	3.09	.59	.78
Conscientiousness	3.48	.59	.78
Openness to Experience	3.31	.61	.72
IPM	2.54	.58	.84
CA	2.34	.54	.81
ELS	2.76	.60	.83
CT	1.55	.51	.83
SRP total	2.30	.46	.94

Note: IPM: Interpersonal Manipulation, CA: Callous Affect, ELS: Erratic Lifestyle, CT: Criminal Tendencies, SRP Total: Self-Report Psychopathy Total Score.
[a] Scores on the Winning scale were reflected, transformed by square root to correct for negative skew, and re-reflected to preserve the original orientation of the variable.
[b] Online frequency was measured with a single item.

3.3. Correlational analyses

Table 3 shows the correlations between the four video game behavior scales, the personality scales, and frequency of playing online. The video game behavior scales were all moderately interrelated. The Aggressing and Helping scales were most strongly correlated, indicating that those who frequently fight and kill in video games also tend to help others within the games. Each behavior scale was significantly correlated with at least one HEXACO trait, although correlations were small. Only the Aggressing and Winning scales were significantly correlated with psychopathy (SRP-III) total scores; the Aggressing scale in particular was significantly positively correlated with all four of the SRP-III factors and also with the total SRP-III score.

We observed that participant sex was significantly correlated with the Aggressing, Winning, and Helping scales, but not with the Creating scale. The correlations indicated that men were engaging in all of these behaviors more frequently than women. In order to determine how this difference might affect the correlations between personality and behavior, we ran a series of partial correlations, controlling for sex. For the HEXACO traits, three correlations reached significance after controlling for participant sex. Honesty–Humility was negatively correlated with Aggressing, $r = -.134$, $p = .048$, Conscientiousness was negatively correlated with Creating, $r = -.144$, $p = .033$, and Agreeableness was positively correlated with Helping, $r = .163$, $p = .016$.

For psychopathic traits, six of the nine correlations reached significance. After controlling for participant sex, Aggressing was positively correlated with total SRP scores ($r = .217$, $p = .001$), Interpersonal Manipulation ($r = .157$, $p = .021$), Callous Affect ($r = .212$, $p = .002$), Erratic Lifestyle ($r = .182$, $p = .007$), and Criminal Tendencies ($r = .174$, $p = .010$). In addition, the Winning scale was positively correlated with Erratic Lifestyle ($r = .169$, $p = .013$) after controlling for participant sex.

Playing online was negatively correlated with Emotionality, suggesting that those who play online most frequently are more insensitive and less anxious than those who play online less frequently. It was also negatively correlated with Honesty–Humility and Conscientiousness, but these correlations did not reach significance after controlling for participant sex. Those who played online more frequently also tended to have higher psychopathy (SRP-III)

Table 3
Zero-order correlations and partial correlations (controlling for participant sex) between Video Game Behavior Scales, HEXACO Personality Scales, and SRP-III Scales.

	Sex[a]	Aggress	Winning	Creating	Helping	Online Freq
Aggress	−.473***					
Winning	−.346***	.514*** (.424***)				
Creating	.016	.330*** (.383***)	.276*** (.300***)			
Helping	−.196**	.522*** (.497***)	.390*** (.350***)	.478*** (.490***)		
Online Freq	−.472***	.565*** (.440***)	.390*** (.274***)	.087 (.107)	.339*** (.285***)	
H	.109	−.169* (−.134*)	−.112 (−.079)	−.050 (−.052)	.045 (.068)	−.147* (−.109)
E	.478***	−.299*** (−.095)	−.189** (−.029)	.057 (.057)	−.097 (−.004)	−.349*** (−.160*)
X	.066	.008 (.044)	−.019 (.004)	−0.21 (−.022)	.047 (.061)	−.024 (.008)
A	−.167*	.067 (−.014)	.072 (.016)	−.003 (.000)	.190* (.163*)	.108 (.033)
C	.201**	−.172* (−.089)	−.017 (.057)	−.138* (−.144*)	−.079 (−.041)	−.174* (−.092)
O	−.098	.059 (.015)	−.022 (−.060)	.107 (.109)	.043 (.024)	.013 (−.038)
IPM	−.190**	.225** (.157*)	.131 (.071)	.133* (.139*)	.044 (.007)	.156* (.077)
CA	−.435***	.373*** (.212**)	.198** (.056)	−.025 (−.021)	.043 (−.048)	.390*** (.232**)
ELS	−.261***	.278*** (.182**)	.243** (.169*)	.106 (.114)	.061 (.011)	.275*** (.178**)
CT	−.049	.176** (.174*)	.076 (.063)	.032 (.033)	.012 (.003)	.180** (.179**)
SRP	−.283***	.317*** (.217**)	.198* (.111)	.078 (.086)	.050 (−.006)	.300*** (.197**)

Note: Partial correlations controlling for participant sex are presented in parentheses below the zero-order correlations. Aggress: Aggressing; Online Freq: Frequency of online video game play; H: Honesty–Humility, E: Emotionality, X: Extraversion, A: Agreeableness, C: Conscientiousness, O: Openness to Experience, IPM: Interpersonal Manipulation, CA: Callous Affect, ELS: Erratic Lifestyle, CT: Criminal Tendencies, SRP: Self-Report Psychopathy Total Score.

[a] Participant Sex was coded as 1 = Male, 2 = Female.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

scores; the largest correlation was with the Callous Affect scale. Playing online was strongly positively correlated with the Aggressing scale, and was also positively correlated with Winning and Helping, but was not significantly correlated with Creating.

In order to better understand the behavior of those who are frequently playing online, we examined the favorite video games of those who played frequently and infrequently online. Fifty-two participants (32 men; 61.54%) rated their frequency of playing online as 5 (*Often*) or higher. Among these participants, the most frequently mentioned favorite video game was *Call of Duty* (any version; $n = 13$), a violent first-person shooter game that can be played in either single-player or multi-player modes. The next most frequently mentioned video games were *Diablo* (a violent role-playing game; $n = 4$) and *Halo* (a violent first-person shooter; $n = 4$) and *NHL 2K11* (a sports game; $n = 4$). In comparison, 136 participants (22 men; 16.18%) listed their frequency of playing online as 3 (*Rarely*) or lower. The most frequently listed video game among this portion of the sample was *Mario Kart* ($n = 20$) followed by *Super Mario Brothers* (any version; $n = 15$). The former is a cartoon-style racing game and the latter is a cartoon-style platform game (in which players direct a character to run and jump from platform to platform while collecting items and avoiding enemies). Thus, there seems to be a general tendency for those who play online more frequently to enjoy violent video games as compared to those who play online less frequently.

4. Discussion

The current study examined the connections between personality traits and behaviors that take place in a variety of video games. The four dimensions of video game behavior were significantly related to both HEXACO personality traits and to psychopathic characteristics. Further analyses indicated that some of the relationships between personality and behavior were partly explained by sex differences. Nonetheless, several correlations remained after controlling for participant sex, indicating that personality is a factor in predicting behavior in video games.

4.1. Aggressing

The Aggressing scale contains seven items, five of which describe aggressive in-game behaviors, one that refers to acquiring items, and one that refers to talking to other players in video games. Given that communication is often prosocial, it is interesting that the item describing player-to-player communication loads positively on the scale with aggressive behaviors. This fact might be explained by the strong positive correlation between the Aggressing scale and online frequency. Many online video games allow players to speak to other players, and many video games that involve frequent aggressive actions are also often played online. Perhaps unsurprisingly, the most frequently mentioned favorite video game among those who often played online was a violent game, Call of Duty. Several recent versions of this video game have multiplayer modes that allow players to play competitively or cooperatively with each other and to communicate with each other online (Watters, 2011).

The Aggressing scale was significantly positively correlated with all of the psychopathic traits, four of which remained significant after controlling for participant sex. The correlation between the Aggressing scale and Honesty–Humility also remained significant after controlling for participant sex, whereas the correlations with Emotionality and Conscientiousness no longer reached significance.

The negative correlation between Aggressing and Honesty–Humility and positive correlations between Aggressing and psychopathic traits suggest that those who engage in more aggressive behaviors in video games tend to display dishonest, manipulative, callous, and irresponsible tendencies in other contexts, as well. It is, perhaps, not surprising to find that individuals who tend to callously take advantage of others more frequently engage in aggressive actions in video games than those who are more honest and sympathetic. This finding provides support for previous research showing that low levels of Honesty–Humility are related to attacking and killing other players in World of Warcraft (Worth & Book, 2014) and also that those with more aggressive personalities commit more aggressive actions in violent video games (Peng et al., 2008).

However, it is important to note that the Aggressing scale was not significantly correlated with Agreeableness, which indicates that aggressive behavior in video games is not necessarily associated with tendencies to be angry, inflexible, and impatient. Instead, it appears that these kinds of aggressive in-game behaviors are mainly associated with low levels of Honesty–Humility and higher levels of psychopathic traits.

4.2. Winning

The Winning scale contains items relating to winning and progressing through video games, perhaps the most obvious goals in

many video games. Although the behaviors in this scale are clearly quite popular among many participants, resulting in a negatively skewed scale, there was still variability in responses. It might seem obvious that all players would try to win while playing a video game, but it is important to note that some video games allow players to focus on other goals or do not have a clear "win" condition (e.g., the virtual-life game *The Sims* and the creative building game *Minecraft*). Even within a particular video game, some players may be more focused on winning or progressing than others. For example, some players in World of Warcraft prefer to spend time exploring the virtual world of the game rather than progressing through game content (Worth & Book, 2014).

The Winning scale, like the Aggressing and Helping scales, was strongly influenced by participant sex. Men, more than women, reported engaging in behavior directed at winning in video games. Although the Winning scale was correlated (at the zero-order level) with Emotionality, Callous Affect, Erratic Lifestyle, and Self-Report Psychopathy total scores, the only correlation that reached significance after controlling for participant sex was with the Erratic Lifestyle factor of psychopathy. It appears that after taking participant sex into account, only psychopathic tendencies to be irresponsible, impulsive, and prone to boredom remain related to win-directed behavior.

4.3. Creating

The Creating scale included items describing activities like building, exploring, categorizing, and choosing a game character. Creating was the only behavior scale that was not significantly correlated with either online play frequency or participant sex. The fact that it was not correlated with online play frequency suggests that these activities are not necessarily incorporated into online video games. In addition, it suggests that men and women engage in these activities at approximately the same frequency, at least in this sample.

The Creating scale was negatively correlated with the Conscientiousness scale and positively correlated with the Interpersonal Manipulation factor. It is not immediately obvious why those who are diligent and organized would be less inclined to create and build in video games, or why those who are manipulative would create more often. Furthermore, although Openness to Experience was positively correlated with exploration and immersion behaviors in World of Warcraft (Worth & Book, 2014), there was no significant correlation between Openness to Experience and Creating in the current study. The absence of a significant relationship with Openness to Experience is rather counterintuitive, as creating and exploring appear to be behaviors well-suited to those who are more inquisitive and creative. Further research will be needed to determine whether these findings can be replicated.

4.4. Helping

The Helping scale contains five items describing cooperating with or assisting others in video games. Helping was modestly positively correlated with Agreeableness, and this correlation remained significant after controlling for participant sex. Those who are kind and patient are, not surprisingly, more likely to help others in video games just as they are likely to do in the real world. This finding provides support for the previous studies of behavior in World of Warcraft, which also found that positive interactions and helping behaviors were related to Agreeableness (Worth & Book, 2014; Yee, Ducheneaut, et al., 2011).

It is interesting to note, however, that the Helping scale was not correlated with any other HEXACO trait or with any of the psychopathic traits. One might expect that a tendency to help others in-game would be associated with higher levels of Extraversion or perhaps lower levels of Callous Affect, as was observed in the study of behavior in World of Warcraft (Worth & Book, 2014). It may be that these personality traits have less influence on the tendency to help in video games generally because some video games encourage helping others as part of a strategy for winning the game. Some video games, including some violent video games, have cooperative missions or modes that encourage players to work together to complete a task. Thus, if helping others is sometimes required by certain video games, player personality will likely play a smaller role in determining who helps and who does not.

4.5. Limitations and conclusions

Although the current study provides some important clues as to the connections between personality and dimensions of behavior in video games generally, certain limitations are worth noting. First, partial correlations controlling for participant sex revealed that differences between men and women accounted for some of the relationships between personality and behavior. Participant sex was significantly correlated with online frequency and all behavior scales except Creating, indicating that men play online more frequently and engage in these in-game behaviors more frequently than women. Male university students tend to play video games more often than female university students (e.g., Terlecki et al., 2011), and this had a significant (and unanticipated) impact on the relationships between personality and in-game behavior in the current study. Differences between men and women have also been found in behavior in Second Life (Guadagno, Muscanell, Okdie, Burk, & Ward, 2011). Thus, one potential limitation of the current study was the relatively small proportion of men in the sample. A study involving a larger sample, and including more men, might be useful for further explicating the links between personality and behavior in video games.

Second, the majority of the participants in the current study played video games relatively infrequently, and this presents an additional possible limitation to the current study. The modal response was "less than once a month" and the mean was between "between once a month and once a week" and "about twice week". The low average frequency of playing video games suggests that very few participants could be considered serious gamers, and many were essentially non-players. When they do play video games, individuals who rarely play may be playing video games chosen by others (e.g., at a party), and while playing they may only be focused on whatever goal is most common or important. Thus, their behavior may be less likely to be influenced by personality traits than might be the case for individuals who play more often. Individuals who play video games a great deal would presumably have more time to select activities that are compatible with their interests, attitudes, and preferences. For example, average playing time for World of Warcraft is generally reported at over 20 h per week (e.g., Billieux et al., 2013; Graham & Gosling, 2013), and behaviors in World of Warcraft were generally more strongly related to personality traits than was the case in the current study (Worth & Book, 2014).

Third, the General Video Game Behavior Questionnaire used in the current study was intended as a very general measure of behaviors that are broadly applicable to a variety of video games. Further research examining behavior in video games might aim to improve the breadth of in-game behaviors covered by this scale.

Nonetheless, the current study provides some important information as to the connections between personality and dimensions of behavior in video games. Several of the observed correlations, particularly those found between Honesty–Humility and Aggressing and between Agreeableness and Helping, could be reasonably understood as compatible with personality trait

definitions. It appears that, rather than prompting players to behave in ways that are truly contrary to their general tendencies, video games seem to provide players with an additional outlet to express certain personality traits. The current study, therefore, suggests that behavior in video games is not quite so different from real-world behavior. In consequence, many interesting avenues of research are possible regarding the correspondence between real and virtual behavior.

Appendix A

A.1. General video game behavior questionnaire

Instructions: The following questions are about some of the different things that people can do in different video games. Please think about what you do in ALL the video game(s) you have played.

If an action is *impossible* to do in any of the games you play, *please select N/A (Not Applicable).* If an action *is possible, but you never do it, please select Never*.

In the video games that you play, how often do you...

[**Response key**: 1 = N/A, 1 = Never, 2 = Almost Never, 3 = Rarely, 4 = Sometimes, 5 = Often, 6 = Very Often, 7 = Almost all of the time]

1. Try to improve your own previous score or record?
2. Create or design something in the game?
3. Participate in a fight, battle, or war?
4. Help another (player or game character) get better at the game?
5. Select a game character to play as?
6. Destroy objects, buildings, cars, or other inanimate (non-living) things?
7. Work on acquiring new, better, or more items?
8. Try to do better than an opponent (player or game character)?
9. Try something that is not usually done?
10. Damage, injure, kill, or destroy other players (controlled by other people)?
11. Give advice to another (player or game character) about the game?
12. View the game action from the point of view of one character?
13. Build objects, items, or structures?
14. Try to prevent an opponent (player or game character) from winning or completing a task?
15. Use a weapon (e.g., a gun, knife, sword, etc.)?
16. Work on achieving a high score?
17. Try to make the game more difficult for an opponent (player or game character)?
18. Work with another (player or game character) on a task?
19. Organize, sort, or categorize objects?
20. Try to beat an opponent's (player or game character's) score or rank?
21. Work on finishing the game or completing all the parts of the game?
22. Try different strategies for playing the game?
23. Create a character to represent you in the game?
24. Try to win (the race/the match/the game/etc.)?
25. Give items/loot/objects to another (player or game character)?
26. Try a new character, strategy, direction, course, etc.?
27. Show or tell another (player or game character) how to do something in the game?
28. Damage, injure, kill, or destroy game characters (controlled by the game)?
29. Work on improving your playing skills or technique?
30. Explore?
31. Work on advancing to the next level/stage/part of the game?
32. Talk to or communicate with other players in the game?
33. Take on a leadership role?
34. Try to finish the game as quickly as possible?

References

Ashton, M. C., & Lee, K. (2007). Empirical, theoretical, and practical advantages of the HEXACO model of personality structure. *Personality and Social Psychology Review, 11*, 150–166. http://dx.doi.org/10.1177/1088868306294907.

Ashton, M. C., & Lee, K. (2009). The HEXACO-60: A short measure of the major dimensions of personality. *Journal of Personality Assessment, 91*, 340–345. http://dx.doi.org/10.1080/00223890902935878.

Ashton, M. C., Lee, K., & de Vries, R. E. (2014). The HEXACO Honesty–Humility, Agreeableness, and Emotionality factors: A review of research and theory. *Personality and Social Psychology Review, 18*, 139–152. http://dx.doi.org/10.1177/1088868314523838.

Ashton, M. C., Lee, K., Perugini, M., Szarota, P., de Vries, R. E., Di Blas, L., et al. (2004). A six-factor structure of personality-descriptive adjectives: Solutions from psycholexical studies in seven languages. *Journal of Personality and Social Psychology, 86*, 356–366. http://dx.doi.org/10.1037/0022-3514.86.2.356.

Axelsson, A.-S., & Regan, T. (2006). Playing online. In P. Vorderer & B. Jennings (Eds.), *Playing video games: Motives, responses, and consequences* (pp. 291–306). Mahwah, N.J.: Lawrence Erlbaum Associates.

Bartle, R. (1996). *Hearts, Clubs, Diamonds, Spades: Players who suit MUDs*. Retrieved from http://www.mud.co.uk/richard/hcds.htm.

Bayraktar, F., & Amca, H. (2012). Interrelations between virtual-world and real-world activities: Comparisons of genders, age groups, and pathological and nonpathological internet users. *Cyberpsychology, Behavior, and Social Networking, 15*, 263–269. http://dx.doi.org/10.1089/cyber.2011.0337.

Billieux, J., Van der Linden, M., Achab, S., Khazaal, Y., Paraskevopoulos, L., Zullino, D., et al. (2013). Why do you play World of Warcraft? An in-depth exploration of self-reported motivations to play online and in-game behaviors in the virtual world of Azeroth. *Computers in Human Behavior, 29*, 103–109. http://dx.doi.org/10.1016/j.chb.2012.07.021.

Chory, R. M., & Goodboy, A. K. (2011). Is basic personality related to violent and non-violent video game play and preferences. *Cyberpsychology, Behavior, and Social Networking, 14*, 191–198. http://dx.doi.org/10.1089/cyber.2010.0076.

Ducheneaut, N. (2010). Massively multiplayer online games as living laboratories: Opportunities and pitfalls. In W. S. Bainbridge (Ed.), *Online Worlds: Convergence of the Real and the Virtual Human–Computer Interaction Series* (pp. 135–145). London: Springer-Verlag. http://dx.doi.org/10.1007/978-1-84882-825-4_11.

Eastwick, P. W., & Gardner, W. L. (2009). Is it a game? Evidence for social influence in the virtual world. *Social Influence, 4*, 18–32. http://dx.doi.org/10.1080/15534510802254087.

Entertainment Software Association (2014). *Essential facts about the computer and video game industry: 2014 Sales, demographic, and usage data*. [PDF]. Retrieved from: http://www.theesa.com/about-esa/industry-facts/.

Graham, L. T., & Gosling, S. D. (2013). Personality profiles associated with different motivations for playing World of Warcraft. *Cyberpsychology, Behavior, and Social Networking, 16*, 189–193. http://dx.doi.org/10.1089/cyber.2012.0090.

Griffiths, M. D., Davies, M. N. O., & Chappell, D. (2004). Demographic factors and playing variables in online computer gaming. *CyberPsychology and Behavior, 7*, 479–487. http://dx.doi.org/10.1089/1094931041774631.

Guadagno, R. E., Muscanell, N. L., Okdie, B. M., Burk, N. M., & Ward, T. B. (2011). Even in virtual environments women shop and men build: A social role perspective on Second Life. *Computers in Human Behavior, 27*, 304–308. http://dx.doi.org/10.1016/j.chb.2010.08.008.

Hare, R. D. (2003). *The hare psychopathy checklist – revised* (2nd ed.). Toronto, ON, Canada: Multi-Health Systems.

Hare, R. D., & Neumann, C. S. (2008). Psychopathy as a clinical and empirical construct. *Annual Review of Clinical Psychology, 4*, 217–246. http://dx.doi.org/10.1146/annurev.clinpsy.3.022806.091452.

Jeng, S.-P., & Teng, C.-I. (2008). Personality and motivations for playing online games. *Social Behavior and Personality, 36*, 1053–1060. http://dx.doi.org/10.2224/sbp.2008.36.8.1053.

Lee, K., & Ashton, M.C. (n.d.) *Descriptive statistics and internal consistency reliabilities of the HEXACO-60 scales in a college student sample* [PDF]. Retrieved from http://hexaco.org/downloading.html.

Lee, K., & Ashton, M. C. (2004). Psychometric properties of the HEXACO personality inventory. *Multivariate Behavioral Research, 39*, 329–358. http://dx.doi.org/10.1207/s15327906mbr3902_8.

Lee, K., & Ashton, M. C. (2006). Further assessment of the HEXACO personality inventory: Two new facet scales and an observer report form. *Psychological Assessment, 18*, 182–191. http://dx.doi.org/10.1037/1040-3590.18.2.182.

Lee, K., & Ashton, M. C. (2008). The HEXACO personality factors in the indigenous personality lexicons of English and 11 other languages. *Journal of Personality, 76*, 1001–1053. http://dx.doi.org/10.1111/j.1467-6494.2008.00512.x.

Makuch, E. (2014, October 15). *World of Warcraft gains 600,000 subscribers since June: MMO now has 7.4 million subscribers; milestone achieved ahead of the November launch of the Warlords of Draenor expansion*. Retrieved from: http://

www.gamespot.com/articles/world-of-warcraft-gains-600-000-subscribers-since-/1100-6422961/.
McCreery, M. P., Krach, S. K., Schrader, P. G., & Boone, R. (2012). Defining the virtual self: Personality, behavior, and the psychology of embodiment. *Computers in Human Behavior, 28*, 976–983. http://dx.doi.org/10.1016/j.chb.2011.12.019.
Neal, T. M. S., & Sellbom, M. (2012). Examining the factor structure of the Hare Self-Report Psychopathy scale. *Journal of Personality Assessment, 94*, 244–253. http://dx.doi.org/10.1080/00223891.2011.648294.
Nielsen, S. E., Smith, J. H., & Tosca, S. J. (2008). *Understanding video games: An essential introduction*. New York, NY: Routledge.
Park, J., Song, Y., & Teng, C.-I. (2011). Exploring the links between personality traits and motivations to play online games. *Cyberpsychology, Behavior, and Social Networking, 14*, 747–751. http://dx.doi.org/10.1089/cyber.2010.0502.
Paulhus, D.L., Neumann, C.S., & Hare, R.D. (in press). *Manual for the Hare Self-Report Psychopathy (SRP) scale*. Toronto, ON, Canada: Multi-Health Systems.
Peng, W., Liu, M., & Mou, Y. (2008). Do aggressive people play violent computer games in a more aggressive way? Individual difference and idiosyncratic game-playing experience. *CyberPsychology and Behavior, 11*, 157–161. http://dx.doi.org/10.1089/cpb.2007.0026.
Tabachnick, B. G., & Fidell, L. S. (2007). *Using Multivariate Statistics* (5th ed.). Boston, MA: Pearson Education.
Terlecki, M., Brown, J., Harner-Steciw, L., Irvin-Hannum, J., Marchetto-Ryan, N., Ruhl, L., et al. (2011). Sex differences and similarities in video game experience, preferences, and self-efficacy: Implications for the gaming industry. *Current Psychology, 30*, 22–33. http://dx.doi.org/10.1007/s12144-010-9095-5.
Turkle, S. (1995). *Life on the screen: Identity in the age of the internet*. New York: Simon & Schuster.
Watters, C. (2011). *Modern Warfare 3 sticks to its competitive, cooperative, and single-player guns and reminds you why the series is one of the best in the business.* Retrieved from: http://www.gamespot.com/reviews/call-of-duty-modern-warfare-3-review/1900-6344654/ (November 9).
What is World of Warcraft? (n.d.) In *World of Warcraft: Beginner's Guide*. Retrieved from http://us.battle.net/wow/en/game/guide/.
Williams, K. M., Paulhus, D. L., & Hare, R. D. (2007). Capturing the four-factor structure of psychopathy in college students via self-report. *Journal of Personality Assessment, 88*, 205–219. http://dx.doi.org/10.1080/00223890701268074.
Williams, D., Yee, N., & Caplan, S. E. (2008). Who plays, how much, and why? Debunking the stereotypical gamer profile. *Journal of Computer-Mediated Communication, 13*, 993–1018. http://dx.doi.org/10.1111/j.1083-6101.2008.00428.x.
Worth, N. C., & Book, A. S. (2014). Personality and behavior in a massively multiplayer online role-playing game. *Computers in Human Behavior, 38*, 322–330. http://dx.doi.org/10.1016/j.chb.2014.06.009.
Yee, N. (2006a). The demographics, motivations, and derived experiences of users of massively multi-user online graphical environments. *Presence: Teleoperators and Virtual Environments, 15*, 309–329.
Yee, N. (2006b). Motivations for play in online games. *CyberPsychology and Behavior, 9*, 772–775. http://dx.doi.org/10.1089/cpb.2006.9.772.
Yee, N., Ducheneaut, N., Nelson, L., & Likarish, P. (2011). Introverted elves and conscientious gnomes: The expression of personality in World of Warcraft. In *Proceedings of the 2011 SIGCHI conference on human factors in computing systems* (pp. 753–762), doi: <http://dx.doi.org/10.1145/1978942.1979052>.
Yee, N., Harris, H., Jabon, M., & Bailenson, J. N. (2011). The expression of personality in virtual worlds. *Social Psychological and Personality Science, 2*, 5–12. http://dx.doi.org/10.1177/1948550610379056.