ENGAGEMENT WITH NOVEL INTERNET TECHNOLOGIES: THE ROLE OF PERCEIVED NOVELTY IN THE DEVELOPMENT OF THE DEFICIENT SELF-REGULATION OF INTERNET USE AND MEDIA HABITS

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ABSTRACT

This dissertation attempts to expand our understanding of the deficient self-regulation (DSR) of Internet use and media habit development. Drawing from a social cognitive perspective, DSR is described as lapses in effective self-control that are self-corrected over time. A shortcoming in this area of research is that factors relevant to the technology that may encourage the development of DSR or media habits are rarely, if ever, discussed. A large focus of existing research is instead narrowly placed on individual factors that motivate DSR and media habits.

An extension is proposed to theory on DSR in this dissertation by examining the role played by novelty perceptions of technology. In the initial stages of technology use, when perceptions of novelty generally grow, perceived novelty is hypothesized to elicit a state of flow, which in turn diminishes the subfunctions of self-regulation and provokes DSR. The relationship between perceived novelty and flow is moderated by psychosocial problems, boredom proneness, and self-reactive outcome expectation. As perceived novelty of a technology decreases, it is presumed that self-control is restored given that flow no longer inhibits self-regulation. However, DSR and media habits are hypothesized to persist in later technology use if individuals experience psychosocial problems, boredom proneness, or high self-reactive outcome expectations. The manifestation of DSR in later stages of technology use increases the likelihood of forming media habits.

The influence of novelty perceptions was evaluated on flow, DSR, and media habits at initial and later stages of technology use. The pretest demonstrated that

a novelty frame successfully manipulated novelty perceptions of Second Life, the technology used in this experiment, in anticipated directions. In the main study, perceived novelty resulted in flow, which in turn predicted growth of DSR during initial stages of Second Life use. In the familiar stages of use, DSR led to the development of media habits over time; however, the relationship between novelty perceptions and DSR was not moderated by psychosocial problems, boredom proneness, or self-reactive outcome expectation. The findings of this investigation are discussed aside their implications for research, theory, and practice.

1. INTRODUCTION

The media that messages are exchanged through influence the communication process to the extent that they can brand entire generations (LaFrance, 1996). Each new medium for this reason is carefully evaluated on its benefits and costs (Fidler, 1997). The benefits of broadcast media (e.g., radio, television), for instance, rested in their ability to transmit a set of messages rapidly to a mass audience (Chaffee & Metzger, 2001). Digital communication platforms supported by the Internet capitalized on the favorable qualities of broadcast media but offered greater user control and a larger breadth of channels (Newhagen & Rafaeli, 1996; Walther, Gay, & Hancock, 2005).

The costs of new communication modes that pervade a community are also assessed in the evaluative process. The negative psychosocial harms of Internet use, for example, have at times eclipsed the utility of Internet technologies (DiMaggio, Hargittai, Neuman, & Robinson, 2001). The benefits of a given medium also have the potential to become a cost. Individuals can use media to escape from the real world or satisfy entertainment or informational needs (Ball-Rokeach & DeFleur, 1976). To the extent that a medium is successful in fulfilling these needs, however, users may form what has been described as an addiction or dependency.

The general aim of this dissertation is to gain a better understanding of the development of media addictions that emerge from Internet use. The literature on unregulated Internet use seldom considers the function of the medium in initiating these “addictions.” The extension to research and theory, proposed in this

dissertation, acknowledges technology's role in the loss of self-control by casting light on perceived novelty as an important precursor to the deficient self-regulation (DSR) of Internet use. The term *technology* refers to a collection of tools or platforms that is considered innovative and used to help solve a human problem (Mesthene, 1970). The technologies of interest to this project are the electronic or digital platforms supported by the Internet. Technological *novelty* is described as a quality of perceiving these platforms as unfamiliar, interesting, and unlike those presently used or understood. Modeling perceived novelty as an antecedent of DSR may be a way to explain why Internet use can go through cycles of deregulation and control in the population of normal Internet users.

The following section outlines the tradition of media addiction research to provide a foundation for understanding DSR. The section that follows provides a general framework for interpreting media addictions in the context of Internet use for this project. This chapter concludes by reviewing the social cognitive perspective from which DSR is defined.

Tradition of Studying Media Addictions

The study of media addictions grew in popularity following the widespread adoption of televisions in households but dates back to the early 1940s. Preston (1941) described media addiction as "giving oneself over to a habit-forming practice very difficult to overcome, no matter how the aftereffects are dreaded" (pp. 147-148). Media addictions research flourished as children were observed developing habitual, seemingly unhealthy media consumption practices, interpreted then as

addictions, to radio programs and films. Media addiction was operationalized as the number of horror movies or radio crime programs children in the sample were exposed to in a given week (Preston, 1941; Rowland, 1944). In theorizing about radio addiction, it was proposed that consumers were addicted to the content of the media (e.g., crime stories), not the medium itself (Rowland, 1944). The effects of movies and radio programs on children identified as so-called addicts included sleeplessness, nervousness, and general health problems (Preston, 1941).

The study of media addictions subsided until anecdotal cases of individuals with supposed television addiction emerged (Goleman, 1990; Winn, 1977). Marshall McLuhan (1964, 1978) was among the first to discuss the potentially addictive qualities of television viewing. Parents, teachers, and professionals began to recognize television addiction as a legitimate and genuine disorder (Winn, 1987). Television addiction was described as a dependency similar to pathological gambling marked by prolonged involuntary exposure to the television (Kubey, 1996; McIlwraith, 1998).

Television addiction was conceptualized as a multidimensional phenomenon consisting of three key elements: a loss of control that results in too much time spent watching television, unsuccessful attempts to reduce excessive television use, and functional impairments that grow out of exposure (Kubey, 1990). Several measures of television addiction, some using items adapted from instruments of substance dependence found in the Diagnostic and Statistical Manual (DSM; American Psychiatric Association, 1987), were constructed and used in research

(e.g., Horvath, 2004; Kubey, 1990; McIlwraith, 1990; Smith, 1986). The proportion of individuals who self-identified as television addicts or were determined to suffer from addiction through a measure's predetermined cut-off points was relatively small (McIlwraith, 1990; Smith, 1986).

Research on television addiction provided a better understanding of the broader construct of media addictions. Self-proclaimed television addicts were more likely to spend time watching television, view programs to pass time and relieve boredom, and watch television to escape from unpleasant or negative moods than non-addicted viewers (Schallow & McIlwraith, 1986-1987; Steiner, 1963). Using television viewing to relieve stress and increase relaxation was found to encourage initial gratification and later addiction (Kubey, 1990; Kubey & Csikszentmihalyi, 1990). The program content aired through the television was not considered the source of the addiction; instead, individuals were said to form dependency to the television itself, regardless of the content that was broadcasted (McIlwraith, Jacobvitz, Kubey, & Alexander, 1991).

At the same time research on television addiction gained momentum, the study of video game addiction had begun to receive increasing attention. Components of video game addiction included excessive time spent playing video games, sacrificing important possessions, and an awareness of the deregulation but little capacity to regain control (Fisher, 1994). The criteria for detecting video game addiction were largely informed by early work on television addiction (Greenfield, 1984). Various measures of video game addiction, which were based on the

diagnostic criteria for pathological gambling found in the DSM, were proposed (e.g., Fisher, 1994; Griffiths & Dancaster, 1995; Phillips, Rolls, Rouse, & Griffiths, 1995). The content of the video game (e.g., character and plot development) and the characteristics of the medium (e.g., quality graphics and sound, complex skills) were jointly viewed as important contributors to the addictive nature of video game playing (Phillips et al., 1995; Wood, Griffiths, Chappel, & Davies, 2004). The percentage of children and adolescents estimated to suffer from video game addiction, in the early 1990s, ranged from 6% to 20% (Egli & Myers, 1984; Fisher, 1994; Griffiths & Hunt, 1998; Hauge & Gentile, 2003; Phillips et al., 1995). Impairment in the form of falling academic grades (Egli & Meyers, 1984) and social skills deficiencies (Zimbardo, 1982) resulted from video game addiction.

The tradition of studying media addictions continued and most new media adopted on a large scale have been indicted for their addictive qualities. For this reason, it is not surprising that the Internet and the technologies it supports were met with similar concerns about addiction. Although antisocial or other dystopian views of the Internet have been raised since the inception and mass adoption of these technologies (Kraut et al., 1998; Nie, Hillygus, & Erbing, 2002), characterizations of the Internet as an addictive medium emerged in the early to mid-1990s. Personal accounts of individuals with signs of addiction to the Internet surfaced, which captured the attention of clinicians and researchers (Moore, 1995; Rheingold, 1993). Healthcare practitioners reported growing numbers of patients with psychological and behavioral symptoms consistent with an “Internet addiction”

(Orzack, 1999). Anecdotal cases, in addition to increasing fears of Internet addiction appearing in news media (e.g., Payne, 2006), generated considerable concern about this condition. In a relatively short period of time, a large body of research that attempted to understand the conditions fostering Internet addiction and its implications on Internet users was amassed. Prevalence estimates from this research suggest that somewhere between 1% and 5% of Internet users suffer from this condition (Morahan-Martin, 2008; Tokunaga & Rains, 2010). More recently, the concept of Internet addiction has been refined and better understood in the literature on DSR.

Unpacking the Multifaceted Nature of Deficient Self-Regulation

Confusion exists in research and theory about how to best understand and identify media addictions. Although a fair amount of attention in research has been directed at understanding this phenomenon, the concept is routinely criticized for its failure to explain the basis of the addiction. Wood (2008) broadly argues that research on media addictions is fueled largely by anecdotal experiences and public hysteria than legitimate empirical investigation. Measures of media addiction are also not thoughtfully constructed. Several items used to detect video game addiction, for instance, seem to measure high levels of engagement rather than addiction (Charlton & Danforth, 2007). Livingstone (1999) summarizes the general confusion of media addictions by questioning whether they should be classified as a "pattern of media use, a psychological condition, the outcome of social deprivation, or a scapegoat constructed by a moral majority" (p. 67).

Questions have also been raised about whether the DSR of Internet use is a unique disorder or a behavioral manifestation of other primary problems in one's life (Shaffer, Hall, & Vander Bilt, 2000). Ha et al. (2006) echo these concerns and explain that the DSR concept has been previously characterized as "a genuine diagnosis, a new symptom manifestation of underlying disorders or psychosocial problems in adjusting to a new medium" (p. 821-822). This central issue has not yet been reconciled or rigorously tested in research. Nevertheless, in the endeavor to bring clarity to the complex debate about the legitimacy of DSR and its processes, it is critical to review the perspective from which the idea of DSR originates. Proposed models and theories emerging from this perspective also specify how to best characterize DSR.

The absence of conceptual clarity of the DSR concept stems from the conflicting perspectives from which DSR is drawn. The disease model perspective treats Internet addiction and problematic Internet use (PIU) as pathologies akin to substance dependence or pathological gambling. Limited empirical support has been found for this pathology perspective. LaRose, Lin, and Eastin (2003) contend that the characterization of an Internet "addiction" is largely misguided and the inability to self-control Internet use should instead be interpreted as cases of DSR through the lens of social cognitive theory.

Understanding Deficient Self-Regulation from a Social Cognitive Perspective

Tenets of social cognitive theory (SCT; Bandura, 1986, 1989, 1999) can be used to explain DSR. The theory suggests that previous experiences with a stimulus

inform future interactions through a process of enactive learning. Enactive learning occurs when individuals evaluate the prospective outcomes of a behavior based on anticipated rewards and punishments. Previous positive or negative encounters with Internet use are therefore influential determinants of DSR (LaRose, Mastro, & Eastin, 2001). Normal Internet use becomes uncontrolled when individuals come to expect positive reinforcement through their engagement with the Internet.

Human behaviors are also regulated by an internal balance between external and self-generated sources of influence (Bandura, 1991). People rely on self-observation to audit or control personal behaviors and the effects their behaviors have on others. In monitoring personal behaviors, a judgment is made by weighing self-observed behaviors against personal standards and social norms. Successful self-observation relies on an evaluation of personal behaviors, determining whether these behaviors are socially normative (Bandura, 1999). Incentives in the form of rewards are applied to behaviors deemed appropriate, and punishments are typically used to modify inappropriate behaviors. DSR occurs when the self-observation of behaviors is impaired in some way that makes it difficult to determine whether personal behaviors are inconsistent with social norms.

DSR can even occur when personal behaviors are noticeably inconsistent with relevant norms. This is because some individuals are unable to apply self-corrective measures of normal self-regulation, a failure of self-reaction. Making erroneous judgments about the normalcy of self-observed Internet use can impair self-correction (LaRose, Mastro et al., 2001). Person-specific vulnerabilities can also

corrupt the judgmental process responsible for validating the normalcy of one's Internet consumption behaviors, leading to DSR (LaRose, 2010).

Habits are a central construct in the social cognitive perspective of DSR and rival prevailing uses and gratification explanations (e.g., Lin, 1999; Papacharissi & Rubin, 2000). Media habits involve a form of automaticity that emerges when consumers repeatedly use media over time under stable conditions (Verplanken & Wood, 2006). The automatic nature of habits identifies them as a set of ritualistic, nonconscious behaviors as opposed to active or learned behaviors (LaRose, 2010). Expectations of future incentives gained through media use transition the consciously repeated behavior to nonconscious behaviors (Yin & Knowlton, 2006). Although some conscious intentions (i.e., controlled thoughts) influence media consumption patterns, the automatic responses indicative of media habits directly affect one's amount of media use (LaRose, 2010; LaRose & Eastin, 2004; LaRose et al., 2003). Conscious intentions stem from the immediate outcome expectations individuals anticipate from their Internet use, whereas habitual behaviors are determined and sustained by long-term average outcome expectations (LaRose, 2010; LaRose & Eastin, 2004; Wood & Neal, 2007). DSR also encourages Internet use because individuals sometimes lack the capacity to control their impulses (LaRose et al., 2003).

In sum, the prevailing social cognitive perspective of DSR is informed by theory and has received empirical support when tested against alternative perspectives (Tokunaga, in press; Tokunaga & Rains, 2010). DSR represents a

failure of controllability, which occurs when people are unable to self-correct personal behaviors at odds with social norms (LaRose, 2009). Habits reflect an automatic response that originates from a lack of awareness in or attention to the observation of one's behaviors and inability to judge these behaviors against relevant personal and social standards.

Dissertation Purpose and Objectives

The purpose of this research study is to understand the development and outcomes of DSR as it is described from the social cognitive perspective. A model of DSR that includes novelty, flow, and habit formation is tested at different stages in which perceived novelty grows and then decays and remains stable over time. Expanding the theoretical framework of DSR to include perceived novelty recognizes relevant characteristics of the technology in DSR development. Research on DSR seldom discusses the role of the Internet; instead, focus is largely placed on the user-specific vulnerabilities and anticipated incentives of Internet use. Engagement with novel Internet technology use may uniquely explain why some people report adjustment problems when exposed to new technologies and how cases of DSR occur in the absence of unpleasant moods or high self-reactive outcome expectation (i.e., perceptions that the Internet can be used to adjust aversive mood states). The discovery of novel content in previously adopted Internet technologies can also clarify how people go through cycles of effective self-regulation, DSR, and media habits.

An experimental design that seeks to manipulate perceptions of novelty in Internet technologies is employed to examine the function of Internet use in DSR development. This experiment offers a number of unique contributions to existing empirical research. First, insight is gained into DSR development in normal populations. Second, this will be the first study of its kind to test experimentally factors related to DSR. The preponderance of evidence in DSR research comes from cross-sectional data, which limits the causal inferences able to be drawn from the large collection of studies.

2. EXTENSION OF THEORIES ON DEFICIENT SELF-REGULATION

The purpose of the present chapter is to introduce the conceptual framework for extending research and theory on DSR by focusing on its development and outcomes. DSR research to date fails to articulate fully the specific processes in which the DSR of Internet use develops, particularly in describing the specific role played by Internet technologies. Several models argue that DSR stems from unpleasant moods, self-reactive outcome expectation, and some aspect of Internet use (e.g., Caplan, 2002, 2003, 2005, 2010; Kim & Davis, 2009; LaRose et al., 2003, LaRose & Eastin, 2004; Lee & Perry, 2004). However, these models fail to specify how Internet use is involved in the initiation of DSR, and how DSR can develop in the absence of unpleasant moods and high self-reactive outcome expectations.

This extension advances the argument that perceived novelty of Internet technologies and content, which involves the perception that Internet-related stimuli is new, unfamiliar, interesting, and dissimilar to other technologies presently used (Bohme, 1980; Burke & James, 2008), is not only an important condition for DSR development but ultimately begins the causal chain that leads to DSR and media habits. Perceived novelty, however, first motivates a state called flow, which then translates into DSR. Psychosocial problems, chronic boredom, and high self-reactive outcome expectations may strengthen the relationship between novelty perceptions and flow, particularly when novelty rises in the initial stages of technology use. At familiar stages of use, following the decay of novelty from familiarity with and mastery over the technology, unpleasant moods and self-

reactive outcome expectations impair the self-correction of DSR, which sustains DSR and results in media habits.

This new framework for understanding DSR makes two distinct, important contributions to theory and research. First, perceived novelty of a technology is theorized as a primary precursor of DSR. Perceived novelty is able to articulate the relevance of the Internet in DSR development. An examination of perceived novelty is also able to clarify how DSR can surface in the absence of unpleasant moods or high self-reactive outcome expectations. Second, the function of unpleasant moods and self-reactive outcome expectation in the development of DSR is taken into consideration. Psychosocial problems, boredom proneness, and self-reactive outcome expectation are argued to foster initially and later sustain DSR.

How DSR is understood in the parameters of this research project must first be explained before presenting the main hypotheses. Several assumptions of DSR, primary to this research project, are presented in the following section. These assumptions describe how DSR is conceptualized, how it manifests in normal populations, and the timeframe in which DSR develops. In the section following the assumptions, the process of DSR development is described in detail. The section explains how Internet use first becomes unregulated and then discusses reasons why people are unable to self-correct their DSR. The chapter concludes with hypotheses amenable to quantitative evaluation. A model of DSR development, integrating the idea of novel technology use, is proposed.

Deficient Self-Regulation of Internet Use

Previous research provides a foundation for understanding DSR. DSR is described as a transitory state wherein conscious self-control over a behavior that typically lies under one's volitional control is temporarily lost. In the context of Internet use, self-control is impaired by poorly adapted cognitions and behaviors (Caplan, 2010; LaRose, 2001; LaRose, Eastin, & Gregg, 2001; LaRose, Mastro et al., 2001; LaRose et al., 2003). These maladaptive cognitions and behaviors hinder one's ability to manage Internet use; however, it is possible for self-regulation to recover over time (LaRose & Eastin, 2002; LaRose et al., 2003). The failure to self-control Internet use occurs as a result of several process malfunctions, including the incapacity to monitor Internet use, evaluate the time one spends on the Internet against personal and social standards, and/or correct instances of overuse (Caplan, 2010; LaRose et al., 2003). DSR is operationalized as a bidimensional construct consisting of two key elements: cognitive preoccupation with the Internet and uncontrolled uses of the Internet (Caplan, 2010).

Cognitive Preoccupation

DSR is marked by persistent preoccupation with the Internet or the content delivered through its technologies (Shapira et al., 2003). Preoccupation is the condition of having persistent thoughts about a particular source, which, over time, becomes an automated response triggered by any stimuli relevant to the source (Reingold & Toth, 1996). Preoccupation in DSR involves frequent thoughts of the Internet while away from it or about prospective Internet use (Caplan, 2010).

Individuals may be consumed with thoughts about changes since their previous use or things that may be waiting for them on return. Cognitive preoccupation is described as a craving that causes some users to become irritable and restless during extended periods away from the Internet. Persistent thoughts lead individuals to think they lack personal agency to control their own behaviors (Bandura, 1982). In DSR, these thoughts about the Internet accompany deficient behavioral control over Internet use (LaRose et al., 2003).

Uncontrolled Internet Use

The second dimension of DSR is a behavioral component characterized by compulsions and impulses (Caplan, 2010; LaRose & Eastin, 2002; Meerkerk, Van Den Eijnden, Vermulst, & Garretsen, 2009). Compulsions are dominant urges or desires to perform a behavior from which one is trying to abstain (Schilder, 1938). An uncontrolled response in performing a behavior despite the absence or cessation of a stimulus signals compulsivity (Koob, 2009). These repeated behaviors are commonly used as a mechanism to rid oneself of anxiety or distress when experiencing unpleasant thoughts (Rachman & Hodgson, 1980) and differ from behavioral impulses. Impulses are actions that lead to short-term gains or rewards in spite of the potential for long-term negative problems (Rachlin & Green, 1972). Impulsive behaviors prevail at the beginning of DSR cycles and compulsive behaviors take over toward the end.

The uncontrolled Internet use dimension of DSR is explained as “an inability to control one’s online activity along with feelings of guilt about the lack of control”

(Caplan, 2003, p. 626). Uncontrolled use differs from excessive use, defined as the perception that individuals surpass their own "normal" levels of Internet activity, in that uncontrolled behaviors do not rely on the exact quantity of time spent online (Caplan, 2003, 2005). It is possible to spend excessive amounts of time on the Internet without ever developing uncontrolled Internet use. Likewise, uncontrolled impulses or compulsions concerning the Internet can develop in absence of excessive levels of Internet use. An outcome of this lapse in the effective self-control of Internet use is increased amounts of time spent on the Internet (LaRose & Eastin, 2004; LaRose et al., 2003).

In sum, prior research on DSR offers some clarity about how best to conceptualize this condition. DSR is commonly understood and operationalized as a bidimensional construct of cognitive preoccupation and uncontrolled Internet use. Beyond the simple conceptual understanding of DSR, however, noticeable discrepancies exist in the way various perspectives frame DSR. The following section discusses the core assumptions of DSR made in this dissertation. A limitation of research and theory is then presented to understand the rationale for the project.

Core Assumptions of Deficient Self-Regulation

Several assumptions are explicitly advanced to avoid confusion about how to interpret and understand DSR in this project. DSR is interpreted as a continuous construct, with the most serious form referred to as problematic Internet use (PIU) and the least serious problems identified as unregulated Internet use. PIU is viewed as a condition involving intense maladaptive conditions and extreme compulsivity

of Internet use (Caplan, 2006). The maladaptive cognitions and compulsive behaviors are often accompanied by academic, professional, and/or social problems (Caplan, 2005; Shapira et al., 2003). PIU is not normally distributed in normal populations; empirical estimates suggest that the construct is skewed positively (e.g., Caplan, 2010; Davis, Flett, & Besser, 2002), with genuine PIU sufferers comprising only 1% to 5% of all Internet users (e.g., Aboujaoude, Koran, Gamel, Large, & Serpe, 2005; Johansson & Gotestam, 2004). At the lower endpoint, where most cases occur in normal populations, DSR is interpreted as instances of mild preoccupation and temporary lapses in control over Internet use, which are generally corrected and self-regulated over time (Caplan, 2010; LaRose et al., 2003).

This study explores the development of DSR at the lower end of the continuum and thus interprets the construct as an instance of unregulated Internet use. DSR, described as a relatively benign condition, occurs for only a short while until effective management over Internet use is restored (Hall & Parsons, 2001). Given the modest number of individuals who report serious problems with Internet use, yet the large number of people who claim a loss of control, it is likely that most cases involve mere difficulties in adjusting to a new medium.

DSR is a failure to have self-control over an impulse (Baumeister, 2002), which in this case is the impulsive desire to use the Internet (LaRose, 2010; LaRose et al., 2003). An impulse is "an inclination to respond a certain way in a particular situation on a particular occasion" (Baumeister & Vohs, 2007, p. 2). Impulsive behaviors and the loss of self-regulation represent the struggle between desire and

willpower (Hoch & Loewenstein, 1991). Succumbing to an impulse regularly occurs when a desired novelty is introduced into one's life and a hasty decision is made to obtain it (e.g., impulsive buying) (Rook, 1987).

The lack of impulse control over Internet use can therefore result in DSR, particularly when a technology perceived as novel is introduced. LaRose (2010) suggests that DSR and habituated behaviors differ in that "deficient self-regulation also applies to novel, impulsive actions with zero history" (p. 210). For instance, the DSR of a novel communication technology involves initial introduction to the technology, which may soon be followed by persistent thoughts about the technology while away from it and uncontrolled uses of the technology. The outcome of DSR, over time, may be ritualistic consumption patterns indicative of media habits. These habits are described as automatic behaviors, which work in concert with conscious intentions, to produce repeated behaviors (Verplanken & Wood, 2006).

A Limitation of Research and Theory on Deficient Self-Regulation

Cognitive preoccupation and uncontrolled behaviors, representative of DSR, have been discussed as the result of exposure to generalized Internet use (Caplan, 2010; Davis, 2001; LaRose & Eastin, 2004; LaRose et al., 2003), specific Internet technologies (LaRose et al., 2005; Lee & Perry, 2004), or Internet content (LaRose & Eastin, 2002; LaRose & Kim, 2005). Davis (2001) argues that PIU, the severest form of DSR, is motivated by a chance occurrence of a preexisting vulnerability (e.g., psychosocial problems, chronic boredom) in concert with the introduction of a new

Internet technology or novel content accessed through the technology. PIU may develop from "the first time an individual locates pornography on the Internet, the first time on an online auction service, an online stock trading service, or a chat service" (Davis, 2001, p. 190). However, beyond this description of the Internet's role in the development of DSR, it is unclear how specific elements of new Internet technologies foster DSR and why some people who do not have these vulnerabilities still experience preoccupation and lapses in self-control following exposure to novel technology use. To understand this, it is necessary to review the theorized pathways through which DSR develops.

Psychosocial Problems, Boredom Proneness, and Self-Reactive Outcome Expectation as Vulnerability Factors in Deficient Self-Regulation

Self-regulation involves the close self-observation of a behavior, accurate judgments of the behavior against personal standards and referential performances, and self-reactive incentives (i.e., psychological or behavioral rewards) of and anticipative affective reactions to the behavior (Bandura, 1991). Behaviors are considered under one's control when these subfunctions of self-regulation work together to meet desired personal and social standards. Internet use may become unregulated when people lack conscious self-control (LaRose et al., 2003). A failure of self-reaction is responsible for DSR while failures of self-observation and judgmental processes account for the formation of media habits (LaRose, 2009). Self-regulation is often likely to retard when mood states alter how certain

behaviors are observed and processed (Kuiper, MacDonald, & Derry, 1983). Thus, mood is discussed as a precursor to generalized DSR.

Unpleasant moods are any internal tensions that cause an enduring uncomfortable psychological state (Atkin, 1985). Unpleasant moods can stem from a wide range of circumstances such as psychosocial problems, chronic boredom, and traumatic life events. A basic hedonic drive motivates humans to avoid unpleasant moods and enhance or sustain positive moods (Wegener & Petty, 1994). This is accomplished by moving away from unpleasant situations and toward stimuli that lead to self-reactive incentives, such as the anticipated reward of moderating existing aversive states. Zillmann (1988a, 1988b) explains that people sometimes strategically organize their media environments to sustain pleasant moods or avoid negative affective states.

The development of DSR from unpleasant moods, such as psychosocial problems and boredom proneness, or self-reactive outcome expectation has been explained in the SCT perspective. Unpleasant moods experienced from personal or social circumstances motivate an internal need to relieve the disagreeable states (Zillmann & Bryant, 1985). Mood management theory suggests that media, such as television viewing (Zillmann & Bryant, 1985), music (Knobloch & Zillmann, 2002), and exposure to good-news stories (Biswas, Riffe, & Zillmann, 1994), can provide relief from unpleasant moods. Using Internet technologies also has the potential to alter negative moods by catering the vast and diverse content found online to one's specific needs (Leung, 2004). LaRose et al. (2003) argue that DSR develops to the

extent that Internet use is able to satisfy internal needs motivated by unpleasant moods through a process of enactive learning and operant conditioning. The needs gratified by initial Internet use then mold expectations of future Internet use (LaRose, Eastin et al., 2001).

Unpleasant moods are accompanied by negative cognitive biases, described as self-inflicted stress and personal devaluation (Bandura, 1991), that slight the successful self-regulation of Internet use (LaRose et al., 2003). These biases are self-defeating behaviors (e.g., accepting blame for failures) that stem from bad moods and later risk taking (Leith & Baumeister, 1996). Cognitive biases have the potential to impair goal-motivated successes at first (Kanfer & Hagerman, 1981; Rude, Valdez, Odom, & Ebrahimi, 2003) and later prejudice perceptions of self-regulatory efficacy (Bandura, 1991).

Novelty, Flow, and Deficient Self-Regulation as Novelty Perceptions Increase

Explanations about the function of the Internet in DSR and why DSR sometimes develops in the absence of unpleasant moods or high self-reactive outcome expectations are missing from the social cognitive account of unregulated Internet use. One goal of this dissertation is to close this gap, which exists in theorizing about DSR development. Some theory suggests that DSR happens in the early stages of Internet use and DSR represents mere difficulties adapting to a new medium. Common to these two explanations is that DSR seems to occur when perceptions of the technology are in the formative stage of initial use. At this stage, perceived novelty of a technology rises, with users still interested in determining its

functions and properties. This perceived novelty differs from what LaRose and Eastin (2004) explain as novel outcome expectations of Internet use. In their view, novel outcome expectation mainly represents information acquisition as a predictor of Internet use and habit formation. Instead, perceived novelty in this project reflects the view of a technology as new, interesting, and identifiably different to other technologies used or understood at the time of introduction.

Perceived Novelty

Perceived novelty is relevant to DSR development because, as addressed by exploration theory (Berlyne, 1960, 1966), novel external stimuli promote exploratory behaviors (Berlyne, 1960). Notions of unfamiliarity and interest, the feeling of departing from personal norms, and the desire to seek information emerge when introduced to a novel stimulus (Bohme, 1980; Burke & James, 2008; Magni, Taylor, & Venkatesh, 2010). Novel stimuli can increase arousal states and lead people to become actively engaged in seeking new information about the stimuli (Berlyne, 1960; Loewenstein, 1994). These feelings are strongest in the initial stages of exposure to a novel stimulus and decline with repeated interaction (Berlyne, 1966).

Novelty perceptions are subjective experiences; novelty is not inherent to a particular stimulus (Förster, Marguc, & Gillebaart, 2010). Feelings of excitement and the need to explore Internet use accompany a sense of challenge and desire to develop new skills that help to overcome the challenge. A balance between skills and

challenge, instigated by perceived novelty and constituent exploration, fosters a state of full cognitive immersion called flow (Magni et al., 2010).

Flow

Flow occurs when an activity challenges individuals to such an extent that it results in playful experiences and a sense of exhilaration with the external stimuli (Csikszentmihalyi, 1975, 1990; Malone, 1981). Flow involves a condition known as *optimal experience* (Csikszentmihalyi, 1997, 2008; Csikszentmihalyi & Csikszentmihalyi, 1992), where full attention aimed at balancing complexity and skills results in complete engagement with an activity so that all else becomes irrelevant (Csikszentmihalyi, 1990). The optimal experience translates into a deeply immersive and enjoyable experience in which people are consumed with a specific activity. In flow, individuals become absorbed in the activity, filter out all other cognitions irrelevant to the stimulus, and lose self-consciousness (Csikszentmihalyi, 1990). Flow can be experienced in activities that range from work to leisure given a set of favorable conditions (Csikszentmihalyi & LeFevre, 1989).

The uncertainty of a novel activity breeds complexity (i.e., challenge), and interest in the novel activity elicits a desire to seek skills to overcome the complexity (Csikszentmihalyi, 1975). The introduction of novel stimuli can cultivate feelings of excitement, discovery, and adventure necessary for flow experiences (Csikszentmihalyi, 1991). Flow is thus elicited to the extent that novelty is perceived with the introduction of a technology. In computer use, flow occurs only when control is felt over a technology, attention is narrowed to a specific technology, the

technology inspires curiosity, and the technology is found inherently interesting (Trevino & Webster, 1992). The absorption from flow can be so profound that it may lead to temporal disassociation (i.e., losing track of the time) and distractions in one's life (Agarwal & Karahanna, 2000). The high cognitive load accompanying the immersive state of optimal experience creates an inhospitable environment for effortful self-regulation (Wegner, 1994). Csikszentmihalyi (1996) contends that "while in flow, we are too involved to be concerned with failure. Some people describe it as a feeling of total control; but actually we are not in control" (p. 112).

Model of Deficient Self-Regulation

The qualities of flow parallel dimensions of DSR. Diminished self-consciousness, decaying in the high-involvement environment of flow experiences, impairs the self-observation and judgmental processes of behaviors necessary for effective self-regulation (Carver & Scheier, 1998). Flow is fundamentally incompatible with successful self-regulation because the immersive experiences and declining self-awareness of flow states categorically undermine the effective self-observation of behaviors (Lee & LaRose, 2007). Carver and Scheier (1998) explain that people who experience flow are "fully engaged in behaving but [are] never pressed to wonder whether the behavior can be successfully maintained" (p. 176). Flow experiences, particularly involving novel Internet experiences, make it difficult to maintain conscious self-control over Internet use.

In the initial stages of Internet technology use, when novelty perceptions of the technology steadily grow (Magni et al., 2010), perceived novelty leads to flow

from the desire to explore the technology. The cognitive absorption of flow then leads to self-regulatory failure (Carver & Scheier, 1998; Chou & Ting, 2003; Lee & LaRose, 2007). DSR develops because the high level of exhilaration and complete immersion experienced in flow weakens one's ability to engage in the self-monitoring, judgmental, and/or self-reaction processes of self-regulation (Lee & LaRose, 2007). The challenge related to engagement with a novel technology and obtaining skills necessary to overcome the challenge operate in collaboration to impair the subfunctions of self-regulation. The immersion of flow undermines volitional control over behaviors, including the controllability of Internet use. Accordingly, in initial technology use, perceived novelty facilitates immersion in flow, which in turn results in DSR.

H_1: In initial uses of an Internet technology, perceived novelty causes flow, which in turn leads to deficient self-regulation.

The perspective that novelty perceptions instigate DSR, introduced in this chapter, explicates the process of DSR and habit formation. In LaRose and Eastin's (2004) application of social cognitive theory to Internet use, DSR stems from, among other things, depression and other conditions that cause unpleasant moods in concert with the belief that the Internet is able to manage these moods. Research has demonstrated considerable support for the robust relationship between DSR and psychosocial problems (see Tokunaga & Rains, 2010 for a meta-analysis on this topic). The psychosocial vulnerability perspective to some degree lies in conflict with the view that perceived novelty begins the causal chain eventually leading to

DSR. The novelty perspective presented in the preceding sections, however, cannot dismiss the possibility that unpleasant moods and self-reactive outcome expectation are instrumental in DSR and habit development given robust empirical support.

Psychosocial problems and chronic boredom are vulnerability factors of DSR, particularly if there is a perception that the Internet provides relief from these conditions (LaRose & Eastin, 2004; LaRose et al., 2003). Individuals become operantly conditioned by the rewards of the Internet; in this case, the incentive is mood regulation. Strategic restructuring of one's media environment can help to overcome understimulation or overstimulation, both considered aversive states (Zillmann & Bryant, 1985). Nevertheless, the independent influence of psychosocial problems, boredom proneness, and self-reactive outcome expectation on the relationship between novelty perceptions and flow is not well understood.

The pleasurable state and deep immersion of flow is not always uniformly experienced across Internet users. The extent to which flow is experienced from an activity depends on the motivation that drives the performance of the activity (Kowal & Fortier, 1999). The persistent intrinsic motivation to execute a behavior is indicative of a character type that regularly experiences flow regardless of the nature of the activity, known as an autotelic personality (Csikszentmihalyi, 1999). Csikszentmihalyi (1988) explains that "it takes intrinsic motivation to break through to new levels of complexity in thought or behavior" (p. 373). Therefore, individuals intrinsically motivated to enter a state of full immersion are likely to do whatever is necessary to enter flow.

The hedonic drive for those with unpleasant moods acts as a motive for entering flow. The desire to rid oneself of the aversive state internally motivates individuals to do whatever is necessary to enter flow. While in flow, all other thoughts irrelevant to the activity performed, such as contemplation about the source of the anxiety, loneliness, depression, or boredom, become temporarily forgotten. The temporal dislocation and loss of self-consciousness during flow introduce a generalized loss of self-control over the broad activity.

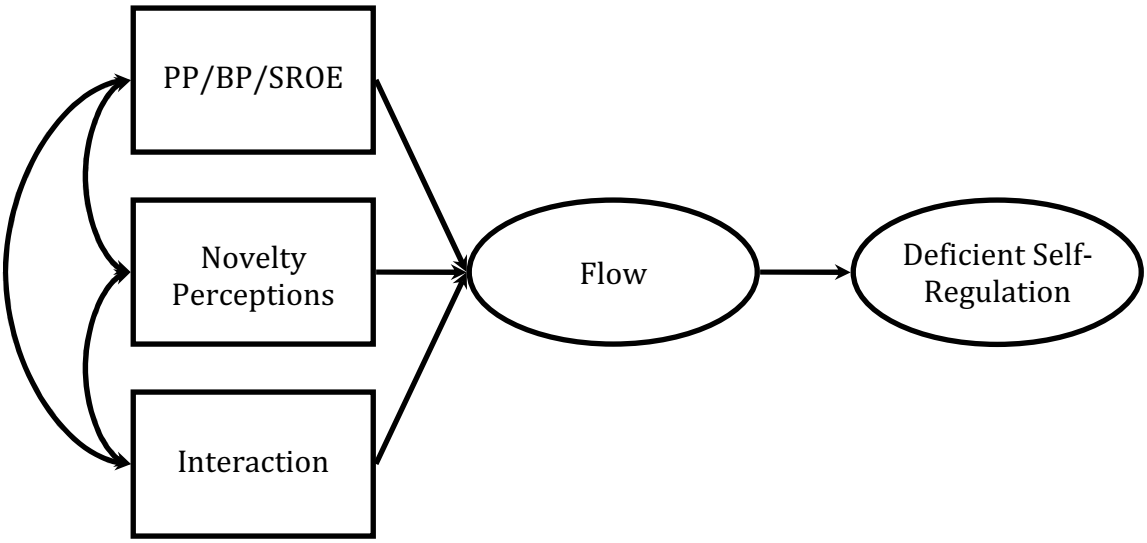
Novel technologies provide individuals who have a large incentive to enter flow, motivated in this case by unpleasant moods and high self-reactive outcome expectations, with the necessary infrastructure to explore in an environment that requires a delicate balance between skills and complexity. Psychosocial problems, boredom proneness, and self-reactive outcome expectation thus independently moderate the relationship between novelty perceptions and flow because people with these vulnerability factors are more motivated to use the technology to enter flow than those without these vulnerabilities. When vulnerability factors are present, the relationship between perceived novelty and flow is strongest.

When intrinsic motivation is missing, from the absence of psychosocial problems, boredom proneness, and self-reactive outcome expectation, flow is generally less likely to transpire. Without these conditions, flow will not emerge when engaged with an Internet technology perceived as old and familiar because neither challenge nor motivation to enter flow exists. Although novelty perceptions marginally increase the likelihood of entering flow, the lack of intrinsic motivation

from absent vulnerabilities lessens the chance that full immersion will occur. While novelty and flow are related in the absence of unpleasant moods or self-reactive outcome expectation, the relationship under this condition is considerably weaker. Because the relationship between novelty perceptions and flow comes to depend on an intrinsic motivation to enter flow, psychosocial problems, boredom proneness, and self-reactive outcome expectation independently moderate this relationship. An illustration of the conceptual model proposed in Hypotheses 1 and 2 is provided in Figure 1.

H_2: In initial uses of a technology, the relationship between perceived novelty and flow is independently moderated by (a) psychosocial problems, (b) boredom proneness, and (c) self-reactive outcome expectation.

Figure 1. An illustration of the conceptual model of flow and deficient self-regulation proposed in Hypotheses 1 and 2.



Note. PP = psychosocial problems; BP = boredom proneness; SROE = self-reactive outcome expectation.

Flow, Deficient Self-Regulation, and Habit Formation after Novelty Perceptions Decay

Familiarity with a technology increases over time as exposure to a novel technology is repeated. The growing familiarity follows proportionately with the retardation of novelty perceptions. The subprocesses of self-regulation, previously suspended on account of the novelty that fostered flow, are expected to function again normally. The return to self-regulation takes shape when the failed subfunction or subfunctions of self-regulation (i.e., self-observation, judgment, and self-reaction) are corrected (LaRose, 2009). Lezak (1995) notes that these subprocesses are hardwired responses that are part of the executive function inherent to humans. The self-correction of DSR is not only possible but anticipated because repeated exposure of the technology increases familiarity, reduces novelty, and curtails the flow states that sustain DSR. Familiarity and later mastery introduce an imbalance between complexity and skill, which undermines flow. It is this absence of flow that ultimately promotes the gradual transition from deficient to successful self-regulation.

The minimal challenge and excess skill when technology use becomes familiar would indicate that flow no longer hinders successful self-regulation. However, this is not to imply that DSR completely fades away after novelty perceptions dissipate. DSR can and does occur in more familiar stages of technology use, as in the DSR of video game play (Lee & LaRose, 2007). It is important therefore to understand how DSR emerges when, in the absence of perceived novelty, it

theoretically should not. SCT may provide useful insights into persistence of DSR and habit formation in later uses of a technology formerly viewed as novel.

The self-correction of DSR should take place when the subprocesses of self-regulation are allowed to function uninhibitedly. The experience of unpleasant moods, however, influences whether self-correction takes place. According to Bandura (1986), unpleasant moods, such as anxiety and depression, are linked to negative cognitive biases that slight one's attempts to perform successful behaviors. The self-correction of DSR is considered one such behavior that can be impaired by psychosocial problems, boredom proneness, and self-reactive outcome expectation. Even though novelty perceptions of a technology decay over time, unpleasant moods restrain the meaningful self-correction of behaviors that became unregulated when novelty perceptions prevailed. The result of persistent DSR over time is the formation of media habits, described as automatic and unconscious media consumption (LaRose, 2010; LaRose & Eastin, 2004; LaRose et al., 2003).

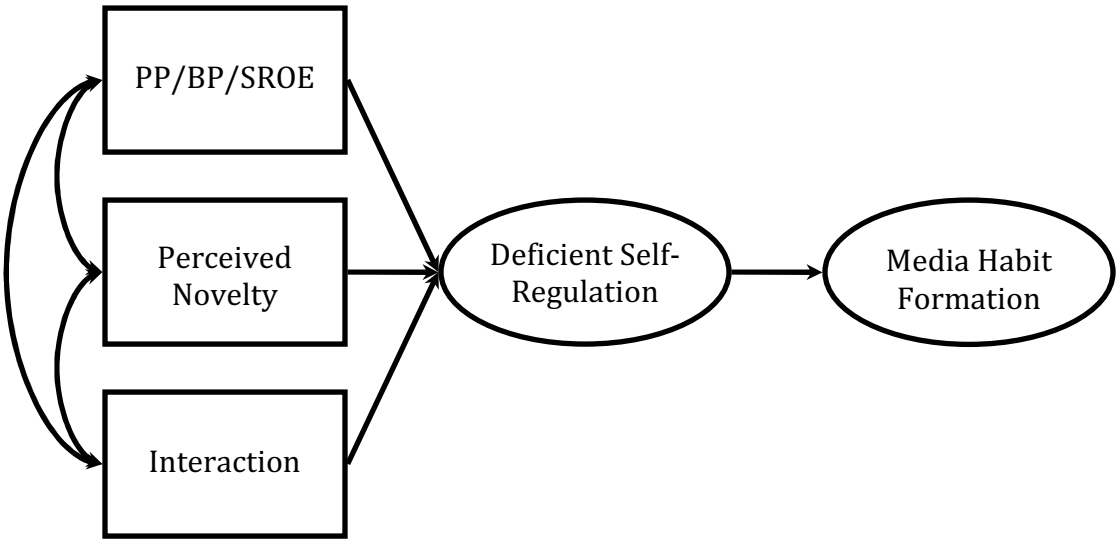
DSR is highest in familiar stages of Internet use when individuals have psychosocial vulnerabilities or high self-reactive outcome expectations because they lack the capacity to self-correct Internet use that became unregulated in initial use. The same vulnerable population would not experience DSR if the technology they use was never initially perceived as novel. The assumption for those without psychosocial vulnerabilities or high outcome expectations is that DSR would not be present in familiar stages of technology use given that the self-correction of unregulated Internet use, if any, is able to occur, leading to a weaker relationship

between novelty perceptions and DSR. Moderation is indicated by the variable relationship between novelty perceptions and DSR, which comes to depend on psychosocial problems, boredom proneness, and self-reactive outcome expectation. The persistence of DSR, even after novelty decays, leads to habituated or ritualistic uses of the Internet. Figure 2 offers a visual illustration of the model proposed in Hypotheses 3 and 4.

H_3: In familiar stages of technology use, the relationship between novelty and deficient self-regulation is independently moderated by (a) psychosocial problems, (b) boredom proneness, and (c) self-reactive outcome expectation.

H_4: In familiar stages of technology use, deficient self-regulation leads to habit formation.

Figure 2. An illustration of the conceptual model of deficient self-regulation and habit formation proposed in Hypotheses 3 and 4.



Note. PP = psychosocial problems; BP = boredom proneness; SROE = self-reactive outcome expectation.

3. PRETEST

Method

Overview

The following sections describe the methods used in the pretest. The goals of the pretest were to evaluate the measurement model for the perceived novelty scale and test the efficacy of two novelty manipulations. A novelty frame and a treatment within the technology were used to manipulate perceptions of novelty. During an information session, the technology used in the pretest, Second Life, was framed as novel in the high-novelty condition and ordinary in the low-novelty condition. In Second Life, perceptions of novelty were manipulated by sending different groups of participants to virtual communities with familiar (high-novelty) or unfamiliar (low-novelty) environments. Participants were randomly assigned to one of the four conditions, asked to come to a respective laboratory appointment based on the condition to which they were assigned, and used Second Life. At the end of the session, participants were asked to complete a measure evaluating the extent to which they perceived Second Life to be novel. Data collected in the questionnaire were used to evaluate whether the novelty measure is consistent with the hypothesized unidimensional nature of the construct. Novelty scores were then used to check the efficacy of the manipulations.

The technology chosen for this pretest was Second Life (Linden Labs). Second Life was selected because the controls are easy to understand and the program itself remains generally unused by college students (Fetscherin &

Lattemann, 2008). Pew data in 2008 reveal that only about 8% of teenagers and college-aged students visit virtual worlds, such as Second Life (Lenhart et al., 2008). Second Life also makes it possible to construct and manipulate familiar and unfamiliar virtual environments, a desirable tool for the within-Second Life novelty manipulation. Lastly, the cognitive processes involved with socializing over programs such as Second Life can be differentiated from online games.

Pretest Participants

Participants were recruited from undergraduate courses at the University of Arizona. Several criteria must have been met for students to participate in this research project: students must have been at least 18 years of age, they must not have used Second Life in the past, and they must have some familiarity with the Internet. Participants were given extra or research credit in exchange for their participation. Seventy-eight (43 male, 35 female) students who met the criteria participated in this pretest study. The average age of the participants was 21.88 years (*SD* = 3.37, range = 18-43). The ethnic or racial makeup of this sample was as follows: 73.1% (*n* = 57) White/Caucasian, 11.5% (*n* = 9) Latino/a, 5.1% (*n* = 4) Asian, and 2.6% (*n* = 2) African American/Black. The additional 7.7% (*n* = 6) of the sample identified their race/ethnicity as mixed or other.

Participants reported being exposed to the Internet for a fair amount of time on a daily basis. The average amount of time participants spend using the Internet was 4.43 hours per day (*SD* = 2.89). Of this time online, they spend an average of 63.7 minutes (*SD* = 84.40) each day socializing with others over the Internet. All

participants (100.0%, *n* = 78) included in the sample reported having over ten years of experience on the Internet.

Pretest Design

A 2 (high-novelty frame/low-novelty frame) x 2 (familiar/unfamiliar environment) full-factorial design was employed in the pretest to evaluate the novelty manipulations. The design was used to evaluate the frame and environment manipulations. Participants were randomly assigned to one of four conditions: high frame/familiar environment, low frame/familiar environment, high frame/unfamiliar environment, low frame/unfamiliar environment.

Pretest Procedure

Participants attended laboratory sessions, based on the condition to which they were assigned, where they were informed about the broad goals of and protocol for the study. Before participants were allowed to participate in Second Life, they were asked to complete a questionnaire that included simple demographic information items. Participants were then asked to use Second Life in a dedicated research computer lab for a 30-minute period. Participants were told to find and socialize with as many people as possible. This level of exposure provided enough time for participants to become familiar with the settings of the program and allow them to socialize with several new people. Half the participants in each condition were randomly assigned to the condition that received the high-novelty frame, and the other half was assigned to the low-novelty frame condition. Within those groups, half was assigned to the familiar environment condition, whereas the other half was

directed to an unfamiliar virtual environment. After the session, participants in all conditions were asked to complete a questionnaire, which included a measure of novelty perceptions of Second Life. This questionnaire took approximately 15 minutes to complete.

Frame manipulation. The information provided during the sessions was identical with the exception of how Second Life was framed. Novelty perceptions of Second Life were manipulated using framing procedures described by Förster, Liberman, and Shapira (2009). In the high-novelty frame condition, novelty was manipulated by characterizing Second Life as a new and interesting Internet technology much different from the technologies that participants presently use. The researcher used the following script in the high-novelty frame condition: "While you are using Second Life, think about the different ways this new program is unlike any other Internet technology you currently use or have used in the past. Focus on the parts of Second Life that you find interesting and exciting. This is a great new way to meet people over the Internet." In the low-novelty frame condition, the researcher mentioned to participants that, "While you are using Second Life, think about how Second Life is a technology no different than chat rooms, instant messengers, or social networking sites, that is, Internet technologies with which you are already familiar. Therefore, you should not consider Second Life new; it is just another way to meet people over the Internet."

Environment manipulation. The second novelty manipulation was carried out in the Second Life environment. Participants were randomly assigned to one of

Figure 3. An image captured from a virtual space in the familiar environment condition of the pretest.

two virtual spaces in Second Life. In the familiar environment condition, participants were gathered in a school setting, a virtual environment intended to parallel reality and foster familiarity. The space was called University of Arizona, an area on Second Life intended for students attending University of Arizona or wishing to visit the campus virtually. The virtual space included familiar user-generated images, such as buildings located on the actual campus (e.g., Old Main). An example image from the familiar environment condition is provided in Figure 3. Participants in the unfamiliar environment condition were directed to virtual spaces on Second Life that included novel shapes and unfamiliar objects. These shapes included amorphous building structures, exaggerated vegetation, and fantasy characters. Figure 4 is a representative screenshot of the unfamiliar environment condition.

Pretest Measurement

Perceived Novelty. An eight-item measure of perceived novelty was created using items adapted from existing novelty scales (e.g., Antonio et al., 2004; Unger & Kernan, 1983; Vitaliano, Russo, Weber, & Celum, 1993). The composite scale, provided in Appendix A, contains items such as "There is novelty in Second Life," "Second Life makes you think about technologies in a different way," and "Second Life is similar to other Internet technologies I use." Items for the novelty scale were measured on a Likert scale, which ranged from strongly disagree (1) to strongly agree (7), with larger numbers representing greater perceived novelty.

Figure 4. An image captured from a virtual space in the unfamiliar novel environment condition of the pretest.

Analysis Plan for Pretest

The dimensionality of the measurement model for the items of the perceived novelty measure was tested using confirmatory factor analysis (CFA). This step was taken because the measure is new (i.e., a collection of items from other measures) and not well-established in the literature. The measurement model "specifies the relations of the observed measures to their posited underlying constructs" (Anderson & Gerbing, 1988, p. 411). CFA provides a metric for internal consistency and dimensionality of the perceived novelty scale. The disturbance of the novelty latent factor was fixed to 1.0 to solve for the scale indeterminacy problem.

Fit indices for the measurement model were used to determine whether the posited unidimensional model fits the data. Model fit was assessed using Hu and Bentler's (1999) dual criteria of a comparative fit index (CFI) of above or equal to .95 and a standardized root mean square residual (SRMR) of below or equal to .10. In instances where the model did not fit the data, the standardized path coefficients were checked for any low-correlated items in addition to the standardized residual matrix for any indicator variables with a high absolute value, which may identify a specification error in the measurement model (Hatcher, 1994). Any low-correlated indicators or ones with a residual absolute value of above 2.00 were removed from the measurement model. The trimmed measurement model was again assessed for model fit. After determining goodness of fit of the measurement model, the items measuring the perceived novelty latent construct were averaged in a single parcel.

The success of the manipulations in influencing change in perceptions of novelty was determined in a 2x2 fully-crossed analysis of variance (ANOVA). Significant main effects for the framing and environment variables indicate that the manipulations were effective in influencing novelty perceptions of Second Life. A nonsignificant main effect suggests that the manipulation associated with the finding did not produce significant differences in novelty perceptions of Second Life.

Pretest Results

Psychometric Properties of the Novelty Scale

The perceived novelty measure used in the pretest was subjected to CFA given that it is a composite of items from several novelty scales, not well-established in their respective literature, and the measure has not been used to evaluate the perceived novelty of Second Life. Initial results of the CFA indicated that the proposed unidimensional factor structure of the novelty scale fits the data poorly, $\chi^2(20) = 38.95$, $p = .007$, CFI = .87, RMSEA = .16, SRMR = .09. The standardized residuals for three items (i.e., "Second Life is similar to other Internet technologies I use" (β = .39), "Second Life is new to me" (β = .08), and "I am intrigued by Second Life" (β = .09)) exceeded an absolute value of 2.00. Therefore, the path from the perceived novelty latent variable to each of these items was removed in sequence. The fit indices were examined after each item was dropped to see whether model fit improved. The fit of the measurement model was acceptable only after fixing the paths of all three indicators to 0, $\chi^2(5) = 7.04$, $p = .22$, CFI = .99, RMSEA = .07, SRMR = .04. The trimmed five-item novelty scale was reliable (α = .86, $M = 3.71$, $SD = 1.36$).

Data from the five items of the novelty measure were averaged to form a composite value representative of the unidimensional novelty variable.

Manipulation Efficacy

Results of the ANOVA demonstrated a significant main effect for the novelty frame, $F(1, 70) = 4.89$, $p = .03$, $\eta^2 = .01$. The group exposed to the high-novelty frame ($M = 4.07$, SD = 1.24, $n = 40$) reported greater novelty perceptions of Second Life than the group exposed to the low-novelty frame ($M = 3.37$, $SD = 1.41$, $n = 38$). The environment manipulation did not elicit significant differences in novelty perceptions of Second Life. Participants in the unfamiliar environment condition ($M = 3.92$, $SD = 1.37$, $n = 38$) reported marginally higher perceptions of novelty than the familiar environment condition ($M = 3.51$, $SD = 1.35$, $n = 40$); however, this difference was not statistically significant, $F(1, 70) = 1.41$, $p = .24$, $\eta^2 = .002$. The interaction between frame and environment was also not statistically significant, $F(1, 70) = 2.45$, $p = .12$, $\eta^2 = .01$. Therefore, the framing manipulation was effective in eliciting differences in novelty perceptions of Second Life, but the environment manipulation in the Second Life program failed produce such variation.

Chapter Summary

The goals of the pretest were to examine the internal consistency and dimensionality of the perceived novelty measure and then use the novelty scores to assess whether the two manipulations, which will be used in the main study, generate significant change in novelty perceptions of Second Life. Findings from the pretest demonstrated good fit of the measurement model for the novelty scale after

three items were trimmed. The test of manipulation effectiveness produced mixed results. The frame manipulation was effective in influencing novelty perceptions of Second Life. However, the in-Second Life environment manipulation did not initiate differences of perceived novelty. Changes were made to the environment manipulation in Second Life for the main study given its ineffectiveness in the pretest study. These changes are discussed in the methods section for the main study.

4. MAIN STUDY

Methods

Overview

The following sections describe the methods used to test the main hypotheses of this project. A mixed design was employed to evaluate the premise that novelty perceptions of a technology foster flow, which in turn leads to DSR during initial stages of technology use. The relationship between novelty perceptions and flow is also theorized to be moderated by psychosocial problems, boredom proneness, and self-reactive outcome expectation in these initial stages. Despite familiarity with the technology, the delayed effects of DSR persist, and eventually lead to habituated behaviors, when preexisting psychosocial problems, boredom proneness, and self-reactive outcome expectation impair one's ability to self-correct DSR.

Main Study Participants

Participants for the main study were recruited through undergraduate Communicology courses at the University of Hawai'i at Mānoa. Students enrolled in courses were given research credit or extra credit for their participation. The inclusion criteria for the study were as follows: (a) students must have been at least 18 years of age, (b) they must not have had prior experience using Second Life, (c) they must have been able to attend an information session that ensured proper protocols for account and avatar creation were followed, and (d) they must have

had regular access to a personal computer or laptop with a broadband or cable Internet connection.

In total, 117 participants began the study by attending the information session, registering for Second Life, participating in the virtual community, and completing the first questionnaire. Although 12 participants dropped out of the study over the 11-day period (i.e., a 10.25% attrition rate), 105 participants (45 males, 60 females) completed all eleven study time points. No systematic differences on the main outcome variables (i.e., flow, DSR of Second Life, habit formation) were detected between those who dropped out of the study and those who remained. The average age of the participants was 21.55 years (*SD* = 5.00, range = 18-51). The ethnic or racial composition of the sample in the main study was as follows: 55.2% (*n* = 58) Asian, 13.3% (*n* = 14) White/Caucasian, 8.6% (*n* = 9) Hawaiian/Pacific Islander, and 2.9% (*n* = 3) Latino/a. The additional 20.0% (*n* = 21) of the sample identified their race/ethnicity as mixed or other. Participants spent an average of 3.71 hours (*SD* = 2.01) on the Internet in a given day; they dedicate approximately 1.17 hours (*SD* = 1.17) of their time online per day to socializing with others.

Main Study Design

The hypotheses of this investigation examine the longitudinal influence of perceptual novelty of a technology on flow, DSR, and media habits. Data were collected at several time points to test these hypotheses. The design had both between-subjects and within-subjects elements. The between-subjects component involved a 2 (high-novelty/low-novelty frame) x 2 (familiar/unfamiliar

environment) full-factorial design, which also included its interaction with psychosocial problems, boredom proneness, or self-reactive outcome expectation. The study design involved manipulating novelty perceptions of Second Life through a frame, communicated to participants during an information session, and an environmental familiarity condition undertaken within the Second Life program. Time was the within-subjects element of the study; participants completed the dependent measures at eleven different time points following Second Life use.

Main Study Procedure

Recruitment. Undergraduate students were recruited through an in-person presentation in Communicology courses. During the recruitment, the researcher informed undergraduate students about the broad goals of the study and participation criteria. Students were told that the study evaluates their attitudes toward and behaviors in virtual communities. Prospective participants were invited to an information session and told they would be further informed about the specific procedures of the study. Interested participants were randomly assigned to one of two framing conditions and told to attend the respective information session. Before arriving to the information session, they were asked to complete a questionnaire, which included measures of social anxiety, loneliness, depression, boredom proneness, and self-reactive outcome expectation.

Information session. The procedures used to frame Second Life as a novel technology parallel the steps taken in the pretest. Attendees were guided through the process of account setup, told how to download and install the Second Life

program on their personal computers, and shown how to meet new people and explore new worlds in Second Life. Account usernames were selected by the participants, but their passwords were given to them. The account password was also used as a unique identification (ID) code that was logged during each wave of the questionnaire to match an individual's responses over the 11-day period. The investigator asked participants to submit their username and password during the initial wave; subsequent collection only required the unique ID code. Students were told they must log on to Second Life daily for 30 minutes during the next 11 days (i.e., roughly two weeks) and complete a brief questionnaire after each session. This exposure period gave participants time for habitual practices to form. Participants in both conditions were told that they must try to meet new people in Second Life during each session, and their conversation numbers and time spent on the technology would be monitored by the researcher.

After the information session, attendees were sent an e-mail with important information (e.g., link to Second Life website, link to questionnaire website, etc.). In this e-mail, participants were told the spaces they were allowed to enter, which corresponded to the familiar environment condition to which they were randomly assigned. Half the participants were sent to familiar rooms with identifiable objects, such as buildings, parks, and beaches, whereas the other half of participants were sent to unfamiliar virtual environments that included novel, unfamiliar objects and situations. Figures 5 and 6 respectively illustrate the differences between the familiar and unfamiliar virtual spaces used in the manipulation.

Figure 5. An image captured from a virtual space in the familiar environment condition of the main study.

Figure 6. An image captured from a virtual space in the unfamiliar environment condition of the main study.

Although the level of activity for participants was carefully monitored, participants were made aware that the content of their conversations with others was not observed. Account activity was checked daily to ensure regular participation; individuals who did not complete a questionnaire at least once in two days were sent an e-mail encouraging participation. Participants were debriefed about the goals of the study after the eleventh session and asked to provide their names for credit granting purposes.

Main Study Measurement

Social anxiety. Trait levels of social anxiety were evaluated using the Interaction Anxiousness Scale (IAS; Leary, 1983). The scale measures anxiety in various social settings, including parties, cross-sex interactions, and telephone conversations. Items in the scale not directly relevant to college students, such as interactions with a boss or potential employer, were removed. The 11-item IAS includes indicators such as "I wish I had more confidence in social situations" and "I often feel nervous even in casual get-togethers." The items were measured on a 7-point Likert scale from strongly disagree (1) to strongly agree (7). Higher scores on the IAS indicate greater trait social anxiety. The items for the IAS are provided for reference in Appendix B.

Loneliness. Loneliness was measured using an eight-item short-form UCLA Loneliness Scale (Hays & DiMatteo, 1987). The loneliness scale evaluates the extent to which people feel they have no close relationships, lack companionship, and feel detached or excluded from social groups. Prior research on the psychometric

properties of the UCLA Loneliness Scale indicates that a three-factor model, which specifies a single bipolar global loneliness factor influencing two method factors for lonely and non-lonely items, fits the data well (Russell, 1996). The scale contains statements such as "I am unhappy being so withdrawn" and "I feel left out" measured from never (1) to always (7), with larger values representing heightened feelings of loneliness. The short-form UCLA Loneliness Scale is given in Appendix C.

Depression. Depression was evaluated using a short form of the Center for Epidemiological Studies Depression Scale (CES-D; Cole, Rabin, Smith, & Kaufman, 2004). The scale was originally created for the diagnosis of depression in the general population (Radloff, 1977). A latent structure analysis of the CES-D reveals a single hierarchical latent factor structure with four lower-order factors: negative affective, positive affect, interpersonal difficulties, and somaticism (Hertzog, Van Alstine, Usala, Hultsch, & Dixon, 1990). The 10-item scale, provided in Appendix D, includes statements such as "I feel that I cannot shake off the blues even with the help of my family or friends" and "I feel my life has been a failure." Higher scores on the CES-D reflect greater bouts of depression.

Boredom proneness. Boredom was measured using Farmer and Sundberg's (1986) Boredom Proneness Scale (BPS). The original 28-item BPS was developed from a pool of 200 true-false questions collected in a review of boredom literature, open-ended surveys of people reporting on boring situations, and informal interviews. A two-factor short form of the original BPS, which demonstrates satisfactory measurement model fit, was developed through item-reduction

procedures (Vodanovich, Wallace, & Kass, 2005). The six-item boredom proneness scale represents the internal stimulation component of boredom, which contains statements such as "It is easy for me to concentrate on my activities" and "In any situation I can usually find something to do or see to keep me interested." Two additional items that directly assessed boredom proneness (i.e., "I often become bored with the various activities I do" and "I quickly lose interest in activities despite how exciting they are") were added to the scale. Items are measured on a scale ranging from strongly disagree (1) to strongly agree (7); higher values on the BPS reflect a person's increased likelihood of experiencing boredom from a lack of internal stimulation. The BPS is included for reference in Appendix E.

Self-reactive outcome expectation. Self-reactive outcome expectation was measured with the sixteen item Self-Reactive Outcome Expectation Scale (SROES; LaRose et al., 2003). The SROES measures people's use of the Internet to regulate their unpleasant moods. Items are measured on a 7-point Likert scale from very unlikely (1) to very likely (7). Higher values indicate greater expectations that future Internet use will relieve unpleasant moods. Indicators of the SROES, which can be found in Appendix F, include "Using the Internet, how likely am I to feel relaxed" and "Using the Internet, how likely am I to forget my problems."

Novelty. Perceived novelty of Second Life was measured with the revised 5-item novelty scale from the pretest, which is compromised of items adapted from established measures. The scale contains statements such as "I feel that Second Life

Table 1

Fit Indices for the Measurement Models of the Novelty Measure at Time 1 through Time 11.

Model	α	χ^2	*df*	*p*	CFI	RMSEA	RMSEA 90% CI	SRMR
Time 1	.73	11.30	9	.26	.98	.05	[.00, .13]	.05
Time 2	.72	9.49	9	.39	.99	.02	[.00, .11]	.04
Time 3	.79	12.84	9	.17	.98	.06	[.00, .14]	.04
Time 4	.71	16.73	9	.05	.95	.09	[.00, .15]	.05
Time 5	.68	40.06	9	<.001	.80	.18	[.13, .24]	.11
Time 6	.66	8.27	9	.51	1.00	.00	[.00, .10]	.04
Time 7	.76	4.09	9	.91	1.00	.00	[.00, .05]	.03
Time 8	.74	21.15	9	.01	.91	.11	[.05, .08]	.07
Time 9	.67	12.67	9	.18	.96	.06	[.00, .14]	.06
Time 10	.78	31.16	9	<.001	.81	.15	[.10, .21]	.09
Time 11	.72	9.91	9	.36	.99	.03	[.00, .12]	.05

Notes: CFI = comparative fit index; SRMR = standardized root-mean-square residual; RMSEA = root-mean-square error of approximation.

is a novel technology" rated on a 7-point Likert scale. Higher scores on the scale represent greater novelty perceptions of Second Life. The fit indices of the confirmatory factor analysis at the 11 time points are provided in Table 1 for reference. The items for the novelty perceptions scale can be found in Appendix A.

Flow experience. Flow was measured using the Flow Experience Scale (Lee & LaRose, 2007), which adapted items from previous flow measures (e.g., Koufaris, 2002; Novak, Hoffman, & Yung, 2000). The nine items of the scale evaluate components of flow, including enjoyment, merge of action and awareness, and concentration, in Second Life. Example items include "I love the feeling of participating in Second Life" [enjoyment], "I am able to block out distractions when participating in Second Life" [merge of action and awareness], and "I am able to participate in Second Life without having to think about it" [concentration]. Items are evaluated on a 7-point Likert scale, with anchors at strongly disagree (1) and strongly agree (7). Larger values on the scale indicate greater flow experiences accompanying Second Life use. Items of the flow scale are available in Appendix G. Table 2 presents the fit of the second-order factor model for the flow scale at the 11 time points.

Deficient self-regulation of Internet use. DSR was measured using items from the DSR subscale of the Generalized Problematic Internet Use Scale 2 (GPIUS2; Caplan, 2010) and the Deficient Self-Regulation of Internet Use Scale (LaRose et al., 2003). Given that the scales address one's DSR to generalized Internet use, items were modified using the term Second Life in place of Internet use. The DSR of

Table 2

Fit Indices for the Second-Order Measurement Models of the Flow Measure at Time 1 through Time 11.

Model	α	χ^2	*df*	*p*	CFI	RMSEA	RMSEA 90% CI	SRMR
Time 1	.83	14.42	11	.21	.99	.05	[.00, .12]	.04
Time 2	.79	16.40	11	.13	.98	.07	[.00, .13]	.04
Time 3	.84	37.24	11	<.001	.91	.15	[.10, .21]	.06
Time 4	.84	16.34	11	.13	.97	.07	[.00, .13]	.04
Time 5	.72	10.59	11	.48	1.00	.00	[.00, .10]	.04
Time 6	.67	12.15	11	.35	.99	.03	[.00, .11]	.03
Time 7	.81	16.72	11	.12	.97	.07	[.00, .14]	.04
Time 8	.87	17.65	11	.09	.98	.08	[.00, .14]	.04
Time 9	.79	7.89	11	.72	1.00	.00	[.00, .08]	.04
Time 10	.82	16.24	11	.13	.98	.07	[.00, .13]	.04
Time 11	.82	13.82	11	.24	.98	.05	[.00, .12]	.05

Notes: CFI = comparative fit index; SRMR = standardized root-mean-square residual; RMSEA = root-mean-square error of approximation.

Table 3

Fit Indices for the Second-Order Measurement Models of the Deficient Self-Regulation Measure at Time 1 through Time 11.

Model	α	χ^2	*df*	*p*	CFI	RMSEA	RMSEA 90% CI	SRMR
Time 1	.86	10.51	12	.57	1.00	.00	[.00, .09]	.03
Time 2	.74	31.40	12	.002	.87	.12	[.07, .18]	.07
Time 3	.63	16.09	12	.19	.96	.06	[.00, .12]	.05
Time 4	.81	38.26	12	<.001	.87	.15	[.09, .20]	.06
Time 5	.81	19.08	12	.09	.96	.08	[.00, .14]	.05
Time 6	.70	17.17	12	.14	.97	.06	[.00, .13]	.05
Time 7	.80	31.08	12	<.001	.90	.12	[.07, .18]	.07
Time 8	.75	36.48	12	<.001	.83	.14	[.09, .19]	.08
Time 9	.83	13.41	12	.34	.99	.04	[.00, .11]	.04
Time 10	.76	16.44	12	.17	.98	.06	[.00, .12]	.05
Time 11	.81	58.13	12	<.001	.83	.19	[.14, .24]	.09

Notes: CFI = comparative fit index; SRMR = standardized root-mean-square residual; RMSEA = root-mean-square error of approximation.

Second Life Scale was treated as a two-factor construct comprised of cognitive preoccupation with and uncontrolled uses of the Internet. The preoccupation subscale includes items such as "When I haven't been online for some time, I become preoccupied with the thought of Second Life" and "I persistently think about Second Life when I am offline." Examples items of the uncontrolled use subscale include "When offline, I have a hard time trying to resist the urge to go on Second Life" and "I feel my use of Second Life is out of control." The items were measured on a Likert scale from definitely disagree (1) to definitely agree (7). Higher scores on these subscales represent greater perceived DSR. Items of the two subscales are offered in Appendix H. The fit for the measurement models at each of the 11 time points is presented in Table 3.

Media habits. Habit formation was measured with the 6-item Habit Strength Scale (LaRose et al., 2003; LaRose & Eastin, 2004) and the Self-Report Habit Strength Index (Verplanken & Orbell, 2003). The composite habit scale measures media use behaviors that are repeated without self-instruction. Items include "Second Life has become part of my usual routine" and "I start to use Second Life before I realize I'm doing it." Items were evaluated on a 7-point Likert scale with anchors at strongly disagree (1) and strongly agree (7). Larger values on the habit scale reflect stronger habitual or ritualistic uses of Second Life. The habit formation scale is available in Appendix I. Fit indices for the measurement model of the media habit scale at the 11 times points are offered in Table 4. Table 5 provides details about the instruments administered before Time 1 and at subsequent time points.

Table 4

Fit Indices for the Measurement Models of the Habit Formation Measure at Time 1 through Time 11.

Model	α	χ^2	*df*	*p*	CFI	RMSEA	RMSEA 90% CI	SRMR
Time 1	.79	12.79	9	.17	.97	.06	[.00, .14]	.05
Time 2	.77	14.68	9	.10	.96	.08	[.00, .15]	.05
Time 3	.73	29.32	9	<.001	.91	.15	[.09, .21]	.07
Time 4	.51	40.73	9	<.001	.86	.18	[.13, .24]	.09
Time 5	.68	6.16	9	.72	1.00	.00	[.00, .08]	.04
Time 6	.65	6.34	9	.71	1.00	.00	[.00, .08]	.04
Time 7	.72	14.90	9	.09	.95	.08	[.00, .15]	.05
Time 8	.70	22.47	9	.008	.87	.12	[.06, .18]	.08
Time 9	.67	27.66	9	.001	.82	.14	[.08, .20]	.08
Time 10	.61	24.11	9	.004	.73	.13	[.07, .19]	.10
Time 11	.71	14.90	9	.09	.94	.08	[.00, .15]	.07

Notes: CFI = comparative fit index; SRMR = standardized root-mean-square residual; RMSEA = root-mean-square error of approximation.

Table 5

An Overview of the Measures Used in the Project.

Measures taken before Time 1
Social anxiety [a]
Loneliness [a]
Depression [a]
Boredom proneness
Self-reactive outcome expectation
Repeated measures taken between Time 1 and Time 11
Novelty
Flow experience
Deficient self-regulation of Second Life use
Habit formation

[a] Items for these measures were collapsed into a psychosocial problem variable.

Analysis Plan for the Main Study

Confirmatory Factor Analyses

The factorial dimensionality of scales not well-established in their respective literatures was tested through CFA. The procedures for the CFAs paralleled steps outlined in the pretest. In the main study, psychosocial problems was specified as one bipolar latent variable with three method factors. The three method factors (i.e., social anxiety, loneliness, depression) were modeled as first-order latent factors, which influence their individual indicators. Although boredom proneness and self-reactive outcome expectation are expected to influence flow and DSR in the same way as psychosocial problems in the hypothesized models, they are considered variables interpretably distinct from psychosocial problems (Sommers & Vodanovich, 2000). Boredom proneness and self-reactive outcome expectation were thus not included in the composite psychosocial problem variable.

Missing Data

Missing data over the 11 time points were evaluated, and procedures to approximate the missing values were used to fill missing cells. Although it is difficult to know for certain whether data are missing at random (MAR) (see Schafer & Graham, 2002), an evaluation of whether data were randomly or systematically missing was undertaken. Only two data points were missing from the entire dataset, so these data were assumed to be MAR. A multiple imputation estimation procedure, employing a linear regression model type, was used to estimate the two missing data points. Multiple imputation provides plausible estimates for the missing data.

Manipulation Check and Systematic Time Point Selection

A two-way ANOVA was used at Time 1 to determine the efficacy of the 2 (frame) x 2 (environment) novelty manipulations. Novelty scores were also used to select time points appropriate to test the hypotheses of the main study. To show increases and decreases in perceptions of novelty, repeated-measures ANOVAs were conducted, with framing and environmental condition as the between-subjects variable (on the assumption that both manipulations were effective) and individual novelty perception scores was treated as the within-subjects variable. Plots were used to determine linearly increasing and decreasing trends. To test Hypotheses 1 and 2, a panel model was estimated at time points that showed linearly increasing perceptions of novelty. A panel model was fitted to the data at time points that demonstrated convergence and stability of novelty perceptions between the groups to test Hypotheses 3 and 4. Data points that demonstrated perceptions of novelty linearly decreasing were disregarded from the analyses because they were not relevant to the hypotheses of this research.

Model Testing

Piecewise latent growth modeling (LGM) was used to interpret the panel data collected in this investigation. Piecewise latent growth modeling decomposes a curvilinear growth trajectory into separate linear components. LGM falls within the structural equation modeling framework (i.e., it is a special case of CFA) and can measure systematic change or growth over time. Because growth can occur at different rates in individuals, LGM can account for intraindividual variance in

growth rates (Preacher, Wichman, MacCallum, & Briggs, 2008). LGM can also evaluate interindividual variability in intraindividual change. In addition to measuring hypothesized growth patterns, LGM can evaluate relationships between time-varying variables and time-invariant covariates (Duncan, Duncan, & Strycker, 2006). Most important to this project is the ability of LGM to carry out mediational analyses of growth variables with longitudinal data, something that cannot truly be accomplished with multilevel (mixed) modeling (Cheong, MacKinnon, & Khoo, 2003). At minimum, three time points are required for estimating a growth model, and theoretically, an LGM can accommodate an infinite number of time points.

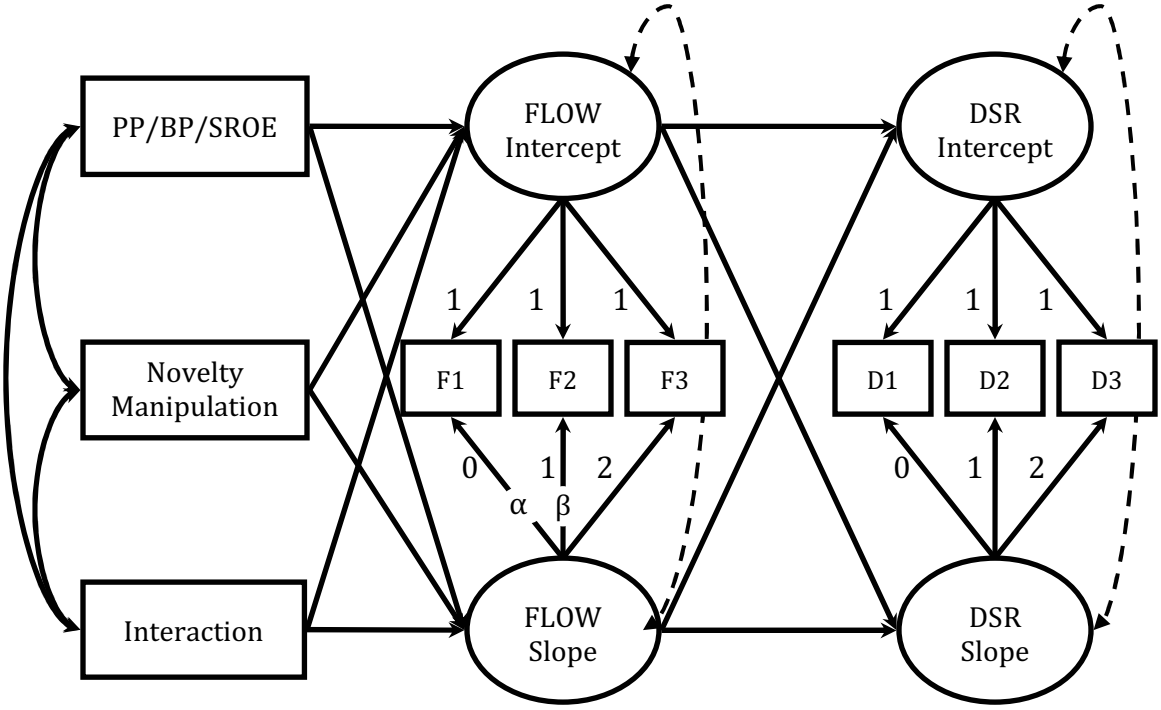
The latent growth curve models (LGMs) were constructed in accordance with models proposed in Hypothesis 1 to Hypothesis 4. A visual illustration of the hypothesized model used to test Hypotheses 1 and 2 is pictured in Figure 7. The structural model included four endogenous latent variables: an intercept variable for flow, a slope variable for flow, an intercept variable for DSR, and a slope variable for DSR. For Hypothesis 1, the indicators of the flow intercept variable were flow scores taken at Times 2, 3, and 4. The selection of these time points is explained in the main study results section. The path from the flow intercept variable to each indicator was constrained to 1 following conventional procedures for LGM. The intercept factor situates the intercept at the initial measurement of the variable (i.e., when the time variable equals zero) (Duncan et al., 2006).

The indicators for the flow slope factor were flow scores taken at Time 2 to Time 4. To measure linear growth over time, the path of the flow slope factor to the

Time 2 manifest variable was constrained to 0, the path to the Time 3 indicator was constrained to 1, and the path to the Time 4 indicator was constrained to 2. The equally-spaced, numerically increasing intervals among the paths indicate *linear* growth of a particular variable over time. In Figure 7, with regard to the slope factor for flow, paths α and β correspond to the difference scores between F2 and F1. Non-linear patterns of growth (e.g., polynomial), not of interest to this project, can be modeled by constraining these indicators to different values (e.g., 1, -2, 1 for quadratic growth curve; Preacher et al., 2008). These same procedures were used to construct the DSR intercept and slope factors.

Three exogenous variables were included in each tested growth model: the novelty frame/environment variable, psychosocial problems/boredom proneness/self-reactive outcome expectation, and the interaction term. Paths were estimated from the three exogenous variables to the intercept and slope factors for the flow variable. Paths were also estimated from the flow intercept and slope factors to the DSR slope and intercept factors. Covariances were estimated between the disturbances of the flow intercept and slope variables, and between the disturbances of the DSR intercept and slope variables. These covariances acknowledge that the intraindividual variance of the "initial measurement" often covaries with the rate at which the variables grow over time (Duncan et al., 2006). The exogenous variables were also allowed to covary freely given the assumption that the exogenous variables follow from common predictors outside of the

Figure 7. The proposed latent growth curve model to test Hypotheses 1 and 2.



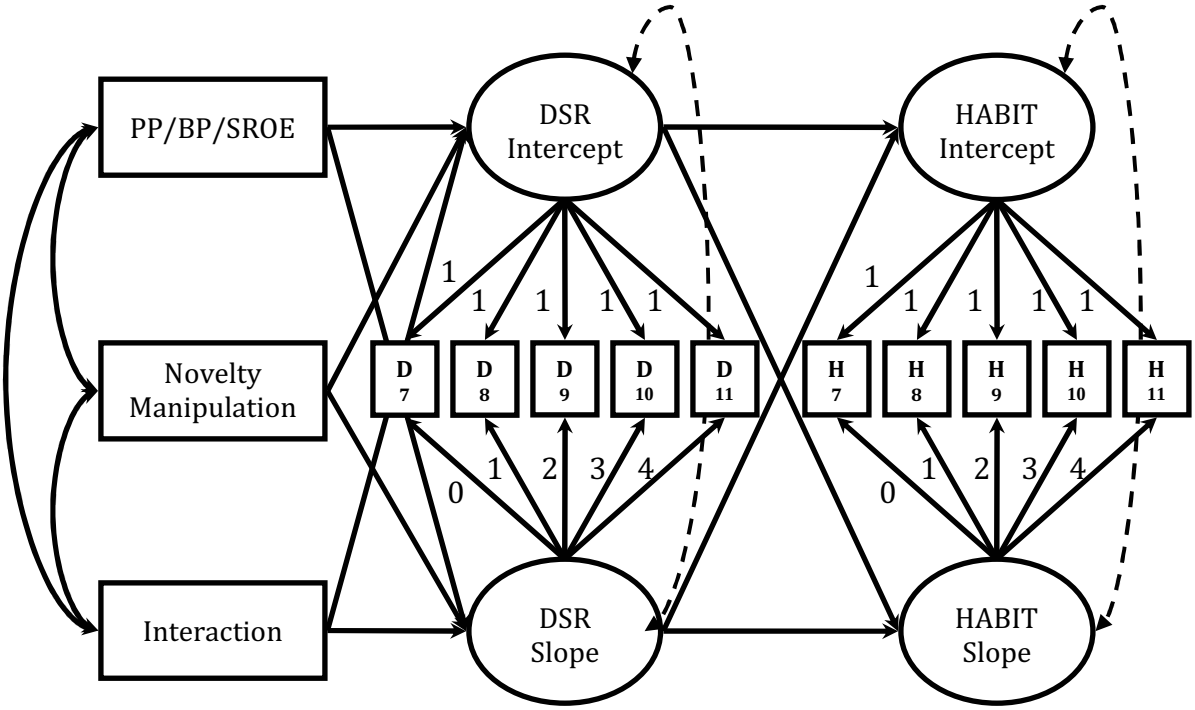
Note. PP = psychosocial problems; BP = boredom proneness; OE = outcome expectation.

proposed model (see Raykov & Marcoulides, 2006). The LGMs were estimated using SAS 9.2.

Similar procedures for testing Hypotheses 1 and 2 were employed in testing Hypotheses 3 and 4. An illustration of the proposed conceptual model is provided in Figure 8. The LGMs used to test Hypotheses 3 and 4 differed from those tested in Hypotheses 1 and 2 in two ways. First, the flow intercept and slope factors were removed from the model, and intercept and slope factors for habit formation were added. Second, the indicators for the latent constructs were DSR and habit scores taken at Time 7 to Time 11; that is, time points in which novelty perception scores between the two groups converged and remained stable over time (see main study Results for more information). Paths were estimated from the three exogenous variables (i.e., psychosocial problems/boredom proneness/outcome expectation, novelty variable, interaction) to the DSR intercept and slope factors. Direct and cross paths from the DSR intercept and slope factors to the habit intercept and slopes factors were also included in the model.

The LGMs used to test Hypotheses 1 to 4 were evaluated in two ways. The goodness of fit of the entire model was determined using Hu and Bentler's (1999) dual criterion. Modification indices (i.e., Lagrange Multiplier and Wald test) were consulted when the proposed models did not fit the data. The significance test for individual path coefficients is also important. The paths from the exogenous variables to the proximal slope factor and the path between the two slope factors are significant because the slope factors represent individual change over time.

Figure 8. The proposed latent growth curve model to test Hypotheses 3 and 4.



Note. PP = psychosocial problems; BP = boredom proneness; SROE = self-reactive outcome expectation; HABIT = habit formation.

Results

Outliers and Influential Points

The data collected in the main study were screened using procedures recommended by Tabachnick and Fidell (2001). The Mahalanobis distance value was used to search for multivariate outliers on the dependent measures at Time 1. No multivariate outliers were found; however, two univariate outliers on the DSR dependent measure were discovered. At later time points (T2 and T3), these cases were no longer recognized as univariate outliers or influential points, so data for these cases were retained. A full correlation matrix of the variables included in the estimation of the LGMs is provided in Table 6. Table 7 presents the means and standard deviations of these variables.

Scale Analysis

Psychometric properties of the scales not well-established in their respective literature were estimated through a series of CFAs. CFAs provide a metric for determining scale dimensionality, internal consistency, parallelism, and factorial invariance over time. Psychosocial problem was treated as a second-order factor of social anxiety, loneliness, and depression. The fit indices for the measurement model of psychosocial problems, measured by social anxiety, loneliness, and depression, showed poor initial fit, $\chi^2(319) = 500.59$, $p < .001$, CFI = .78, RMSEA = .07, SRMR = .09. The factor loadings demonstrated that the second-order latent factor was predictive of social anxiety ($\beta = .76$, $p < .001$), loneliness ($\beta = .94$, $p < .001$), depression ($\beta = .87$, $p < .001$). However, given the poor model fit, two items

Table 6

A Zero-Order Correlation Matrix for Variables Used in the Main Study.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
1. PP	- -																																	
2. BP	.03	- -																																
3. SROE	-.01	.23	- -																															
4. NV 2	.12	-.15	.16	- -																														
5. NV 3	-.18	.01	.16	.34	- -																													
6. NV 4	.04	-.13	.14	.42	.48	- -																												
7. NV 7	-.13	.13	.07	.34	.31	.11	- -																											
8. NV 8	-.07	.11	.08	.45	.31	.12	.77	- -																										
9. NV 9	-.09	.06	.10	.39	.25	.14	.66	.71	- -																									
10. NV 10	-.12	.07	-.03	.31	.15	.05	.60	.62	.67	- -																								
11. NV 11	-.16	.05	.26	.31	.14	.08	.35	.47	.59	.52	- -																							
12. Flow 2	-.10	-.03	.25	.49	.44	.24	.47	.46	.39	.26	.25	- -																						
13. Flow 3	-.11	.09	.12	.36	.42	.18	.37	.38	.28	.27	.12	.77	- -																					
14. Flow 4	-.03	.03	.17	.49	.29	.18	.44	.51	.42	.37	.26	.68	.74	- -																				
15. Flow 7	.07	.16	.00	.20	.09	.09	.52	.48	.52	.45	.15	.37	.39	.49	- -																			
16. Flow 8	.04	.10	.05	.27	.24	.25	.51	.50	.48	.30	.16	.46	.46	.50	.79	- -																		
17. Flow 9	-.03	.11	.13	.32	.15	.12	.55	.54	.63	.44	.31	.43	.38	.49	.83	.75	- -																	
18. Flow 10	.00	.08	.87	.25	.16	.20	.45	.43	.52	.42	.22	.40	.27	.39	.76	.72	.73	- -																
19. Flow 11	-.10	.09	.31	.18	.10	.15	.21	.31	.43	.24	.43	.24	.15	.32	.42	.47	.58	.46	- -															
20. DSR 2	.05	.18	-.04	.18	.04	-.06	.33	.24	.19	.21	.22	.25	.24	.13	.22	.13	.15	.19	.12	- -														
21. DSR 3	-.06	.13	.09	.18	.11	-.03	.21	.24	.07	.08	.10	.42	.44	.28	.16	.17	.04	.16	.04	.56	- -													
22. DSR 4	.03	.16	-.11	.17	.17	.01	.30	.26	.14	.22	.08	.27	.38	.30	.32	.25	.13	.23	.07	.61	.56	- -												
23. DSR 7	.04	.12	-.02	.05	.14	.09	.25	.21	.19	.01	.15	.22	.13	.17	.32	.33	.19	.25	.25	.38	.21	.45	- -											
24. DSR 8	.05	.16	.07	.06	.05	-.03	.23	.23	.23	.04	.21	.19	.07	.18	.32	.32	.20	.33	.39	.41	.26	.44	.73	- -										
25. DSR 9	.28	.10	-.06	.15	-.12	.08	.11	.08	.19	.12	.06	.08	-.01	.14	.43	.32	.24	.48	.17	.22	.09	.19	.48	.48	- -									
26. DSR 10	.00	.06	-.01	.22	.12	.14	.07	.07	.09	.00	.16	.20	.14	.15	.33	.31	.20	.29	.30	.31	.16	.41	.66	.56	.58	- -								
27. DSR 11	-.13	.09	.00	.21	.17	.17	.25	.22	.30	.13	.15	.31	.18	.21	.49	.41	.38	.50	.33	.38	.18	.38	.56	.52	.41	.70	- -							
28. HAB 2	.08	.23	.03	.37	.10	-.06	.28	.24	.20	.27	.17	.44	.40	.36	.25	.17	.30	.25	.20	.63	.48	.45	.25	.22	.22	.28	.37	- -						
29. HAB 3	.02	.15	-.04	.32	.18	.03	.29	.29	.20	.21	.14	.46	.54	.55	.36	.34	.27	.30	.11	.45	.57	.52	.36	.28	.29	.25	.26	.56	- -					
30. HAB 4	.13	.12	-.03	.31	.03	.02	.34	.38	.34	.30	.22	.36	.32	.46	.43	.39	.34	.40	.32	.52	.43	.64	.52	.58	.45	.44	.39	.51	.61	- -				
31. HAB 7	.02	.12	-.04	.16	.19	.11	.39	.36	.34	.12	.15	.38	.32	.35	.59	.62	.47	.56	.39	.40	.33	.42	.67	.64	.53	.57	.63	.31	.50	.61	- -			
32. HAB 8	.21	.16	-.01	.20	-.06	.10	.39	.25	.34	.26	.13	.28	.20	.34	.68	.53	.49	.61	.24	.37	.24	.37	.51	.54	.69	.44	.50	.33	.39	.62	.68	- -		
33. HAB 9	.10	.07	.06	.25	-.03	.21	.36	.31	.46	.28	.26	.32	.12	.28	.62	.57	.57	.72	.40	.26	.16	.22	.43	.45	.69	.42	.52	.29	.28	.52	.59	.75	- -	
34. HAB 10	.09	.11	.00	.09	.03	.19	.34	.27	.42	.35	.24	.18	.04	.19	.52	.41	.49	.65	.39	.24	.11	.10	.32	.28	.54	.27	.40	.20	.15	.27	.42	.62	.62	- -
35. HAB 11	-.03	.17	.07	.21	.04	.09	.25	.22	.46	.41	.34	.22	.08	.21	.49	.41	.50	.57	.48	.25	.08	.14	.31	.36	.56	.50	.59	.44	.22	.41	.41	.54	.63	.61

Note. NV = novelty perceptions; HAB = habit formation.

Table 7

Means and Standard Deviations of Variables Used in the Main Study.

Variable	Mean	Standard Deviation	Variable	Mean	Standard Deviation
Novelty 1	4.45	1.00	DSR 1	1.40	0.57
Novelty 2	4.04	0.98	DSR 6	1.42	0.45
Novelty 3	3.98	1.13	DSR 7	1.46	0.47
Novelty 4	4.11	1.26	DSR 8	1.34	0.40
Novelty 5	3.65	1.07	DSR 9	1.36	0.47
Novelty 6	3.44	1.10	DSR 10	1.24	0.33
Novelty 7	3.43	1.10	DSR 11	1.21	0.38
Novelty 8	3.27	1.07	Habit 1	1.54	0.59
Novelty 9	3.45	1.02	Habit 2	1.51	0.53
Novelty 10	3.42	0.96	Habit 3	1.60	0.58
Novelty 11	3.58	0.90	Habit 4	1.60	0.55
Flow 1	3.00	1.08	Habit 5	1.74	0.66
Flow 2	2.52	0.95	Habit 6	1.63	0.57
Flow 3	2.24	0.97	Habit 7	1.75	0.66
Flow 4	2.36	0.93	Habit 8	1.67	0.57
Flow 5	2.50	0.92	Habit 9	1.64	0.53
Flow 6	2.35	0.93	Habit 10	1.69	0.55
Flow 7	2.21	0.84	Habit 11	1.70	0.58
Flow 8	2.16	0.92	PP	2.93	0.76
Flow 9	2.24	0.84	BP	3.16	0.85
Flow 10	2.24	0.92	SROE	3.33	0.62
Flow 11	2.05	0.70			

Note. PP = psychosocial problems; BP = boredom proneness; SROE = self-reactive outcome expectation; HABIT = habit formation.

from the social anxiety scale and two items from the loneliness scale were removed for their low correlations and high standardized residuals with other indicators. After the model was trimmed, the second-order CFA showed acceptable fit to the data, $\chi^2(167) = 209.91$, $p = .01$, CFI = .91, RMSEA = .05, SRMR = .08. The item responses for each variable were then averaged into a single composite parcel and used to estimate the panel models.

Information on dimensionality and factorial invariance of the perceived novelty, flow, DSR, and habit formation scales across the 11 time points are provided in Tables 1 to 4. In some instances, the proposed model did not fit the data well. For instance, the fit indices for the novelty scale at Time 5 did not meet the minimum criteria for good model fit; however, no modifications were made to this scale at Time 5 because the use of different items can potentially confound assessments of change over time. Accordingly, items for each scale that led to the best fitting models across the time points were retained; that is, the models that fit the data well at the most time points were selected.

Manipulation Check

A manipulation check was performed at Time 1 to determine the efficacy of the frame and environmental manipulations. The manipulation check was carried out through a 2x2 full factorial ANOVA. The results indicate that the environment manipulation in Second Life was again not successful in the main study, $F(1, 101) = 0.04$, $p = .85$, $\eta^2 = .00$, insofar as participants assigned to the unfamiliar environment ($M = 4.48$, $SD = 0.98$) reported only marginally higher perceptions of

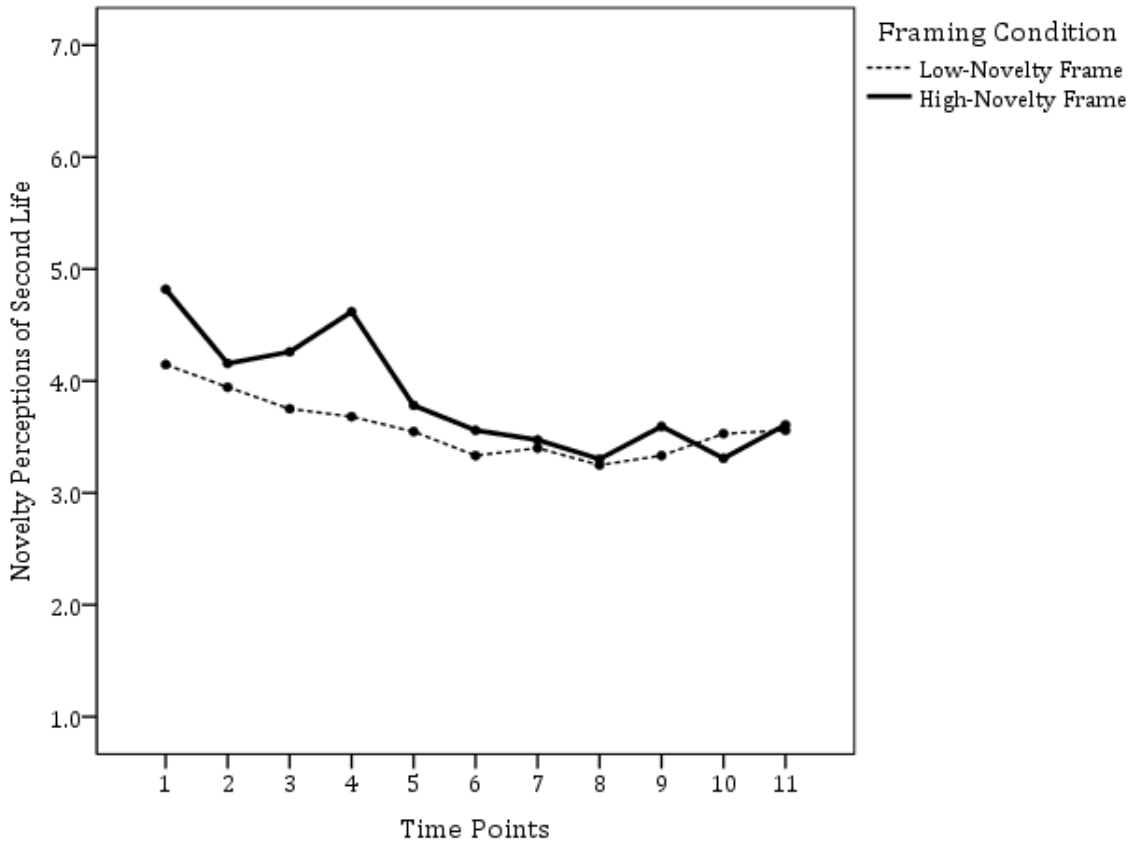
novelty than those directed to the familiar environment (M = 4.42, SD = 1.03). The frame, however, was effective in manipulating novelty to the extent that participants exposed to the high-novelty frame (M = 4.82, SD = 0.85) reported greater novelty perceptions of Second Life than participants exposed to the low-novelty frame (M = 4.15, SD = 1.02) at Time 1, $F(1, 101) = 13.88$, $p < .001$, $\eta^2 = .12$. The frame-by-environment interaction was nonsignificant, $F(1, 101) = 3.68$, $p = .06$, $\eta^2 = .03$. Because only the frame manipulation was effective, the environmental condition variable was disregarded from the analyses.

Time Point Selection

Piecewise LGM is implied by the hypotheses of this investigation. A linearly increasing growth trajectory of novelty perceptions is relevant in Hypotheses 1 and 2 whereas time points representing non-growth of novelty perceptions is relevant to Hypotheses 3 and 4. The time points used to test the LGMs were thus determined through an evaluation of the novelty scale across the 11 time points using a mixed between-and-within-subjects ANOVA.

A decision was made not to use the novelty perception score at Time 1 in determining the time points to use in the LGM because Second Life was so new to all participants. A brief period of time was given to each individual to become acquainted with the Second Life program before deciding on time points germane to the hypotheses. An interpretive analysis of the between-by-within subjects plot across the 11 time points, illustrated in Figure 9, demonstrates an increasing trend in novelty perceptions of the high-novelty frame group and slightly decreasing trend

Figure 9. Plot of the novelty perception scores between the high-novelty frame and low-novelty frame groups across the 11 time points.



of the low-novelty frame group between Time 2 and Time 4. Perceptions of novelty in the high-novelty frame group decrease between Time 4 and 7 and remain stable until Time 11. To test the growth trajectory between Time 2 and Time 4, a mixed ANOVA was used, with novelty perceptions over time specified as the within-subjects variable and framing condition as the between-subjects variable. The assumption of sphericity was not violated in the mixed ANOVA, Mauchly's W = 1.00, $\chi^2(2) = 0.11$, $p = .95$. Although the main effect of time was not significant, Huyhn-Feldt $F(2, 206) = 0.79$, $p = .45$, the interaction between time and framing variable was significant, Huyhn-Feldt $F(2, 206) = 4.80$, $p = .01$. This significant interaction supports the difference in trajectories of novelty perceptions between the linearly increasing high-novelty and marginally decreasing low-novelty frame groups. Therefore, scores taken at Time 2 to Time 4 are appropriate for the piecewise latent growth model that tests Hypotheses 1 and 2.

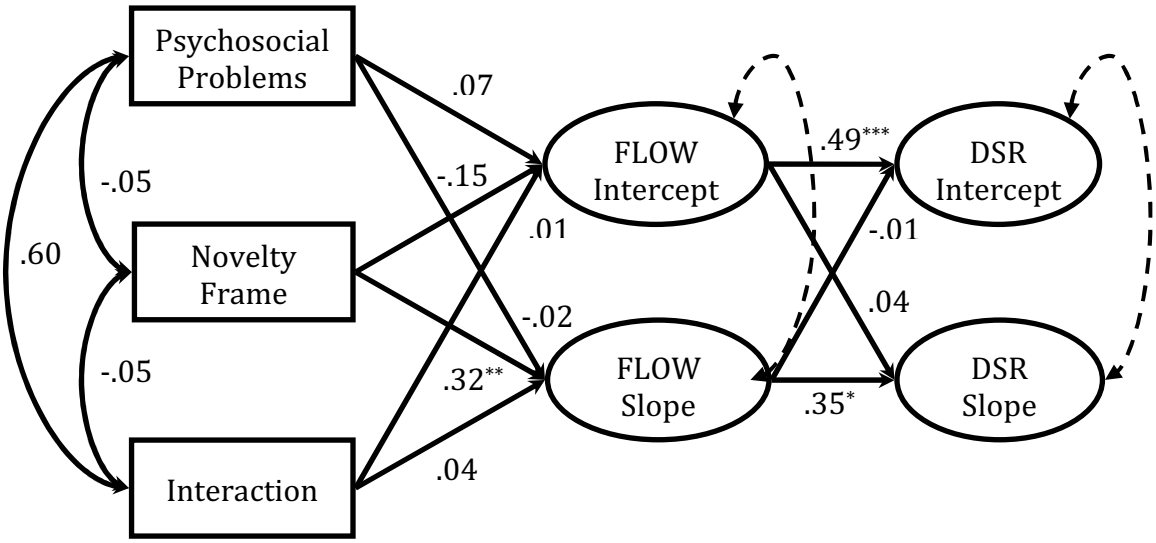
Hypotheses 3 and 4 are interested with only those time points in which novelty perceptions of Second Life between the high-novelty and low-novelty frame groups converge and remain stable over time (i.e., neither increasing nor decreasing trajectory). Figure 9 shows a linearly decreasing trend in novelty perceptions of the high-novelty frame group between Time 4 and Time 7, with the convergence of novelty perceptions occurring at Time 7. Perceptions from thereon remain stable. A second mixed ANOVA, with novelty scores between Time 7 and Time 11 as the within-subjects factor and framing condition as the between-subjects factor, was conducted to validate the visual evaluation. The assumption of sphericity in this

mixed ANOVA was violated, Mauchly's W = .68, $\chi^2(9) = 39.05$, $p < .001$; thus, multivariate as opposed to univariate tests were used. Although the within-subjects effect indicates significant changes in perception over Time 7 to Time 11, Wilks' λ = .89, $F(4, 100) = 3.19$, $p = .02$, the main effect is nonlinear as expected, $F(1, 103) = 2.75$, $p = .10$. Moreover, the interaction effect demonstrated that the trajectory of the high-novelty and low-novelty frame groups did not differ significantly over the five time points, Wilks' λ = .91, $F(4, 100) = 2.43$, $p = .052$. Given that the nonsignificant interaction and main effects demonstrate convergence of the two groups without linearly increasing or decreasing trajectories, the growth model testing Hypotheses 3 and 4 can be fit to data taken from Time 7 to Time 11.

Hypotheses 1 and 2: Growth of Flow and Deficient Self-Regulation as Novelty Perceptions Increase

Hypothesis 1 proposes that novelty perceptions of a technology increase the likelihood that flow is initially experienced, which then leads to DSR during initial stages of technology use. Hypothesis 2 predicts that the novelty frame and flow relationship is independently moderated by psychosocial problems, boredom proneness, and self-reactive outcome expectation. These hypotheses were tested using an LGM approach, with novelty frame (dummy coded as 0 [low-novelty frame] or 1 [high-novelty frame]) as one exogenous variable, psychosocial problems, boredom proneness, or outcome expectation as a second exogenous variable, and their interaction as the third exogenous variable. The exogenous variables independently predicted the flow intercept and slope factors, which in turn

Figure 10. A latent growth curve model of the effect of novelty framing, moderated by psychosocial problems, on flow and deficient self-regulation at Time 2 to Time 4.



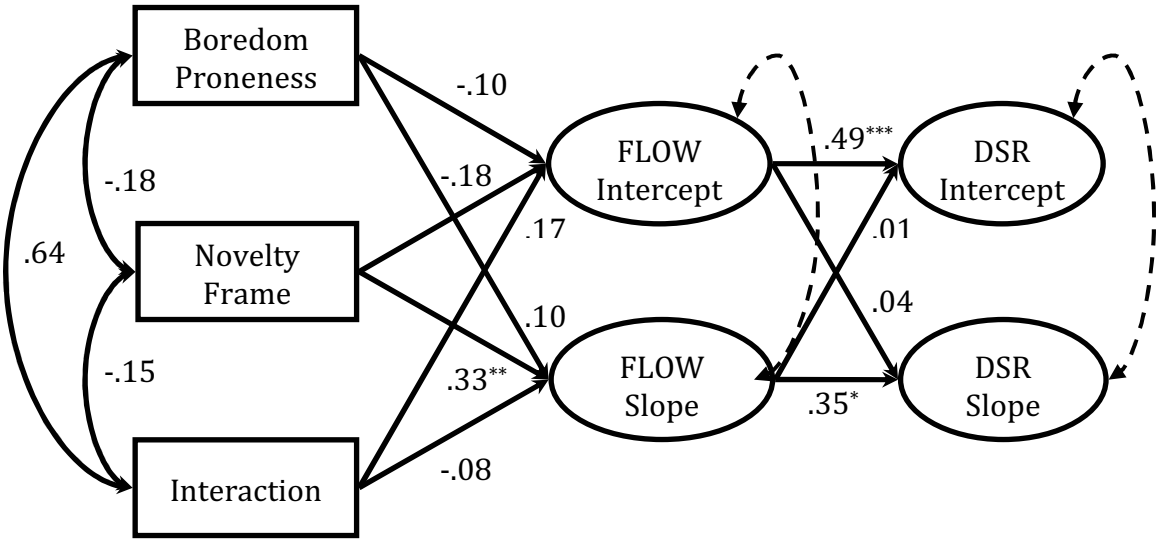
Note. The parameter estimates provided in the model are standardized coefficients. For the novelty variable, the low-novelty frame condition was coded as 0, and the high-novelty frame condition was coded as 1. * $p < .05$, ** $p < .01$, *** $p < .001$.

predicted the DSR intercept and slope variables. Three LGMs were constructed to examine separately the influence of psychosocial problems, boredom proneness, or outcome expectation.

Psychosocial problems. The first model tested investigates the influence of psychosocial problems (i.e., a variable composed of social anxiety, loneliness, and depression), frame condition, and their interaction on flow; the model also evaluates the influence of flow on DSR. The fit of the model, evaluated using Hu and Bentler's (1999) dual criteria, is satisfactory, $\chi^2(18) = 30.99$, $p = .03$, CFI = .96, RMSEA = .08, SRMR = .06. As illustrated in Figure 10, the relationship between novelty frame and the flow slope variable is significant, $\beta = .32$, $p < .01$. The finding indicates that individuals in the high-novelty frame condition reported greater growth of flow experiences over the three time points than those in the low-novelty frame condition. Additionally, the growth rate of the flow variable is predictive of growth of DSR, as evidenced by the significant relationship between the flow slope and DSR slope variables, $\beta = .31$, $p < .05$. These findings collectively provide support for Hypothesis 1. The interaction between the frame variable and psychosocial problems is not associated with the flow slope factor, $\beta = .04$, *ns.* Hypothesis 2a is therefore not supported by the data.

Boredom proneness. The second model included boredom proneness and the boredom-by-frame interaction term as primary exogenous variables of interest. The model, depicted in Figure 11, demonstrates moderate model fit, $\chi^2(18) = 34.99$, $p = .01$, CFI = .95, RMSEA = .10, SRMR = .09. The path coefficients show a significant

Figure 11. A latent growth curve model of the effect of novelty framing, moderated by boredom proneness, on flow and deficient self-regulation at Time 2 to Time 4.



Note. The parameter estimates provided in the model are standardized coefficients. For the novelty variable, the low-novelty frame condition was coded as 0, and the high-novelty frame condition was coded as 1. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

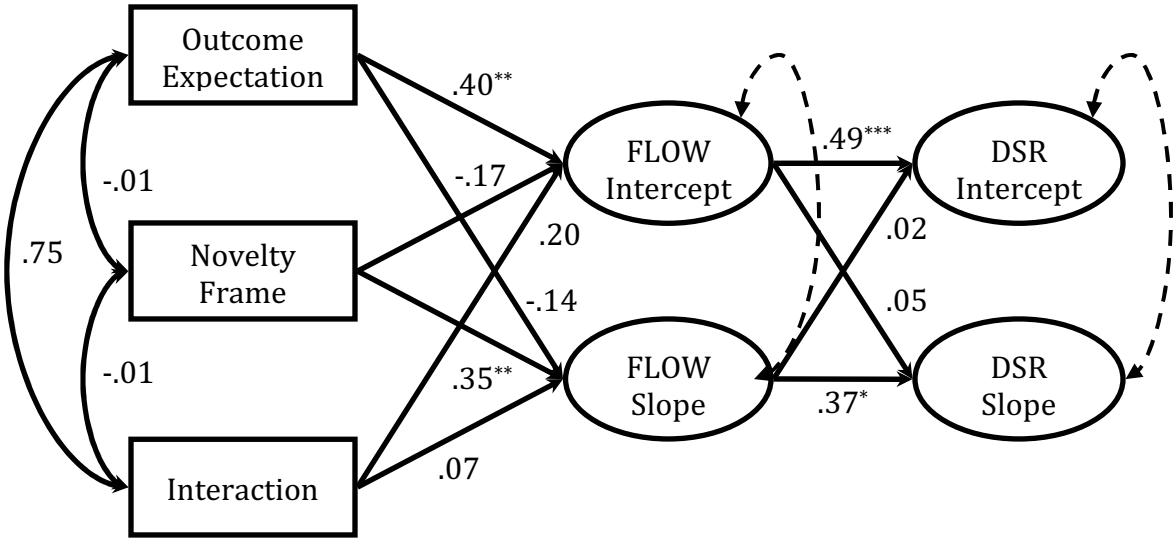
relationship between the novelty frame and flow slope variable, β = .33, $p < .01$; people exposed to the high-novelty frame developed greater flow experiences than those exposed to the low-novelty frame. Growth of flow is also associated with individual increases in DSR, β = .35, $p < .05$. However, the relationship between the interaction term and flow slope variable is nonsignificant, β = -.08, *ns*, and thus did not support Hypothesis 2b.

Self-reactive outcome expectation*.* The third model tested the hypothesis that self-reactive outcome expectation moderates the relationship between novelty frame and growth of flow. The fit of this model, illustrated in Figure 12, is satisfactory, $\chi^2(18) = 43.53$, $p = .001$, CFI = .94, RMSEA = .12, SRMR = .07. Although the interaction between outcome expectation and frame condition is not associated with flow growth, β = .07, *ns*, providing little evidence for Hypothesis 2c, the frame condition, β = .36, $p < .01$ significantly predicts individual growth of flow. The path from the flow slope variable to the DSR slope variable is also significant, β = .37, $p < .05$. The results from all models collectively support Hypothesis 1 but did not demonstrate any support for the argument of Hypothesis 2.

Hypotheses 3 and 4: Deficient Self-Regulation and Habit Formation after Novelty Perceptions Decay

Hypothesis 3 argues that although novelty perceptions are expected to weaken and fade over time, the residual effects of previous exposure to a high-novelty frame persist, leading to DSR in familiar stages of technology use. However, this influence is moderated by existing psychosocial problems, boredom proneness,

Figure 12. A latent growth curve model of the effect of novelty framing, moderated by self-reactive outcome expectation, on flow and deficient self-regulation at Time 2 to Time 4.



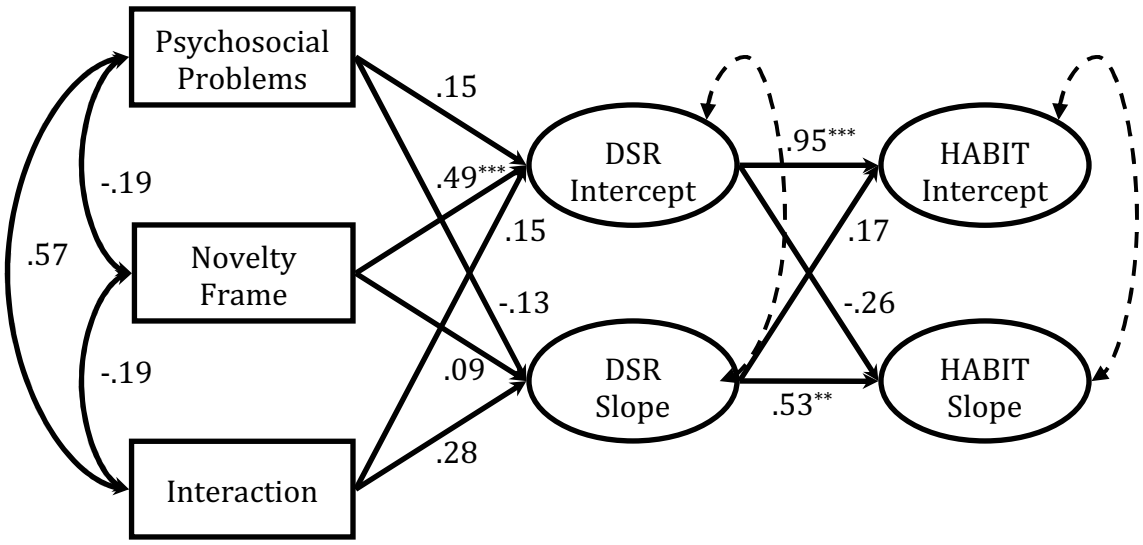
Note. The parameter estimates provided in the model are standardized coefficients. For the novelty variable, the low-novelty frame condition was coded as 0, and the high-novelty frame condition was coded as 1. * $p < .05$, ** $p < .01$, *** $p < .001$.

and self-reactive outcome expectation. In Hypothesis 4, the case is also made that the growth rate in DSR is related to intraindividual growth of habit formation. Data taken from Time 7 to Time 11, when novelty perceptions for the high-novelty frame group converge with the low-novelty frame group remain stable over time, were used to construct the models. Hypotheses 3 and 4 were tested with three LGMs, specifying novelty frame as one exogenous variable, psychosocial problems, boredom proneness, or outcome expectation as a second exogenous variable, and the interaction term as the third exogenous variable. Paths were estimated from the exogenous variables to the DSR intercept and slope factors. Paths were also estimated from the DSR factors to habit formation intercept and slope.

Psychosocial problems*.* The important relationships in the model that tests Hypotheses 3 and 4 are the paths estimated between the psychosocial problems-by-frame interaction and DSR slope factor, and between the DSR slope factor and habit formation slope factor. The latter path demonstrates the influence of intraindividual change in one variable on change in another variable over time. The model that includes psychosocial problems, illustrated in Figure 13, does not fit the data well, $\chi^2(58) = 140.49$, $p < .001$, CFI = .90, RMSEA = .12, SRMR = .09. No reasonable modifications were suggested by the LaGrange multiplier or Wald test. Additionally, no patterns apart from linear growth were modeled due to the lack of theoretical or empirical support to justify nonlinear growth.

Despite unsatisfactory model fit, individual path coefficients were inspected for statistically significant relationships between constructs in the model. Significant

Figure 13. A latent growth curve model of the effect of novelty framing, moderated by psychosocial problems, on deficient self-regulation and habit formation at Time 7 to Time 11.



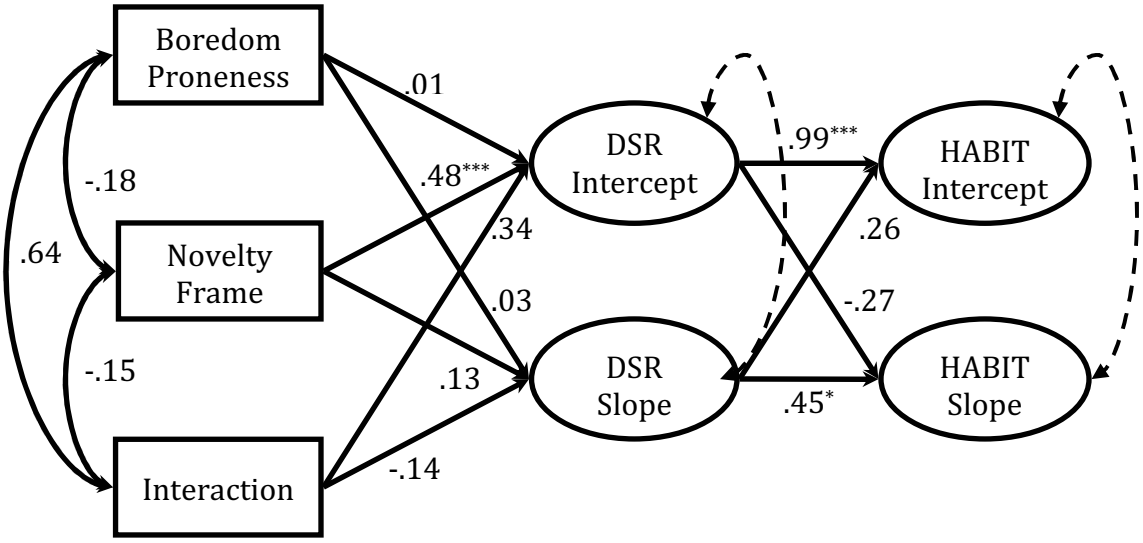
Note. HABIT = Habit formation. The parameter estimates provided in the model are standardized coefficients. For the novelty variable, the low-novelty frame condition was coded as 0, and the high-novelty frame condition was coded as 1. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

differences in the DSR of Second Life between the high-novelty and low-novelty frame groups can be observed at Time 7, β = .49, $p < .001$, but neither the novelty frame, β = .09, *ns*, psychosocial problems, β = -.13, *ns*, nor their interaction, β = .28, *ns*, is associated with growth of DSR from Time 7 to Time 11. Nevertheless, the DSR slope factor predicts the habit formation slope, β = .53, $p < .01$, indicating that intradividual growth of DSR leads to habit formation even after novelty perceptions of a technology subside.

Boredom proneness. The second model used to test Hypotheses 3 and 4 included boredom proneness and a boredom proneness-by-frame interaction as the exogenous variables of interest. The tested model, depicted in Figure 14, fits the data poorly, $\chi^2(59) = 159.28$, $p < .001$, CFI = .88, RMSEA = .13, SRMR = .09. No reasonable modifications were recommended, and no alternative growth patterns were modeled. The individual paths suggest no relationship between the interaction term and DSR growth variable, β = -.14, *ns*. However, growth of DSR, even after novelty perceptions diminish, is related to the individual development of media habits over the five time points, β = .45, $p < .05$.

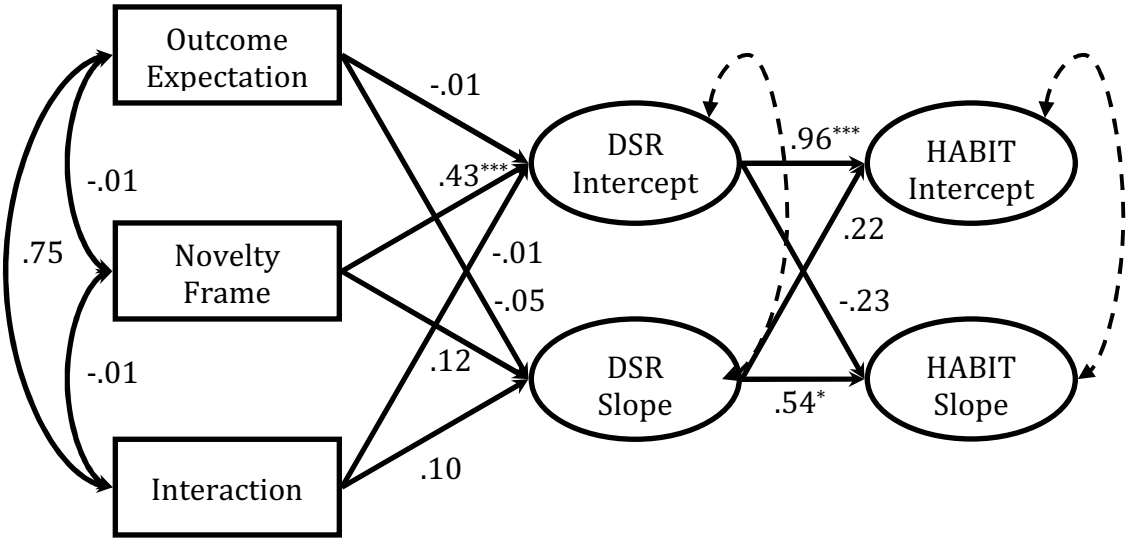
Self-reactive outcome expectation. The final model examined the hypothesis that the residual effects of the novelty frame influence DSR development, but the relationship depends on outcome expectations of Second Life. The proposed model, illustrated in Figure 15, does not satisfactorily fit the data, $\chi^2(59) = 161.62$, $p < .001$, CFI = .88, RMSEA = .13, SRMR = .09. Although the high-novelty frame group reports greater DSR than the low-novelty frame group at Time 7 (β = .43, $p < .001$),

Figure 14. A latent growth curve model of the effect of novelty priming, moderated by boredom proneness, on deficient self-regulation and habit formation at Time 7 to Time 11.



Note. HABIT = Habit formation. The parameter estimates provided in the model are standardized coefficients. For the novelty variable, the low-novelty frame condition was coded as 0, and the high-novelty frame condition was coded as 1. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Figure 15. A latent growth curve model of the effect of novelty priming, moderated by self-reactive outcome expectation, on deficient self-regulation and habit formation at Time 7 to Time 11.



Note. HABIT = Habit formation. The parameter estimates provided in the model are standardized coefficients. For the novelty variable, the low-novelty frame condition was coded as 0, and the high-novelty frame condition was coded as 1. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

they did not report greater growth of DSR from Time 7 to Time 11 (β = .12, *ns*.). The relationship between the DSR slope factor and the interaction of frame and outcome expectation is also nonsignificant, β = .10, *ns.* Growth of DSR predicts individual growth of habit formation, β = .54, $p < .05$, in this model.

Post Hoc Analysis of Equivalent Models at Alternative Time Points

A series of LGMs was tested to examine whether the processes of DSR development hypothesized in the initial stages of technology use (H1 and H2) could be eliminated in the familiar stages of technology use. These tests provide further evidence for the hypotheses of this dissertation by showing that the relationships only hold at time points specified in the predictions and justifying the distinctions made between initial and familiar stages of technology use. These tests also demonstrate that DSR functions in different ways at various stages of engagement with a novel technology.

The LGMs for this post hoc analysis were constructed in the same manner as depicted in Figure 7, but flow and DSR scores at Time 2 to Time 4 were exchanged with flow and DSR indicators at Time 9 to Time 11 (preserving equivalent numbers of time points but at familiar stages of Second Life use). Three LGMs were conducted for the post hoc test addressing Hypotheses 1 and 2, interspersing psychosocial problems, boredom proneness, or self-reactive outcome expectation.

The first model in the post hoc analysis evaluated the effects of psychosocial problems, novelty frame, and the interaction on flow growth and in turn DSR growth. This model, tested at Time 9 to Time 11, shows considerably worse fit to the

data than the model testing Hypotheses 1 and 2, $\chi^2(18) = 61.79$, $p < .001$, CFI = .89, RMSEA = .15, SRMR = .09. The relationships between the flow slope factor and psychosocial problems (β = -.09, *ns*), novelty frame (β = .10, *ns*), and the interaction (β = .12, *ns*) are all nonsignificant. Additionally, growth of flow does not significantly predict growth of DSR at the later time points, β = .35, *ns*.

The second model examined the effects of boredom proneness, novelty frame, and their interaction on the flow slope factor. The fit of the model with boredom proneness included is satisfactory, $\chi^2(18) = 44.10$, $p = .001$, CFI = .94, RMSEA = .12, SRMR = .07. Neither boredom proneness (β = -.10, *ns*), novelty frame (β = .08, *ns*), nor their interaction (β = .07, *ns*) significantly predicts growth of flow from Time 9 to Time 11. The flow slope variable is also not related to the DSR slope variable at these data points, β = .48, *ns*.

The final model tested the influence of self-reactive outcome expectation, novelty frame, and the interaction term on flow and in turn DSR. The proposed model showed poor fit to the data, $\chi^2(18) = 63.26$, $p < .001$, CFI = .90, RMSEA = .16, SRMR = .10. Growth of flow is not associated with self-reactive outcome expectation (β = -.29, *ns*), novelty frame (β = .15, *ns*), or the interaction (β = .29, *ns*). The slope factor for flow in this model is also not predictive of DSR growth, β = .45, *ns*.

A second set of LGMs was tested to investigate whether the processes of DSR and habit formation hypothesized in the familiar stages of technology use (H3 and H4) occurred in the initial stages of technology use. This test provides further evidence that the relationships between perceived novelty, DSR, and habit

formation occur exclusively at later stages of technology use. Three LGMs, constructed identically to the model shown in Figure 8, were estimated using data taken at Time 2 to Time 6.

The initial model of the second set of LGMs in the post hoc analysis evaluated the effects of psychosocial problems, novelty frame, and the interaction on DSR growth and in turn habit formation growth from Time 2 to Time 6. The results indicate that the proposed model does not fit the data, $\chi^2(59) = 125.72$, $p < .001$, CFI = .91, RMSEA = .10, SRMR = .10. The relationships between the DSR slope factor and psychosocial problems (β = .03, *ns*) and the interaction (β = .16, *ns*) are nonsignificant. However, DSR growth is directly related to the novelty frame at initial stages of Second Life use (β = .61, $p < .001$). Lastly, growth of DSR, even in the initial stages of technology, predict growth of media habits, β = .86, $p < .001$.

The second model estimated the effects of boredom proneness, novelty frame, and the interaction on the DSR slope factor. The growth model does not satisfactorily fit the data, $\chi^2(59) = 116.00$, $p < .001$, CFI = .92, RMSEA = .10, SRMR = .09. Although the novelty frame significantly predicts DSR development from Time 2 to Time 6 (β = .61, $p < .001$), neither boredom proneness (β = -.01, *ns*) nor the interaction term (β = .25, *ns*) is associated with DSR. Growth of DSR significantly predicts growth of habit formation in this model as well, β = .86, $p < .001$.

The final model tested the influence of self-reactive outcome expectation, novelty frame, and their interaction on DSR and habit formation. The proposed growth model poorly fits the data taken at Time 2 to Time 6, $\chi^2(59) = 117.05$, *p*

< .001, CFI = .92, RMSEA = .10, SRMR = .09. The novelty frame again successfully predicts DSR growth in the initial stages of technology use, β = .57, $p < .001$; however, self-reactive outcome expectation (β = -.08, *ns*) and the interaction term (β = -.03, *ns*) do not predict the DSR slope variable. Lastly, growth of flow is significantly related to growth of media habits, β = .86, $p < .001$.

Results from the post hoc analysis are generally consistent with expectations. The development of DSR in familiar stages of technology use is not, as expected, predicated on the amount of flow experienced given that familiarity with and mastery over a technology interrupts the immersive state of flow. Flow at these later stages is also not affected by the novelty frame or psychosocial problems, boredom proneness, and self-reactive outcome expectation. DSR is predicted by the novelty frame in the initial stages of technology use. DSR can therefore grow directly from novelty perceptions without first initiating flow. Although not originally anticipated, DSR may also account for early stages of habituated media use in the initial engagement with novel technologies.

Chapter Summary

The methods for testing the hypotheses of the main study and the results of the tests are reported in this chapter. The hypotheses were examined using a between-group repeated-measures experiment, which produced data on novelty perceptions, flow, DSR, and habit formation over 11 time points. The scores were taken after participants were exposed to Second Life, a social-based technology, for a 30-minute period each day for 11 consecutive days. The data were analyzed using

LGM, a procedure that can accommodate panel data and various growth patterns of variables included in the proposed model.

Results of the models tested reveal important findings. Consistent with the argument of Hypothesis 1, novelty perceptions of a technology elicit flow during initial technology use. Individual growth of flow in turn translates into DSR over time. However, the influence of the novelty frame on flow growth is not moderated by psychosocial problems, boredom proneness, or self-reactive outcome expectation. Therefore, Hypotheses 2a, 2b, and 2c are not supported.

The residual effects of the novelty frame does not have any influence on the individual development of DSR in familiar stages of technology use; this relationship also does not depend on whether psychosocial problems are experienced or self-reactive outcome expectation are anticipated, as speculated in Hypothesis 3. Intraindividual growth of DSR, however, predicts growth of habit formation in familiar stages of Second Life use. This result demonstrates preliminary support for Hypothesis 4. Implications of the findings are discussed in the next chapter.

5. DISCUSSION

Chapter Overview

Chapter 5 concludes this dissertation by discussing the results relative to their theoretical and practical contributions to body of research on DSR and media habits. The key findings of the main study are discussed, and their significance to broader theorizing on DSR and habituated media consumption is explained. Finally, the limitations of this project and directions for future investigations are presented. The chapter closes with an overview of the dissertation, directing attention to the most important lessons learned from the pretest and main study.

Key Findings and Implications

The principal objective of this dissertation was to understand the processes through which DSR and media habits develop from technology use. The studies reported in this dissertation fill an existing gap in research and theory on DSR and media habits; that is, present theorizing does not explicate the function of or one's interaction with technology in motivating DSR or media habits. A model of perceived novelty, flow, DSR, and habit formation at different points of technology use was tested through a longitudinal experimental design to overcome this conceptual gap.

The LGMs tested in this dissertation endeavor to make at least two important contributions to the literature on DSR and media habits. First, causal factors involved with the development of DSR and media habits are better understood by integrating novelty perceptions into the proposed model. DSR stemming from

novelty perceptions of a technology may be a theoretically defensible explanation why deregulation occurs among the population of normal Internet users, whose media use falls temporarily out of their control, from which most of the research on DSR is drawn (LaRose et al., 2003). Second, the methodology of this study is in itself a contribution to research and theory. A few studies have investigated DSR through longitudinal designs (e.g., Gentile et al., 2011; Kerkof, Finkenauer, & Muusses, 2011; Tokunaga, in press; van den Eijnden, Meerkerk, Vermulst, Spijkerman, & Engels, 2008); however, no previous research has empirically tested the development of DSR through a controlled experiment. A benefit of controlled experimental designs is the ability to draw causal inferences from analyses of the data (Shadish, Cook, & Campbell, 2002). This methodological contribution is particularly significant when considering that most of research on, and thus understanding of, DSR and media habits comes from cross-sectional data. Findings of the pretest and main study, which collectively provide insight into the predictions of this investigation, are reviewed in the following sections. The implications of the findings in the broader scope of theory on DSR and media habits are then discussed.

Novelty, Flow, and Deficient Self-Regulation of Second Life

The first prediction tested is that novelty perceptions during initial technology use make salient appraisals of challenge in using the technology and one's desired skills to overcome the challenge. Attention directed at these two components of technology use is an important requisite for entry in flow. The deeply immersive state of flow retards the subfunctions of successful behavioral self-

regulation, thereby increasing the likelihood of experiencing DSR. Additionally, the relationship between novelty perceptions and flow in this conceptual model is moderated by the experience of psychosocial problems, boredom proneness, or self-reactive outcome expectation, factors in previous research that have been shown to mitigate or exacerbate DSR and media habits.

Results from the between and within-subjects experiment reveal that flow was reported more among individuals who were told to think of Second Life as new and unlike other technologies they currently use than those in the low-novelty frame condition. These findings expand theoretical insight into DSR by uncovering at least one pathway through which people lose control over their technology use. Individuals attempt to develop mastery over technologies during initial engagement with a technology appraised as novel. Mastery is gained over the technology by building a repertoire of skills to overcome the challenges associated with learning to use the unfamiliar technology effectively.

The acquisition of skills to use a novel technology impairs one's ability to self-regulate novel technology use. An important contribution of testing Hypothesis 1 is identifying flow as a potential pathway to DSR in initial stages of technology use but not in later stages. Although flow has been linked to DSR in cross-sectional studies (Lee & LaRose, 2007), the directionality of this relationship is obscured by confounding interindividual change with interindividual differences in intraindividual change, a major limitation of single survey designs (see Baltes & Nesselroade, 1973; Farrington, 1991). No prior research has tested the relationship

between flow and DSR longitudinally, which can provide more confidence about the directionality between the variables. In testing the relationship between intraindividual growth of flow and DSR, the design of this investigation effectively allows individuals to function as their own control group. The comparison of their initial scores on DSR and habit formation with their scores at later time points following each exposure to Second Life allows for tentative causal conclusions to be made about the influence of Second Life use on DSR. This study therefore mitigates the limitations of its predecessors that regularly implement cross-sectional designs. Nevertheless, only tentative relationships can be supported among the time points tested. A cyclical or non-recursive relationship between flow and DSR may be uncovered if the time points were not restricted, other growth patterns in the data were tested, or other directional paths were modeled.

The concentration required to balance skill and challenge can lead to a profoundly immersive state in which focus is placed on the task and nothing else, sometimes even dismissing emotions or cognitions unrelated to the task (Csikszentmihalyi, 1996). Yet, Goleman (2005) also explains that being "caught in the ennui of depression or the agitation of anxiety is to be barred from flow" (p. 91). Individuals with depression or other related conditions are unable to enter flow because the unpleasant moods associated with these psychosocial problems prohibit them from full immersion, making it impossible for these variables to be related, as the results find. Arguments in support of Hypothesis 2 suggest that flow diverts attention from unpleasant moods to Internet use; however, it may be that

individuals who experience psychosocial problems, boredom proneness, and self-reactive outcome expectation cannot initially enter flow. They must therefore develop DSR through a different theoretical process than flow.

The post hoc analysis indicates that merely perceiving technologies as novel can directly lead to DSR without necessitating entry into flow. Individuals experiencing psychosocial problems, boredom proneness, or self-reactive outcome expectation can directly develop DSR by merely perceiving novelty without ever having to achieve a flow state. Findings from this dissertation therefore recognize that flow is not the only route through which DSR occurs. Other studies have documented a direct relationship between psychosocial problems and DSR using longitudinal data (e.g., Tokunaga, in press). Several theorists have also identified psychosocial problems as a primary antecedent in DSR development (Davis, 2001; LaRose et al., 2003; LaRose, Kim, & Peng, 2011). It may therefore be that DSR has common origins of psychosocial problems and flow.

The findings juxtaposed bring up an interesting and somewhat complex point about DSR development. Because psychosocial problems prevent one from entering flow (Goleman, 2005), flow is functionally incompatible (i.e., cannot be experienced contemporaneously) with psychosocial problems as precursors to DSR. Given this incompatibility, it is likely that DSR grows on account of psychosocial problems or flow but not both, yet DSR development from either origin is likely to involve novelty perceptions. It might be worthwhile for future investigations to examine

whether conditions such as psychosocial problems moderate the relationship between perceived novelty and DSR.

Novelty, Deficient Self-Regulation of Second Life, and Media Habits

The second general prediction of this investigation addresses DSR and media habits when novelty of a technology diminishes over time. If novelty plays such a seminal role in the development of DSR, then decaying novelty must lead to the self-correction of DSR for most people as familiarity with and mastery over the technology prevail. However, for some individuals, DSR is predicted to persist over time despite a reduction in novelty perceptions. The uncorrected behaviors are motivated by the experience of psychosocial problems, boredom proneness, or perceived self-reactive outcome expectation. These conditions initiate self-biases that slight successful attempts at self-correction (Bandura, 1999). Therefore, DSR is likely to be highest when people have psychosocial problems, boredom proneness, or self-reactive outcome expectation and have been exposed to the novelty frame.

This investigation finds no evidence for main or interaction effects of the novelty frame and psychosocial problems, boredom proneness, and self-reactive outcome expectation after novelty perceptions of Second Life decay. It may be that the novelty frame over time is forgotten by the participants as familiarity with and mastery over Second Life increases. The familiarity with the technology allows distractions to infiltrate participants' prolonged attention to Second Life, in effect breaking the flow state and allowing for the self-correction of DSR. The return to effective regulation means that individuals exposed to the high-novelty and low-

novelty conditions report similar levels of DSR only after novelty decays. Regaining control over DSR occurs even when people envision self-reactive outcome expectations, are prone to boredom, or experience psychosocial problems.

The absence of relationships between DSR growth and psychosocial problems, boredom proneness, and self-reactive outcome expectation is seemingly inconsistent with the existing body of work on this topic. Although these relationships have been extensively documented in research (e.g., LaRose et al., 2003, 2011; LaRose & Eastin, 2004), the results of Hypothesis 2 may to some degree support LaRose et al.'s (2003) social cognitive perspective of DSR; that is, DSR is a "continuum of media behaviors that includes normal media consumption that has occasional lapses in self-control" (p. 235). The automatic self-correction response following the decay of novelty may have mitigated any effect of psychosocial problems, boredom proneness, or outcome expectation on DSR. Individuals who were simply regaining self-control over Second Life use from Time 7 to Time 11 may have overridden the negative biases of psychosocial problems, boredom proneness, or outcome expectation to correct their DSR. Caplan (2003) describes DSR as a cyclical process in which people go through lapses of unregulated media consumption, regain control through self-corrective mechanisms, only to have media use again fall out of one's self-control. It may be that during times in which the self-correction of DSR occurs, namely Time 7 to Time 11 in this investigation, psychosocial problems, boredom proneness, and outcome expectation are not relevant to the expression of DSR.

The repeated measures of DSR and media habit over the course of the 11 exposures to Second Life may also be in part responsible for the self-correction of DSR. Because DSR can emerge from the ineffective monitoring of personal standards of Internet use, items repeatedly asking about one's preoccupation, uncontrolled use, and ritualistic behaviors may call attention to these personal averages and elicit natural self-corrective responses. In the context of the findings, behaviors become unregulated from Time 2 to Time 4 but fall back under one's control after being primed to the absence of self-regulation. This view of self-regulation again places DSR aside other benign behaviors in which control is temporarily lost and regained rather than a serious condition requiring clinical intervention. At least among the "normal" population of Internet users, control is lost and gained in a predictable recurring pattern (LaRose et al., 2003), known in the DSR literature as a feedback-loop model of self-regulation (Carver & Scheier, 1981). This may also explain why DSR was corrected even among those who experience psychosocial problems and boredom proneness or hold self-reactive outcome expectation for Internet use.

The inability to predict DSR in familiar stages of Second Life use may in itself indicate that DSR does not exist for most people during these time points. Nevertheless, DSR lies on a continuum and some at the upper end of the range may experience DSR at later stages of Internet use. Although DSR does not manifest in predictable patterns at these familiar stages as it would in stages when novelty is perceived, an important observation in the later time points is the growth of habits from DSR, a finding consistent with extant research (e.g., LaRose, 2009; LaRose &

Eastin, 2004; LaRose et al., 2003). As LaRose and Eastin (2004) explain, Internet use becomes an end and not a means to an end when DSR is experienced. Active consideration of the anticipated outcomes of Internet use is no longer made at this stage. The conditioned response to Second Life use, in response to the loss of conscious self-control, results in the automaticity of Second Life use, which is executed without self-instruction (LaRose et al., 2003).

At a conceptual and operational level, it is difficult to disentangle DSR from habituated Second Life use. The literature on habituated behaviors and DSR is often unclear about their conceptual distinction, at times even arguing that DSR is a habit (e.g., Marlatt, Baer, Donovan, & Kivlahan, 1988). From an operational standpoint, items used to measure DSR and media habits shared considerable overlap and were accordingly removed from the scales. The items retained to evaluate the DSR reflect a failure of judgment and self-reaction (i.e., inability to control behaviors despite negative consequences). Habit was measured as a failure of self-monitoring and self-observation. Although these concepts need further conceptual and operational explication, the scales used in this study make clear the distinction reflected in contemporary theorizing on the nature of DSR and media habits.

Implications of Findings on Research and Theory

The support for the hypotheses of this investigation is mixed. In the initial stages of Second Life use, when novelty perceptions are on the rise, framing a technology as novel leads to flow, which in turn results in DSR. This basic model of Hypotheses 1 and 2 is indeed supported by the findings. The model tested for

Hypotheses 3 and 4 had mixed results. After novelty perceptions fade, novelty does not directly predict DSR; however, growth of DSR is instrumental in provoking habituated uses of Second Life over time. Psychosocial problems, boredom proneness, and self-reactive outcome expectations neither moderate the relationship between novelty and flow in initial use nor novelty and DSR in familiar stages of Second Life use as initially anticipated. The absence of moderation signals the powerful nature of self-correction that likely occurs after familiarity with and mastery over Second Life increase proportionally to a drop in novelty perceptions, thereby breaking the profound immersive hold of flow.

The self-correction of unregulated behaviors is generally not well understood or explicated in the DSR literature. As Baumeister and Heatherton (1996) contend, "past theories have not devoted a great deal of attention to how [self-corrective] processes actually function to bring about change, partly because they may have seemed complex and heterogeneous" (p. 2). LaRose (2010) speculates that DSR emerges when individual standards for appropriate Internet use are not personally established. Unclear standards exist when inner conflicts are experienced (Emmons & King, 1988), which is why psychosocial problems, boredom proneness, and outcome expectation are thought to hamper efforts at successful self-regulation. Unclear standards surface in partnership with ineffective monitoring to motivate DSR; that is, people who are unable to manage Internet use effectively are incapable of monitoring their present standards against peer and personal standards. When they appraise their current behaviors to fall short of the

benchmarks, regulatory processes that regain self-control are enacted to correct the discrepant standards. Nevertheless, in some circumstances, control is not regained and thus DSR matures.

The present investigation sheds some light on the self-correction of DSR in that lapses of self-control can occur as a result of novel interest in some stimulus. In this study, the stimulus under investigation is Second Life but it can easily be extended to other stimuli with which individuals have difficulty controlling their impulses. The novel interest facilitates deep immersion in a flow state, which then inhibits one's ability to regulate Internet behaviors. As familiarity with the technology rises, as commonly happens with anything new, the novelty of the technology drops. The absence of this novelty, which once initiated and sustained flow, now allows skills to prevail over challenge, thereby breaking the hold of the stimulus over the individual. DSR is thus corrected or remedied because the circumstances surrounding the DSR change (i.e., something is no longer perceived as a novel stimulus), not because something is consciously or unconsciously triggered in the individual that helps to regain self-control over their behaviors.

In summary, the results of this investigation are mixed, but important contributions of this investigation are the methodology used to obtain the data and the focus on novelty perceptions. Although the relationships of DSR have been tested with longitudinal data in previous research (e.g., Kerkhof, Finkenauer, & Muusses, 2011; Tokunaga, in press), no study has tested models of DSR using a between- and within-subjects controlled experimental design. Using this design,

tentative causal conclusions can be made about the influence of novelty on flow. Moreover, a clearer picture emerges of the influence of flow on DSR and DSR on media habits. The implications of the results to theory are that some of the confusion about DSR is reconciled. The discrepant characterizations of DSR, presented in this dissertation, occur along the lines of severity (i.e., severe or benign) and remediation (i.e., clinical invention or self-correction). These findings are consistent with the interpretation of DSR, advanced by Hall and Parsons (2001), as a benign condition that can be self-corrected over time. Given the recent research on DSR among normal Internet users that supports this position, the way DSR has been framed as an addiction or similar pathology in normal populations should be reconsidered.

Novelty Manipulations

Novelty perceptions in this project were experimentally manipulated through a high-novelty and low-novelty frame and an environment manipulation that was undertaken in the Second Life program. The importance of these novelty manipulations cannot be overlooked because the hypotheses of the main study rely on their effectiveness. In the high-novelty frame condition, individuals were told to think about Second Life as a new, innovative way of socializing with others on the Internet. Participants in the low-novelty frame were told to think about Second Life as being similar to other social-based technologies they presently use and just another way to communicate over the Internet. In the pretest, the results showed that the novelty frame was effective, whereas the manipulation in the Second Life

program did not elicit differences in novelty perceptions. The ineffectiveness of the environment manipulation in the pretest was thought to be the result of the virtual worlds to which participants in the unfamiliar environment condition were sent. To increase variance of novelty perceptions in the main study, the virtual worlds that participants were randomly assigned to were modified.

The manipulations in the main study mirrored the pretest manipulations, with the exception of the modifications made to the virtual worlds. The results of the study showed little support for the effectiveness of the environment manipulation but demonstrated support for the efficacy of the novelty frame. Although not an explicit hypothesis in this investigation, novelty perceptions increased and decayed in a predictable manner over the 11 time points. Indeed, while participants' perceptions of novelty in the low-novelty frame group remained stable over time, the perceptions of those in the high-novelty frame group spiked initially and dissipated, converging with the general perceptions of the low-novelty frame group after about the sixth exposure to Second Life. The environment manipulation that occurred in the Second Life program was likely ineffective because the program, not the virtual world in the program, was novel to both groups. Given the ineffectiveness of the environment manipulation in Second Life, no further analyses were conducted using environment as a predictor.

Limitations

The strengths of this investigation should be considered aside limitations of this project. Six limitations, in particular, are discussed in this section although this

does not represent an exhaustive list. First, the methodology employed lacks external validity. Part of the difficulty to generalize from the experimental design involves the technology selection process employed in the methods. In real life, individuals select technologies they like, use the technology, and then possibly develop DSR and habituated behaviors given certain preconditions. In this experiment, however, participants were told to use an Internet program not of their volition and their perceived DSR and media habits were evaluated. Because choice or personal preference of Internet technologies was limited, the findings may not necessarily represent what happens outside the laboratory setting. With this said, the relationships between flow, DSR, and media habits are in anticipated direction, which provide some level of confidence that using Second Life in a laboratory setting parallels technology use outside the laboratory.

Second, the repeated measures used in the design may have motivated change in people over time that otherwise would not exist in regular technology use. Bringing awareness to one's Internet use by repeatedly asking about cognitive preoccupation, uncontrolled Second Life use, or habituated behaviors may have drawn attention to the deregulation, which would then hasten the process of self-correction. The repeated measures may thus have stimulated the self-observation, judgmental, and/or self-reaction processes that return unregulated behaviors under one's self-control. It may be argued that the self-correction observed after novelty decayed could have been an artifact of the repeated measures and not the increased familiarity with Second Life.

Third, the repeated measures may also have signaled to participants the true goals of the study and sensitized their responses in later questionnaires. The items in the questionnaires ask directly about preoccupation, uncontrolled use, and media habits. It may be that the scales indicated to participants the purpose of Second Life use, thereby changing the way they respond at later time points. The problem of pretest sensitization is more significant given the use of within-subjects designs; that is, the intraindividual responses between the time points are as important as the between-subjects (interindividual variation in intraindividual) differences.

Fourth, the findings bring little insight into what it is to which people are forming DSR and media habits. Although Second Life is the stimulus from which people generally develop DSR and habits, the technology confounds the medium and message. It is impossible to discern whether individuals are forming DSR and habits to the technology, the social interactions that take place through the technology, or a combination of both. From an applied perspective, for this research to have practical implications, it would be helpful to know the exact stimulus involved in the precipitation of DSR and media habits; in this way, DSR sufferers can better assuage their transitory preoccupation, uncontrolled uses, and habituated behaviors by decreasing novelty in some way (e.g., not exploring new conversations, not using different technologies). Even supposing that DSR and habits are mild conditions that ultimately fall under one's control over time, people may still experience functional impairment during the moments in which behavior is unregulated (Kerkhof et al., 2011; Tokunaga, 2012), so escaping these states quickly is desirable.

Fifth, the manipulation in the Second Life platform did not generate differences in novelty perceptions between the familiar and unfamiliar environment groups. The manipulation that took place in Second Life was challenging because it was impossible to control the number of interactants, conversations, and other conditions in the dynamic virtual environment of Second Life. Although efforts were made to select virtual environments with very different shapes (i.e., familiar vs. unfamiliar objects), no differences in novelty perceptions were detected. The avatars of conversation partners in the virtual environment remained constant between the virtual environments given that they represented autonomous people also navigating through Second Life. It may be that the conversations in Second Life eclipse the environment in importance when users evaluate novelty. That is, novelty may be appraised by the novel interactions with others, not the illustrations in the virtual environment.

Sixth, the results of this investigation may be obfuscated by the restriction of variance in the psychosocial problems, boredom proneness, and self-reactive outcome expectation variables. The restricted variance may explain why no association was found between these variables and flow or DSR.

Directions for Future Research

Future areas of empirical investigation on DSR and media habits can be ascertained from this study. The area of research that requires foremost attention is the "negative consequences" stemming from DSR and media habits. A common extension of DSR models is the inclusion of functional impairment or these negative

consequences. DSR can "interfere with normal life activities, producing negative real world consequences (e.g., faltering relationships, failing grades) that in turn lead to deeper negative effects and a spiral of mounting media usage" (LaRose, Lai, Lange, Love, & Wu, 2006, p. 6). Yet, the methodology testing this extension in prior research cannot substantiate claims of consequence because cross-sectional data can only be used to support covariation, not causation. The methodology used in the present investigation holds promise for scholarly rigor in testing the causal relationships between DSR, media habits, and functional impairment. Further, the within-subjects design may refine future attempts at measuring negative consequences. Participants no longer need to estimate their declining relationships and vocation performance due to Internet use, things on which they have difficulty reporting. In its place, relational and vocational impairment can be assessed over time using measures of relational satisfaction, commitment, GPA, and present occupational productivity to observe impairment or gains.

A second area of future investigation extends from the indeterminate role of psychosocial problems, boredom proneness, and self-reactive outcome expectation in the findings of the present investigation. A large number of studies have substantiated, through cross-sectional and longitudinal designs, the role of psychosocial problems in motivating DSR (see Tokunaga & Rains, 2010 for review). However, psychosocial problems, boredom proneness, and self-reactive outcome expectation do not directly predict DSR in familiar stages of Second Life use. The inconsistency between cross-sectional, longitudinal, and experimental research

deserves further attention. Additionally, the nature of the relationships between DSR and psychosocial problems, boredom proneness, and self-reactive outcome expectation need to be better understood. LaRose et al. (2003) contend that these relationships are predicated on negative cognitive biases, stemming from the psychosocial problems or boredom proneness, that slight successful attempts at self-regulation. They also argue it may be the reinforcement experienced from Internet use that instigates operant conditioning, which then leads to DSR. A third explanation is based on the idea of limited resources; that is, the self-regulation over one behavior occurs at the cost of self-regulation over other behaviors. Managing the unpleasant moods associated with psychosocial problems, boredom proneness, or outcome expectation can come at the cost of regulation over Internet use. Future investigations should endeavor to clarify the discrepant explanations for these relationships.

Future investigations might also reconsider the growth patterns of DSR and media habits. The present study looked only at linear growth, but perhaps DSR and media habits develop in alternative, nonlinear patterns. Further, the timeframe of this study can be expanded to examine whether the relationships discovered in this investigation recur over time as theorized by others. This information can be valuable in understanding DSR and habits as a process beyond the very early stages of technology use.

Chapter Summary

Chapter 5 reviews the findings from the pretest and main studies, discusses the implications of these findings for research and theory of DSR and media habits, examines shortcomings of the project, and specifies possible areas of prospective inquiry. The basic model tested in this project was supported, and a significant contribution to theorizing about DSR was made in highlighting the importance of novelty perceptions of a technology. Although predictions about psychosocial problems, boredom proneness, and outcome expectation were not supported, the finding still provided valuable insight into the self-corrective mechanisms that work to reduce DSR after novelty decays. Future research must continue to not only answer some of the primary questions about DSR and media habit but explore other more complex questions as well. In the endeavor to answer questions fundamental to a better understanding of DSR and media habits, sophisticated and appropriate methodological approaches must be employed.

APPENDIX A

PERCEIVED NOVELTY SCALE

1. Second Life makes me think about technologies in a different way.
2. Second Life is new to me.
3. Second Life introduced a novel perspective to my views about online technologies.
4. Second Life is familiar like other technologies I commonly use.*
5. There is novelty in Second Life.
6. Second Life satisfies my sense of curiosity.
7. Second Life offers novel experiences.
8. Second Life makes me feel like I'm exploring new worlds.

APPENDIX B

INTERACTION ANXIOUSNESS SCALE

1. I often feel nervous even in casual get-togethers.
2. I usually feel uncomfortable when I am in a group of people I don't know.
3. I am usually at ease when I am speaking to a member of the opposite sex.
4. Parties make me feel anxious and uncomfortable.
5. I am probably less shy in social interactions than most people.*
6. I sometime feel tense when talking to people of my own sex if I don't know them very well.
7. I wish I had more confidence in social situations.
8. I seldom feel anxious in social situations.*
9. In general, I am a shy person.
10. I often feel nervous when talking to a person I am attracted to.
11. I usually feel relaxed around other people, even people who are quite different from me.*

* Item is reverse-coded.

APPENDIX C

UCLA LONELINESS SCALE

1. I lack companionship.
2. There is no one I can turn to.
3. I am an outgoing person.*
4. I feel left out.
5. I feel isolated from others.
6. I can find companionship when I want it.*
7. I am unhappy being so withdrawn.
8. People are around me but not with me.

* Item is reverse-coded.

APPENDIX D

CENTER FOR EPIDEMIOLOGIC STUDIES DEPRESSION SCALE

1. I feel my life has been a failure.
2. I feel fearful.
3. I feel that I am just as good as other people.*
4. People are unfriendly.
5. I feel that I cannot shake of the blues even with the help of my family or friends.
6. I am bothered by things that usually don't bother me.
7. I feel that everything I do is an effort.
8. I feel hopeful about the future.*
9. I feel lonely.
10. I have trouble keeping my mind on what I am doing.

APPENDIX E

BOREDOM PRONENESS SCALE

1. It is easy for me to concentrate on my activities.
2. I find it easy to entertain myself.
3. I get a kick out of most things I do.
4. In any situation I can usually find something to do or see to keep me interested.
5. Many people would say that I am a creative or imaginative person.
6. Among my friends, I am the one who keeps doing something the longest.
7. I often become bored with the various activities I do.
8. I quickly lose interest in activities despite how exciting they are.

APPENDIX F

SELF-REACTIVE OUTCOME EXPECTATION

1. Using the Internet, how likely am I to cheer myself up.
2. Using the Internet, how likely am I to play a game I like.
3. Using the Internet, how likely am I to feel entertained.
4. Using the Internet, how likely am I to get support from others.
5. Using the Internet, how likely am I to find something to talk about.
6. Using the Internet, how likely am I to feel like I belong to a group.
7. Using the Internet, how likely am I to maintain a relationship I value.
8. Using the Internet, how likely am I to provide help to others.
9. Using the Internet, how likely am I to relieve boredom.
10. Using the Internet, how likely am I to find a way to pass the time.
11. Using the Internet, how likely am I to feel less lonely.
12. Using the Internet, how likely am I to forget my problems.
13. Using the Internet, how likely am I to feel relaxed.
14. Using the Internet, how likely am I to find others who respect my views.
15. Using the Internet, how likely am I to find people like me.
16. Using the Internet, how likely am I to improve my future prospects in life.

APPENDIX G

FLOW EXPERIENCE SCALE

1. I love the feeling of participating in Second Life.
2. Participating in Second Life gives me a feeling of satisfaction.
3. I am able to participate in Second Life without having to think about it.
4. My performance in Second Life is automatically done.
5. I am totally concentrated while on Second Life.
6. Second Life blocks out other distractions.
7. When on Second Life, my attention is entirely focused.

APPENDIX H

DEFICIENT SELF-REGULATION SCALE

1. When I haven't been online for some time, I become preoccupied with the thought of participating on Second Life. [a]
2. I would feel lost if I were unable to go on to Second Life. [a]
3. I persistently think about Second Life when I am offline. [a]
4. I logon to Second Life so much it interferences with my thoughts. [a]
5. I find it difficult to stop thinking about Second Life. [a]
6. I have difficulty controlling the amount of time I spend on Second Life. [b]
7. I find it difficult to control my Internet use when I'm using Second Life. [b]
8. When offline, I have a hard time trying to resist the urge to go on Second Life. [b]
9. I sometimes have to struggle to limit my use of Second Life. [b]
10. My use of Second Life is out of control. [b]

[a] Items measuring cognitive preoccupations. [b] Items measuring uncontrolled use (called compulsive use in the original scale).

APPENDIX I

HABIT FORMATION SCALE

1. Second Life has become a part of my usual routine.
2. Using Second Life is a habit I've gotten into.
3. I use Second Life without really thinking about it.
4. I would miss Second Life if I could not use it anymore.
5. I use Second Life automatically.
6. I use Second Life without having to consciously remember.
7. It makes me feel weird when I do not use Second Life.
8. I start using Second Life before I realize I'm doing it.
9. I have no need to think about using Second Life.
10. Using Second Life is something typically "me."

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