AN IMPERFECT SHADOW: PERSONALITY IN THE VIRTUAL WORLD

by

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(Under the Direction of W. Keith Campbell)

ABSTRACT

Does personality in the virtual world converge with personality in the real world? Two exploratory studies address this question ontologically and structurally. In study 1 (N = 185), we view real and virtual as latent constructs, extracting a nomological network from participant evaluations of items as more virtual or more real in both forced-choice and Likert-type paradigms. An exploratory factor analysis of these items reveals 6 easily interpretable categories embedded within the measured construct. Significant correlations are observed between individuals' ratings within these categories and levels of intellect/imagination and agreeableness, as measured by Goldberg's (1993) IPIP-50. Study 2 surveys the mean-level and structural differences between personality contextualized to reflect behavior in the virtual world versus behavior in the real world, finding significant structural differences such that extraversion and openness to experience converge into a single plasticity factor.

INDEX WORDS: Personality, Big Five, Virtuality, Technology

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CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

Introduction

Ideas like "virtual reality," "virtual environments," "virtual avatars," and even "virtual wallet" are all common currency in an increasingly digital society. However, academics have long debated the meaning of the term virtuality and the nature of its relationship to reality (Grimshaw, 2014). While connected technologies have certainly enabled new ways of experiencing and conceptualizing virtuality, the history of the term predates the advent of modern digital technologies by thousands of years. And despite this long history, many questions remain, especially regarding the long-term effects of virtualization on human behavior, culture, perception, and health. The ubiquity of networked digital technologies has only added urgency to our efforts to answer these questions.

For psychologists, the question of behavior in virtual spaces may be split into two distinct, but connected lines of inquiry. The first of these deals with whether or not there is truly any difference between real and virtual spaces as situational contexts in which behavior takes place; if there are differences as we intuit, what are they? The second deals with the broad patterns of behavior individuals actually exhibit in real and virtual spaces – are they the same or different? The first question is largely ontological, while the second is wholly empirical. That is to say, the first question frames the second, and it is the dynamic relationship between context and behavior which will ultimately need to be addressed in order to gain a more comprehensive

understanding of how the virtual world converges with and diverges from the real world, partly as a virtue of its distinctiveness as a behavioral medium.

One way of approaching the question of how individuals do behave in a certain context is to first ask how they do not behave in that context, or how the context itself limits or predictably influences behavior. This is one of the predominating approaches of environmental psychologists, who examine transactions between individuals and their physical settings (see Barker, 1968), as well as of behavioral economists, who explore how people make decisions, especially those involving risk or the allocation of resources like time and money (see Kahneman & Tversky, 1979). In these fields and others, emphasis is put increasingly on the built environment and the numerous ways in which its particular configuration prefigures human behavior.

Just as the design of a material good might suggest how it ought to be used by consumers (e.g., the shape and structure of a chair suggests it should be sat in), the design of the built environment suggests how the individuals in it ought to behave (e.g., the placement of many chairs in rows facing the same direction suggests a singular focus of attention and little interaction). And to the extent that the built environment can enhance the probability of some behaviors and diminish the probably of others, it can also exert influence over one's thoughts, feelings, and emotions. For example, the view through a window in a hospital room can influence patient outlook and recovery outcomes (Ulrich, 1984) and workers are likely to be more productive in well-lit office spaces (Sundstrom, 1986). The implications of the many basic findings to come out of these literatures are clearly vast, especially for societal institutions and infrastructure (for a review, see Gifford, Steg, & Reser, 2011). However, these same basic findings face a major ontological challenge in an age of increasing virtual abundance.

Only relatively recently have researchers begun to consider how our basic understanding of human behavior in the real world maps onto the virtual world. The discussion has been mostly confined to the field of human-computer interaction (HCI) since the early 1980s, following the advent of personal computing in the late 1970s. It was during this time that the broader public gained access to computers, presenting novel problems to be grappled with, dealing especially with nonfunctional aspects of software development and implementation, such as usability. Interactive systems were recognized as key components of the personal computing future, and graphical interfaces in particular were idealized to replace complex system dialogues and commands which required extensive training, experience, and cognitive resources to master (Grudin, 2012; Carroll, 1997).

Early pioneers in HCI were quick to identify direct manipulation in interface design – that is, the sensation of engaging with data directly rather than with a computer intermediary (Schneiderman, 1992) – as a necessity for achieving greater parity between user goals and the behaviors required by the interface to accomplish them (Hutchins, Hollan, & Norman, 1985). A routine example of this is continuous representation: as you drag a folder or other object across the screen with a pointer, the image of that folder or object continues to display "under" the pointer in real-time, as you would expect if you were dragging a physical object across a physical surface. This is the early vocabulary of virtual affordances literature, which focuses on how design implies function; or more specifically, how design bridges user perception to user action (Gaver, 1991). A latent byproduct of this approach is that, because technology development is iterative, the provision of technology affordances is also iterative. Caroll, Kellogg, and Rosson (1991) coined this the "task-artifact cycle" in which technology is created to satisfy user goals by enabling users to complete specific tasks, and user goals are then

modified to reflect the expectations, concepts, and skills developed within the bounds of the technology's present affordances and limitations, thereby shaping the further evolution of those affordances within design and development contexts. In plainer terms, there exists an open feedback loop between technology design and utilization such that an initial need informs an initial design, which informs subsequent uses, which in turn inform new iterations of the technology, and so on and so forth. It is in this way that technology can give rise to new affordances, new needs and gratifications (Sundar & Limperos, 2013), and new behaviors over time.

This large body of HCI literature is now echoed, amplified, and extended in the behavioral sciences. Environmental psychologists such as Stokols and Montero (2002) have suggested the development of an environmental psychology of the internet, focusing on transactions between the "designed environment" and the individual; Thaler and Sunstein (2008) have inspired a new generation of behavioral economists to explore how configurations of digital environments give contour to the choices made by individuals (Weinmann, Schneider, & vom Brocke, 2016); and an army of human development scholars are actively pursuing integrated models of virtual behavior and health.

What is clear from this accumulation of research and its funding is that there is much interest in how technology positively and negatively impacts human health, development, and wellbeing. However, framed so generally around the latent outcomes of such a broadly construed construct as "technology use," these research agendas have remained confined to special topic areas within disciplines. There is a lack of conceptual frameworks upon which these many and varied programs of inquiry might align themselves and, in so doing, greatly enhance the likelihood that significant findings will be translated into improved design, development, and

implementation protocols. Thus, one value of basic research at this juncture is that it can greatly deepen our shared understanding of the relationship between virtual environments and the individuals who inhabit them.

The present research is a preliminary examination of the broad patterns of behavior individuals exhibit in the virtual world and how these compare to those exhibited in everyday contexts. Or, for the sake of simplicity, how does personality in the virtual world vary from personality in everyday contexts in terms of both central tendency and structure?

Everyday Personality and Its Constraints

> "[My body] works in Euclidean space, but it only works there. It sees in a projective space; it touches, caresses, and feels in a topological space; it suffers in another; hears and communicates in a third; and so forth, as far as one wishes to go (Serres, Bell, & Harari, 1982, p. 44)."

Bound for the southern hemisphere aboard the HMS *Beagle* in the early to mid 1830s, Charles Darwin found himself transfixed by Charles Lyell's *Principles of Geology*. In its pages, Lyell argued that what we observe in the natural world – the contour of a coastline, the jaggedness of a mountain, the extent of a forest – can be attributed to gradual processes operating persistently over enormous expanses of time (Lyell, 1830).

Lyell's appeal to the heaving forces of geological change was compounded in Darwin's intellectual file drawer with Thomas Malthus's grim depiction of a bloated human population competing for limited resources and destined for decline (Malthus, 1888). Darwin's master theory of evolution by means of natural selection emerged through roughly two decades of dense contemplation on these ideas and their implications for the vast collection of specimens he had scrupulously amassed on his voyage to the New World. *Origin of Species* is so illuminating

precisely because its thesis is so unintuitive: change is the aegis of persistence. As Lyell had likened his own theory to the narrative of man, so too did Darwin see the complexities of human behavior and temperament bound inexorably to the contexts in which humans evolved.

It is most evident within the evolutionary framework that the boundaries of human behavior have always been constrained. Whether imposed by physiology or by the environment, these constraints can explain the contour of species-typical behavior across thousands of generations. Everyday behavior in the physical world is contoured toward survival, and many behavioral competencies in modern humans are shadows of those behaviors which had some survival value to our forebears. Keller Breland and Marian Breland, both students of B. F. Skinner, were among the first to show that all species are biologically predisposed to learn some behaviors more automatically than others (Breland, 1961). Gallistel (2000) reviewed evidence that classical and instrumental learning mechanisms are adaptively specialized, saying, "[O]ne cannot use a rhodopsin molecule as an oxygen carrier, any more than one can see with an ear or hear with an eye (Gallistel, 2000, p. 1)." That is to say, we respond to stimuli in a manner consistent with our biological evolutionary histories. And so if we exhibit great adeptness at driving cars, for example, it is not because we are evolved to drive cars, but because car-driving involves behaviors and abilities which enhanced the functional and reproductive success of our ancestors in their particular situational contexts (for a conversation, see Pinker, 1997). *Behavior* has always been inextricably linked to the *situation*.

Lewin (1936) famously modeled the person-situation relationship as a function, $B = f(P, S)$, in which behavior B is expressed as the outcome of the characteristics of the person P and their particular situation S. Lewin's function – a cornerstone of twentieth-century social, personality, and environmental psychology – nonetheless came many decades after Francis

Galton, Darwin's cousin, began to more fully pursue the nature of what then was referred to as "human character" (Galton, 1883). He employed this term in a manner more or less identical to the modern day conceptualization of personality. Galton would claim that human character is knowable chiefly because human behavior is *measureable*, claiming "[i]t is the statistics of each man's conduct in small everyday affairs, that will probably be found to give the simplest and most precise measure of his character (Galton, 1949)." The leading minds of Galton's generation agreed.

Galton's contemporary Karl Pearson introduced the correlation coefficient as a means for surveying the heritability of traits and behavior (Pearson, 1896). And Pearson's successors would go on to develop uses for the correlation coefficient such as factor analysis which, it was hoped, could throw light onto those elements of human behavior, faculty, and temperament which are common to all individuals across the variety of contexts and situations in which humans behave (Thurstone, 1934; Wolfle, 1942).

Over 100 years of personality and social psychology have elapsed since this time, and a number of personality models have proven to be useful in both the taxonomization and prediction of individual behavior, including the big five model (Digman, 1990; Costa & McCrae, 1992; Goldberg, 1993), the six-factor HEXACO model (Ashton, Lee, & De Vries, 2014), the big two model (DeYoung, 2006), and a general factor model (Musek, 2007).

The situation, in this case, has received much less attention from psychologists in the intervening years than has the person. Insufficient measurement protocol (Rauthmann et al., 2014) is merely a symptom of the larger issue that psychological situations have been inadequately conceptualized (Hogan, 2009). And so the "person-situation debate" has concluded in much the same place as it started – $B = f(P, S)$ – this time with a robust and most-utilized five-

factor structure (i.e., the Big Five – extroversion, agreeableness, conscientiousness, emotional stability, openness to experience) of human personality (*P*) which has been corroborated across many cultural, demographic, and temporal contexts, without any such analogue for the situation (*S*). In the absence of a robust taxonomy and structure corresponding to the situational contexts in which people behave, the science of personality has been left largely to assume the structural sameness of behavior across the various situational contexts which we intuit to exist.

The pervasiveness of digital technologies in the day-to-day behaviors and transactions of modern humans challenges this assumption. On the one hand, digital technologies are extensions of human faculties and are useful for amplifying and extending the capabilities of the human organism (Brey, 2000); virtual worlds can be seen in this same light, especially in personality contexts (e.g., Twitter as an extension of the capacity to communicate – perhaps an extension of extraversion, agreeableness, and openness to experience). On the other hand, something akin to the "task-artifact" cycle mentioned earlier in the context of human-computer interaction and software design raises the spectre that user behavior is not necessarily in alignment with design intention – that the virtual world is responsive, and evolves according to user behavior rather than the other way around. If this is the case, then it might also be the case that virtual affordances can magnify certain traits and faculties relative to others (e.g., Twitter may be less an extension of trait conscientiousness and trait neuroticism, and so the relative "weight" of extraversion, agreeableness, and openness to experience may increase as a result within the Twitter environment, both at an individual level and among the population of Twitter users). In other words, it is possible in virtual contexts that personality differs because the configuration of the virtual environment is constrained such that individuals are limited to the expression of those personality traits made sufficiently "expressable" by the affordances within the virtual

environment. The more often one operates under these contraints, the more one's behavior might reflect the ways in which they are not constrained – likely, the ways in which virtual affordances *encourage* them to behave. And so we return to the essential premise that, because reality and virtuality impose different constraints on individuals, personality in virtual contexts might differ structurally and existentially from personality in everyday contexts. A person under one set of constraints may simply be different from that same person under another set of constraints, especially if there exist such varied configurations of virtual environments that individuals may self-select into those which feature affordances that match their particular configuration of needs and gratifications.

Mobile Internet and Access to Virtual Worlds

> "After my wife died… That's when I started to do texts to keep up with everyone. And that made a big difference, I think. Plus, now I read all the time [because] the Kindle is like having your own library. And I use the GPS to get around[…] It's funny. I never understood cell phones, but now I'm on mine as much as my grandkids. It makes it easier to do the stuff I want. [It is] hard to remember what I did before it (M. Lewis, personal communication, September 25, 2017)."

An unmitigated swelling of internet access has followed the introduction of mobile internet-enabled devices in the mid-2000s and the vast global expansion of the mobile broadband networks on which they rely for their connection to the world wide web. Among these devices are an ever-growing number of smartphones, tablet computers, and "wearables." The popularity and variety of these devices has fueled the dominance of mobile, relative to fixed or land-based, internet access. As of 2015, mobile broadband subscriptions outnumbered fixed broadband subscriptions 4.4 to 1 (UN Broadband Commission, 2015), and this gap continues to widen.

According to the Pew Research Center, over three-quarters of the adult population in the United States owns a smartphone, including over 90% of 18-29 year olds. College education, high income, and young age are all significant predictors of smartphone ownership. In tandem, tablet computers are now in the hands of half of the American adult population, with traditional desktop and laptop computers maintaining a saturation point of around 80% (Anderson, 2015).

Recent trends additionally reveal that exclusive reliance on smartphones for internet access is increasing, especially among young, non-white, low-income, uneducated segments of the population. In effect, the growth of mobile internet access is to some degree at the expense of non-mobile internet access, with nearly 1 in 10 American adults opting solely into a mobile broadband subscription (Smith, 2015).

An experience sampling survey of smartphone users revealed the most popular uses to be text messaging, browsing the internet, voice and video calls, email, and social networking. Younger cohorts especially report using smartphones to avoid boredom (18-29 year olds: 93%; 30-49 year olds: 82%), to avoid others (18-29 year olds: 47%; 30-49 year olds: 32%), and to navigate the physical world around them (Smith, 2015).

Like the interviewee above, what many researchers are finding is that – as individuals and as a species – we are in some sense spending less time in the real world (Andreasson, 2015), particularly now that virtual worlds can be accessed from almost anywhere via computers, mobile devices, and, specifically, the internet. An unmitigated swelling of internet access is also an unmitigated swelling of access to virtual worlds. The digitalization of society is also the virtualization of society.

What is most intriguing and most consequential from the vantage point of social and personality psychology is how the situational topography of the internet (and virtuality more generally) influences individuals on an everyday basis. In other words, is there a comingling of the real and virtual at the level of behavior, especially in the language of personality? In which ways are they the same and in which ways are they different?

Personality Structure

The Five Factor Model of human personality, or Big Five, has proven to be the most robust and useful model for the taxonomization and prediction of characteristic patterns of behavior. The Big Five divides personality into five factors: neuroticism, extraversion, openness to experience, agreeableness and conscientiousness (Costa & McCrae, 1992; Goldberg, 1993).

These traits can converge into a general factor of personality, the Big One, which entails low neuroticism (or rather, high emotional stability) and high levels of the other four traits (extraversion, openness, agreeableness and conscientiousness)(Musek, 2007). The Big One has been found by some researchers to correspond in part with social desirability (Bäckstrom, Bjorklund, & Larsson, 2009) – that is, high scores on the Big One are culturally desirable. Still, other personality researchers have found that neither social desirability nor self-esteem account for the Big One (Erdle & Rushdon, 2011). DeYoung (2006) has proposed a higher-order two factor model, the Big Two, of plasticity (also referred to as Alpha or Self-Control) and stability (also referred to as Beta or Engagement). Whereas plasticity entails the variance shared by extraversion and openness to experience, stability entails the variance shared by agreeableness, conscientiousness, and emotional stability. These metatraits are supported in part by work demonstrating their link to neurotransmitter functioning (DeYoung, Peterson, & Higgins, 2002).

While the mean level of traits in everyday contexts is well established for the general population, much less work has been done on personality in virtual spaces. A recent meta-analysis examining Big Five and Big Two traits and social media use (e.g., online friends, gaming, etc.) found that social media outcomes were predicted especially by high extraversion, emotional stability, and openness to experience, and to a much lesser extent by conscientiousness. Generally speaking, high plasticity and low stability predicted all social media activities (Dong & Campbell, 2017). There is less work on virtual and fantasy spaces outside of social media, however. One large series of studies on "geek culture" which included a range of interests from cosplay and live action role playing (LARPing) to gaming and science fiction fandom found that geek cultural engagement was associated with narcissism (which largely entails high extraversion and low agreeableness), openness to experience, and high neuroticism (McCain, Gentile, & Campbell, 2015). These interests are often expressed especially in online communities dedicated specifically to these interests.

Personality Across Different Contexts: The Big Five

In general, the Big Five seem to share a similar structure across such situational variables as culture, with some exceptions (Thalmayer & Saucier, 2014). That is, the Big Five structure is *invariant* across cultural contexts. Similarly, the Big Five seems to be invariant across age and gender cohorts (e.g., Nye, Allemand, Gosling, Potter, & Roberts, 2015; Gustavsson, Eriksson, Hilding, Gunnarsson, & Ostensson, 2008). Establishing structural invariance is highly important, as it ensures that personality measurements in one context are compatible with personality measurements in other contexts.

Invariance analyses on personality measurements in everyday contexts versus virtual worlds have not been tested. There is some suggestion that personality should be the same, or invariant, across these contexts. For example, social behaviors in virtual worlds like Second Life seem to work as they do in real life (McLeod, Liu, & Axline, 2014). Likewise, the same can be said for social behavior and social media; personality seems to work the way it does in the everyday world (Back, Stopfer, Vazire, Gaddis, Schmukle, Egloff, Gosling, 2010).

There is also some suggestion, however, that it should be different, with researchers in many fields providing compelling evidence that individuals behave differently (Reser, 2009; Stokols & Montero, 2002), make decisions differently (Weinmann et al., 2016), and perceive differently (Hutchins et al., 1985; Plewan & Rinkenauer, 2017) in virtual worlds.

In sum, the limited evidence available suggests that personality in virtual or fantasy spaces is especially likely to involve high extraversion and openness to experience (high plasticity), and low conscientiousness. The role of neuroticism is complex, as low neuroticism might predict desire to go into these virtual or fantasy spaces, but, assuming the reasons for this include some element of escapism, neuroticism in these spaces might be lower than everyday. Agreeableness in virtual and fantasy spaces is also less clear. Some evidence suggests agreeableness will predict some aspects of online behavior; but other work on gaming suggests the opposite – that virtual behavior is more antagonistic.

Theoretical Sketches

We are not at the point where we can develop durable models of personality levels in virtual or fantasy realms; however, it is useful to at least sketch out some possibilities. The first is simply no difference: real and virtual worlds are essentially the same psychologically and therefore personality levels should be the same across conditions. The second, the social

desirability model, is a version of the first but in the direction of social desirability. In this model, because virtual and fantasy realms are currently largely a matter of choice (i.e., we are generally not forced into these realms), personality should match more social desirability by shifting in the direction of the Big One (i.e., lower scores on neuroticism, but higher scores on the rest of the Big Five.)

The third is a Discontents model based on Freud's masterwork, *Civilization and its Discontents*. Freud speculated that culture shaped everyday personality to constrain personal desires, largely sexual and aggressive in the interest of maximum overall societal well-being. The cost of this constraint was less hedonistic fun and aggression and increased shame/guilt (i.e., part of neuroticism). Therefore, virtual and fantasy realms, less constrained by cultural demands, should include more hedonism and aggression and less shame. In Big Five terms, this means high extraversion and openness (see Roberts and Robins, 2000), low neuroticism (a proxy for low shame and guilt) and low agreeableness and conscientiousness (proxies for aggression).

CHAPTER 2

REAL AND VIRTUAL, AS CONTRUCTS

The Present Study

Chronbach and Meehl (1955) suggested that a valid construct for measurement is one which is supported by a "nomological network" which bridges a construct's theoretical and empirical frameworks. What is being measured? How are its various components theoretically related? What measurements are most appropriate for capturing this construct?

A challenge faced by early personality psychologists was determining the relationship between the many varied trait descriptors embedded in language. Allport and Odbert (1936) sorted a list of 17,953 dictionary terms into 4 columns, reducing the number of those terms related to personality traits to a list of 4,504 terms. Researchers like Cattell (1943), Fiske (1949), and Norman (1967) further narrowed this list to a subset of anywhere between approximately 1600 and 2800 terms after eliminating those terms which had fallen out of use, were archaic, overly ambiguous, or which had varied usages.

Similarly, there seems to be some consistency in terms of how the terms 'real' and 'virtual' are employed in everyday language. They are used as if constructs embedded within the same conceptual structure, implying that they are connected constructs. Given their inverse usage – that is to say, given one is very often used to mean the opposite of the other – it is possible to begin the process of extracting an empirical structure from a theoretical one. If individuals employ the terms 'real' and 'virtual' with some sort of systematic variation, then the conceptual structure underlying these terms should be investigable.

On this premise, the present research study begins by randomly deriving items from a modern dictionary corpus, and pragmatically extracts a small subset of items through a forced-choice sorting protocol in which participants identify items as real, virtual, or neither. Retaining only those items which achieve a consensus categorization, a separate sample of participants rates items on a 5-point likert scale, indicating where each item falls between the extremes of "completely virtual" and "completely real." By employing factor analysis to explore these data, we extract a theoretical structure from which we can move forward.

Methods

Participants

Participants were 78 males and 104 females (3 no-response) aged 19 to 86 (males: M = 37.37, SD = 12.65; females: M = 36.3, SD = 10.73) recruited via Mechanical Turk. All participants lived in the United States at the time of participation. The vast majority of participants (87.57%) had graduated high school and completed some amount of post-secondary education, and a large majority (75.68%) estimated their yearly income before taxes to be less than $70,000.

Procedures

Qualifying participants accessed an internet-based survey through an anonymous link (no identifying meta information was collected) displayed on a Mechanical Turk research study HIT. Participants verified their eligibility to participate and indicated consent before being directed into the study questionnaire. Participants were compensated a small fee in exchange for their participation.

Measures

127-Item Virtual-to-Real Survey

In a pilot study, 100 participants recruited via Mechanical Turk spontaneously organized lists of items into 3 categories: “virtual,” “real,” and “neither virtual nor real.” From this pilot study, a shortened 127-item survey (the item “this survey” was added for comparison) was generated, with items retained based on the strength (frequency) of their categorizations. A cutoff of 50% was chosen such that items retained were those for which there was a simple majority consensus as to which of the three categories those items belonged. Study 1 participants were asked to evaluate each item of the resulting survey using an expanded 5-point Likert-type scale (1-Completely virtual, 2-More virtual than real, 3-Equally virtual and real, 4-More real than virtual, 5-Completely real). Item order was randomized for each participant.

IPIP-50

The International Personality Item Pool – 50 (IPIP-50) is a 50-item personality inventory measuring five traits – surgency, agreeableness, conscientiousness, emotional stability, and intellect/imagination – which have demonstrated adequate parity with the Big Five personality dimensions (Thalmayer et al., 2011).

Results

Exploratory Factor Analysis

Parallel analysis, implemented with adjustments for sample error-induced inflation as recommended by Horn (1965), indicated that the number of latent factors was 6. The virtual-to-real conceptual continuum is conceived in the present study as having a plurality of nonorthogonal categories. Accordingly, we employed an exploratory factor analysis using maximum likelihood extraction and oblique rotation, as recommended by Costello and Osborn

(2005), resulting in a six-factor model with generally adequate fit for exploratory purposes, $\chi^2(184) = 10002.17$, $p < .001$, CFI = .76, TLI = .75, RMSEA = .07, [.04, .04], with sums of squared loadings ranging from 4.43 to 16.59 and correlations between factors ranging from -.02 to .49 (see Table 2). Factor loadings are reported in Table 1. Items with loadings greater than or equal to .4 are retained for analysis.

Table 1. *EFA factor loadings (N=185)*

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Fear	**0.83**	-0.03	0.03	0.02	-0.01	0.10
Happiness	**0.83**	0.05	0.06	0.00	0.06	0.11
Sadness	**0.82**	0.00	0.03	0.02	0.11	-0.09
Self Esteem	**0.78**	-0.03	-0.04	0.08	0.09	0.03
Behavior	**0.72**	0.07	0.09	0.05	0.05	0.04
Anxiety	**0.71**	-0.08	-0.02	0.10	0.04	0.03
Emotions	**0.68**	0.00	-0.10	0.06	0.22	0.03
Duties	**0.67**	-0.05	0.19	0.21	-0.20	0.03
Love	**0.67**	-0.13	0.01	0.08	0.08	0.11
Depression	**0.64**	-0.13	-0.06	0.12	0.22	-0.10
Rights	**0.64**	0.02	-0.01	0.31	-0.09	0.00
Truth	**0.63**	0.06	0.00	0.02	0.20	0.07
Thinking	**0.62**	-0.05	0.06	0.03	0.07	0.30
Terror	**0.61**	-0.03	0.03	0.24	0.02	-0.04
Justice	**0.56**	-0.03	-0.09	0.38	0.05	0.07
Addiction	**0.53**	-0.09	-0.07	0.19	0.12	-0.10
Popularity	**0.53**	0.07	0.13	0.21	-0.11	0.35
Intelligence	**0.49**	0.09	0.10	0.14	0.22	-0.01
Culture	**0.49**	0.16	-0.01	0.27	0.02	-0.16
Spirituality	**0.48**	-0.08	-0.05	0.00	0.11	0.48
Pers. Relationships	**0.47**	0.11	0.12	0.02	0.22	-0.09
Religion	**0.46**	-0.01	0.08	0.14	-0.01	0.37
Power	**0.45**	0.01	-0.06	0.34	0.13	0.08
Robots	**-0.45**	0.34	0.21	0.12	0.16	0.02
Control	**0.43**	-0.01	0.02	0.42	0.04	0.08
Racism	**0.43**	0.02	0.04	0.39	0.17	-0.23
Privacy	**0.42**	0.17	-0.02	0.38	-0.02	0.07
Homelessness	**0.40**	0.00	0.30	-0.08	0.33	-0.17
Ethnicity	**0.40**	-0.09	0.15	-0.13	0.30	0.07

Table 1 (cont). *EFA factor loadings (N=185)*

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Instagram	0.09	**0.93**	0.00	-0.06	-0.01	-0.08
LinkedIn	0.08	**0.87**	-0.05	-0.06	-0.01	-0.01
YouTube	-0.01	**0.87**	0.05	-0.11	-0.09	-0.03
Twitter	0.10	**0.87**	0.05	-0.05	-0.20	-0.02
Facebook	-0.03	**0.85**	-0.01	0.07	-0.07	-0.10
Netflix	-0.12	**0.81**	-0.03	0.07	-0.02	0.00
Pinterest	0.04	**0.81**	-0.01	0.04	-0.11	-0.06
Webcam	0.00	**0.79**	-0.01	-0.01	0.00	-0.12
Internet	-0.06	**0.76**	-0.06	-0.10	0.13	0.12
Texting	0.07	**0.71**	0.07	-0.05	0.09	-0.06
Cloud Storage	0.01	**0.65**	-0.20	0.06	0.07	0.00
Survey	0.02	**0.57**	0.09	0.00	0.06	0.02
Online Dating	-0.11	**0.56**	-0.08	0.25	0.05	0.21
Movies	-0.12	**0.51**	0.17	0.06	0.02	0.18
Videogames	-0.33	**0.48**	0.05	0.09	0.05	0.17
Bitcoin	0.12	**0.47**	-0.11	0.00	-0.04	0.28
Television	-0.32	**0.47**	0.15	0.25	0.05	0.13
Porn	-0.18	**0.44**	0.06	0.26	0.18	0.07
Holograms	-0.05	**0.42**	-0.25	0.17	0.06	0.18
Talking on the Phone	0.03	**0.42**	0.25	0.06	0.12	0.04
AI	-0.15	**0.40**	-0.08	0.10	0.19	0.13
Golf	0.10	0.00	**0.87**	-0.08	-0.02	0.02
Volleyball	-0.06	-0.06	**0.87**	0.08	-0.04	0.03
Football	0.01	0.01	**0.85**	-0.01	-0.02	0.13
Basketball	-0.01	-0.03	**0.82**	0.03	0.01	0.00
Soccer	0.08	-0.03	**0.80**	-0.04	0.04	-0.09
Baseball	-0.05	-0.06	**0.79**	0.17	-0.03	-0.04
Tennis	0.05	-0.01	**0.78**	0.04	0.07	-0.19
Ping Pong	0.07	0.15	**0.72**	-0.19	0.07	-0.01
Sports	-0.01	0.02	**0.68**	0.11	0.07	-0.04
Chess	-0.21	0.12	**0.58**	0.09	0.09	0.07
Monopoly	-0.35	-0.01	**0.50**	0.23	0.11	0.25
Books	-0.11	0.20	**0.48**	-0.05	0.23	0.10

Table 1 (cont). *EFA factor loadings (N=185)*

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Politics	0.12	-0.04	0.07	**0.71**	0.02	-0.03
Government	-0.05	0.00	0.17	**0.67**	0.10	0.09
Political Parties	0.02	-0.06	0.01	**0.65**	0.15	0.01
The Economy	0.09	0.00	0.09	**0.64**	-0.05	0.04
Wealth	-0.01	0.04	0.03	**0.63**	0.10	0.19
Laws	0.32	0.10	0.16	**0.57**	-0.09	-0.06
Security	0.29	0.13	0.05	**0.54**	-0.02	0.12
Discrimination	0.29	-0.07	-0.16	**0.53**	0.26	-0.16
Democracy	0.35	-0.07	0.07	**0.53**	-0.08	0.11
Fitness	0.14	-0.14	0.15	**0.50**	0.21	-0.20
Terrorism	0.10	-0.02	0.21	**0.45**	0.00	0.00
Money	-0.11	0.16	0.24	**0.43**	-0.04	0.23
Credit	-0.01	0.26	-0.01	**0.43**	0.04	0.22
SES	0.32	0.00	-0.08	**0.40**	0.16	-0.01
Air	0.08	0.03	0.02	-0.10	**0.77**	0.07
Germs	0.04	-0.08	0.01	-0.02	**0.69**	-0.05
Gravity	0.04	-0.10	0.06	0.07	**0.66**	0.03
Space	-0.19	-0.08	-0.07	0.14	**0.64**	0.02
Atoms	0.02	-0.06	0.04	-0.10	**0.63**	0.03
Natural Environ.	0.05	-0.11	0.38	-0.07	**0.51**	-0.22
Climate Change	0.02	-0.06	-0.16	0.10	**0.51**	-0.10
Smell	0.23	-0.09	0.21	-0.06	**0.50**	0.10
Temperature	0.08	-0.13	0.07	0.22	**0.48**	-0.12
Vision	0.14	-0.09	0.07	0.04	**0.47**	0.22
Energy	0.24	0.08	0.04	-0.08	**0.46**	0.15
Science	0.14	0.03	-0.03	0.17	**0.46**	-0.12
Sound	0.00	0.17	0.25	0.05	**0.45**	0.08
Colors	-0.08	0.07	0.12	0.25	**0.42**	0.25
Sex	0.01	-0.03	0.27	0.09	**0.42**	-0.09
People	0.00	0.06	0.34	-0.02	**0.41**	-0.20
Daydreams	0.38	-0.17	-0.06	-0.04	0.11	**0.50**
Hallucinations	0.32	-0.29	-0.05	0.00	-0.03	**0.50**
Mystical Exp.	0.26	-0.05	-0.23	0.03	0.10	**0.49**
God	0.34	0.01	0.11	0.01	-0.12	**0.45**
Miracles	0.33	-0.09	0.02	0.12	-0.07	**0.45**
Simulation	-0.01	0.39	-0.16	0.01	0.06	**0.40**
Fame	0.31	0.05	0.13	0.29	-0.04	**0.40**

Table 1 (cont.).

EFA factor loadings (N=185)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Crime	0.10	0.17	0.31	0.27	0.22	-0.34
Time	0.38	-0.02	-0.06	0.23	0.25	0.19
Poverty	0.33	-0.08	-0.02	0.26	0.29	-0.13
Print Media	-0.32	0.14	0.27	0.16	0.20	0.01
Hunger	0.32	-0.11	0.24	0.05	0.27	-0.19
Physical Pain	0.31	-0.10	0.11	0.21	0.19	-0.16
Communication	0.16	0.38	0.08	0.14	0.27	0.05
Photographs	-0.20	0.38	0.34	0.06	0.17	0.12
VR	-0.14	0.35	-0.33	0.09	0.03	0.25
Information	0.30	0.31	0.04	0.29	0.01	0.00
Music	0.07	0.29	0.28	0.04	0.22	0.21
Gender	0.28	-0.03	0.39	-0.05	0.19	0.06
Transportation	0.03	-0.13	0.39	0.10	0.25	-0.17
Fashion	0.02	-0.04	0.38	0.31	-0.05	0.18
War	0.23	0.11	0.37	0.03	0.05	-0.33
Journalism	-0.16	0.14	0.36	0.31	0.08	0.16
Medicine	-0.01	-0.01	0.35	0.17	0.33	-0.12
Brands	-0.04	0.12	0.32	0.31	0.01	0.31
Education	0.17	0.19	0.27	0.38	0.13	-0.04
Homosexuality	0.18	-0.03	-0.03	0.34	0.22	-0.19
Marriage	0.25	0.03	0.05	0.30	0.22	0.10
Immigration	0.27	0.08	0.17	0.00	0.38	-0.05
Health	0.29	-0.05	0.12	0.09	0.37	-0.18
Taste	0.22	-0.21	0.10	0.15	0.35	0.12
Reality	0.19	-0.03	0.02	0.27	0.35	-0.03
Extraterrestrials	-0.07	-0.08	-0.16	0.10	0.27	0.25
Literature	0.09	0.27	0.24	0.07	0.27	0.08

Note. Factor loadings >.4 in bold. Only items with factor loadings >.4 are retained.

Table 2.

Correlations among factors (N=185)

Factor	1	2	3	4	5
2	-0.16				
3	0.12	0.15			
4	0.49	0.14	0.33		
5	0.34	-0.04	0.38	0.33	
6	0.14	0.10	-0.03	0.18	-0.02

27 items failed to load onto any single factor at the cutoff. The remaining 100 items are depicted in Table 3. Factor composition, by number of items, ranges from 6 to 29 items. For each factor, a mean-level is computed, with lower means belonging to items which tended to be rated as more virtual and higher means belonging to items which tended to be rated as more real. Table 4 shows means and standard deviations. Cronbach's alpha, used here as an indicator of discriminant validity, can be found for each factor in the last column of the table, and range from .77 for factor 6 to .96 for factor 1, with 4 factors exhibiting alpha reliability coefficients greater than .9. For exploratory purposes, we interpret this to mean that there is robust systematic variation between the scores participants assigned to items in each factor.

Figure 1. *Location of factors, by mean-level scores*

Figure 1 depicts the mean-level relationships between each factor by mapping each of the six factors onto a continuum from "completely virtual" to "completely real," or, in terms of the scale, from 1 to 5. Means range from 2.63 to 4.52; hence, all factors tend to involve items which are rated as more real than virtual.

Relationships Between Ratings, Personality Traits, and Demographic Characteristics

Personality trait means, standard deviations, and alpha reliability coefficients are reported in Table 5 alongside trait norms (Goldberg, 1992). Personality scores are correlated with factor scores; results are reported in Table 6. Trait agreeableness is significantly correlated with factor 1, $r = .24$, $p < .001$; factor 3, $r = .18$, $p < .05$, factor 4, $r = .16$, $p < .05$; and factor 5, $r = .24$, $p < .01$. Conscientiousness is significantly correlated with factor 5, $r = .16$, $p < .05$. Emotional stability is significantly correlated with factor 2, $r = -.20$, $p < .01$, and factor 5, $r = .14$, $p < .01$. These results indicate that individuals higher in agreeableness tended to rate items in factors 1, 3, and 5 as more real, while those higher in emotional stability tended to rated items in factor 2 as less real and items in factor 5 as more real.

As the experiences of the various demographic groups identified in the closing demographic questionnaire may differ significantly with regard to technology use and virtual/fantasy behaviors, t-tests were conducted between the factor ratings across gender to detect mean-level differences (see Table 3), while correlations were calculated been ratings and measures of age, financial income, and education (see Table 7).

Significant gender differences were such that males rated factors 1 ($t(143) = 2.04$, $p = .04$) and 6 ($t(163) = 2.25$, $p = .03$) as significantly more real than did females. Age and income were positively correlated with factor 2, such that older individuals rated items in factor 2 as significantly more real ($r = .33$, $p < .001$), as were those with greater financial income ($r = .14$, $p = .05$). Age was significantly correlated with emotional stability, $r = .16$, $p = .02$, and with conscientiousness, $r = .15$, $p = .05$, such that older individuals scored higher in these traits. Income was significantly correlated with emotional stability, $r = .18$, $p = .02$, and openness to

experience, $r = -.22$, $p < .01$, such that higher financial income was associated with greater emotional stability and less openness to experience.

Table 3

Mean-level differences on mean factor ratings, between gender

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
T-value (sig)	$t(143) = 2.04$, $p=.04$	$t(165) = 1.19$, $p=.24$	$t(173) = 1.46$, $p=.15$	$t(157) = 1.69$, $p=.09$	$t(161) = .58$, $p=.56$	$t(163) = 2.25$, $p=.03$

Note. Positive T-values indicate greater factor mean-level among males.

Table 4

Correlations between big five traits, demographics, and factors

			Correlations with factors					
	M	*SD*	F1	F2	F3	F4	F5	F6
Big Five traits								
Extraversion	3.98	1.60	-.06	.05	-.09	-.06	-.09	.07
Agreeableness	4.91	1.33	.24***	.00	.18*	.16*	.24**	.04
Conscientiousness	5.04	1.31	.13	-.05	.11	.04	.16*	.08
Openness	4.65	1.41	.08	.12	.05	.01	.00	.04
Emot. Stability	5.01	1.29	-.03	-.20**	-.02	-.02	.14*	-.05
Demographics								
Age	-	-	.10	.33***	.11	.08	.05	-.13
Income	-	-	.01	.14*	.10	.02	-.10	.03
Education	-	-	-.09	.08	.06	-.07	-.05	-.13

Note. * $p<.05$ ** $p<.01$ *** $p<.001$

Table 5

Factors resulting from 127-item EFA

Factor 1	Factor 2	Factor 3
Fear	Instagram	Golf
Happiness	LinkedIn	Volleyball
Sadness	YouTube	Football
Self Esteem	Twitter	Basketball
Behavior	Facebook	Soccer
Anxiety	Netflix	Baseball
Emotions	Pinterest	Tennis
Duties	Webcam	PingPong
Love	Internet	Sports
Depression	Texting	Chess
Rights	Cloud Storage	Monopoly
Truth	Survey	Books
Thinking	Online Dating	
Terror	Movies	
Justice	Videogames	
Addiction	Bitcoin	
Popularity	Television	
Intelligence	Porn	
Culture	Holograms	
Spirituality	Talking on the Phone	
Personal Relationships	AI	
Religion		
Power		
Robots		
Control		
Racism		
Privacy		
Homelessness		
Ethnicity		

Table 5 (cont.)

Factors resulting from 127-item EFA

Factor 4	Factor 5	Factor 6
Politics	Air	Daydreams
Government	Germs	Hallucinations
Political Parties	Gravity	Mystical Experiences
The Economy	Space	God
Wealth	Atoms	Miracles
Laws	Natural Environment	Simulation
Security	Climate Change	
Discrimination	Smell	
Democracy	Temperature	
Fitness	Vision	
Terrorism	Energy	
Money	Science	
Credit	Sound	
SES	Colors	
	Sex	
	People	

Note. Only items retained (factor loadings >.4) included.

Table 6

Means and standard deviations of ratings, by factor

	N	*M*	*SD*	∝
Factor 1	185	3.91	0.82	0.96
Factor 2	185	2.69	0.95	0.94
Factor 3	185	4.52	0.61	0.93
Factor 4	185	3.96	0.78	0.92
Factor 5	185	4.41	0.58	0.89
Factor 6	185	2.63	0.99	0.77

Note. Means, standard deviations, and alpha reliability coefficients apply only to items retained.

Table 7

IPIP-50: Means, standard deviations, and alpha reliability

	Sample			IPIP-50 (Goldberg)		
	M	*SD*	∝	*M*	*SD*	∝
IPIP-50						
Extroversion	3.98	1.60	0.93	4.44	1.45	0.88
Agreeableness	4.91	1.33	0.87	5.23	1.11	0.88
Conscientiousness	5.04	1.31	0.92	5.40	1.32	0.85
Emotional Stability	4.65	1.41	0.93	4.83	1.42	0.88
Openness to Experience	5.01	1.29	0.86	5.38	1.07	0.84

CHAPTER 3

STRUCTURAL INVARIANCE AND MEANS

The Present Study

In the present study, we examine self-reported personality on the Big Five in everyday and virtual/fantasy contexts. Based on past research and theory, we predict personality in virtual contexts will be characterized by higher extraversion and openness to experience, as well as lower neuroticism (e.g., Dong & Campbell, 2017; McCain, Gentile, & Campbell, 2015). Differences in conscientiousness and agreeableness are more difficult to predict, though research on social media and geek culture implies that they should be lower in virtual worlds.

Our examination begins by contextualizing personality to reflect "everyday" versus "virtual" behavior, broadly speaking, with everyday personality reflecting the characteristic day to day behaviors of the individual while virtual personality reflects how the same individuals behave in virtual spaces. Personality measurements in these two contexts are analyzed for mean-level and structural invariance.

Participants and Design

Participants were 362 individuals (202 male; 157 female; 3 no response) recruited from Mechanical Turk. All participants were 18 years or older and living in the United States at the time of participation. The study used a within-participants design with two fully crossed variables: 2 "Realm" (Everyday, Virtual/Fantasy) x 5 Personality (neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness).

Participants were first asked to list the five online environments, virtual environments, and/or fantasy experiences they engaged with most. This was followed by two consecutive administrations of Widiger's Five Factor Model Rating Form (FFMRF), a 30-item descriptive measure of big five personality traits (Samuel & Widiger, 2004). Participants were prompted with the scale's unaltered instructions on the initial administration. For the second, participants were asked to describe their characteristic behaviors in online environments, virtual environments, and/or fantasy experiences. Means and mean-level differences between measures were examined.

Results

Mean-Level Differences

The mean differences between reality and virtuality can be seen in Table 8. Participants rated themselves as significantly less neurotic ($t[697] = -6.08$, $p < .001$), agreeable ($t[721] = -3.84$, $p < .001$), and conscientious ($t[721] = 2.72$, $p < .05$), and significantly more extraverted ($t[715] = 4.12$, $p < .001$) in virtual contexts than in real. Figure 2 depicts a pirate plot of these mean differences.

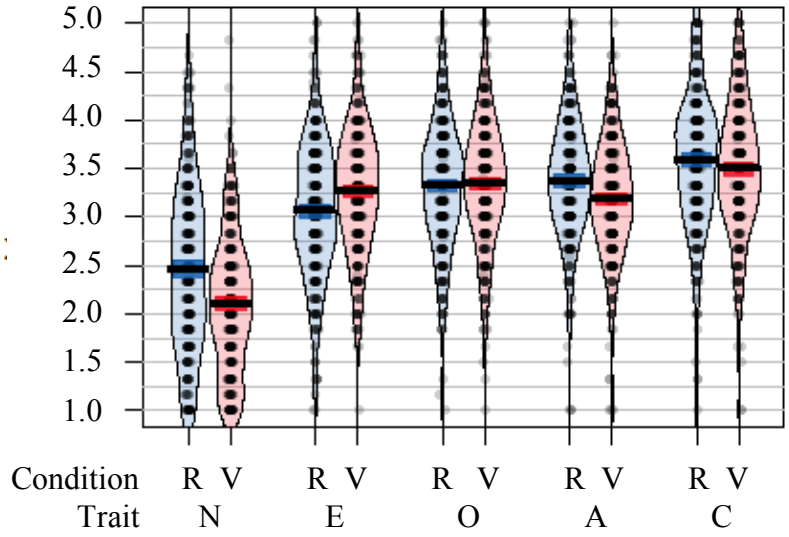

Figure 2. *Pirate plot of mean-level differences between personality measurements in real (R) and virtual (V) contexts*

Table 5

Mean-level differences between personality in real and virtual contexts

	N	E	O	A	C
T-value (sig)	t(697) = -6.08, *p*<.001	t(715) = 4.12, *p*<.001	t(721) = .54, *p*=.58	t(721) = -3.84, *p*<.001	t(721) = 2.72, *p*<.05

Invariance Analysis

To test whether the FFMRF measures personality the same way across both real and virtual contexts, we conducted tests of measurement invariance. Tests of both configural (i.e., factor structure) and metric (i.e., magnitude of factor loadings) invariance (see Vandenberg & Lance, 2000) were conducted using structural equation modeling (SEM) in R. As there is some variation in the implementation of measurement invariance calculations between different statistical

software programs, we additionally conducted the same measurement invariance tests using SEM in Mplus (Muthén & Muthén, 2008). While chi-squared test statistics are scaled differently by the semTools package in R (semTools Contributers, 2016) versus MPlus, model fit comparison statistics (i.e., CFI and RMSEA) were reliably similar, to the nearest hundredth decimal place.

The configural invariance test consists of testing whether the factor structure (i.e., five factor personality structure) varies between the real life and virtual contexts. This is done by fitting a structural equation model to the data and constraining the model to be equal for both contexts. In the case of the 30-item FFMRF, this means specifying a model with 6 predictors (scale items) for each of the Big Five personality domains. Results indicated that the factor solutions for the two contexts (see Tables 8-9) were a poor fit for each other, $\chi^2(790) = 2381.7$, $p < .001$, CFI = .75, RMSEA = .08, [.07, .09]. We therefore expected a similarly poor fit to result from a test of metric invariance, as the metric invariance test goes a step beyond the configural invariance test by constraining factor loadings to be equal in both contexts. Results indicated that this constrained model was an even worse fit overall, $\chi^2(815) = 2430.4$, $p < .001$, CFI = .75, RMSEA = .08 [.08, .08], and was a significantly worse fit than the configural invariance model, $\chi^2 (25) = 48.683$, $p = .003$.

Confirmatory Factor Analysis of the FFMRF

A confirmatory factor analysis was conducted using SEM on FFMRF in the real context to confirm the fit of the null model (the Big Five) to the data as expected. Results revealed an overall inadequate fit of the SEM model to the data, converging normally after 65 iterations, $\chi^2 (395) = 1281.53$, $p < .001$, CFI = .75, RMSEA = .081 [.08, .09].

Exploratory Factor Analysis of the FFMRF

Exploratory factor analyses were conducted on FFMRF data in each context, respectively, in order (a) to specify structural differences between contexts revealed through measurement invariance analysis at the item-level and (b) to clarify the poor fit of the null model (see Samuel & Widiger, 2004) to the data in the everyday context. In each case, oblique rotations were used to most accurately reflect the structure of the data actually collected (see Tabachnick & Fiddell, 2007), and because the complexity of variables and correlations between latent factors are of interest (see Kim & Mueller, 1978).

Parallel analysis suggested that the ideal number of factors in both contexts was 5. As recommended by McDonald (1985), the smallest number of factors needed to adequately explain all inter-item correlations was retained, which was 5 at the specified loading cutoff of .4.

An exploratory factor analysis of FFMRF responses in the *real* context using maximum likelihood extraction and oblique rotation, resulted in a five-factor model with adequate fit, $\chi^2(435) = 3990$, $p < .001$, TLI = .90, RMSEA = .05, [.04, .05], with sums of squared loadings ranging from 1.99 to 3.14 and correlations between factors ranging from .00 to .32 (see Table 11). Factor loadings are reported in Table 9.

An exploratory factor analysis of FFMRF responses in the *virtual* context using maximum likelihood extraction and oblique rotation, resulted in a five-factor model with robust fit, $\chi^2(435) = 3326.31$, $p < .001$, TLI = .91, RMSEA = .042, [.03, .05], with sums of squared loadings ranging from .86 to 3.07 and correlations between factors ranging from .01 to .34. Factor loadings are reported in Table 10. Correlations between factors are reported in Table 12.

Table 6

EFA factor loadings of FFMRF (real context), using maximum likelihood estimation (N = 362)

	ES	C	A	E	O
Anxiousness	**0.83**	0.02	0.07	-0.02	-0.01
Vulnerability	**0.75**	-0.13	0.14	0.01	0.00
Angry	**0.73**	0.06	-0.14	0.25	-0.07
Depressiveness	**0.70**	0.01	-0.11	-0.24	0.08
Self-consciousness	**0.61**	0.00	0.07	-0.16	0.05
Impulsivity	**0.44**	-0.20	-0.02	0.43	0.10
Positive Emotions	-0.35	0.18	0.21	0.34	0.21
Order	0.03	**0.71**	-0.06	-0.03	-0.01
Self Discipline	-0.08	**0.66**	0.04	0.20	-0.08
Competence	0.00	**0.65**	-0.03	-0.04	0.24
Dutifulness	-0.02	**0.64**	0.13	-0.08	-0.07
Achievement	-0.07	**0.56**	0.06	0.34	-0.13
Deliberation	0.04	**0.53**	0.07	-0.25	0.07
Tender-minded	0.10	0.02	**0.75**	-0.08	0.05
Altruism	0.03	-0.01	**0.63**	0.15	-0.06
Warmth	-0.18	-0.02	**0.60**	0.11	0.09
Modesty	0.15	0.19	**0.46**	-0.30	0.02
Trust	-0.08	-0.05	**0.45**	0.20	-0.12
Compliance	-0.04	0.23	**0.42**	-0.16	0.01
Straightforwardness	-0.08	0.18	0.32	-0.04	0.01
Activity	-0.22	0.21	0.10	**0.57**	0.05
Excitement	-0.03	-0.02	-0.01	**0.55**	0.32
Assertiveness	-0.01	0.23	-0.16	**0.52**	0.08
Actions	-0.05	-0.01	0.02	**0.45**	0.35
Gregariousness	-0.16	0.02	0.19	**0.43**	0.00
Ideas	0.01	0.03	-0.06	0.05	**0.71**
Values	-0.11	-0.03	0.13	-0.01	**0.50**
Fantasy	0.09	-0.19	0.06	0.02	**0.48**
Aesthetic	0.06	0.05	0.08	0.06	**0.46**
Feelings	0.07	0.08	0.39	0.01	**0.40**

Note. Items with loadings ≥ .4 appear in bold.

Table 7

EFA factor loadings of FFMRF (virtual context), using maximum likelihood estimation (N=362)

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Excitement seeking	**0.73**	-0.07	-0.05	-0.07	-0.01
Actions	**0.59**	0.13	-0.03	0.02	0.10
Assertiveness	**0.56**	0.14	-0.06	-0.11	-0.09
Fantasy	**0.55**	-0.14	0.10	0.13	0.10
Activity	**0.54**	0.24	-0.04	0.05	-0.11
Positive Emotions	**0.45**	0.08	-0.33	0.23	0.01
Ideas	**0.43**	0.09	0.06	0.09	0.31
Impulsivity	**0.42**	-0.17	0.34	-0.12	-0.05
Gregariousness	**0.37**	0.04	-0.10	0.10	-0.10
Aesthetic	**0.36**	-0.09	0.04	0.25	0.32
Order	-0.03	**0.73**	-0.05	-0.10	0.06
Competence	0.05	**0.64**	-0.06	-0.04	0.14
Self Discipline	0.02	**0.64**	-0.11	0.08	-0.14
Dutifulness	0.00	**0.63**	0.06	0.11	-0.08
Deliberation	-0.14	**0.59**	0.02	0.08	0.15
Achievement	0.29	**0.56**	0.06	-0.01	-0.16
Vulnerability	0.02	-0.05	**0.78**	0.06	-0.11
Depressiveness	-0.12	0.01	**0.71**	-0.01	0.12
Anxiousness	0.02	0.04	**0.70**	-0.06	-0.01
Angry Hostility	0.17	-0.05	**0.60**	-0.11	0.02
Self-consciousness	-0.13	0.06	**0.56**	0.11	0.06
Tender-minded	-0.04	-0.09	0.00	**0.75**	0.01
Warmth	0.01	0.06	-0.19	**0.52**	-0.07
Altruism	0.09	0.12	0.10	**0.48**	-0.09
Straightforwardness	0.10	0.04	-0.14	**0.46**	0.06
Modesty	-0.26	0.17	0.07	**0.43**	0.13
Feelings	0.20	0.20	0.03	**0.40**	0.28
Compliance	-0.01	0.27	0.07	**0.37**	-0.26
Trust	0.10	0.01	-0.06	0.34	**-0.42**
Values	0.21	0.12	0.00	0.19	**0.35**

Note. For exploratory purposes, all items are retained in the virtual context and ordered by magnitude of loading. All items load onto at least one factor with a magnitude of .35 or greater.

Table 8

Correlations between factors (everyday)

Factor	ES	C	A	E
C	-0.32			
A	-0.13	0.28		
E	-0.26	0.15	0.03	
O	0.00	0.05	0.23	0.2

Table 9

Correlations between factors (virtual)

Factor	1	2	3	4
2	0.19			
3	-0.10	-0.25		
4	0.15	0.34	-0.15	
5	0.01	-0.02	0.09	0.08

CHAPTER 4

DISCUSSION

Across two studies, we have shown evidence that 'virtual' and 'real' are meaningful labels when applied to familiar objects, phenomena, feelings, actions, and ideas, and that people are different in virtual versus everyday contexts. Specifically, study 1 demonstrates that individuals do systematically evaluate some things as more or less virtual or real, and that these ratings vary somewhat with age and income, implicating the role of experience and familiarity with digital technologies in perceptions of what is real and virtual. The role of personality is also examined, with evidence that trait agreeableness and emotional stability are significant predictors of how individuals evaluate the extent to which something is virtual or real. Study 2 shows that individuals evaluate their own behavior differently in virtual versus everyday, or real, contexts, and that there are important structural dissimilarities between personality in these two contexts on a self-report measure.

The convergence of extraversion and openness to experience in virtual contexts raises the spectre of a two-factor structure entailing a strong plasticity factor and a stability factor, respectively. Indeed, post hoc analyses conducted to extract the hierarchical structure of the virtual personality data in Study 2 involved trimming the "Trust" and "Values" items, resulting in a four-factor structure with slightly better fit, and a higher-order two-factor structure with inadequate fit, but with evidence that more sensitive instruments may yield still different results. It is also possible, however, that a higher-order stability factor entailing conscientiousness,

agreeableness, and emotional stability would still remain structurally weaker in a virtual context than in an everyday context.

The manner in which individuals interface with virtual worlds should be considered here. In the most normative virtual spaces – social media, text messaging, etc. – individual behavior is generally either creative or reactive by virtue of the virtual affordances available to users which direct or encourage certain behaviors. Interacting with others in the most regularly inhabited or most-visited virtual worlds such as Facebook, MMOs, text messaging, and various social media platforms generally predisposes individuals – their virtual selves – toward extraversion and openness to experience, or plasticity in big two terms. These are the social currencies within the virtual world. There are less affordances available directing one to express behaviors circumscribed to trait conscientiousness and emotional stability, specifically. And the case with agreeableness is much less clear because agreeableness is afforded at both extremes – on the one hand, the availability actions such as upvotes, likes, follows, and comments can "nudge" the agreeable individual toward behaviors consistent with their everyday personality, while withholding them can convey the opposite. It is also a short distance from this consideration to the motivations which one has in spending time in such spaces. Thinking back to the experience sampling survey mentioned in chapter 1, for example, it is striking that many of the behaviors one might be most afforded to actualize in the virtual world (e.g., extraversion) are prompted to some extent by real-world motives which are precisely the opposite (e.g. the desire to avoid others). Nor is it irrelevant that low emotional stability may be involved in individual preferences for certain virtual spaces over others, as previous research has implied (McCain et al., 2015).

Nonetheless, we are left with a tantalizing prospect that begs further exploration. Study 1 implies that individuals may evaluate the extent to which something is real or virtual automatically. Note, for instance, that the order of items in the Study 1 measure were randomized, and yet there was remarkable systematicity with regard to how items representing human factors (factor 1), internet and social media platforms (factor 2), sports (factor 3), societal issues and institutions (factor 4), and material reality (factor 5) were rated when individuals were forced to classify items dichotomously along an ordinal spectrum from completely virtual to completely real. On what information are these ratings contingent? This is unclear, but it is obvious that ratings were assigned intentionally and a nomological network relating these various concepts theoretically and empirically is within reach.

Meanwhile, study 2 provides early evidence that personality in the virtual world is structurally different from personality in the real world. When considered in light of modern trends in technology use, this prospect takes on new meaning. For, if more of our waking hours as individuals and as a society are spent in virtual worlds, to which person and to which behaviors shall we ascribe a personality – the real or the virtual? Like the technology of virtual spaces, are the inhabitants of virtual spaces under revision? How do cultural norms and desirability shape the differences we observe between real and virtual selves? And what does this mean for society? For technology developers? For individuals?

Virtual Migrations: Considerations

What is especially intriguing from this vantage point is how growing global access to the internet – and to virtual worlds by extension – will shape human behavior moving forward. Whereas mobile internet access represented a natural technological evolution in industrialized countries (i.e., USA), it represents a significant leapfrog in non-industrialized countries in which

land-based internet access was previously either scarce or non-existent. In this way, the widening of one gap signals the closing of another, between the virtual experiences and practices of diverse populations across the globe. Can we expect the structural invariance of personality across culture, ethnicity, gender, and age to remain more stable or less stable as access to virtual worlds becomes less constrained? Here too, the conversation regarding virtual affordances takes on a different meaning, for the virtual environments and virtual affordances we see today are products of decades of utilization trends. That is to say, modern virtual worlds are configured as they are based on years of data. As more individuals in more remote or more impoverished or more isolated or more traditionalist parts of the world gain access to shared online virtual worlds, how will their values, their customs, their traditions, their behaviors, and their personalities be preserved in a virtual world designed by and for others? Will the affordances of their virtual environments suggest to them a new virtual self more like their distant virtual peers?

Discontents

It is worth mentioning a couple of large studies which have demonstrated patterns of behavior associated with trends in modern technology use (see Anderson, Crespo, Bartlerr, Cheskin, & Pratt, 1998; Marshall, Biddle, Gorely, Cameron, & Murdey, 2004). In a study featuring large samples gathered from both Canada and the United States, for example, Iannotti and colleagues (2009) examined the influences of screen-based digital media use on physical and social outcomes and health indicators. Their analysis found that screen-based digital media use (SBDM) was correlated positively with health complaints, physical aggression, and cigarette smoking. On the other hand, SBDM was found to be associated negatively with quality of life, physical health status, and strength of family relationships. Interestingly, however, greater SBDM was related to higher quality of peer relationships.

When considering affordances and constraints in everyday and virtual contexts, it could also be considered that the prevalence of sexually explicit media use has been estimated to be as high as 65% of internet users (Weaver et al., 2011). Examining the behavioral consequences of sexual media, Drouin et al. (2015) found that exposure to sexually explicit media and "sexting" can alter perceptions and dispositions toward sexuality and relationships, including attitudes toward the opposite sex. A survey of 480 young adults found that approximately one-fifth had engaged in sexting when they did not wish to, and these "coerced" experiences – especially for females – were characterized by significant retrospective trauma, anxiety, and depression. Additionally, there was an association between sexting, alcohol use, unprotected sex, and sex with multiple partners.

Andreasson and colleagues (2015) have previously demonstrated that extreme technology use can fulfill the criteria for addiction. Further work revealed additionally that females are more prone to the addictive use of social media, whereas males are more likely to become addicted to videogame use.

Still, other researchers have enumerated on potential mental health benefits of certain types if interactive digital media consumption, such as stress-management. It was found in one study that all three conditions in an experimental test involving exposure to interactive experiences, positive emotions were induced and stress was successfully managed to some measureable extent. This was found to be especially true of the virtual reality (VR) medium (Villani et al., 2012).

These highly-cited studies, among hundreds of others, are used here to demonstrate that there is immense concern among researchers in nearly every discipline over how virtual behavior and real-world behavior are related, and that this relationship is often framed in terms of its

negative real-world consequences. Personality and social psychologists can be instrumental in helping reframe many of these concerns theoretically around behaviors and affordances.

One possibility seems to be that individuals may self-select into virtual environments that lack the cultural constraints in everyday contexts which prevent those behaviors which match their inner, or unconstrained motivations and desires. This is the idea of the discontents model, based on Freud's masterwork *Civilization and its Discontents*, and we can perhaps see in such a model why designers may be motivated to create virtual worlds which lack certain constraints, why individuals might be driven to those virtual worlds, and why individuals may then be so committed to their virtual world experiences and communities that they accept (or perhaps become less concerned with) the various resulting real-world costs and consequences.

Limitations

The results of this study are preliminary, and should be treated as such. Replication studies should be conducted which utilize other measures of personality and other sampling protocols. The personality measure used in Study 2 was only 30-items, and future studies could benefit from longer measures in terms of power and discriminant validity. Additionally, the real and virtual contexts can be framed with greater precision or with greater clarity by changing the actual situation in which the measures are given by utilizing the results of study 1 or similar analogue to determine how real and virtual contexts are construed at the individual level. For example, a "real" condition could involve taking a personality measurement using survey software or in a physical lab, while the "virtual" condition may involve taking a personality measurement on facebook or within a videogame.

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