

THE SECOND LIFE OF SOCIAL SCIENCE RESEARCH: AN ASSESSMENT OF  
SAMPLING AND DATA COLLECTION METHODS, DATA QUALITY, AND  
IDENTITY CONSTRUCTION IN VIRTUAL ENVIRONMENTS

by

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(Under the Direction of Deborah Bandalos)

ABSTRACT

The purpose of this study was to investigate the ways in which social science data can be collected in virtual environments. In particular, this project focuses on sampling strategies when the population characteristics are not known, how virtual worlds residents may or may not differ from a nationally representative sample of Americans, and the factors surrounding how virtual worlds residents construct their identity and the relationship that has with physical and mental health. Using the largest virtual world in existence, Second Life, as the virtual platform for data collection, respondents were asked a series of demographic and health-related questions. The most significant contribution of this project is the methods used to design a quasi-random sampling frame for individuals in Second Life. A sample of 297 virtual worlds residents completed a survey instrument that contained replicated questions from the NHIS 2009 adult core questionnaire as well as questions designed specifically for this project. Results suggest that attempts at random sampling in virtual environments may not be worth the extra time and cost over convenience sampling methods since the differences between the two samples appear to be relatively slim – only choice of survey language and primary language spoken were significant at the .05 level. When SL

respondents are compared to a nationally representative sample of US adults, using the NHIS 2009 adult sample, there are significant differences in age (the NHIS sample is about 13 years older, on average), gender (there are more males in the NHIS sample), and physical and mental health indicators but no significant difference in income levels between the two groups. When age is controlled for, gender remains significant but the differences in health conditions largely disappear. This suggests, at least preliminarily, that residents of virtual worlds may not be that different from the population as a whole.

**INDEX WORDS:** Second Life, Virtual Worlds, Sampling, Data Quality, Identity, Survey, Methodology, Health, Measurement

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## DEDICATION

This is dedicated to my amazing sons, Junah and Jeremiah. You have taught me more than any teacher, school, or book. When I started this process, you were both but a twinkle in my eye, yet through you I have become what I was truly meant to be.

I love you with everything I am.

Listen to the mustn'ts, child.

Listen to the don'ts.

Listen to the shouldn'ts, the impossibles, the won'ts.

Listen to the never haves, then listen close to me...

Anything can happen, child.

Anything can be.

*-Shel Silverstein*

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## **Chapter 1**

### **Introduction**

At any given time, millions of individuals across the globe are online engaging in any number of activities such as emailing, browsing sites on the Internet, chatting with friends on instant messaging services, taking classes, playing games, buying and selling goods, and interacting socially. As interest and use of these technologies increases, so too does the possibility of using them for something other than entertainment. Virtual worlds represent one such online technology that is emerging as a serious venue for education, research, and intervention in both the physical and social sciences.

Though the exact number of residents of virtual worlds is a source of debate, one thing is certain: virtual worlds are booming. A leading research firm that specializes in technology recently estimated that 80% of active Internet users will be participating in virtual worlds by the end of 2011 (Gartner, 2007). Virtual worlds are fast becoming a place not just for entertainment but also for education, commerce, research, support, and information. Residents actively engage in identity construction in every aspect—from shoe size to gender to human status—and join or construct communities that support their identities.

Despite the seemingly unreal nature of these individuals and communities, the emotions and connections of virtual worlds residents are, in some cases, as genuine as those experienced in the physical world (Bell & Consalvo, 2009; Ikegami & Hut, 2008). Of course, there are situations where the emotions and connects are not as real as in the physical world, but the separation between the real and virtual is not as clear cut as it may initially seem.

Virtual worlds are quickly emerging as one of the most hotly debated areas for social science research. As the largest virtual world of its kind, Second Life (SL) boasts millions of participants each month (LindenLabs, 2009b)—called “residents”—and has an economy that is active and strong (LindenLabs, 2009c). This has led to significant interest in SL as a venue for health and education programs, commerce, and research. While the fastest growing area in SL is education-based activities (Robbins & Bell, 2008), many of the pioneers of health education and intervention in the physical world are experimenting with interventions in virtual worlds. Some may question investing real dollars for virtual world interventions, but the early research seems to show support for these programs as a viable tool for health behavior modification (Beard, Wilson, Morra, & Keelan, 2009; Krebs et al., 2009; Norris, 2009).

Virtual worlds give individuals the opportunity to engage students, friends, colleagues, and research participants in a way that has never been possible. Educators can lecture to a classroom of students from different countries without ever leaving home in a way that may give both the teacher and the student a greater feeling of presence than more traditional forms of distance learning. In the past if a researcher wanted to modify the gender or ethnicity of an interviewer, say to study interviewer effects, it would require

a great deal of time, make-up, and costume changes and would likely still not be realistic. Not anymore. Virtual worlds allow the researcher to change age, gender, ethnicity, or even human form with the touch of a button. Public health advocates have the potential to design interventions that elicit similar responses to those in a physical lab, but they can quickly alter the scenario to match the needs of each individual participant for a much more tailored treatment program. Virtual worlds are a complex series of user-defined settings that, if harnessed properly, have great potential for research, education, and socialization.

### **Statement of the Problem**

Currently, the most hotly discussed issue among researchers is how to conduct research in virtual worlds such that the results are comparable to those obtained under the scientific rigor that is applied to physical world research. Although there is not a wealth of peer-reviewed publications detailing research methods in virtual worlds, those that exist tend to center around strategies to recruit and engage participants (Bell, Castronova, & Wagner, 2009), the validity of the data collected (Wood, Griffiths, & Eatough, 2004), and ethical issues in virtual worlds (McKee & Porter, 2009; Sveningsson, 2004).

Several questions come to the forefront when researching the attitudes, behaviors, and experiences of virtual worlds residents. First, how is identity and meaning constructed in a virtual environment? If an individual is free to physically modify oneself, what does this mean for the construction of identity? Do avatars follow the same social norms in world that their physical counterparts do in real life? Second, what role can these virtual worlds play in furthering health, social, behavioral, and educational research? Third, what sort of methodological issues must researchers contend with when conducting research in virtual worlds in order to collect valid, high-quality data? Do the

same rules for sampling, data collection, and analysis hold in virtual realities? If not, what are some of the strategies and adaptations to traditional research that are viable? And finally, is the data obtained through virtual worlds research able to meet the standards for validity that traditional research must meet?

The purpose of this study is therefore to investigate broadly the methods available for collecting high-quality data in virtual environments; to establish the differences, if any are present, between respondents of quasi-random and convenience sampling methods; to determine in which ways data collected in Second Life are comparable, in both quality and responses, to that collected via a nationally representative sample; and finally to investigate how identity construction may differ among various types of Second Life residents.

### **Research Questions**

The following research questions are proposed for examination in this study:

1. Are the responses of a quasi-random sample of SL residents significantly different from a sample of SL residents obtained through convenience sampling?
2. How does the quality of data differ between that collected in Second Life and from a nationally representative sample—the National Health Interview Survey (NHIS)? Regarding quality, the author will focus on the non-response rates for sensitive health- and behavior-related questions.
3. Are Second Life residents with poorer self-reported health status more likely to gender swap or say that their avatar is someone different than themselves?

## **Chapter 2**

### **Review of Literature**

The author seeks to shed light on the previously outlined research questions as well as additional questions surrounding research in virtual worlds in general and in Second Life in particular. This review of literature will be organized in the following manner: Section one will summarize the research on identity construction and community in virtual worlds. This section will explore how an individual begins to construct and present himself or herself, the idea of presence in virtual worlds, similarities and differences in gestures and gender reporting and roles, and how the perceptions of individuals lead to formation of real communities. Section two will explore ongoing research, education, and intervention programs in Second Life as well as areas for potential future research. Finally, section three will delve into the methodological challenges of collecting research data in a virtual world. The section will begin by providing background information on gathering public opinion data and the advent of modern sampling methods and will end by discussing the ethical considerations of virtual worlds research.

#### **Introduction**

Though commonly called “virtual worlds” these platforms are technically referred to as massively-multiplayer online role-playing games (MMORPGs). These worlds are framed by different narrative environments and are typically very sophisticated and elaborate worlds that evolve based on user interaction and imagination (Wood et al., 2004). Popular examples of this type of environment include World of Warcraft,

EverQuest, Neverwinter Nights, There, and Second Life. Time spent in these types of environments is quite extensive, with millions of users each spending an average of 22 hours a week interacting in these and many other virtual worlds (Yee, Bailenson, Urbanek, Chang, & Merget, 2007).

Of these, the virtual world known as Second Life (SL) represents a haven for study in that it boasts the largest and most active global constituency of members. In June 2009 Linden Labs—the creators of Second Life—found that there were 741,945 unique, repeated logins in SL; this is a 24% increase from the same time the previous year (LindenLabs, 2009c).<sup>1</sup> At any given time, there are approximately 50, 000–60,000 users online (referred to as “in-world”) who, on average, tend to be in their mid-30s (KZero, 2009). These residents interact with one another through the use of virtual representations of themselves—called “avatars” or “toons.” Often described as “real life, only better” (Ondrejka, 2004), SL gives avatars the opportunity to engage in education-based activities (such as taking college courses), commerce activities (buying and selling land and goods), and leisure activities (dancing, talking, and even flying).

A basic account in Second Life, which provides an avatar and a few customizable body modifications, is free. Those who want to own land have to purchase a premium account, which starts at about \$10 a month (not including the price of the land). Second Life has its own economy, the currency of which is Linden Dollars, and has recently

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<sup>1</sup> There are several instances throughout this paper where a blog or Internet site is referenced. With the exception of the blog used by Linden Labs—which is the official source of data and media releases on Second Life—many blogs and websites reflect personal opinion or experience and are not considered peer-reviewed publications. As such, the reader should use caution when evaluating statements from these sources. As with any source, it is advised that the reader evaluate the original source and come to their own conclusion as to the quality of the work cited.

posted an annual run rate<sup>2</sup> of more than half a billion USD, making SL the largest virtual economy in existence. In the second quarter of 2009 alone, SL had 144 million USD in user-to-user transactions, an increase of 95% from the same quarter in 2008 (LindenLabs, 2009b, 2009c). Though virtual, SL has the potential to simulate all things in real life, with significant implications and possibilities for “real-world” research.

### **Identity Construction and Community in Virtual Worlds**

As previously mentioned, MMORPG users typically interact with one another through the use of virtual representations of themselves, most commonly known as “avatars.” Though virtual in nature, the avatar is a vital part of a user’s in-world life. The avatar is the self-representation of the individual and, in virtual worlds, is the primary identity cue for an individual (Yee & Bailenson, 2007). In some cases the avatar may be human and closely resemble the individual in appearance, speech, and behavior; in other cases, the avatar may be completely non-human, such as a dwarf, elf, animal, or spirit. The representation of the avatar and the goal of the interaction tend to be shaped to some degree by the virtual environment in which the individual engages. For instance, World of Warcraft (WoW) is a MMORPG that is heavily action oriented, has a strong fantasy basis, and relies largely on predesigned environments. Therefore it is not surprising to see many avatars fashioned after fantasy characters and the main themes and activities in this world based around fantasy role playing. Second Life, on the other hand, is a world built by its residents and tends to mimic, to some degree, the physical world. That is not to say that SL residents do not engage in fantasy-based role play but rather that fantasy gaming

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<sup>2</sup> A run rate is a basic calculation that takes current revenues and extrapolates them to a given period of time in order to give some measure of financial status. In other words, if a company had \$100 billion in revenues for the 1st quarter of a given year, the company could post a predicted annual run rate of \$400 billion (assuming the same revenue and expenditures were steady each quarter).

is not the express purpose of SL as it is in WoW. While residents may choose to engage in role or fantasy play, SL residents have complete choice over how they spend their time and are not required to compete or interact on any level (Ludlow & Wallace, 2007). That is to say, residents of SL are free to shape their SL environments to suit their individual needs and desires. The experiences and situations in SL are as varied as the individuals who create them.

**Identity in virtual worlds.** Historically, much of the research into virtual worlds has focused on online gaming and has generally presented limited, and mostly negative, aspects of individuals who use MMORPGs such as gaming addiction (Huh & Bowman, 2008; Wood et al., 2004), negative psychological and physiological effects, (Hu, 2009; Kraut, Patterson, Lundmark, Kiesler, Mukophadhyay, & Scherlis, 1998) and has by and large focused on younger players (Griffiths, 1997). Though some research points to positive benefits of online gaming (Wack & Tantleff-Dunn, 2009), the generally one-sided approach to MMORPG research has further contributed to a negative social image of players.

In order to understand the possibilities and challenges that virtual worlds research holds, one must understand how individuals in virtual worlds organize and construct both their individual identities and their communities as a whole. A great deal of research has focused on player typologies (such as socializer, explorer, killer, gamist, or simulationist) (Bartle, 1996, 2003; Yee, 2003) and less on how the individuals and communities to which these avatars belong come into being. Interestingly enough, in their quest to identify types of players, researchers have assumed the existence of the larger construct of social identity (Salazar, 2009). Because we, to some degree, base our personal identity

on what others see in us (Cooley, 1902), it is important to understand the nature of the interactions in virtual worlds and how they may or may not differ from that of the physical world.

Recent research on virtual worlds is focused on a few key concepts. Chief among these are how “real” the virtual world is to its residents (Blascovich, 2002), how behaviors in virtual worlds and physical worlds compare (Yee et al., 2007), and similarities and differences in demographics among users (Griffiths, Davies, & Chappell, 2004). By understanding how a user behaves in virtual worlds and the propensity for a virtual world to alter behavior in the physical world, a researcher can begin to consider the implications for social science research. In order to understand behavior, one must first understand how the individual creates and processes his or her identity.

**Emotion and behavior.** A person’s first experience with the Second Life world may seem very much like a video game. Avatars can fly and teleport to different locations and may wear clothes and have body shapes and colors that are not at all similar to what a person sees in the physical world. However, underlying this seemingly surrealistic environment is a true community that, in many ways, operates similarly to the physical world in its social norms and behaviors (Ikegami & Hut, 2008; Yee et al., 2007). Though the landscape and the avatars that an individual interacts with may be virtual, the person behind the avatar is real, and the emotions that he or she feels can be as real as those experienced in physical worlds (Ikegami & Hut 2008). The symbols and delivery are often non-traditional (such meeting at a virtual coffee shop instead of a real one), but the messages of love, hate, friendship, and happiness appear to be as genuine in virtual worlds as they are in the physical world (Bell & Consalvo, 2009).

If we extend Erving Goffman's (1963) observations of behavior in public places to include virtual worlds, then the way in which avatars engage with one another is important to understanding the community as a whole. Goffman believed that behavior in public and semi-public spaces "of any community tell us a great deal about its most diffuse forms of social organization" (Goffman, 1963, p. 4). Avatars often engage in both public and private activities one would typically only believe to be present in the physical world, such as going to dinner with a date, having drinks with friends, dancing at a club, laying down to bed at night, having sex, camping, swimming, or going shopping. Once avatars, and their human counterparts, immerse themselves in the virtual environments, there can be a sense of co-presence with other individuals that is stronger than other forms of electronic or virtual communication such as email (Ikegami & Hut, 2008). Avatars are able to interactively communicate with one another through not only verbal cues but physical gestures as well. This closely mimics the interpersonal communication that individuals experience in the physical world, thus giving avatars the feeling of real presence in the virtual world.

**Virtual presence.** Presence is a fundamental part of in-world identity construction and is essential to understanding how residents become integrated into the virtual world. Broadly speaking, presence "measures how 'real' one believes a mediated environment is in terms of nonverbal behaviors, physiological responses, and other measures" (Yee et al., 2007, p. 116) and is largely comprised of personal, social, and environmental presence (Heeter, 1992). This construct is vital because one cannot predict the impact of a virtual world environment on an individual until one understands the extent to which that virtual world is "real" to the individual.

The process for creating personal presence is much the same in virtual worlds as it is in the physical world. That is, one must be able to discern his or herself as an entity separate from the larger environment as a whole (Heeter, 1992). In virtual worlds, much of the focus on creating personal presence is done by simulating the sights and sounds that individuals experience in the physical world. Basic things, such as being able to see your hand, are vital to convincing the person that they actually exist in the virtual world (Heeter, 1992).

Sociologists, psychologists, and philosophers frequently discuss how the shared perception of a group will shape how the individual understands his or her role within that group (Cooley, 1902). In the physical world, this realization of the “generalized other” is a key developmental milestone in early childhood development and is just as important in developing a socially functioning virtual identity. Creators of virtual worlds often design automated programs that interact with avatars in order to give the avatar the sense that they are noticed by the virtual world (Heeter, 1992), which is really the crux of social presence. Societies generally shape and mold what the individual sees as “real” through media, interpersonal communication, and social norms (Hawkins & Pingree, 1982); and this is not really different in virtual worlds. The presence of other avatars and the interactions with them strengthens an individual’s belief that that he or she exists in the virtual world.

The ability to create, destroy, or modify the virtual world around you is a key component of environmental presence (Sheridan, 1992). Many virtual worlds are basically framed by their creators and any change in that design is considered “hacking” and usually against the rules. However, this is not the case with Second Life, which

prides itself on the fact that “everything in Second Life is user-created, from the strobe lights in the nightclubs, to the car (or spaceship) in your driveway” (LindenLabs, 2009a). An avatar can buy land and build on it, or he/she can create cars, clothing, or hairstyles and sell them to other avatars. This likely creates a strong sense of environmental presence among SL avatars.

**Non-verbal cues.** Nonverbal communication has long been recognized as one of the primary components of interpersonal interaction (Argyle, 1988; Hall, 1959). Nonverbal communication can include any gesture, action, or representation of the self that conveys meaning between individuals without relying on spoken language. Research has found that certain gestures such as personal buffer spaces between individuals, hand gestures, and eye contact exist in much the same manner in virtual worlds as they do in the physical world (Yee et al., 2007). Researchers Yee and colleagues (2007) found that male avatars interacting with other male avatars maintain significantly larger distance between one another than is the case with female-to-female or male-to-female avatar interactions. In addition, they found that eye gaze is impacted by personal distance, much as it is in the physical world, and that the location of the interaction influenced the personal distance and eye gaze. This led the authors to conclude overall that residents in Second Life are “governed by the same social norms as social interactions in the physical world” (p. 120).

**Gender and “gender swapping.”** Another way that individuals represent themselves, although often unconsciously so, is through their gender and the way they convey their identity through that gender. It is interesting to note that though virtual environments provide unprecedented amounts of freedom for individuals and how they

represent themselves, users frequently gravitate towards familiar embodiments. In making this choice, the social and physical rules that restrict bodies in the physical world have come to control “embodied identities” in the virtual world (Yee et al., 2007). Perhaps one of the most interesting areas of research is the way in which individuals create and represent their gender, or lack thereof, in their virtual world and how that choice affects their interactions.

Though relatively little research exists, it is widely known that virtual world users often engage in “gender swapping.” That is, a user who is gendered male in the physical world will present himself as a female avatar in the virtual world or vice versa. The available research is contradictory, likely due, in part, to the differences in orientations of virtual worlds. Gender swapping is likely to occur for one reason in a fantasy, action-oriented world, whereas a different reason might prevail in a more social or education-based world.

Griffiths et al. (2004) found that 60% of their sample had played a different gendered character online. They speculated that increased popularity among games whose lead characters are female (such as Lara Croft Tomb Raider) has led to the normalization of gender swapping in gaming communities. Although these first female virtual pioneers tended to be, as one researcher put it, “ultra-fem drag queens, level-headed female soldiers, and sexy doll automatons” (Schleiner, 2004, p. 129), they took female characters from being battle trophies to lead characters (Dumitrica & Gaden, 2009).

Later research on gender swapping produced similar but somewhat conflicting results; Hussain and Griffiths (2008) found that 57% of players had gender swapped, with

significantly more females (68%) than males (54%) doing so. While reasons vary, it seems that in action based games, women tend to swap to male characters in order to avoid harassment or undue attention. As one female respondent stated, “I made my male character because I was tired of creepy guys hitting on my female characters. It’s utterly ridiculous, very annoying, and not the reason why I play the game” (Hussain & Griffiths, 2008, p. 23). Male characters tend to gender swap in order to be treated better or to have easier social interactions (Hussain & Griffiths, 2008) which further supports previous research that there are a number of positive attributes associated with being a female avatar (Griffiths, Davies, & Chappell, 2003). Unlike in the physical world, in virtual worlds a user may choose which gender to be; similar to the physical world, the interactions they have with other avatars are guided, in part, by that gender.

**Community in virtual worlds.** At the turn of the 20th century early sociologists W. I. Thomas and Dorothy Swain Thomas presented evidence on the social construction of reality in what has come to be known as the Thomas theorem, or more commonly thought of as “self-fulfilling prophecy.” Basically, the Thomas theorem posits that “if men define situations as real, they are real in their consequences” (Thomas & Thomas, 1928, p. 572). Given that the emotions and passions of people in virtual worlds are real, it should be no surprise then that the society they create is considered real as well (Castranova & Falk, 2008). The effects—sense of community, friendship, love, and loyalty—are all experienced in as “real” a manner in the virtual worlds as they are in the physical world because, as Thomas and Thomas might argue, they have become real through the belief in them.

Additional research has concluded that people in virtual worlds tend to abide by the same social norms and mores in their virtual communities as they do in their physical ones. In researching communication and nonverbal norms, Yee et al. (2007) concluded that:

If people behave according to the same social rules in both physical and virtual worlds even though the mode of movement and navigation is entirely different (i.e., using keyboard and mouse as opposed to bodies and legs), then this means it is possible to study social interaction in virtual environments and generalize them to social interaction in the real world. (p. 119)

Accepting the presence and reality of individuals and their virtual communities, even if they differ from physical communities, opens the door to a variety of educational and research activities in these worlds.

### **Health and Education Research in Virtual Worlds**

New technologies and their applications are growing and evolving as the “Net” generation—those who were born around the time that PCs were becoming popular and have always known this type of technology (Oblinger & Oblinger, 2005)—are entering adulthood. This connected generation does not draw boundaries between human and avatar, real and virtual, in-world and out-of-world in the same way that the generation before them did. The boundaries between countries may be geographically limiting, but through virtual means, the individuals in these countries freely travel from world to world and island to island where they interact with other individuals across the globe.

Not only are virtual worlds being used for entertainment, but they are increasingly being used for education, research, and support—particularly in health-related fields. Currently, in-world research and demonstrations are being used to inform individuals

about various health-related issues (Beard et al., 2009; CDC, 2009d) to shape interventions (Baumann & Sayette, 2006; Bordnick, Graap, Copp, Brooks, Ferrer, & Logue, 2004), to enhance health-related educational experiences (Walker, 2009), or to further support or challenge research conclusions from studies conducted out-of-world (Dean, Cook, Keating, & Murphy, 2009).

For example, in one study conducted by Dean and colleagues (2009) at RTI International, the researchers found that individuals whose avatars engaged in healthy behaviors in-world were more likely to engage in physical activities in the real world than were those individuals with avatars who were less physically active. Additionally, they found that individuals with thinner avatars were more likely to report lower body weight in real life. Dean et al. also found that avatars were more likely to report a heavier SL body size and higher real-life BMI to a heavier avatar than they were to a thinner avatar. What is unclear from this research, and is an area of debate in the literature, is whether or not the fit individual creates a fit avatar or whether the creation of a fit avatar motivates the individual to act in a way that he or she believes is expected of him or her—a phenomenon called the “Proteus Effect.”

The notion that individuals internalize and modify their behaviors based on both real and perceived expectations—the Proteus Effect (Yee & Bailenson, 2007)—is largely grounded in self-perception theory (Bem, 1972). The extent to which this phenomenon operates in virtual worlds and the impact of this effect have important implications for research in terms of understanding how the individual and avatar work together or separately and raises many questions. For instance, if an avatar engages in a virtual world-based research project, what impact, if any, does that have on the real person? Can

researchers modify the health behaviors of individuals by engaging their avatars in health behaviors? In addition to health research, there is a large interest among educational psychologists about the efficiency and efficacy of education programs delivered in virtual worlds. Is this a new vehicle for education? Is there a difference in the level of understanding or retention of course materials for classes delivered in-person as opposed to those delivered via traditional virtual methods (email, listservs, or web based) or newer virtual worlds methods?

**Health.** A recent survey by Beard and colleagues (2009) sought to identify and categorize the health-related activities in SL, to study the most popular and innovative sites, and to determine the possibility of using Second Life for disseminating health information and creating behavior change. Among the several hundred listed health-related sites in SL, the most frequently occurring were those aimed at patient education and awareness, followed by support sites, training sites, and marketing sites; very few were designed specifically for the purpose of conducting health-related research or intervention (Beard et al., 2009; Wetpaint, 2009) .

Although the health-related sites in SL are varied, they represent many of the major names in health care and wellness in the United States. For example, the Centers for Disease Control and Prevention (CDC) has an extensive facility on its own island in SL that averages about 200 visitors a month (CDC, 2009d). It is designed to provide information, conduct focus groups, and anonymously interact with a CDC representative. Also present is the Women's Health Center (WHC) at the Ann Myers Medical Center whose SL facility is run by real-life doctors and nurses and was the first community to offer medical simulations. At the WHC, women are taught how to conduct self-breast

exams and are given the opportunity to virtually simulate a mammogram (Beard et al., 2009). Finally, in the realm of mental health support, the SL site called Virtual Hallucinations simulates the perceptual abnormalities that schizophrenics often experience, helping to educate users on the strain of daily living for those with mental illness (Beard et al., 2009; Schizophrenia.com, 2009). The hope is that these innovative sites will help to bring often uncomfortable topics to an area where people can interact and educate themselves with relative anonymity. However, to date there is no published research on whether this is, in fact, happening.

On the surface, it would seem that increased use and immersion in Internet technology and virtual worlds would be more detrimental to individual health outcomes than not. It stands to reason that increasing an activity that requires the participant to almost exclusively remain sedentary would then result in a decrease in healthy behaviors (such as exercise and maintaining an ideal weight) among users (Dean et al., 2009). There is, in fact, a significant body of literature that has documented the negative outcomes of extensive online activities. In particular there has been concern over the high rates of obesity among virtual users (Wack & Tantleff-Dunn, 2009), the lack of social connectedness with other non-virtual individuals (Hussain & Griffiths, 2008), mood loneliness among users (Hu, 2009), and excessive hostility in both virtual play and real-world interactions (Eastin, Appiah, & Cicchirillo, 2009).

In contrast, recent and emerging research that targets and engages a wider range of virtual worlds, such as Second Life, is finding that while the user dictates the activities of the avatar, there may be a reciprocal effect—meaning that while the human drives the activities of the avatar, the avatar also drives the actions of the human (Dean et al., 2009;

Yee & Bailenson, 2007). The underlying theory for this is that humans are likely to create avatars that are generally better representations of themselves (physically at least) (Dean et al., 2009) and that the expectations of those thinner, fitter, and healthier avatars begin to change the behavior of the individual (Walther, 1996; Yee & Bailenson, 2007). In a sense, they begin to act the part of a healthier or more attractive individual. In one study, Yee and Bailenson (2007) used a between-subjects design to randomly assign subjects to an avatar with an attractive face (of the same gender) or an unattractive face and then collected data on the interactions of these participants with a research confederate. They found that individuals with an attractive avatar were more likely than those with an unattractive avatar to lessen their interpersonal distance (thus creating more intimacy between avatars) and increase their self-disclosure (also a measure of intimacy and friendliness). Finally, in a similarly set up experiment Yee and Bailenson (2007) manipulated the participant avatar's height and found that participants with taller avatars were more likely to behave in a confident manner and negotiate for things more aggressively than were shorter avatars.

This lead them to conclude that “the appearance of our avatars shape how we interact with others. As we choose our self-representations in virtual environments, our self-representations shape our behaviors in turn. These changes happen not over hours or weeks but within minutes” (Yee & Bailenson, 2007, p. 287). Even simple clothing changes, such as the color of the avatar's robe, can impact the desired behaviors of the user (Merola, Penas, & Hancock, 2006). Avatars are becoming the dominant way to represent oneself in virtual worlds (Walther, 1996), and as this form of representation

increases, so too will the interplay between the human and the avatar (Yee & Bailenson, 2007).

The fact that a person's avatar changes their behavior, coupled with the speed at which the change occurs, is especially encouraging for interventions aimed at changing health behavior. In particular, there has been promising research in Second Life to address two of the leading causes of preventable death and healthcare expenditures in the United States—tobacco use and obesity-related conditions.

***Targeting obesity.*** During the past two decades, there has been an alarming increase in obesity among both adults and children (CDC, 2009a). According to the CDC (2009a), 26.1% of adults are obese, and about another one third are considered overweight; overweight- and obesity-related expenditures totaled about \$147 billion dollars in 2008 (CDC, 2009b). Given the seriousness of the obesity epidemic, researchers are working to find new ways of engaging individuals that not only modify behavior quickly but create long-term knowledge and effects. Given the large number of SL residents and the preliminary research on the interaction of the avatar and the human, SL seems a reasonable laboratory for testing virtual treatment programs.

The preliminary research on obesity treatment programs in Second Life is promising. For instance, a recent experiment conducted by Fox and Bailenson (2009) showed that people who watched “self-representing avatars” (i.e., avatars whose physical characteristics are designed to look like the human who they represent) exercise on a treadmill were more likely to engage in some form of physical exercise in the 24 hours following the virtual exercise. Additionally, there was a significant difference between those who watched their own avatar exercise and those who watched either another

person's avatar using a treadmill or doing nothing at all (Fox & Bailenson, 2009) indicating the real possibility of modifying behavior in the real world through virtual world interaction.

Expanding this line of research, the Texas Obesity Research Center (TORC) has devised a Second Life research facility to combat obesity in the physical world. With the mission of “promoting a translational, interdisciplinary, lifespan perspective in obesity research,” TORC prides itself on trying innovative ways to address obesity (TORC, 2009). Currently, TORC is sponsoring the International Health Challenge in Second Life in which avatars from Canada, Mexico, Switzerland, and the United States have a chance to earn Linden Dollars for exercising and eating healthy fruits and vegetables in Second Life (TORC, 2009). Although preliminary research on the connection between the activity level and BMI of the avatar and human (i.e., active avatars have active humans and thin avatars are more likely to have thin humans) is promising, current research proves only association, not causality (Dean et al., 2009). However, the hope at TORC and among other obesity researchers is that exposure to healthy activities and behaviors in Second Life will modify behaviors in the physical world and lead to better health outcomes.

***Targeting smoking.*** The CDC estimates that each year approximately 443,000 Americans die of smoking-attributable deaths and although smoking is generally on the decline in the United States—going from 42.4% in 1965 to 19.8% in 2007 (CDC, 2009c)—there is still more to be done. One area in particular that has received extensive research attention in the real world has been relapse prevention (Krebs et al., 2009; Marlatt & Gordon, 1985; U.S. Department of Health and Human Services, 2008). In an

analysis of 42 relapse prevention interventions with a minimum of 6-month follow-up, researchers Lancaster, Hajek, Stead, West, and Jarvis (2006) found that the overall research on outcomes of such interventions have been largely inconclusive due to the limited power to detect moderate differences between groups found in most research designs. However, those interventions that have consistently shown promise in the real world typically use standard behavioral rehearsal, role playing, and other coping strategies such as how to respond to situations that often trigger the need to smoke (Lancaster et al., 2006; Rigotti, Munafo, & Stead, 2008). Given the ability to interact with fairly realistic environments, virtual worlds are uniquely situated to give ex-smokers the opportunity to confront things that trigger their urge to smoke in a safe and educational way.

Smokers, like most people, have conditioned cues that increase the desire to smoke. For some it may be the smell of coffee; for others it may be after eating a meal or being in social situations where others are smoking. Traditional therapies tend to involve showing the ex-smoker photographs of visual cues intended to bring about the desire to smoke and then to engage them in coping skills. However, new therapies that include virtually presented cues have been shown to bring about more cravings than the static photographs used in traditional therapies (Baumann & Sayette, 2006; Bordnick et al., 2004).

Researchers from the Memorial Sloan-Kettering Cancer Center designed a facility in Second Life to engage previously hospitalized ex-smokers in a virtual reality coping skills (VRCS) game to help them learn to manage cues that trigger smoking (Krebs et al., 2009). The goal of the game was for ex-smokers, upon return from the hospital, to have

the skills they needed to control the urge to smoke and to successfully stay smoke free. The VRCS contained a virtual home that was populated with commonly known smoking triggers as well as a “toolkit” with scripted actions that helped the user to engage in coping strategies and manage his or her urges. The researchers concluded that while not for everyone, the VRCS game has potential as a viable treatment modality for hospitalized smokers (Krebs et al., 2009).

Other organizations, such as SilkQuit, have taken to Second Life as a way to enhance their current online support groups. The SilkQuit virtual retreat center in SL offers a lounge room where avatars can chat with one another, a library with smoking cessation resources, a notice-board with the latest discussions, a live link to an out-of-world chat room, and fun activities such as a hot tub to relax in, skydiving, a dance floor, and a waterfront area to watch the sun set (SilkQuit.org, 2009). While the efficacy of online support groups and health-related facilities such as these in Second Life and other virtual worlds is still an area of debate (Eysenbach, 2003; Norris, 2009), there is much promise for the future of healthcare support, education, and program intervention within virtual worlds.

**Education.** The fastest growing use of Second Life is neither entertainment nor commerce, as one might think, but instead is education-based activities (Robbins & Bell, 2008). Over 300 universities have created virtual campuses in Second Life for the purposes of education, recruitment, and entertainment (Jarmon, Lim, & Carpenter, 2009); as a result, there is increased interest in the outcomes of these new ventures in digital learning. Researchers are increasingly becoming interested in how more established

worlds, such as Second Life, can inform and change educational pedagogy for adult learners.

In fact, researchers have found that virtual worlds in general, and Second Life in particular, likely provide some advantages for specific types of learners and subject areas over other distance learning scenarios (Roussou, Oliver, & Slater, 2006; Slator, Chaput, Cosmano, Dischinger, Imdieke, & Vender, 2005). In particular, virtual worlds environments in which the individual has an avatar, such as Second Life, gives the person a sense of presence and of being in a real space that more closely mimics a real-world educational or classroom experience than does a listserv or other distance-based learning techniques.

Education in virtual worlds allows both the educator and student to let go of traditional constraints (such as gravity and space) and create and learn in an environment that is open to change and evolution. Educators in Second Life are giving students hands-on experiences with simulations, role playing, building, and social events (Robbins & Bell, 2008). Second Life is easily adaptable for a variety of learning situations that provide the student with a chance to apply their learning in a new way. For example, starting a business is a complex and costly proposition. However, given a small budget of Linden Dollars, business students can start a real business and earn real dollars in Second Life (Robbins & Bell, 2008). They can learn about budgeting, marketing, hiring, and profits and losses in a real but protected way. In other words, it gives them the chance to apply the business principles they are learning in class without the risk of financial and personal ruin that often accompanies the start up of a physical world business. Virtual

world-based education is being used as a supplement to in-person instruction, as a complement to it, or in complete replacement of in-person instruction.

The rapidly increasing use of virtual technologies has brought about many different ways to engage learners outside of the classroom, which has led to a great deal of interest and growth in distance learning among higher education institutions. In academic year 2006–2007, there were approximately 12.2 million enrollments in distance education courses among all 2- and 4-year postsecondary institutions in the United States (National Center for Education Statistics, 2008). Distance education is very different from traditional learning because the student and teacher are physically separate and must rely on alternative means of communication (Walker, 2009). Fortunately, research has shown that presentations with richer multi-media components, similar to many of those that educators use in SL, support learning of more advanced and in-depth topics (Kemp & Livingstone, 2006). Using SL gives students the chance to simulate face-to-face interactions, use gestures, and interact with other users in a way that closely simulates aspects of in-person contact. Virtual environments represent a completely new type of learning environment that, at worst, does not seem to detract from the learning process (Walker, 2009), and at best, it provides a viable, exciting alternative to education that expands the classroom beyond its brick and mortar building (Herz, 2002).

Among the more notable institutions of higher education that are taking advantage of the new possibilities offered by virtual world education are Columbia University, Harvard, Indiana University, M.I.T., Ohio State, Princeton, and Yale. In the fall of 2006, the Berkman Center for Internet and Society at Harvard University held its first ever course in Second Life (Foster, 2006). Despite some early technical difficulties, the

course—entitled “CyberOne: Law and the Court of Public Opinion”—was a success for both educator and students alike (Harvard, 2009).

In addition to serving students, virtual worlds are providing a unique environment for educators to share research (Angel, 2009), challenge one another with new technologies, and develop and share their new virtual projects (Jennings & Collins, 2007). For example, one frequently visited learning environment for educators in Second Life is ANGEL Learning Isle (ALI). ALI was launched in 2007 as a collaborative effort between ANGEL learning—a well-known learning management software system used in real-world education settings—and the Second Life Educator’s community (SLED). Though developed, in part, by a software company, ALI is not designed to promote the use of any one particular software or program but rather to advance the knowledge of the educational opportunities in the virtual world of Second Life. Angel was the first educational company in Second Life, and the isle was built specifically for educators to “experiment in the use of virtual collaboration technologies in online learning” (Angel, 2009) and is still a popular place for educators to come together. ALI features an orientation garden (which teaches educators basic navigation and controls), the Educator’s Tool Gallery (which offers a variety of virtual educational tools and instructions on how to best use them), a sandbox (where they can practice building objects), a concourse (which displays other educator and student projects), and a teleportation kiosk which takes you to different educational sites in Second Life (Angel, 2009; Robbins & Bell, 2008).

There are, of course, limitations to using virtual worlds for education. Issues such as technical competency among users and latency, and general issues with the Internet are

highlighted when using Second Life (Bainbridge, 2007). For instance, bandwidth problems tend to cause latency (which is a lag that occurs in real time and causes interactions to be disjointed), and this is particularly problematic in countries that have slower Internet speeds (Campbell, 2009). Despite the fact that the education realm in SL is the fastest growing area to date, there is relatively little research and evaluation of education-based programs in Second Life and other virtual worlds (Sherman & Tillies, 2007). This is likely due in part to the natural lag that happens when new technologies emerge faster than the capacity to research and evaluate them. However, this paucity of research is also partly due to the fact that while many educational researchers know what sort of questions to ask about virtual environments, very few are knowledgeable enough about the methodologies (where they exist) to ask them. This is not an issue that is isolated to only educational researchers—research methodology in virtual worlds is a fast-paced and changing field. New methods are being tested and old ones evaluated, all with the hope of maintaining established scientific rigor in a new world.

### **Conducting Research in Virtual Worlds**

Well-established educational institutions and research conglomerates, such as Indiana University and the Research Triangle Institute, are rushing to examine the tools needed to engage virtual worlds residents in research that adds to the body of knowledge, particularly around methodological issues such as sampling (Bell, Castronova, & Wagner, 2008; Bell et al., 2009) and interviewer effects (Dean et al., 2009).

Interestingly enough, even though virtual worlds offer unparalleled advancements in technology, teaching, and entertainment, they are not always terribly easy to work with for those wishing to conduct serious research on virtual world residents. Wood et al. (2004) identified four key areas of methodological concern when conducting research in virtual worlds: recruiting and utilizing research participants, viable methods of data collection, validity of data collected, and ethical issues.

This final section will detail the literature around these issues as well as the new possibilities and opportunities for research that occur in virtual worlds broadly and Second Life in particular. There is limited literature that exists on qualitative data collection techniques such as psychological testing (Barak & English, 2002), participant observation (Suler, 1996), interviewing (Chappell, Eatough, Davies, & Griffiths, 2004), and other ethnographic studies (Dumitrica & Gaden, 2009); thus, this literature review will be largely limited to quantitative-based studies.

**Background.** In order to understand the future of virtual worlds research, it is important to understand the historical methods that lay the foundation for many current research practices and how we might adapt these practices to successfully address the issues mentioned and begin to transition research from the physical world to the virtual. Much of the way we approach social science research today is grounded in the methods started by public opinion pollsters in the 1930s and 1940s.

It was during this time that Elmo Roper, George Gallup, and Archibald Crossley publicly began refining and changing the way that America views research. These researchers were part of a movement away from straw polling, community surveys, and anecdotal evidence to one of empiricism and rigorous scientific methods. As sampling

techniques improved, thanks in large part to advanced statistical sampling methods developed by Harvard professor Theodore Brown, these “opinion researchers developed quantitative methods and human networks that allowed a tiny cross-section of Americans of different regions, classes, and races to stand for the whole” (Igo, 2006, p. 111). In other words, researchers no longer had to ask everyone in the population a question: they could get the answer from a carefully selected smaller subgroup.

Over the years, Gallup and Roper sought to further refine their sampling techniques, moving from ballot polling to in-person interviewing and later to telephone interviews, in addition to improving questionnaire construction and design. The end goal of these actions was to keep the discipline moving towards an unbiased vocabulary that could be used to gauge public opinion free of interviewer partiality (Igo, 2006). George Gallup, known across disciplines for his methodological rigor, argued that his standards served the scientific and research community as a whole because the ability to accurately predict human behavior was central to social science research (Gallup, 1951). Current researchers are facing issues similar to those Gallup, Roper, and Crossley faced in the early part of the 20th century—just with a new twist. How do you maintain the strict scientific methods of physical world data collection in a virtual world that does not play by the same rules?

**Benefit of virtual data collection.** In-person interviews and RDD telephone surveys have been a foundation for the survey research community for the better part of the past 50 years. However, the way in which Americans interact with one another is changing, and social science researchers are feeling the strain of trying to collect data from a population that is in transition. There has been a steady decline in response rates in recent years—particularly with surveys that are in-person or via telephone (Singer, 2006).

One of the contributing factors to the decline in response rates is the increase in households that are cell-phone only or mostly. The number of households with wireless-only telephones continues to grow annually. Results from the July–December 2010 National Health Interview Study (NHIS) indicate that three out of every 10 households (29.7%) are wireless only—a 3.1% increase from the first 6 months of 2010 (Blumberg & Luke, 2010). Having a landline in the home is not an indicator of use either, as 15.7% of those with landlines reported receiving all or most of their calls on a wireless telephone (Blumberg & Luke, 2010). One solution to this sampling problem is to include cell phone numbers in the sampling frame for telephone surveys. However, the increased cost associated with calling cell phones and the safety and ethical issues surrounding asking personal questions from a person who may be in a situation where answering these questions is not safe for them makes this an impracticable alternative.

Another solution, and one of the major developments in social science research, is to include web-based survey administration into research designs because of the increasing household prevalence of Internet use—as of December 2010, 77% of American adults use the Internet (Pew Internet & American Life Project, 2010). One

problem with web-based administration is that the response rates are typically lower than those achieved through other modes (Cook, Heath, & Thompson, 2000; Couper, 2000). However, response rates for Internet surveys often depend on the population, and the time required to complete the survey, the salience of the survey topic, as well as other characteristics of the survey design (Dillman, Smyth, & Christian, 2009); thus, it is possible that virtual survey administration may significantly increase the response rate and decrease non-response bias in some populations.

**Sampling and data collection.** One of the biggest issues facing researchers in general, and virtual worlds in particular, is how to get individuals to participate in research projects and how to select them in a manner that does not introduce any undue bias into the project—usually accomplished through sampling (Wood et al., 2004). There are two broad categories in which most samples fall: those selected at random and samples of convenience. A convenience sample is a non-probability sample in which the respondents typically volunteer for the study because the experiment is attractive to them for various reasons (Keppel & Wickens, 2004). The problem with samples of convenience is that there is usually no known probability for each respondent, which means that any generalizations must be based on non-statistical grounds (Keppel & Wickens, 2004). In contrast, in a random sample respondents are drawn from a known population such that each member has an equal probability of selection, and, if done randomly and appropriately, the sample will ideally yield results very close to what would have been achieved by interviewing each member of the population.

However, random sampling in virtual worlds is difficult because very few, if any, worlds openly share information about their users. There is no phone book, so they

cannot be called, no permanent addresses to send a letter, and no easy way to randomly identify individuals. Unfortunately, this makes it all but impossible to design a truly random sample in which each individual has an equal probability of selection. At present, most research in virtual worlds relies on convenience samples, which can be problematic when trying to generalize to a broader population (Keppel & Wickens, 2004). In fact, to date there has been only one survey completed in Second Life—headed by prominent SL researcher Mark Bell—that can make a reasonable claim to have randomly collected data, but even that data is considered a quasi-random sample (Bell et al., 2009).

Researchers at Indiana University and Germany’s DIW Berlin—Mark Bell, Edward Castronova, and Gert Wagner—recently released results from the largest ever in-world study of SL residents. Their study, with 2,094 valid responses, tells a great deal about the demographic make up of SL residents as well as giving insight into new research tools being used in Second Life, in particular the use of virtual data collection interfaces (VDCI) (Bell et al., 2008). The VDCI boxes are essentially free-standing kiosks that allow the resident to approach the kiosk, receive consent information, and begin the survey in privacy (it is scripted so that no other avatar can read the questions or the responses) (Bell et al., 2009). Researchers designed three different sampling frames to recruit respondents and then evaluated the representativeness and impact of each method.

The first sampling frame included the following three SL related mailing lists: the SL Educators List, the SL Researchers List, and the Association of Internet Researchers List. Members of these lists were contacted via email and given a URL that would only work in Second Life (SLurl) to follow to complete the survey.

These researchers note that “this resulted, in principle, in a random sample of members with those lists”; however, “compared with the universe of all SL users it is most likely a heavily biased sample because SL users who are interested in education and research most likely did not represent the average user community” (Bell et al., 2009, p. 10). The second sampling frame used SL’s in-world classified ads to place an English ad for participation in a survey. In the end, as would be expected, this created a convenience sample of SL residents who were able to read English.

Finally, and most interestingly to those trying to randomly sample in SL, Bell and colleagues (2009) used a program to identify all searchable locations in SL. They then randomly selected from these locations areas in which they would attempt to place the VDCI kiosks. In order to place the VDCIs on each geographic location, they were required by SL Terms of Service to gain permission from the owner of the location. Approximately 10% of owners agreed—a very low cooperation rate—which calls into question the true randomness of this particular method. All in all, the project resulted in the largest survey ever completed of Second Life residents ( $N=2,127$ ); however, only 79 of those respondents were recruited via the VDCI quasi-random protocol (Bell et al., 2009).

After reviewing the participation rates and analyzing data in addition to comparing the relative cost of each method (the classified ad and email frames were much less intensive and expensive than the VDCI method), the researchers concluded that the differences between the quasi-random protocol and the classified ad mode were not large enough to warrant the increased expense (Bell et al., 2009). The differences noted were primarily between the sample email list group and the other two sampling

methods (classified ad and quasi-random VDCI). The only real difference between the quasi-random sample and the other samples was age and income, both of which showed a more spread-out distribution in the quasi-random protocol than they did in the classified ad or email list frames. The researchers were not surprised by this because the email list sample, which tended to include higher education academics or researchers, was very unlikely to be representative of the broader SL population. Although there were demographic differences, as noted in age and income, between respondents in the three modes, the differences between the classified ad system and the VDCI were small and the authors concluded that “the evidence seems to support an argument that classified-ad sampling obtains a representative sample of the SL population” (Bell et al., 2009, p. 23). Their project contributes a great deal to the methodological research literature on Second Life by highlighting not only the different methodological opportunities and obstacles to researching in SL but also some of the logistical and ethical issues.

**Sources of error.** Preliminary findings seem to indicate that virtual worlds operate and impact users differently than do other technological mediums such as the Internet, email, or chat rooms (Bell et al., 2008; Walker, 2009), likely making the sources of error similar in their broad categories but different in the specific ways they manifest themselves.

Generally, coverage error is much more of a concern in web surveys than in telephone, mail, or in-person surveys. This is due mainly to problems with Internet prevalence, the frequency with which email addresses change, and the problem of knowing the entire population that is active on the Internet or in a virtual environment at any given time. When considering survey administration in virtual environments, coverage error is a significant issue simply due to the lack of information available on the populations in virtual environments.

Measurement error is also a concern in virtual environments though perhaps less so than in-person or via telephone. Research has shown that different modes elicit different responses to the same questions (Christian, Dillman, & Smyth, 2007); in particular, respondents tend to give more positive responses to scale questions on the telephone than they do on the web (Dillman et al., 2009). Overall it seems probable that the sources of measurement error will decrease when changing mode from telephone or in-person to a self-administered Internet survey. This is largely due to the absence of an interviewer, which simultaneously lessens the motivation to respond in a socially desirable manner and lessens the cognitive burden on the respondent because they have less to remember when responding—the questions and choices are available to read again if necessary. When the questions are presented visually, the respondent has more time to process the responses and is less likely to choose the most recently shown response—called a recency effect—than if presented aurally (Dillman et al., 2009). However, there is also concern that surveys presented visually tend to push respondents towards the first categories in a response set (particularly if they are nominal categories) because they are subject to deeper cognitive processing (Krosnick & Alwin, 1987).

There is, however, one source of measurement error—interviewer effects—that will likely be very different when the survey is administered through a virtual platform instead of in-person or over the telephone. A survey administered virtually is more likely to be a self-administered questionnaire (SAQ), which has been shown to produce more truthful answers to sensitive questions (Tourangeau, Rips, & Rasinski, 2000). In the absence of an interviewer, the respondent will have little motivation to underreport or overreport behaviors. This could significantly decrease the overall measurement error when asking about sensitive matters and may yield responses that are closer to the true response.

Because research in virtual worlds in general and Second Life in particular is so new, it is generally unknown how most of the sources of error will change from traditional modes. It is possible to form hypotheses about the sources of error based on the current research literature on mode effects between telephone, in-person, mail, and web surveys; however, surveys conducted in virtual environments are not the same as what is traditionally considered a web survey, and such conclusions may be inappropriate. The ways in which virtual worlds respondents are recruited and surveyed tend to be as different as are their responses (Bell et al., 2009). Therefore, it is more efficient to loosely anticipate the sources of error and how they will change and be innovative in managing and correcting these sources of error once they present themselves.

**Validity.** Concerns over data validity are not limited to virtual worlds research but tend to be highlighted and, in many cases, exacerbated in virtual worlds. When collecting data from a resident of a virtual world, many of the visual and aural cues that

both researchers and participants rely on in the physical world are absent. For instance, a virtual researcher can ask the gender of a resident but they have no way to verify the actual gender of the individual behind the avatar, whereas in the physical world, they would be able to determine this with a reasonable degree of certainty from seeing the participant or talking with them. Although the problem of verification is highlighted in virtual world research, it is largely similar to any self-reported data that is administered remotely (such as a questionnaire by mail or telephone) and requires the researcher to build in checks (such as follow-up emails) to attempt to determine the validity of the data (Wood et al., 2004).

Larger threats to data validity, and ones that are rarely addressed by researchers in their writings, are technical and interference issues (such as hacking, harassing, and generally disrupting the process—also broadly referred to as “griefing”) that can immobilize the entire research project and destroy or corrupt all the data collected. In the best of situations, it is nearly impossible to conduct a research project without some level of technical difficulties, whether that is making sure that your survey participants understand the questions on paper, trying to minimize interviewer effects in telephone surveys, or ensuring that all proctors administer exams with the same instructions. However, surveying in virtual worlds brings a whole new host of technical issues that require specialized learning to address, such as server protection and security, programming, and general technical literacy. Another big issue is that the environment in which the research is conducted is largely out of the researcher’s control (Bell et al., 2009) such that if the host world experiences a glitch and is forced to shut down, then so

is the research project. To a certain extent, researching in virtual worlds puts the researcher at the mercy of the creators of that world and its inhabitants.

The creators of virtual worlds usually want to keep their system up and running with little to no complications; however, that is not always the case for all of the inhabitants of virtual worlds. In most virtual worlds there is a “general absence of law and some degree of social indifference” (Bell et al., 2009, p. 6) that proves to be a breeding ground for organized crime groups and lone individuals (called “griefers”) who seek to disrupt the experiences of other residents. In general, griefers are individuals who are very skilled at virtual world play and online games but “what they most enjoy about these games is making other players not enjoy them” (Dibbell, 2008, p. 2). In other words, they are basically online spoilsports. While most of their antics are more irritating than anything—such as blasting an area with flying phalluses, Super Mario characters, or images of Bill Cosby with a pudding pop—they have been known to depict more violent actions such murder (Dibbell, 2008) and rape (Dibbell, 1993).

Griefers have recently become an issue to the research field as they attempt to hack into payment systems or, as was the case in one large-scale SL survey conducted in-world, fill-out surveys in a manner that indicates that the information was not true (Bell et al., 2009).<sup>3</sup> This oftentimes forces the temporary suspension of research projects and can yield unusable data. These individuals and groups can make conducting research unpredictable and put data collection and quality at risk, but unfortunately there is not a great deal that a researcher can do to prevent these occurrences. Generally they just have to be dealt with when or if they happen by taking steps to ensure that research accounts

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<sup>3</sup> In cleaning their data, Bell et al. (2009) excluded 33 observations who chose the first response for all the questions in the questionnaire. The researchers believed that a consistent and unlikely pattern such as that was likely indicative of non-serious response behavior.

are monitored and data is properly vetted and cleaned (Bell et al., 2009). For example, it is important to pay attention to response trends (always choosing the same answer for all questions), unrealistically short response times (if all other respondents are taking 20 minutes to complete the survey and someone takes only 3, then it is likely that the responses are false), or inconsistencies within the data. In addition, the researcher must frequently monitor any/all accounts related to payment or communication to ensure that the project is going as intended and not being hacked into or experiencing any other sort of technical interference.

**Ethics.** The ethical issues in virtual worlds research are not terribly different from that of the physical world. McKee and Porter (2009) suggested that most of the ethical issues under consideration for virtual worlds—informed consent, respondent burden and stress, vulnerable populations—all have some counterparts in the physical world. For instance, researchers know they must gain informed consent from a person before beginning a research experiment. But, an avatar is not a human. Should it be afforded the same protections as a human? What about private space? Is there such a thing as “private space” in a totally open society such as Second Life? If two avatars are engaged in conversation in-world, is it ethical to record that conversation without their knowledge? These types of questions are just a few among the many that virtual worlds researchers are attempting to answer.

Informed consent is the cornerstone of ethical research in the physical world, and by and large the same rules transcend to the virtual world. This is likely due, in part, to the fact that even if researching in a virtual world, a researcher must first get clearance from his/her organization’s Human Subjects Review Board. The rules are quite simple in

most research organizations—all research participants must be fully informed of the possible risks and benefits in a clearly understood manner unless the research unobtrusively occurs in a public place. Typically, pieces of data recorded in public space (such as how many people in blue jeans walk past a store) do not require informed consent.

In 2004, researcher Malin Sveningsson argued that the public-private dichotomy is not sufficient to determine ethical judgments, particularly in a virtual world. Instead, she stated, one must consider both the issue of the public versus private sphere as well as how sensitive the information is to the respondent (Sveningsson, 2004). A few years later McKee and Porter (2009) further extended this argument, and the design of Sveningsson's visual grid, to include examples of cases and where they lie on the ethical spectrum (see Figure 1).

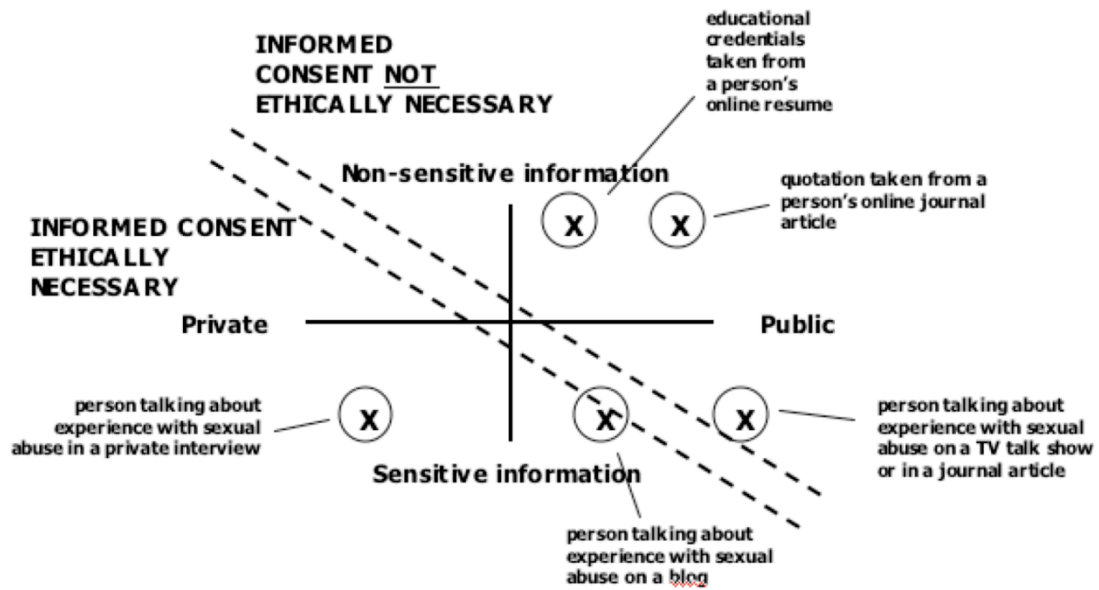


Figure 1. Mapping of types of interactions with research participants.

(Adaptation of Sveningsson by McKee & Porter, 2008, p. 732)

Another ethical consideration that is somewhat different in virtual worlds is the burden to the research participants. While the concern is by no means a new one, the potential reason for increased burden is different. Wood et al. (2004) cautioned that there may be an increased chance of respondent stress when completing in-world research projects due to the lack of verifiable nonverbal cues (such as age, race, gender, inflection in voice, and eye contact). In addition, researchers are able to modify their appearance to mask their real age, ethnicity, or gender, thereby conveying an identity that is not truly theirs. In the absence of these indicators that convey unspoken meaning, researchers should take great care to create environments and word questions in such a way as to ensure clarity and meaning, avoid deception, and respect a participant's right to privacy

(Wood et al., 2004). Along these same lines, the researchers suggested that because there is no way to determine with certainty who is behind the avatar participating in the study, it is important to consider the presence of typically vulnerable populations (Wood et al., 2004) and to act accordingly.

By and large, the researchers in virtual worlds who are highly respected and frequently publish their research tend to favor openness and candor and err on the side of caution with regard to ethical considerations. Despite often receiving conflicting advice on whether or not to disclose oneself as a researcher, most virtual worlds researchers feel that they are ethically required to do so. In interviews with leading virtual worlds researchers, McKee and Porter (2009) found that many researchers have experienced a sort of wariness from participants due to previous researchers who have ignored participants' rights to privacy by publically posting the analysis and transcripts of researchers and participants without express consent. Research in virtual worlds is a rapidly evolving science that, while similar to research in the physical world, does have very different ethical challenges that must be approached with the same degree of seriousness as research in the physical world.

## **Chapter 3**

### **Methods**

This chapter describes the participants, data collection procedures, and instrument design.

#### **Participants**

Participants were individuals, aged 18 and older,<sup>4</sup> who were active users (called “residents”) of the virtual environment Second Life. The only two exclusion criteria were 1) individuals under the age of 18 and 2) those who did not state that they agreed to the informed consent statement. The targeted sample size for this study was initially 800 (400 from the quasi-random protocol and 400 from the convenience protocol). However, after a lengthy field period, it became clear that the time required to obtain 800 interviews was not feasible with the time and resources available. In order to ensure that there were enough responses to conduct the analysis with confidence, a power analysis was conducted that determined that a total sample size of 210 (at least 105 in each group) would have a power of 95% to detect a treatment effect. While there are no stringent guidelines for standards of power, most researchers follow Cohen’s assessment that .80 is sufficient power for most analytic tests (Cohen, 1988). Because this was more than enough power needed, it was decided to end data collection. After removal of duplicate and false entries, the final number of respondents for this study was 297. The protocol for data cleaning is detailed in the chapter on results.

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<sup>4</sup> This was verified by asking the individual their date of birth. Anyone under the age of 18 was not allowed to complete the survey. This was accomplished by programming the survey to accept only birthdates that indicated that the individual was at least 18 years of age.

## **Data Collection Procedures**

**Field period.** The data collection began on September 1, 2010 and ended on March 1, 2011. There were approximately 4 weeks when data collection was suspended, pending human subjects approval of revised consent documents, which became necessary after multiple false entries were discovered (discussed in detail in the section on Survey Administration Access).

**Sampling.** The unit of analysis is the individual Second Life resident, and the sampling was conducted via two different approaches. The primary objective for having a dual sampling frame is to be able to compare the characteristics, attitudes, and behaviors of those who were sampled quasi-randomly with those gained through convenience sampling. This is an area of interest in virtual worlds research both in 1) how we attempt to gain a more random sample in a virtual world and 2) whether that quasi-random sample is different enough to warrant the extra time and cost required to obtain it. The two sampling strategies, random sampling and convenience sampling, are detailed below.

***Quasi-random sample.*** There is no implicit virtue in randomness, but we employ random selection in sampling surveys in order to eliminate selection bias and improve the representativeness of our samples. I employed a two-stage cluster sample in my selection of research respondents for the “quasi-random” part of my study. The first stage of the sample—my primary sampling units (PSU)—consisted of a sample frame based on the Second Life Destination Guide (SLDG). The SLDG lists the “islands” that are virtual destinations that SL users commonly visit; the SLDG is created by Linden Labs, the creator of SL, and stands as the best sampling frame of destinations available. According to documentation from Linden Labs regarding the SL Destination Guide, venues and content in the SLDG are not paid placements, and there is no overlap between categories;

thus, a location that is present in the art category will not be present in the featured events category.<sup>5</sup>

The Destination Guide is constantly maintained and updated by the creators of SL so that the likelihood of choosing a geographic location that is out of date (meaning no longer in use) is slim, although not impossible. I randomly selected approximately 10 locations per category (five locations per category were the primary sampling location and five served as replacement locations) for a total of 220 locations (110 primary and 110 replacement). The locations were then split among three field interviewers who were responsible for approaching avatars within those locations. Because many islands were sparsely populated, in the end, all primary and secondary islands in the sampling frame were visited by a researcher in order to recruit participants.

The second stage of the sampling process, selecting respondents within the islands (PSUs) also meets the standard of randomization, although a complete sampling frame of users does not exist. Nevertheless, my two-stage sampling process follows the standards employed in probability intercept surveys such as exit polls, where no sampling frame exists for respondents. In fact, similar sampling strategies have also been used in research with young gay and bisexual men – another group of individuals for which little to no population level information exists (Waldo et al., 2000). However, by randomizing the selection of avatars within the selected islands (PSUs), I maintained the probabilistic nature of the selection process, thereby reducing selection bias and producing a quasi-random sample of Second Life residents.

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<sup>5</sup> This documentation was obtained from the Destination Guide Frequently Asked Questions page on the Second Life Wiki. Information was retrieved on 05 July 2011 from [http://wiki.secondlife.com/wiki/Destination\\_Guide](http://wiki.secondlife.com/wiki/Destination_Guide). As stated previously, the reader should use caution when evaluating documentation from Internet sources, as they are often opinion and are not peer reviewed.

**Convenience sample.** The second phase of sampling, the convenience sampling frame, used the Second Life classified ad system as the primary means of recruitment. The recruitment ad ran in three classified locations—employment, personal, and wanted—for the duration of the convenience sample recruitment period. The ad consisted of an open invitation for any resident to complete the survey and a link to the survey website as well as the SLUrl for residents to teleport to the University of Georgia (UGA) Second Life Survey Research Facility.

**Field interviewers.** Three individuals were chosen as field interviewers for this project. The interviewers were all women (both in real life and Second Life), and all were graduate research assistants with the department of Health Policy and Management at UGA. Each research assistant was trained on how to use Second Life prior to the start of the project. Field interviewers completed the Second Life orientation process, which takes a new SL user through the basics of existing and interacting in Second Life, as well as specific orientation for this project. The field interviewers and I met frequently in-world both prior to the start of the project—to role play and practice the recruitment protocol—and during the project to touch base as needed. The choice of interviewers who had no experience with Second Life was intentional. I wanted to ensure that each interviewer was trained specifically for this project and did not have any in-world connections or experience that would distract from the project.

**Incentives and recruitment.** Upon completion of the study, all respondents were given \$250 Linden Dollars (approximately \$1USD), regardless of whether they were in the quasi-random or convenience sample. It was the intent that respondents were only eligible to receive one incentive payment.

*Quasi-random sample recruitment protocol.* During the quasi-random recruitment portion of the study, field interviewers teleported to their assigned islands. They landed on the island at the specified geographic coordinates given in the SL Destination Guide. From that point, they began working their way around the island in a counter-clockwise manner, approaching every other person beginning with the first person they encountered. This interval helped ensure the randomness of the sample so that interviewers did not only approach those who appeared friendly or willing to participate in the survey. If an island did not have any avatars present, the interviewer was instructed to wait 30 minutes. If after that time there were still no avatars present, the interviewer was instructed to make two more attempts at recruitment on each island during different day and time periods because islands see different levels of activities at different days and times. An island was considered a “dead island” if, after three attempts, there were no avatars present at an island. The island was then removed from the sample and a replacement island was selected from the same strata.

Interviewers were given a script (see Appendix A) to guide the interaction with the potential research participants; however, in most cases interviewers went beyond the script to assist and inform the resident about the project. While not ideal, it was important for interviewers to have the flexibility to engage the research participant in ways not anticipated in the script. This was because many of the research participants wanted to make sure the interviewer was not an automated avatar or was not being used to spam or grief them. Interviewers provided the selected resident with an invitation notecard that contained both the in-world location (commonly called a SLUrl or Second Life URL) and the external web address for accessing the survey, the incentive available, a personal

access code, and the topic of the survey (see Appendix A for complete text). Interviewers also offered assistance, if needed, to teleport to the survey location.

During and after the interaction with the resident, interviewers recorded the resident's location, apparent gender, time of approach, and any other relevant information about the interaction. Once at the SL survey facility, I was on hand to assist should any questions arise during the survey. If, after approximately two weeks, the resident did not complete the survey, they were sent a reminder via another in-world notecard that encouraged them to complete the study and get their incentive. Follow-up was possible because each resident was given an individual access code that interviewers recorded along with avatar first and last name. These were the only two contacts that researchers initiated with Second Life residents.

One somewhat unforeseen complication was the formal and informal gatekeepers present on many islands. These people typically spend a great deal of time in-world and serve to “protect” the residents of their island. Most often, these gatekeepers had to be approached or in some way placated before the field interviewer could enter the virtual space and begin recruitment. Through the course of the field period, interviewers were only asked to leave one island. The gatekeepers on this particular island had a no soliciting rule and they felt that research recruitment was solicitation. Other islands required the research avatars to change clothes to match dress code requirements and were usually very accommodating with the research team—even providing clothes and other accessories so that they fit in with the island on which they were recruiting.

*Convenience sample recruitment protocol.* Residents who responded to the ads for the convenience sampling portion of the project had no introductory notecard or

follow-up from researchers because this sample was entirely self-selected. The recruitment came from residents visiting the classified ads in-world and responding to the advertisement.

**Survey administration.** The web-based questionnaire was hosted on a secure server at The University of Georgia's Carl Vinson Institute of Government. The questionnaire was programmed for web administration using Sawtooth Software CiW System for General Interviewing version 7.

**Access.** The survey was available either by teleporting to the UGA Survey Research Facility in Second Life (for picture, see Appendix D) or going to an external web page and logging onto the survey from there. Those who chose to take the survey in Second Life teleported to the location via the given coordinates, entered the facility, and walked up to one of the touchscreens. The touchscreens looked similar to smart boards used at UGA and had information about the survey as well as advising the participant that other individuals in the survey research facility would not be able to see their responses. Once they touched the screen, the survey opened in either an external web browser or via Second Life's own in-world web browser.<sup>6</sup>

Participants in the quasi-random sample were given an individual access code. Research assistants then recorded the access code given, along with the first and last name of the avatar for payment and verification purposes later. The code could only be used to complete the survey once, which served as a means for controlling who could access the survey. The convenience sample survey was also password protected, but that password was posted in the classified ads so that each person who responded via classified ads used the same password.

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<sup>6</sup> This is a preference set by the individual and was beyond the control of the researcher.

While a general password did limit access to the survey to those who had seen the classified ad, it was possible for one respondent to fill out, and be compensated, for multiple responses using the access code for the convenience sample. This occurred several weeks into the data collection, when a few individuals began filling out the survey multiple times with false information.<sup>7</sup> Because the initial invitation and consent documents did not contain language that explicitly stated that there was only one payment per real-world person, there were cases of multiple payments going to the same individual. Once this was detected, the survey was temporarily suspended for 4 weeks while I obtained IRB approval to modify the language of the consent form as well as the payment protocol. This issue of multiple responses will be discussed in detail in the results chapter under the heading of data-cleaning protocol.

**Instrumentation.** The instrument was available in both English and Spanish and contained approximately 50 questions. Each respondent, regardless of which sampling frame they were in, received the same survey questions. Because of Human Subjects Protection rules and regulations, a participant could not be required to complete any question, so the survey was programmed to accept questions even if there was no answer. The average time it took for an individual to complete the survey was 14 minutes. The instrument comprised essentially two parts: The first portion included questions replicated from the 2009 National Health Interview Survey for Adult Populations, and the second portion included questions that were designed specifically for the purposes of this dissertation research project.

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<sup>7</sup> The survey programming package captures data on time began, time ended, IP address, operating system, and web browser. I used this data to determine when one individual filled out the survey multiple times.

*NHIS replicated questions.* The National Health Interview Survey (NHIS) is an annual survey administered by the National Center for Health Statistics (NCHS), a division of the CDC. First fielded in 1957, the NHIS measures the overall health of Americans. According to documentation from the CDC,<sup>8</sup> the NHIS is a cross-sectional household interview survey that follows a multistage area probability design in order to produce a sample representative of the U.S. population. This type of design is structured to allow for representative sampling of households and noninstitutional group quarters. Sampling and interviewing are conducted throughout the year, and the sample plan is redesigned after each decennial census. Interviews are collected through personal household interviews, and the instrument is composed of 1) a set of basic demographic and health items and 2) one or more sets of questions on current health-related topics. The data collected from these interviews is disseminated widely so that public health officials, researchers, and policy makers can evaluate the trends in health, healthcare access, and federal programs.

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<sup>8</sup> For more information on the current NHIS, please see: <http://www.cdc.gov/nchs/nhis.htm>

One of the main goals of the NHIS is to be able to analyze health characteristics by different demographic and socioeconomic characteristics. This is considered a major strength of the NHIS and one of the reasons that it is the primary survey instrument for health indicators in the United States.<sup>9</sup> The replicated NHIS 2009 sample adult core questions included those that asked about general health status, specific health attitudes and behaviors, weight, activity level, and personal demographic characteristics<sup>10</sup> such as landline/cell phone status, household income, and household makeup.

***Original survey questions.*** The second component of the instrument included questions intended to capture new information on SL residents as well as to collect data to compare to other research findings on virtual worlds residents generally and Second Life residents in particular. For example, one big question in virtual worlds research is the extent to which the individuals who engage as research participants are responding as their real selves, their virtual selves, or some combination of the two. This is the first study to explicitly ask the individuals how they regard their avatars with respect to their real identities. Additionally, there were questions designed to capture the degree to which the individual engages in virtual worlds activities, what sort of activities, behaviors and attitudes while in-world, and the characteristics of that individual's in-world identity. These are all topics that are currently being discussed or researched among those with an interest in virtual worlds and, to the best of my knowledge, this is the first survey that attempts to gain these responses in any sort of systematic, empirically tested manner. Much of the research done in virtual environments has been focused on only one aspect

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<sup>9</sup> General information about the NHIS is available at: [http://www.cdc.gov/nchs/nhis/about\\_nhis.htm](http://www.cdc.gov/nchs/nhis/about_nhis.htm)

<sup>10</sup> The complete survey instrument, as proposed, can be found in Appendix B. Each question is noted as a NHIS replicated question or original research question.

of virtual worlds research. For example, a survey may go to great lengths to address a methodological question (e.g., What is the best incentive rate to offer?), but once they have the respondents, they do not ask any questions of substantive interest. Conversely, some research asks interesting substantive questions but pays little to no regard to any sort of methodological rigor. This dissertation addresses both methodological and substantive questions through a strategic split sampling design and also by utilizing an instrument that has the potential to be used to compare SL residents to a nationally representative sample. It also presents new data on identity construction and health-related attitudes and behaviors which will expand the body of knowledge around social science research in virtual environments.

### **Research Hypotheses and Analytic Strategy**

The following analytical strategies are used to address the three primary research hypotheses.

**Research question 1.** Preliminary research on quasi-random versus convenience sampling in virtual worlds has indicated that responses gained through quasi-random sampling are slightly different than those obtained through convenience sampling (such as age and socioeconomic status), but not enough to warrant the increased cost and time required to obtain a quasi-random sample (Bell et al., 2009). In particular, research has found slight differences in land ownership, use of multiple avatars, age, income, and permission to recontact.<sup>11</sup> However, there are some concerns with Bell et al.'s (2009)

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<sup>11</sup> As footnoted previously, the differences Bell et al. (2009) found were primarily between the sample email list group and the other two (classified ads and quasi-randomly dropped kiosks). The researchers were not surprised by this because the email list, which tended to include higher education academics or researchers, was very unlikely to be representative of the broader SL

random sampling procedure, as it did not obtain a truly random sample. Instead, the researchers pointed out that it was more akin to a quasi-random sample. The main reason for this is that Bell and colleagues relied on research kiosks being placed on various SL islands that required property owner consent, and only 10% consented. The potential for bias due to the low rate of cooperation among land owners is a limitation of the study as it pertains to the quasi-random and convenience sampling. This project seeks to improve upon this design by using a quasi-random sampling technique that brings the option for participation directly to the respondent.

*Hypothesis 1: Responses obtained from a quasi-random sample of SL residents will be significantly different from those obtained from a convenience sample of SL residents, especially with respect to age, income levels, and self-reported health status.*

In order to test the differences in these two samples, I conducted t-tests using a two-tailed test of significance at both the .05 and .10 levels.<sup>12</sup> This tests the null hypothesis that the means of the two populations are equal.

**Research question 2.** Are there significant socio-demographic differences between SL residents who live in America and a nationally representative sample? Do the levels of non-response on sensitive questions differ between that collected in Second Life and the NHIS?

*Hypothesis 1: Data gathered in Second Life will have significant differences compared to data collected from a nationally representative sample. Expected*

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population. The only real differences between the quasi-random sample and the other samples were age and income, both of which showed a more spread-out distribution.

<sup>12</sup> Because of small sample sizes and large numbers of tests of significance, I felt that it was important to also examine relationships that were significant at the .10 level, even though this is not the most common threshold of significance for social science research.

*differences are anticipated with income (higher income in SL), gender (more men in SL), and race (more white in SL).*

*Hypothesis 2: Data gathered in Second Life will show reduced item non-response rates on sensitive health-related questions relative to a comparative sample from the NHIS.*

These hypotheses, similar to research question 1, are best tested using a comparison of means with a two-tailed test of significance at .05 level. For income, I used a t-test; for gender, race, and item non-response I used chi-square tests of independence.

**Research question 3.** Do Second Life residents with poorer self-reported health measures construct their identity differently than those who have better health?

*Hypothesis: SL residents who have poorer health will be more likely to try to escape their real-life problems by constructing a character that is different from themselves. In particular, SL residents with poorer health will be more likely to gender-swap and to say that their character is different from them.*

This hypothesis is tested by comparing mean health scores between those who do and do not gender swap and those who say their character is or is not different from their real-world person. Throughout the analysis, I used chi-square tests of significance for dichotomous variables and t-tests for ordered categorical or continuous variables.

## Chapter 4

### Results

Chapter 4 details the results of the data collection methods outlined in Chapter 3, including the overall response rate, data cleaning protocols, and the analysis and results of each research question presented in the prior chapter. I used an alpha level of .05 and .10 for all statistical tests. In the case of multiple tests of significance, the alpha level was modified using a Bonferroni correction to adjust for the increased likelihood of Type I errors that occur when conducting multiple tests of significance.<sup>13</sup> The Bonferroni adjusted alpha level is calculated by taking the current alpha level (.05 or .10) and dividing it by the number of tests. The adjusted alpha levels are noted on each analysis table.

#### Data-Cleaning Protocol

Initially, the data collection methods outlined in Chapter 3 yielded 350 completed surveys from Second Life respondents. However, because it was known that there was at least one individual who completed numerous surveys in order to receive multiple incentive payments, there was a need for in-depth quality control checking and data cleaning.

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<sup>13</sup> There is some debate among researchers about using a Bonferroni correction in the case of multiple tests of significance. While it is commonly used to correct for Type I error inflation, it can conversely increase the likelihood of Type II errors. Some research has suggested that a middle ground for negotiating the tradeoff between the two types of error inflation is to move from a .05 level of significance to a .10 level. It is for this reason that I examine both .05 and .10 levels of significance.

As part of the data collection, the survey software was programmed to collect background data about those who entered the survey. The following fields were used to remove duplicates from the data: user's IP address, user's operating system, user's system browser, and survey start and end times. Because there is no way to identify a real-life individual with 100% certainty, the decision to remove duplicates was a very conservative one. As shown in Figure 2, in order for a record to be considered for deletion as a duplicate response, the record had to have the same IP address, the same operating system, and the same Internet browser as another record. If those conditions were met, the duplicate records were then checked for unrealistically short completion times. If the completion time was unrealistically short (under 5 minutes), then the record was deleted as a duplicate entry. As noted previously, the average time to complete the survey was 14 minutes, so a 5-minute or less completion time from someone with the same IP address, same operating system and same Internet browser was highly unlikely. In the case of multiple entries, the first completed record was accepted, and the remaining entries were discarded. In the end, 53 entries were deleted due to duplicate entries for a final sample size of 297 completed surveys—169 responses from the quasi-random sample and 128 from the convenience sample.

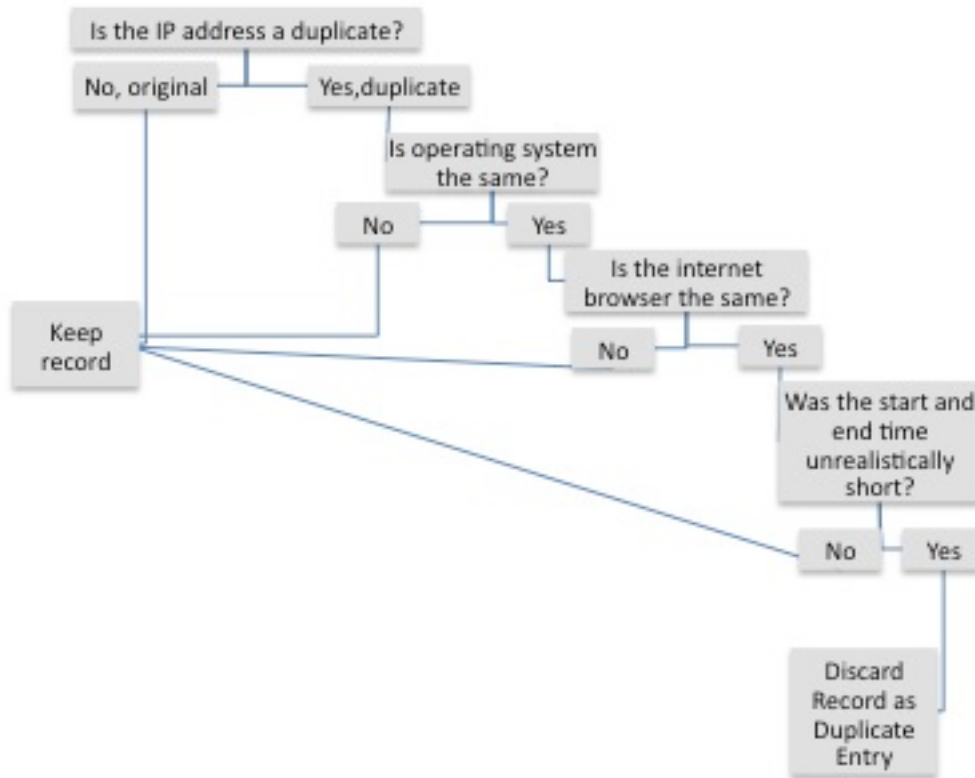


Figure 2. Decision tree for removal of duplicate entries.

### Response Rate Calculations

Response rate calculations are usually fairly straightforward with either telephone or mail survey administration modes because information on eligibility and refusals is typically known. Web-based survey administration is a newer modality, so established guidelines or industry standards on response rates and response rate calculations have not been established in the literature. However, even if they were, the rates would not be directly comparable because this is the first study to attempt to calculate a response rate for a survey that was recruited and conducted entirely in a virtual environment. For this project, the response rate was calculated for the quasi-random sample ( $n=169$ ) only; response rate calculations for the convenience sample portion of this study ( $n=128$ ) were

impossible because there was no way of knowing how many individuals were exposed to the recruitment ads.

During the quasi-random sampling phase of the project, field interviewers approached 803 individuals and invited them to participate in the survey; of that number, 169 did. This gives a very conservative, basic response rate of 21%. However, this response rate includes those who either refused the invitation note card or never opened the invitation notecard (of which there were 269). These individuals may not have actively refused to participate in the study, but rather they refused a note card from someone they did not know (which usually happens due to concerns over spamming) or they never received the notecard—in which case they should be treated as a non-contact or undeliverable survey. The American Association for Public Opinion Research (AAPOR) guidelines indicate that non-contacts should be removed from the response rate calculation (AAPOR, 2009). Thus, using AAPOR Response Rate Calculator Version 3.1, the Response Rate #1 (RR1)<sup>14</sup> for the quasi-random sampling portion of this project is 39%.

Caution should be used when interpreting the response rate as anything other than purely a measure of the number of people who participated in a survey. Unfortunately, there is a tendency to equate higher response rates with lower non-response error. This is not always the case; several studies have established that lower response rates do not necessarily mean that there is higher non-response error (Groves, 2006; Keeter, Miller, Kohut, Groves, & Presser, 2000). As there are no currently available industry-supported

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<sup>14</sup> RR1 is the most conservative response rate calculation available within the AAPOR Response Rate Calculator. The model for determining the response rate is as follows:  $I/(I+P) + (R+NC+O) + (UH+UO)$ , where I= complete interviews, P= partial interviews, R= refusals, NC= non-contact, O=other, UH= Unknown Household, and UO= Unknown Other. The response rate calculator is available online at [www.aapor.org](http://www.aapor.org).

guidelines on response rates for varying modalities, it is up to the reader to determine whether or not the reported response rates are acceptable.

### **Missing Data**

The data gathered in Second Life, like most social science data, are subject to missing information. Missing data arises for a number of reasons, including the respondent not wanting to answer a question, technological difficulties, problems understanding the question or response option, or any number of other issues. As outlined in Table 1, the missing data for the variables of interest in this project range from 0% to 15.8%. Of the 36 variables outlined in Table 1, only three have greater than 5% of responses missing: income (15.8%), number of children in the household (13.13%), and BMI (15.4%). The implications of the rates of missing data for those three variables are discussed in detail in Chapter 5 under limitations.

### **Descriptive Statistics of Second Life Respondents**

The Second Life sample contains respondents from both inside and outside of the United States. Prior to conducting any of the analyses, I compared the responses from SL respondents living in and outside of the United States. I found no significant differences between the two groups that would warrant further analysis. In addition to quantitative tests of significance, I looked at the qualitative responses of both groups to see if those living outside of the United States appeared to respond in a way that would indicate that they did not understand the questions. This did not appear to be the case at any point. Although some grammar or word choices obviously came from non-native English speakers, there was no indication that the respondents from outside of the United States had difficulty understanding or responding to the survey questions.

In keeping with the larger goal of this project, to further the understanding of virtual worlds residents and how to collect quality data from them, I present basic information about those who responded to this study via Second Life. Table 1 shows basic demographics, health-related statistics, and virtual worlds–related statistics of those who completed the survey in Second Life.

The average age of study respondents was 35 years old. Respondents had an average annual household income of \$48,768 and, on average, had two adults living in the house and no children. Sixty-one percent of respondents were female, 36% male, and 3% identified as transgendered or something other than male or female. Housing status among respondents varied: 39% owned their own home, 29% rented, 22% lived with their parents, and 10% had other living arrangements. One third of respondents did not have a landline in their home.<sup>15</sup> Among those respondents who do have a landline telephone, 25% said they used their cell phones almost all the time, and another 31% said they used their cell phones most of the time (not shown in Table 1).

Second Life respondents reported lower levels of physical health conditions such as hypertension, heart attack, diabetes, and cancer than mental health conditions such as being sad, nervous, or restless or feeling like everything was an effort. The physical health condition percentages are likely underestimates because respondents were asked to check a box if they had ever been diagnosed with a certain health condition, but no box

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<sup>15</sup> Current population estimates, as released by the NHIS 2009 Wireless Substitution Report (<http://www.cdc.gov/nchs/data/nhis/earlyrelease/wireless201012.htm>) show that during the first 6 months of 2010, approximately 26.6% of U.S. households were cell-only households, while only 1.7% had no telephone service (either landline or cell). Given this, I assumed that those without a landline were cell-phone-only households versus households without any telecommunications device. However, because the question only asked about the presence of a landline (not also the presence of a cell phone), it is impossible to know with 100% certainty that these individuals did indeed have a cell phone.

was available if they did not have a condition. Thus, if a person failed to check a given condition, it is unclear whether the person had in fact never been diagnosed with that condition or if it was either a missed question or a refusal to answer.

Language was a concern from the outset of this project because the virtual environment is one that is not limited to geographic boundaries and that attracts individuals all over the world. The survey was offered in two languages—English and Spanish—and 93% of respondents chose English even though more than one third of respondents (36%) lived outside of the United States. This result is similar to another large-scale study that found that most respondents could complete a survey in English regardless of their primary language (Bell et al., 2008). The majority of respondents (63%) had a female avatar in Second Life, and nearly one quarter of respondents had gender-swapped their avatar. A majority of SL respondents (51%) had also created an avatar that was thinner than they were in real life. Additionally, respondents spent an average of 22 hours a week in SL. This result is similar to other research that has found that virtual worlds users spend an average of 22 hours a week in-world (Yee et al., 2007).

Table 1

*Summary Statistics for Second Life Respondents (N=297)*

	<b>Second Life Respondents</b>	<b>% Missing</b>
<b>Number of Observations</b>	<b>297</b>	
<b><i>Demographics</i></b>		
Age in years (mean, <i>SD</i> )	35.1 (13.010)	4%
Annual household income in US Dollars (mean, <i>SD</i> )	\$48,768 (58,097)	15.8%
Adults in household (mean, <i>SD</i> )	2.2 (1.057)	3.7%
Children in household (mean, <i>SD</i> )	0.52 (.947)	13.13%
Living in United States	64%	0%
White	74%	
Female	61%	.3%
Male	36%	.3%
Transgendered	3%	.3%
No landline in home	33%	1%
Owens home	39%	2.3%
Currently working for pay	55%	3.3%
Covered by health insurance	73%	3.3%
<b><i>Health-Related Statistics</i></b>		
Ever had hypertension	11%	2.6%
Ever had coronary heart disease	0.7%	2.6%
Ever had heart attack	0.7%	2.6%
Ever had asthma	13%	2.6%
Ever had diabetes	2%	2.6%
Ever had ulcer	2%	2.6%
Ever had cancer	2%	2.6%
Ever had arthritis	3%	2.6%
Ever had weight problem	22%	2.6%
Ever had depression problem	21%	2.6%
Felt sad in last 30 days	11%	3.3%
Felt nervous in last 30 days	27%	3.3%
Felt restless in last 30 days	33%	3.3%
Felt hopeless in last 30 days	12%	3.3%
Felt everything was effort in last 30 days	21%	3.3%
Sleep per night (mean, hours)	7.1(2.571)	4.3%
Body Mass Index (mean)	25.88 (5.760)	15.4%
<b><i>Virtual Worlds Related Statistics</i></b>		
Chose English as survey language	93%	0%
Speaks English as primary language	80%	0%
Time spent in VW per week in hours (mean, <i>SD</i> )	21.7 (19.485)	0%
Number of avatars (mean, <i>SD</i> )	2.1 (1.928)	4.3%
Female avatar	63%	4.7%
Male avatar	35%	4.7%
Non-gendered avatar	2%	4.7%
Gender swapped with avatar	23%	4.3%
Avatar with different race	13%	4.3%
Thinner avatar than real person	51%	4.5%

## **Research Question #1: Examining Recruitment Protocol**

*Hypothesis 1: Responses obtained from a quasi-random sample of SL residents will be significantly different from those obtained from a convenience sample of SL residents, especially with respect to age, income levels, and self-reported health status.*

Generally, the time and cost involved in collecting data using a quasi-random protocol is much higher than that required using convenience sampling methods.

However, as has been noted previously in studies conducted in the real world, there are typically significant differences between data collected with the two methods.

An independent samples t-test was conducted to compare the respondents recruited through the quasi-random sampling protocol with those recruited using the convenience sampling protocol on three measures: age, income, and self-reported health status.

Tests of the three primary hypotheses were conducted using Bonferroni adjusted alpha levels of .016 and .033 per test for .05 and .10 levels of significance, respectively. As Table 2 shows, results indicated no statistically significant differences in age, income, or self-reported health status at the .05 level. However, age was significant at the .10 level, with quasi-random sampling respondents having a slightly older average age than those in the convenience protocol. In addition to testing the primary variables of interest, I also tested additional demographic, health, and behavior-related variables of interest. There were significant differences across protocols for language chosen for survey and primary language spoken; however, this may be due to the placement of the Spanish recruitment ads for the convenience protocol. I believe it is likely that the Spanish ads got

lower billing (i.e., placed in less visible areas) and therefore may have been responsible for the large difference in language choice and language spoken.

Of the additional 36 secondary variables of interest tested in Table 2, only three are significant at the 10% level, which is slightly less than the nearly four that we would expect to see at quasi-random using this level of significance (10% of 36). Thus, these results suggest that the respondents are similar across the two protocols.

Caution should be used when interpreting the significance results with respect to the variable that measures the number of avatars that an individual has in Second Life. At the midpoint of the convenience sample recruitment, there was a change in recruitment protocol and the consent statement, explicitly said that a real-life individual could only be compensated once for completing the survey regardless of how many times it was completed with different avatars. This may have resulted in a disincentive for those with multiple avatars to complete the survey.

Table 2

*Comparison of Quasi-random and Convenience Recruitment Protocol Respondents*

	<b>Quasi-random Protocol</b>	<b>Convenience Protocol</b>	<b>Significance Tests</b>
<b>Number of Observations</b>	<b>169</b>	<b>128</b>	
<b>Main Variables of Interest (1)</b>			
Age in years (mean, SD) +	36.7 (13.210)	33.1 (12.510)	$t=2.299(283)$ ; $p=.022$
Annual household income, USD (mean, SD)	\$46,052 (61,135)	\$51,854 (54,535)	$t=-.787(248)$ ; $p=.432$
Health Status (mean, SD)	2.1 (.940)	2 (.946)	$t=.774(281)$ ; $p=.440$
<b>Secondary Variables of Interest (2)</b>			
Gender (%female)	56%	67%	$\chi^2(1, N=296)=6.096$ , $p=.107$
No landline in home	31%	35%	$\chi^2(1, N=294)=.602$ , $p=.438$
Adults in household (mean, SD)	2.2 (1.124)	2.1 (.955)	$t=1.410(284)$ ; $p=.160$
Children in household (mean, SD)	0.6 (1.0)	0.4 (.848)	$t=1.753(256)$ ; $p=.081$
Living in United States +	57%	72%	$t=2.589(295)$ ; $p=.010$
White	76%	70%	$\chi^2(1, N=294)=1.051$ , $p=.305$
Owns home	40%	39%	$t=.117(288)$ ; $p=.907$
Currently working for pay	54%	56%	$t=.896(285)$ ; $p=.371$
Covered by health insurance	70%	75%	$t=.923(285)$ ; $p=.357$
<b>Health-Related Statistics (3)</b>			
Ever had hypertension	14%	6%	$\chi^2(1, N=289)=5.411$ , $p=.020$
Ever had coronary heart disease	1%	0%	$\chi^2(1, N=289)=1.535$ , $p=.215$
Ever had heart attack	0.6%	0.8%	$\chi^2(1, N=289)=.037$ , $p=.847$
Ever had asthma	15%	10%	$\chi^2(1, N=289)=1.457$ , $p=.227$
Ever had diabetes	4%	0.8%	$\chi^2(1, N=289)=2.452$ , $p=.117$
Ever had ulcer	4%	2%	$\chi^2(1, N=289)=1.674$ , $p=.196$
Ever had cancer	3%	0.8%	$\chi^2(1, N=289)=1.764$ , $p=.184$
Ever had arthritis	3%	3%	$\chi^2(1, N=289)=.005$ , $p=.942$
Ever had weight problem	24%	20%	$\chi^2(1, N=289)=.588$ , $p=.443$
Ever had depression problem	18%	25%	$\chi^2(1, N=287)=2.184$ , $p=.139$
Felt sad in last 30 days	10%	12%	$\chi^2(1, N=287)=.198$ , $p=.657$
Felt nervous in last 30 days	25%	30%	$\chi^2(1, N=287)=.781$ , $p=.377$
Felt restless in last 30 days	35%	30%	$\chi^2(1, N=287)=.842$ , $p=.359$
Felt hopeless in last 30 days	10%	15%	$\chi^2(1, N=28)=1.994$ , $p=.158$
Felt everything effort in last 30 days	18%	24%	$\chi^2(1, N=287)=1.767$ , $p=.184$
Sleep per night (mean, hours)	7.2	6.9	$t=.921(282)$ ; $p=.358$
Body Mass Index (mean)	26.4	25.2	$t=1.539(295)$ ; $p=.125$
<b>Virtual Worlds Related Statistics (4)</b>			
Chose English as survey language*	88%	100%	$\chi^2(1, N=297)=16.242$ , $p=.000$
Speaks English as primary language*	74%	88%	$\chi^2(1, N=297)=9.378$ , $p=.002$
Hours spend in VW per week (mean, SD)	24 (20.826)	19 (17.345)	$t=1.865(295)$ ; $p=.063$
Number of avatars (mean, SD)	2.3 (2.272)	1.8 (1.319)	$t=2.165(282)$ ; $p=.031$
Female avatar	59%	67%	$t=-1.366(281)$ ; $p=.173$
Male avatar	39%	31%	$t=-1.366(281)$ ; $p=.173$
Non-gendered avatar	2%	2%	$t=-1.366(281)$ ; $p=.173$
Gender swapped with avatar	23%	22%	$\chi^2(1, N=284)=.042$ , $p=.837$
Avatar with different race	14%	13%	$\chi^2(1, N=284)=.026$ , $p=.872$
Thinner avatar than real person	51%	50%	$t=-.219(282)$ ; $p=.827$

\* Significant at .05 alpha level + Significant at .10 alpha level

- (1) The Bonferroni adjusted alpha level for this group is .016 per test (.05/3) and .033 (.10/3)
- (2) The Bonferroni adjusted alpha level for this group is .005 per test (.05/9) and .011 (.10/9)
- (3) The Bonferroni adjusted alpha level for this group is .002 per test (.05/17) and .005 (.10/17)
- (4) The Bonferroni adjusted alpha level for this group is .005 per test (.05/10) and .010 (.10/10)

## **Research Question #2: How do SL Respondents Compare to a Nationally Representative Sample?**

*Hypothesis 1: Data gathered in Second Life will have significant differences compared to data collected from a nationally representative sample. Expected differences are anticipated with income (higher income in SL), gender (more men in SL), and race (more white in SL).*

For this analysis, SL residents who lived in the United States ( $n=189$ ) were compared with respondents to the 2009 National Health Interview Study—all of whom lived in the United States ( $N=27,731$ ). Because the differences between those selected by the quasi-random and convenience protocols were small, all SL respondents were pooled together for the remaining analyses. Before discussing the analyses, it is important to note the differences and similarities in the sampling protocols used for the SL respondents and the NHIS respondents and the possible implications. As noted in detail in the previous chapter, the SL sample is a two-stage randomized cluster sample and the NHIS follows a multistage area probability design in order to produce a sample representative of the United States population. In terms of randomization, there is not a significant difference between the two studies—both studies produce a quasi-random sample of individuals. However, the NHIS does something that the SL study cannot claim to do—that is, the NHIS produces a probability sample that is representative of the U.S. population as a whole. While I believe that there is a strong likelihood that the SL sample is representative of the SL population as a whole, at the current time there is no way to empirically test that notion because population-level data are largely proprietary and not released to either the public or academic researchers. The most significant implication of this difference is the chance that I am comparing a nationally representative sample (the

NHIS) to a group of U.S. SL residents who may be drastically different from other U.S. SL residents or to the U.S. population as a whole. Because many of my key demographic findings are similar to the Indiana study (Bell & Castranova, 2008), the only other large-scale SL study published at the current time, I do not believe it is likely that I have a group of respondents that are wildly different from the whole of U.S. SL residents; however, it is still important to consider this possibility when looking at comparisons of the two samples.

Using chi-square tests, as shown in Table 3, the most significant difference between the SL and NHIS samples is the average age of the respondent. SL respondents on average are 35 years old and NHIS respondents have an average age of 48. There are no significant differences between SL respondents and NHIS respondents on either race or income<sup>16</sup>; however, there is a significant difference with respect to gender. There is a greater fraction of men in the NHIS sample (44%) than in the SL sample (30%), which is contrary to the initial hypothesis that a greater fraction of respondents would be men in the Second Life sample.

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<sup>16</sup> NHIS elected to use a multiple imputation methodology to deal with missing data on the income variable. For 2009, the weighted percentages of individuals with unknown family income was within the range of 25%–33%. This creates five datasets that have varying point estimates for missing dollar amounts. NHIS does not advise using only one data set nor does it advise combining the data sets to create an average. Instead, NHIS recommends that each of the five data sets be analyzed separately, and if the statistics package is available, pool the results for a single number. For more information, please see: <http://www.cdc.gov/nchs/nhis/2009imputedincome.htm>.

Table 3

*Comparison of U.S. SL Respondents and NHIS Respondents*

	<b>SL Study</b>	<b>NHIS Study</b>	<b>Significance Test (I)</b>
<b>Number of Observations</b>	<b>189</b>	<b>27,731</b>	
Age in years (mean, <i>SD</i> ) *	34.85 (12.904)	47.71 (17.94)	$t=-9.629(27910)$ ; $p=.000$
Male *	30%	44%	$\chi^2(1, N=27,911)=$ 14.656, $p=.000$
White	73%	69%	$\chi^2(1, N=27,918)=$ 1.456, $p=.228$
Income (imputation 1)	\$54,996	\$55,027	$t=-.009(27,979)$ ; $p=.993$
Income (imputation 2)	\$54,996	\$49,378	$t=1.588(18,772)$ ; $p=.112$
Income (imputation 3)	\$54,996	\$49,388	$t=1.587(18,772)$ ; $p=.112$
Income (imputation 4)	\$54,996	\$49,347	$t=1.605(18,772)$ ; $p=.109$
Income (imputation 5)	\$54,996	\$49,295	$t=1.614(18,772)$ ; $p=.106$

\* Significant at .05 alpha level + Significant at .10 alpha level

(1) The Bonferroni adjusted alpha level for this group is .006 per test (.05/8) and .012 (.10/8)

Because of the significant difference in age between U.S. SL respondents and NHIS respondents, I restricted the NHIS sample to individuals with the same age distribution as the SL sample in order to make the samples more comparable. To do this, I selected all NHIS respondents between the ages of 23 and 48 in order to achieve a similar distribution to the SL sample. The following analysis compares then the full U.S. SL sample with an age-restricted NHIS sample. This resulted in selection of 13,460 cases from the complete NHIS data file. As Table 4 shows, when the files are restricted by age, the significant difference in gender that we see in the full sample remains significant at the .05 level. The differences between race and income remain statistically insignificant.

Table 4

*Comparison of U.S. SL Respondents and Age-Restricted NHIS Respondents*

	SL Study	NHIS Study	Significance Test ( <i>I</i> )
<b>Number of Observations</b>	<b>189</b>	<b>13,460</b>	
Age in years (mean, <i>SD</i> )	34.85 (12.904)	35.25 (7.756)	$t=-.685(13,639)$ ; $p=.493$
Male *	30%	45%	$\chi^2(1, N=13,640)=$ 15.289, $p=.000$
White	73%	65%	$\chi^2(1, N=13,647)= 6.013,$ $p=.014$
Income (imputation 1)	\$54,996	\$57,496	$t=-.669(13,618)$ ; $p=.504$
Income (imputation 2)	\$54,996	\$52,091	$t=.807(8919)$ ; $p=.419$
Income (imputation 3)	\$54,996	\$52,141	$t=.793(8919)$ ; $p=.428$
Income (imputation 4)	\$54,996	\$51,932	$t=.858(8919)$ ; $p=.391$
Income (imputation 5)	\$54,996	\$52,064	$t=.817(8919)$ ; $p=.414$

\* Significant at .05 alpha level + Significant at .10 alpha level

(1) The Bonferroni adjusted alpha level for this group is .006 per test (.05/8) and .012 (.10/8)

Based on these results, it is difficult to say whether the SL sample and the NHIS sample are very different. In order to investigate this further, I compared the SL sample with the NHIS full and age-restricted samples on physical and mental health-related indicators in order to get a better understanding of any underlying differences between the two groups with respect to health. It is important to note that the questions have been recoded into dummy variables that indicate the presence of the physical or mental health-related condition or attitude in question. This is vital because the question wording between the two questions is not the same, so caution should be used when interpreting them. For example, the SL sample received the question, “In the past 30 days have you felt...?” and were given the options of “sad, nervous, restless, etc...” and allowed to check the ones they had experienced. The NHIS respondents were given the question

“During the PAST 30 DAYS, how often did you feel Sad/ Nervous/ Restless/ etc....?” with the responses being “All of the time, Most of the time, Some of the time, A little of the time, None of the time.” Responses from the NHIS sample were coded 1 for having experienced the condition on any level (all, most, some, or a little of the time) and 0 for any other response (which could have included none of the time, don’t know, or a refused response). Similarly, SL respondents were coded as 1 if they checked that they had experienced a condition and were coded as 0 if the condition was left unchecked.

Table 5 shows the results of tests of significance between the SL sample and both the full and age-restricted NHIS samples. As the table illustrates, the full NHIS sample shows significantly higher rates of both physical and mental health conditions. This is not surprising given that the NHIS full sample is, on average, about 13 years older and has more dispersion with regard to age. When I restrict the sample to mimic the age range of the SL sample, many of the significant results disappear. Only two mental health indicators, feeling sad and nervous, are significant at the .05 level after restricting the age of the sample.

Table 5

*Health-Related Comparisons of U.S. Second Life Respondents to NHIS Respondents (1)*

	<b>Second Life Respondents</b>	<b>NHIS Full Sample</b>	<b>Significance Results Between SL Respondents and Full NHIS Sample</b>	<b>NHIS Age-Restricted Sample</b>	<b>Significance Results: SL Respondents vs. Restricted</b>
<b>Number of Observations</b>	<b>189</b>	<b>27,731</b>		<b>13,460</b>	
Ever had hypertension	12%	31%*	$\chi^2(1, N=27,920)=33.617, p=.000$	15%	$\chi^2(1, N=13,649)=2.015, p=.156$
Ever had coronary heart disease	.5%	5%+	$\chi^2(1, N=27,920)=7.823, p=.005$	.9%	$\chi^2(1, N=13,649)=.243, p=.622$
Ever had heart attack	.5%	4%	$\chi^2(1, N=27,920)=5.198, p=.023$	.8%	$\chi^2(1, N=13,649)=.152, p=.696$
Ever had asthma	16%	13%	$\chi^2(1, N=27,920)=1.968, p=.161$	13%	$\chi^2(1, N=13,649)=1.686, p=.194$
Ever had diabetes	3%	10%*	$\chi^2(1, N=27,920)=10.817, p=.001$	4%	$\chi^2(1, N=13,649)=.834, p=.361$
Ever had ulcer	2%	8%*	$\chi^2(1, N=27,920)=8.801, p=.003$	6%	$\chi^2(1, N=13,649)=4.645, p=.031$
Ever had cancer	3%	8%+	$\chi^2(1, N=27,920)=7.935, p=.005$	3%	$\chi^2(1, N=13,649)=.002, p=.961$
Felt sad in last 30 days	12%	27%*	$\chi^2(1, N=27,920)=21.096, p=.000$	26%*	$\chi^2(1, N=13,649)=19.580, p=.000$
Felt nervous in last 30 days	28%	36%	$\chi^2(1, N=27,920)=5.651, p=.017$	39%*	$\chi^2(1, N=13,649)=9.588, p=.002$
Felt restless in last 30 days	32%	34%	$\chi^2(1, N=27,920)=.488, p=.485$	37%	$\chi^2(1, N=13,649)=1.847, p=.174$
Felt hopeless in last 30 days	13%	13%	$\chi^2(1, N=27,920)=.033, p=.855$	14%	$\chi^2(1, N=13,649)=.177, p=.674$
Felt everything was effort in last 30 days	21%	26%	$\chi^2(1, N=27,920)=2.800, p=.094$	27%	$\chi^2(1, N=13,649)=3.938, p=.047$

\* Significant at .05 alpha level + Significant at .10 alpha level

(1) The Bonferroni adjusted alpha level for this group is .004 per test (.05/12) and .008 (.10/12)

*Hypothesis 2: Data gathered in Second Life will show reduced item non-response rates on sensitive health-related questions relative to a comparative sample from the NHIS.*

To present the most conservative test possible, only respondents to the NHIS who actively refused to answer the question were considered to have item non-response. This did not include respondents who either did not know the answer to the question or for whom the interviewers could not ascertain a response. This decision was based upon the notion that item non-response is a decision not to answer a given question (presumably, in this case because of the sensitive nature of the question), which is different from not knowing the answer or from the interviewer not being able to get an answer to the question (which can occur for a variety of reasons). For example, the individual may not have understood the question or may not have been able give an answer that made sense in the context of the question. In the Second Life data, individuals who did not respond to a given question were coded as item non-response for that question. Because of Human Subjects Protection rules, no respondent could be required to answer any question. Therefore, in the absence of a response, it is considered a refusal to answer a given question. This is a more passive action than the NHIS data in which a respondent is only coded as non-response if they actively refuse.

Although there are many health-related questions present on both the SL survey and the NHIS, three questions were identified as potentially sensitive and included in this analysis.<sup>17</sup> A sensitive (or sometimes called “threatening”) question is generally thought to encompass three things: the social desirability/undesirability of answers, invasion of

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<sup>17</sup> Note that none of the health conditions could be included in this analysis because, as discussed earlier in Chapter 3, it is not possible to ascertain whether a person who did not check a box does not have the condition or if it was either a missed question or a refusal to answer.

privacy, and risk of disclosure to other parties (Tourangeau et al., 2000). For this analysis, the questions included were 1) “Have you smoked at least 100 cigarettes in your entire life?” 2) “In your entire life, have you had at least 12 drinks of any type of alcoholic beverage?” and 3) Body Mass Index (BMI). BMI is a composite variable that is calculated using the height and weight of a person. For this analysis, BMI was calculated using the standard protocol of dividing the weight in pounds by height in inches squared and then multiplying by the conversion factor of 703.<sup>18</sup> In the SL sample, the BMI variable was one of three variables that had an item non-response rate of greater than 5%. In the SL sample, 15.4% of the cases were missing for the BMI variable. This is due in large part to the fact that, of the two questions that compose BMI, respondents were less likely to answer the weight question, thereby leading to a missing BMI calculation.

The differences in item non-response rates were statistically significant across data sets for all variables tested. What is surprising is that they are not in the direction anticipated. As shown in Table 4, chi-square tests of independence showed a statistically significant difference at the .05 level between item non-response rates for SL respondents compared to NHIS respondents with respect to questions gauging smoking and drinking behavior, and a statistically significant difference in non-response rates on body mass index at the .10 level. In each question, the item non-response rates were significantly higher for respondents in the SL study than they were for respondents in the NHIS study. These differences persist, in the same direction and with the same level of significance, when comparing the age-restricted NHIS sample as well. Possible reasons and

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<sup>18</sup> More information on calculating BMI and interpreting the results can be found at the CDC’s website [http://www.cdc.gov/healthyweight/assessing/bmi/adult\\_bmi/index.html](http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html)

implications for the higher levels of item non-response with the Second Life sample are discussed in Chapter 5.

Table 6

*Comparison of Item Non-Response Rates Between Second Life Respondents and NHIS*

*Respondents*

	<b>% Item non-response SL Data (n)</b>	<b>% Item non-response NHIS data (n)</b>	<b>Significance test (I)</b>
<b>Number of Observations</b>	<b>189</b>	<b>27,731</b>	
Ever smoked 100 cigarettes*	4% (8)	0.1% (28)	$\chi^2 = 178.192(1, N=27,920)$ $p=.000$
Ever drank at least 12 drinks in lifetime*	3% (6)	0.3% (83)	$\chi^2 = 36.495(1, N=27,920)$ $p=$ .000
Body Mass Index +	6% (11)	3% (831)	$\chi^2 = 4.789 (1, N=27,920)$ $p=$ .029

\* Significant at .05 alpha level + Significant at .10 alpha level

(1) The Bonferroni adjusted alpha level for this group is .016 per test (.05/3) and .033 (.10/3)

### **Research Question #3: Health Status and Virtual Identity Construction**

*Hypothesis: SL residents who have poorer health will be more likely to try to escape their real-life problems by constructing a character that is different from themselves. In particular, SL residents with poorer health will be more likely to gender-swap and to say that their character is different from them.*

For research question 3, two questions were used to categorize virtual identity construction in the analysis. The first question, which looks at gender-swapping behavior, is as follows: “Have you ever changed the gender of your avatar to a gender that is different from your ‘real-life’ gender?” Respondents were coded into those who had ever gender swapped and those who had never gender swapped.

As Table 5 shows, there are no significant differences among those who gender swap and those who do not with respect to physical health issues. However, when examining mental health indicators, results suggest that the number of individuals feeling that everything was an effort in the past month is higher among those who have gender swapped their character than those who have not. This may suggest that individuals with recent depressive symptoms create characters that are different from themselves.

Table 7

*Comparison of Gender-Swapping Behaviors and Health-Related Indicators*

	<b>Ever Gender Swap</b>	<b>Never Gender Swap</b>	<b>Significance Test<sup>19</sup></b>
<b>Number of Observations</b>	64	220	
<b>Physical Health Conditions (1)</b>			
Ever had hypertension	11%	11%	$\chi^2(1, N = 284) = .012, p = .912$
Ever had coronary heart disease	2%	1%	$\chi^2(1, N = 284) = .870, p = .351$
Ever had heart attack	3%	0%	$\chi^2(1, N = 284) = 6.924, p = .009$
Ever had asthma	13%	14%	$\chi^2(1, N = 284) = .055, p = .814$
Ever had diabetes	2%	3%	$\chi^2(1, N = 284) = .280, p = .597$
Ever had ulcer	3%	3%	$\chi^2(1, N = 284) = .001, p = .982$
Ever had cancer	0%	3%	$\chi^2(1, N = 284) = 1.782, p = .182$
Ever had arthritis	8%	1%	$\chi^2(1, N = 284) = 5.805, p = .016$
Ever had weight problem	27%	21%	$\chi^2(1, N = 284) = .918, p = .338$
BMI (mean)	25.4 (SD=5.749)	26.1 (SD=5.825)	$t = -.702(243); p = .483$
Overweight	27%	24%	$\chi^2(1, N = 284) = .231, p = .631$
Obese	31%	33%	$\chi^2(1, N = 284) = .084, p = .772$
<b>Mental Health Conditions (2)</b>			
Ever had depression problem	25%	20%	$\chi^2(1, N = 284) = .744, p = .388$
Felt sad in last 30 days	19%	9%	$\chi^2(1, N = 284) = 5.215, p = .022$
Felt nervous in last 30 days	38%	25%	$\chi^2(1, N = 284) = 4.176, p = .041$
Felt restless in last 30 days	38%	31%	$\chi^2(1, N = 284) = .848, p = .357$
Felt hopeless in last 30 days	19%	10%	$\chi^2(1, N = 284) = 3.602, p = .058$
Felt everything was effort in last 30 days *	38%	15%	$\chi^2(1, N = 284) = 14.826, p = .000$

\* Significant at .05 alpha level + Significant at .10 alpha level

(1) The Bonferroni adjusted alpha level for this group is .004 per test (.05/12) and .008 (.10/12)

(2) The Bonferroni adjusted alpha level for this group is .008 per test (.05/8) and .013 (.10/8)

<sup>19</sup> Chi-square tests were used for dichotomous variables and t-tests were used for continuous variables, of which BMI was the only one.

The second question used to identify virtual identity construction was, “In your mind, is there a difference between your avatar and yourself? In other words, is your avatar his/her own person/character or do you consider your avatar to be a virtual representation of your physical (‘real-life’) person?” Respondents were coded into those who said that their avatar has a unique identity that is different from the real-life person and those who said that their avatar is just a virtual representation of the real-life person and does not have its own separate identity.<sup>20</sup> As noted in Table 6, there are no significant differences on any of the physical or mental health issues tested between those whose avatar has a unique identity and those whose avatar has the same identity.

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<sup>20</sup> Respondents were given the option of choosing “something else” with the ability to enter in an open response, of which 19 respondents did. These qualitative responses were analyzed and, in general, they could be grouped, as the respondent saying that there was some “combination of unique and similar” identities between the real person and the avatar. However, because of the small numbers in this group, they were ultimately removed from the analysis.

Table 8

*Comparison of Avatar Identity and Health-Related Indicators*

	<b>Avatar has Unique Identity</b>	<b>Avatar is Same as RL Person</b>	<b>Significance Test<sup>21</sup></b>
<b>Number of Observations</b>	<b>86</b>	<b>180</b>	
<b><i>Physical Health Conditions (1)</i></b>			
Ever had hypertension	12%	11%	$\chi^2(1, N = 266) = .069, p = .793$
Ever had coronary heart disease	1%	1%	$\chi^2(1, N = 266) = .288, p = .592$
Ever had heart attack	0%	1%	$\chi^2(1, N = 266) = .963, p = .326$
Ever had asthma	13%	14%	$\chi^2(1, N = 266) = .133, p = .715$
Ever had diabetes	1%	3%	$\chi^2(1, N = 266) = 1.070, p = .301$
Ever had ulcer	4%	3%	$\chi^2(1, N = 266) = .101, p = .751$
Ever had cancer	2%	2%	$\chi^2(1, N = 266) = .137, p = .711$
Ever had arthritis	2%	3%	$\chi^2(1, N = 266) = .203, p = .653$
Ever had weight problem	21%	22%	$\chi^2(1, N = 266) = .057, p = .811$
BMI	26.3 (5.927)	25.6 (5.663)	$t = .770(229); p = .442$
Overweight	24%	24%	$\chi^2(1, N = 266) = .001, p = .996$
Obese	33%	32%	$\chi^2(1, N = 266) = .021, p = .884$
<b><i>Mental Health Conditions (2)</i></b>			
Ever had depression problem	22%	20%	$\chi^2(1, N = 266) = .155, p = .693$
Felt sad in last 30 days	7%	13%	$\chi^2(1, N = 266) = 2.350, p = .125$
Felt nervous in last 30 days	27%	27%	$\chi^2(1, N = 266) = .007, p = .935$
Felt restless in last 30 days	29%	36%	$\chi^2(1, N = 266) = 1.289, p = .256$
Felt hopeless in last 30 days	14%	12%	$\chi^2(1, N = 266) = .156, p = .692$
Felt everything was effort in last 30 days	22%	20%	$\chi^2(1, N = 266) = .083, p = .774$

\* Significant at .05 alpha level + Significant at .10 alpha level

- (1) The Bonferroni adjusted alpha level for this group is .004 per test (.05/12) and .008 (.10/12)  
 (2) The Bonferroni adjusted alpha level for this group is .008 per test (.05/8) and .013 (.10/8)

<sup>21</sup> Chi-square tests were used for dichotomous variables and t-tests were used for continuous variables, of which BMI was the only one.

## **Chapter 5**

### **Discussion**

#### **Overview of Research**

Gathering information about people's attitudes and behaviors is not an easy task, regardless of the venue. People are increasingly difficult for researchers to survey, even with mail and telephone surveys—two of the staples of traditional survey research methodology. This is problematic because so much of social science research depends on interaction with the individual and the data collected in these interactions. The increased presence of individuals in virtual environments—whether they be virtual worlds, list serves, or communities like Facebook, Myspace, and Twitter—means that there is an opportunity to engage individuals in a new medium.

In particular, virtual worlds offers an exciting venue in which researchers can engage participants in a scenario that can closely mimic the real world but that offers many advantages—no geographic boundaries, few language limitations, no need to have a physical location, and the ability to manipulate the environment. However, with virtual worlds research, there are limitations as well. Researchers know very little about the populations in most virtual worlds because creators of these environments have very stringent privacy policies and rarely, if ever, release information on their populations. Additionally, it is difficult to employ traditional probability-based sampling methods because, again, population information is not made publicly available. Despite these limitations, and perhaps because of them, it vital that research explore the populations

present in virtual environments, the ways in which potential research participants might be recruited, and the quality of the data collected from them.

### **Limitations**

Before discussing the implication of the results presented in the previous chapter, it is important to note two limitations. These limitations affect the ability to make inferences to other populations as well as the ability to apply these findings to other contexts.

The most significant limitation of this study stems from the fact that the virtual worlds respondents constitute a non-probability sample. Because of this, it is impossible to make inferences about the broader population of either Second Life residents or other virtual worlds residents. Until the creators of virtual worlds release population data, this will remain a considerable limitation for all research conducted in virtual worlds.

Second, it is not possible to make causal inferences with any of the analyses presented, in particular with regard to the interplay between health status and how a person creates his or her avatar. It may be tempting to say that a given health condition or health status (such as poor mental health) would drive the choices people make about their avatars' gender or the way they interact with others. However, it is also possible that the choices people make about their avatars' characters are attributable to other characteristics that are correlated with health.

Third, it is possible that a respondent is duplicated within the data set. All efforts were made to ensure that each record constitutes a unique real-world individual; however, it is possible that a person filled out the survey more than once and made it through the data-cleaning protocol. While not extremely likely, it is still a possibility.

Finally, the questions and interpretations are limited in part due to the levels of missing data in each question. As mentioned previously, respondents were not required to answer any question. Instead, they were given the option to leave the question blank. One example in particular where missing data is an issue is the research question that deals with item non-response and uses BMI as a variable of interest. The BMI calculation showed higher levels of missing data—15.4%—than did other variables measured. This was usually because the respondent did not answer the weight portion of the two questions. However, because I could not force a respondent to answer any question, the failure to answer any part of the two questions resulted in a missing computation for BMI. In general, the larger concern with missing data is that it can reduce the representativeness of the sample and limit or skew the inferences about the larger population. With respect to this particular study, the large amounts of missing data on income and BMI, both of which are correlated with health, makes it such that the results regarding health indicators may be biased and should be considered carefully.

### **Discussion of Results**

Despite these limitations, this analysis has important implications for how research is conducted in virtual worlds and for understanding SL residents—their health and identity construction in particular.

**Methodological implications.** One of the primary goals of this research project is to inform the way data is collected in virtual environments. In particular, I have focused on sampling protocols and data quality. Results presented in Chapter 4 suggest that quasi-random sampling in virtual environments may not be worth the extra time and cost required over convenience sampling. There were very few statistically significant differences found between those recruited by quasi-random sampling and those recruited

by convenience sampling. Among the primary variables of interest—age, income, and self-reported health status—only age was significantly different at the .10 level. The only differences noted at the .05 level include primary language spoken and language used in the survey. As noted previously, caution should be used with these indicators because of concerns over placement of English and Spanish recruitment advertisements. The only other study published that compares quasi-random sampling to convenience sampling also concluded that the differences between the two samples are small and substantively insignificant (Bell et al., 2009).

The response rate for this study had a range of 21%–39% (depending on the calculation), both of which are respectable response rates for a survey that 1) asks sensitive health questions and 2) conducts all aspects of the study—from the recruitment to the administration to the follow-up—through virtual means. Because many people equate response rates with data quality—which is a false association—most researchers keep response rates close to the vest, and the survey research industry is hesitant to publish such guidelines for that reason. However, one of the largest national surveys to gauge health-related attitudes and behaviors—the Behavioral Risk Factor Surveillance System (BRFSS)—reported a median response rate of 53.2% in 2003 (Battaglia, Khare, Frankel, Murray, Buckley, & Peritz, 2008). While not directly comparable to this study, it gives some indication as to the response rate that a similar instrument—although one with far more resources and completed in a mode that is known for higher response rates—is able to attain. Given that this study is conducted completely in a virtual manner, a mode that typically has among the lowest response rates, I feel that even the most conservative response rate of 21% is very respectable.

In terms of data quality, one measure that is important for health-related data collection is the amount of non-response for a given item, usually a sensitive question. The presence of sensitive questions in an instrument has the potential to exacerbate certain types of errors—such as non-response and measurement (Tourangeau et al., 2000)—and a researcher must be cautious when including sensitive questions in an instrument. One potential benefit of virtual worlds research is that the individual has a built-in anonymity in that they are interacting with the research project through an avatar. When examining item non-response rates for three sensitive questions—drinking behavior, smoking behavior, and body mass index—there was, in fact, a difference between Second Life respondents and those who responded to the NHIS study; however, it was not in the direction hypothesized. Rather, all item non-response rates were significantly higher for SL respondents.

Although it is difficult to determine why this is the case, it may be that the distance between the self and the avatar is not as great as originally thought so that there may not be as great of a protective factor as was hypothesized. As the data from this project shows, the majority of respondents (63%) feel as though their avatar is simply a virtual representation of themselves, and they interact with others as themselves within the virtual world. It is also possible that the presence of an interviewer (as was the case in the NHIS study) made it such that respondents were more likely to answer questions—even those of a very sensitive nature—because it is not the social norm to refuse to answer a question.

**Understanding Second Life residents.** In addition to informing how we engage and collect data in virtual environments, this project contributes to the body of literature

that expands our understanding of Second Life residents in particular and possibly virtual worlds residents in general. This project is the first to compare the profile of virtual worlds residents who live in the United States to a nationally representative sample. The results suggest that a quasi-random sample of U.S. SL respondents is similar to NHIS respondents with respect to two very important demographic variables—income and race—but is different with respect to gender (more women are in SL). This challenges the notion that primarily men utilize virtual environments.

This project also sheds considerable light on how the SL respondents in this study frame their character and construct their identity. One area of particular interest is the number of respondents who engaged in gender-swapping (appearing as a gender opposite of their true gender) and how that seems to correlate with mental health indicators. In general, there is no significant difference among respondents who do and do not gender swap with regard to physical health. However, SL respondents who gender swap appear to be more likely to report feeling like everything was an effort in the prior month than were those who did not gender swap. This result implies that perhaps individuals with depressive symptoms are creating virtual identities that are different from themselves. This did not appear to be the case with respondents who stated that their avatar had their own unique identity.

Finally, there appears to be an “identity melding” that occurs between the real-life individual and the avatar, with the attitudes and behaviors of one impacting the other. This phenomenon is seen when an avatar’s behaviors change the actions of the real-world individual (Dean et al., 2009) and has huge implications for public health research. In particular, the potential for mental health intervention is significant and possibly needed,

as it appears that many of those presenting with depressive symptoms may be undiagnosed. (Only 21% of SL respondents had ever been diagnosed with depression but far more reported symptoms that are indicative of the condition.)

**Future research.** In as much as is possible, future research in this area should seek to expand the sampling strategies available to virtual worlds researchers. While researchers, including myself, cannot currently make a claim that our work is representative of a broader population, we are building the case for what the population may look like. As noted previously, this will always be somewhat limited as long as the creators of these environments keep information about their populations secret. And, although this study sheds considerable light on respondents in Second Life, it would be interesting to see how residents of various virtual worlds are similar to or different from the SL respondents in this study.

The ways in which we collect data, from the design of the sampling frame to the way we measure the concepts, is full of potential error—error that detracts from the true value of whatever we are measuring. In most social science research, there is a good understanding about the sources of error and the ways in which this error is affected by various research designs, modes of data collection, or question wording. However, the sources of error (both new and more traditionally understood ones) are not well-documented or analyzed in virtual worlds research. Many assume that the sources of error will be similar to other electronic-based research methods, but until we make greater strides in determining and documenting the different types of error in virtual worlds research, there will remain a significant gap in our understanding of how to conduct research in virtual environments and how much we can trust the data gathered there. For

example, current literature seems to hint at the presence of a protective factor in responding to sensitive questions. In other words, the individual responding would feel freer to answer questions because of the absence of an in-person interviewer, which typically invokes the desire to 1) respond and 2) respond in a manner that is socially acceptable. However, this was not the case in this research. In fact, SL respondents were less likely to answer select sensitive questions than were individuals in the NHIS sample. This could be for any number of reasons, but future research should certainly explore the motivation and patterns of responses in research settings.

Because of the nature of this data, it is impossible to make causal inferences about the relationship between the way in which a person creates his or her virtual identity and his or her health status. While the data suggests that SL respondents who gender swap may report higher levels of depressive symptoms than do those who do not, it is impossible to say which causes which. Future research could potentially address this question with a longitudinal study designed to look at the causality of health and character creation.

### **Opportunities and Lessons Learned**

Virtual environments give researchers many new opportunities that are particularly exciting for social science research. To start, in virtual worlds the environment is easily manipulated. This gives the opportunity to test the different effects of the environment or interviewer traits in a way that could not be done previously. Because a person's gender, weight, race, or clothes can be changed quickly, as can the research environment, it allows for researchers to test how any number of environmental manipulations can impact a respondent in a fairly quick manner.

There are also no geographic boundaries in virtual worlds, so the researcher can recruit from all over the real world without the added time and expense of actually traveling there. This is a great opportunity for both the researcher and the participant, as virtual worlds are also flexible with time constraints. In the real world, a researcher would have to hold a focus group when a facility is open (which would usually be during the day or early evening), and the respondents would have to travel to that facility (which imposes a time and cost burden on the respondent). In a virtual world, the focus group can be held at the time that works best for the participants and the researcher. There is no need for the extra time and cost needed to travel to a location or to work within someone else's time frame.

Finally, virtual worlds have great potential for distance learning. Because the sense of presence is greater in virtual environments than it is in traditional distance learning settings—like video classroom conferencing or listservs—it has a lot of potential to draw students and educators together from across the globe.

## **Conclusions**

This study is among the first to adapt empirically tested real-world methodologies to a virtual world. It is the first study to use a quasi-random sampling strategy for in-person virtual world recruitment as well as the first study to compare a sample of virtual worlds residents who live in the United States to a nationally representative sample of individuals also living in the United States on a variety of demographic measures. This research has significantly expanded the knowledgebase about the methodological toolbox needed to conduct virtual worlds research as well as expanding the understanding of virtual worlds health-related outcomes and behaviors and virtual identity construction. This study advances the general thinking about virtual worlds residents and helps provide a foundation for future researchers who engage in this type of endeavor.

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## Appendix A

### Contact Documents

**[The following are draft documents of all communication or contacts with respondents. This includes the initial contact when approaching an avatar, the notecard inviting them to participate in the survey, the consent form which will be given prior to beginning the survey and a follow-up postcard for non-respondents]**

#### **[TEXT FOR RESEACHER TO APPROACH AVATAR]**

RESEARCH AVATAR: Hi, my name is XXX and I am a research assistant with the University of Georgia. We are currently conducting a survey of Second Life residents and would like to see if you are interested in participating in our study. It should only take about 15 minutes to complete and you will be compensated \$250 Linden Dollars for your time. If you are interested, I can hand you a notecard which will give you information on the study, a SLUrl to go to in order to complete the survey, and payment information.

May I hand you that notecard?

[if avatar says yes]: Here you go (pass notecard to avatar). Thank you for your time. If you have any questions, there is information on the notecard with contact information. Thank you.

[if avatar says no]: Okay, thank you for your time. If you decide that you are interested in participating, please IM me in-world and I will give you information on how to participate. Thank you.

[Record avatar name, location, date & time for sampling information]

**[NOTECARD TEXT]**

Thank you for your interest in participating in this project. We are conducting research to learn about Second Life residents. Your input is vital to ensure that we have a representative sample of residents. Please keep this notecard in your inventory as it has information you will need in order to complete the survey.

The survey should take about 15 minutes to complete and you will be paid \$250 Linden Dollars for your time. The results of the survey are for scientific purposes and individual data will not be analyzed. All analyses will be conducted at the aggregate level. Your responses will remain confidential and we will not release data publicly that will enable others to deduce your identity. Taking part in this survey is completely voluntary. You may choose to skip any item of the survey; you may stop taking the survey at any time; or you may withdraw your participation in this study at any time without giving any reason and without penalty or loss of benefits.

There are no foreseeable risks or discomforts associated with this survey. You will be paid \$250 Linden Dollars for your participation. There is no cost to you to participate. As a member of a newly and under-studied population, you may enjoy the opportunity to provide perspectives on Second Life generally and your thoughts and attitudes about your role in Second Life in particular.

If you would like to participate in this study, please go to the University of Georgia Survey Facility at [ENTER SLUrl HERE]. Once get to the facility, you will go inside where you will get more information on how to complete the survey. You will need to enter an access code in order to begin the survey. Your access code is [ENTER CODE HERE]. You will need to enter an access code in order to begin the survey. Your access code is [ENTER CODE HERE]. Alternatively, you can go online to [ENTER WEB ADDRESS HERE] to access the survey.

Thank you for your time and consideration.

If you have questions about the research, contact Kelly Foster at knfoster@uga.edu or (706) 542-7384.

Additional questions or problems regarding your rights as a research participant should be addressed to The Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address IRB@uga.edu

**[DRAFT CONSENT FORM GIVEN BEFORE START OF SURVEY]**

**Informed Consent  
Survey of Second Life Residents**

*Important Information about Your Rights as a Research Participant*

You are invited to participate in a research project entitled the **Survey of Second Life Residents**. The research is designed to determine the demographic characteristics of Second Life residents as well as their attitudes and behaviors on a variety of issues.

The results of the survey are for scientific purposes and individual data will not be analyzed. All analyses will be conducted at the aggregate level. Your responses will remain confidential and we will not release data publicly that will enable others to deduce your identity. Taking part in this survey is completely voluntary. You may choose to skip any item of the survey; you may stop taking the survey at any time; or you may withdraw your participation in this study at any time without giving any reason and without penalty or loss of benefits.

There are no foreseeable risks or discomforts associated with this survey. You will be paid \$250 Linden Dollars for your participation. There is no cost to you to participate. As a member of an newly and under-studied population, you may enjoy the opportunity to provide perspectives on Second Life generally and your thoughts and attitudes about your role in Second Life in particular.

We estimate that the questionnaire will take approximately 15 minutes to complete. The web site and its associated server have been secured for privacy. Identifiers will be removed when data collection has ended, and the link between your identity and the survey will be destroyed; statistical analyses will be conducted with no ability to identify you. However, there is a limit to the confidentiality that can be guaranteed due to the Internet technology itself. Once we receive data from completed surveys standard confidentiality procedures will be employed.

If you understand and agree to the terms, please affirm your consent by entering the access code provided in the notecard that you were given by the UGA research avatar. At this point you will gain access to the survey.

If you have questions about the research, contact Kelly Foster at knfoster@uga.edu or (706) 542-7385.

Additional questions or problems regarding your rights as a research participant should be addressed to The Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address IRB@uga.edu

**[FOLLOW-UP IM TO NON-RESPONDENT AVATARS]**

Last week you were approached by a research avatar with the University of Georgia. You were invited to participate in a study of Second Life residents. To date, it appears that you have not completed the survey.

This project is a survey of Second Life residents on a variety of issues as well as demographic characteristics and attitudes and beliefs. Your participation is vital to ensure that we have an accurate representation of Second Life residents.

We understand that you might be hesitant to participate in a survey. Please rest assured that your responses are confidential and will never be linked with your name (either real or avatar name) and all responses will be analyzed as a group – never as an individual. Your input will help shape how others understand and view Second Life residents.

The survey should take about 15 minutes to complete and is voluntary. You may skip any question you do not want to answer. You will be given \$250 Linden Dollars for your time.

If you would like to participate in this study, please go to the University of Georgia Survey Facility at [ENTER SLUrl HERE]. Once get to the facility, you will go inside where you will get more information on how to complete the survey. You will need to enter an access code in order to begin the survey. Your access code is [ENTER CODE HERE]. Alternatively, you can go online to [ENTER WEB ADDRESS HERE] to access the survey.

Thank you for your time and consideration. You will receive no further correspondence from the UGA research team regarding this project.

If you have questions about the research, contact Kelly Foster at knfoster@uga.edu or (706) 542-7384.

Additional questions or problems regarding your rights as a research participant should be addressed to The Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address IRB@uga.edu

## Appendix B

### Survey of Virtual Worlds Residents

**[NOTE: THIS REPLICATED QUESTIONS ARE INDICATED BY A \* BY THE QUESTION. ALL OTHER QUESTIONS ARE ORIGINAL SURVEY QUESTIONS.]**

Thank you for your interest in participating in this survey of Virtual Worlds Residents. The survey will ask some questions about your “real life” as well as your “second life”. Many of these questions are background information about yourself, your health, and the time you spend in-world. While some of these questions are sensitive in nature, please remember that your responses are **confidential** and information will only be reported in group form. **No individual person or avatar will be identified.**

First, we’d like to ask a few questions about when you joined Second Life.

1. When did you first join Second Life?
  - a. \_\_\_\_ [enter month]
  - b. \_\_\_\_ [enter year]
2. What made you decide to join Second Life?
  - a. [open ended response]
3. What do you do most often in Second Life?
  - a. Social activities
  - b. Educational activities
  - c. Role-playing/fantasy games
  - d. Research
  - e. Building and developing
  - f. Business venture
  - g. Something else (please specify):
4. On average, how many hours a week do you spend in-world?
  - a. [open ended response]
5. Would you say you are...
  - a. A very active Second Life resident – I spend a lot of time in-world, I am very comfortable buying/selling land and building things.
  - b. A somewhat active Second Life resident – I spend a good bit of time in-world and have some relationships with other SL residents
  - c. Not very active in Second Life – I spend some time in-world but don’t do a whole lot
  - d. Not at all active in Second Life – I rarely come in-world

Now we'd like to ask a little bit about yourself. Please answer these questions from the perspective of your real-world self – not your avatar or any activities you engage in in-world (we'll ask more about those later). Some of these questions are sensitive in nature. Please remember that we will not identify any individual avatar or individual or link them with their data. Your responses are confidential.

6. What is your primary language?
  - a. [open ended response]
7. What country do you currently live in?
  - a. [open ended response]
8. [If United States] In what state do you live?
  - a. [drop down with all 50 states]
9. \*Is there at least one phone in your home that is currently working and is not a cell phone?
  - a. Yes
  - b. No
10. (If Yes) Which of the following best describes you and your telephone habits?
  - a. I use my cell phone almost all the time – I only have a landline for emergencies or for Internet use
  - b. I use my cell phone most of the time, but I occasionally use the landline phone
  - c. I both my landline and cell phone about the same amount
  - d. I use my landline a little bit more than my cell phone
  - e. I use my landline almost all of the time – I only have a cell phone for emergencies or convenience
11. Do you consider yourself male, female, or transgendered?
  - a. Male
  - b. Female
  - c. Transgendered
12. In what month and year were you born?
  - a. Month:
  - b. Year:
13. \*What is your race? (please check all that apply)
  - a. White
  - b. Black, African-American or Negro
  - c. American Indian or Alaskan Native
  - d. Asian Indian
  - e. Chinese
  - f. Filipino
  - g. Japanese
  - h. Korean
  - i. Vietnamese

- j. Native Hawaiian
  - k. Guamanian or Chamorro
  - l. Samoan
  - m. Other Pacific Islander (please specify):
  - n. Other Asian (please specify):
  - o. Some other race (please specify):
14. \*How tall are you without shoes on?
    - a. \_\_\_ Feet and \_\_\_ inches OR
    - b. \_\_\_ height in metric
  15. \*How much do you weigh without shoes?
    - a. \_\_\_ pounds OR
    - b. \_\_\_ kilograms
  16. \*What is your approximate annual household income before taxes?
    - a. \_\_\_\_\_ [in US Dollars]
  17. What is your housing status?
    - a. Own my own home
    - b. Rent a home
    - c. Live with parents
    - d. Something else (please specify):
  18. \*How many adults live in your home?
  19. \*How many children under the age of 18 live in your home?
  20. \*What is your current working status?
    - a. Working for pay at a job or business
    - b. With a job or business but not at work [????]
    - c. Looking for work
    - d. Working, but not for pay, at a family-owned job or business
    - e. Not working at a job or business and not looking for work
    - f. Working, but not for pay, as a homemaker or stay-at-home parent
    - g. Don't know
  21. Are you currently covered by some form of health insurance?
    - a. Yes
    - b. No
    - c. Don't know
  22. Which of the following best describes your current status with regards to health insurance?
    - a. Currently covered by private health insurance
    - b. Currently covered by Medicaid
    - c. Currently covered by Medicare
    - d. Something else (please specify):
  23. \*Now we'd like to ask you a few questions about certain medical conditions.  
Have you EVER been told by a doctor or other health professional that you had...
    - a. Hypertension, also called high blood pressure
    - b. Coronary heart disease
    - c. A heart attack
    - d. Asthma
    - e. Diabetes

- f. An ulcer
- g. Cancer
- h. Rheumatoid arthritis/lupus/or fibromyalgia
- i. A weight problem (underweight or overweight)
- j. Depression, anxiety, or other mental or emotional issue

24. \*How long have you had a weight problem?

- a. \_\_\_ months
- b. \_\_\_ years

25. \*How long have you had depression, anxiety or an emotional problem?

- a. \_\_\_ months
- b. \_\_\_ years

26. Now we'd like to ask you a few questions about feelings you may have experienced over the past 30 days. During the past 30 days, how often did you feel... (check all that apply)<sup>22</sup>

- a. So sad that nothing could cheer you up
- b. Nervous
- c. Restless or fidgety
- d. Hopeless
- e. That everything was an effort

27. \*Compared with 12 MONTHS AGO, would you say that your health is better, worse, or about the same?

- a. Better
- b. Worse
- c. About the same
- d. Don't know

These next questions are about cigarette smoking, drinking, and leisure activities.

28. \*Have you smoked at least 100 cigarettes in your ENTIRE LIFE?

- a. Yes
- b. No
- c. Don't know

29. \*How old were you when you first started to smoke fairly regularly?

- a. [enter age in years]

30. \*Do you NOW smoke cigarettes every day, some days, or not at all?

- a. Every day
- b. Some days
- c. Not at all – skip next question

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<sup>22</sup> This question is worded the same as the NHIS survey. However, there was a mistake in the programming and the response options of “All the time, most of the time, some of the time, or none of the time” were omitted. Instead, respondents were asked to check as many boxes as applied to them in the past 30 days.

- d. Don't know
31. \*On average, how many cigarettes do you now smoke a day?
    - a. [enter number]
  32. \*In ANY ONE YEAR, have you had at least 12 drinks of any type of alcoholic beverage?
    - a. Yes
    - b. No
    - c. Don't know
  33. \*In your ENTIRE LIFE, have you had at least 12 drinks of any type of alcoholic beverage?
    - a. Yes
    - b. No
    - c. Don't know
  34. \*In the PAST YEAR, how often did you drink any type of alcoholic beverage
    - a. \_\_\_\_ # of beverages consumed OR
    - b. \_\_\_\_ # of days per week you consumed any type of alcoholic beverage OR
    - c. \_\_\_\_ # of days per month you consumed any type of alcoholic beverage
  35. \*In the PAST YEAR, on those days that you drank alcoholic beverages, on the average, how many drinks did you have?
    - a. \_\_\_\_ # of drinks
  36. \* In the PAST YEAR, on how many DAYS did you have 5 or more drinks of any alcoholic beverage?
    - a. \_\_\_\_ # of days
  37. \*How often do you do VIGOROUS leisure-time physical activities for AT LEAST 10 MINUTES that cause HEAVY sweating or LARGE increases in breathing or heart rate?
    - a. I do not regularly engage in vigorous activities.
    - b. \_\_\_\_ times per day or
    - c. \_\_\_\_ times per week or
    - d. \_\_\_\_ times per month
  38. \*About how long do you do these vigorous leisure-time physical activities each time?
    - a. \_\_\_\_ minutes
    - b. \_\_\_\_ hours
  39. \*About how often do you do LIGHT OR MODERATE LEISURE-TIME physical activities for AT LEAST 10 MINUTES that cause ONLY LIGHT sweating or a SLIGHT to MODERATE increase in breathing or heart rate?
    - a. I do not regularly engage in light or moderate activities.
    - b. \_\_\_\_ times per day or
    - c. \_\_\_\_ times per week or
    - d. \_\_\_\_ times per month
  40. \*About how long do you do these light to moderate leisure-time physical activities each time?

- a. \_\_\_\_ minutes
  - b. \_\_\_\_ hours
41. \*How often do you do LEISURE-TIME physical activities specifically designed to STRENGTHEN your muscles such as lifting weights or doing calisthenics? (Include all such activities even if you have mentioned them before).
- a. I do not regularly engage leisure-time activities to strengthen my muscles.
  - b. \_\_\_\_ times per day or
  - c. \_\_\_\_ times per week or
  - d. \_\_\_\_ times per month
42. \*On average, how many hours of sleep do you get in a 24-hour period of time?
- a. \_\_\_\_ # of hours

Finally, we'd like to ask you a few questions about your life in-world (that is, while you are in Second Life) and your avatar. If you have more than one avatar, please consider the avatar that you most frequently use.

43. How many avatars do you have?
- a. \_\_\_\_ # of avatars
44. What is the gender for the avatar that you use most frequently?
- a. My avatar is male
  - b. My avatar is female
  - c. Something else (please specify:)
45. When you interact with other residents in-world, do you act "in character" (in other words, do you play a different role with your avatar) or do you act, speak, and interact as your real self?
- a. I interact with others in character
  - b. I interact with others as myself
  - c. Don't know
46. In your mind, is there a difference between your avatar and yourself? In other words, is your avatar his/her own person/character or do you consider your avatar to be a virtual representation of your physical ("real-life") person?
- a. My avatar has his/her own unique identity or character
  - b. My avatar is a virtual representation of myself so when I interact with others, it is as myself just through my avatar.
47. Have you ever changed the gender of your avatar to a gender that is different from your "real-life" gender?
- a. Yes
  - b. No
48. What is the main reason you did this?
- a. [open ended response]

[PLEASE CLICK "NEXT" BUTTON TO SUBMIT YOUR SURVEY AND GO TO SCREEN TO ENTER YOUR AVATAR NAME IN ORDER TO RECEIVE YOUR PAYMENT]

Finally, we need you to enter your avatar name (please double check your spelling) so that we may pay you the \$250L incentive we promised you. Your avatar name will not be associated with your responses or linked in any way during the final data analysis. All identifying information will be stripped from the file.

Please enter your avatar name in order for us to process your payment. Again, please check to make sure that your avatar's first and last name are spelled correctly.

Avatar First Name

Avatar Last Name

[CLICK NEXT TO SUBMIT YOUR NAME FOR PAYMENT]

Thank you for participating in this study. If you have any questions about this study please contact Ms. Kelly Foster by email at [knfoster@uga.edu](mailto:knfoster@uga.edu) or in-world as Analei Haalan. If you have questions about your rights as a research participant, please contact The Chairperson, Institutional Review Board, University of Georgia, 612 Boyd Graduate Studies Research Center, Athens, Georgia 30602-7411; Telephone (706) 542-3199; E-Mail Address [IRB@uga.edu](mailto:IRB@uga.edu)

## Appendix C

### Second Life Destination Guide

The Second Life Destination Guide (SLDG) highlights locations in Second Life. The areas included in the Destination Guide are not paid placements but rather are chosen by the creators of Second Life, Linden Labs, as an exciting or interesting place to visit. The SLDG was chosen to help provide a variety of locations, which were likely active. Below is a table that shows the categories present in the SLDG in August 2010 when the sample frame was built as well as a brief description of one example of an island that was chosen within that category.

Category	Description of Example Location Chosen
Adventure	fairytale forest with elves
Art	objects from past civilizations
Beaches	surf and beach bar
Business	furnished offices for rent
Castles	Asian castle destroyed in 1582
Chat Hot Spots	hangout spot
Cosmic	study of an instable star
	support group for relationships, every Thursday at 2 PM
	Pacific a qualified psychotherapist and life coach Micca
Discussions	Hendrick facilitates
Editor's Picks	waterside café
Education	10 pharmacy schools R and D lab
Fashion	cute store with garden accessories and a café
Featured Events	search for shells in fashion hunt between July 25-August 8th
Help	basics of creating in SL in Spanish training area
LGBT-Friendly	basic tutorials on LGBT services in SL
Media	classic cartoon cinema
	raise awareness about breast cancer, for survivors and
Memorials	victims
Miscellaneous	small medieval village
Music	dance club featuring techno and progressive house music
Nature	remote island
Newcomer	
Friendly	Hyde park is the community gateway for the UK
Pets	market for breedable pets and animals

Popular Places	outdoor club with classic music
Real Life	stroll La Rambla Avenue of Barcelona
Role Playing	
Communities	Pirating role-play adventures in 9 islands

## Appendix D

### Photos of Second Life Survey Facility

