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Proposing the Multimotive Information Systems Continuance Model (MISC) to Better Explain End-User System Evaluations and Continuance Intentions

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Abstract

To ensure that users want to continue using a system, information system designers must consider the influence of users' intrinsic motivations in addition to commonly studied extrinsic motivations. In an attempt to address this need, several studies have extended models of extrinsic motivation to include intrinsic variables. However, these studies largely downplay the role of users' intrinsic motivations in predicting system use and how this role differs from that of extrinsic motivation. The role of met and unmet expectations related to system use is often excluded from extant models, and their function as cocreators in user evaluations has not been sufficiently explained. Even though expectations are a firmly established consequence of motivations and an antecedent of interaction evaluations, this area remains understudied. Our paper addresses these gaps by developing and testing a comprehensive model—the multimotive information systems continuance model (MISC)—that (1) explains more accurately and thoroughly the roles of intrinsic and extrinsic motivations, (2) explains how the fulfillment of intrinsic and extrinsic motivations affects systems-use outcome variables differently through met expectations, and (3) accounts for the effects of key design constructs.

Keywords: *Expectations, Intrinsic Motivations, Extrinsic Motivations, Hedonic Motivations, Disconfirmation, Continuance, User Beliefs, Satisfaction, Hedonics, Gaming, Utilitarian Systems, Design Aesthetics, Ease of Use, Usefulness, Design-Expectations Fit.*

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Proposing the Multimotive Information Systems Continuance Model (MISC) to Better Explain End-User System Evaluations and Continuance Intentions

1. Introduction

Most extant models of user perceptions and evaluations of information systems focus on fulfilling users' extrinsic motivations, such as desires for productivity, efficiency, and general utility (e.g., Davis, 1989; Kim & Kankanhalli, 2009). These models, however, do not fully explain the range of intrinsic and extrinsic motivations that influence these outcome variables (van der Heijden, 2004). Intrinsic motivations in particular have been shown to be a strong predictor of meaningful user outcomes, such as satisfaction, continuance intentions, and perceived performance (Cyr, Head, & Ivanov, 2009a; Hsu & Lu, 2004; 2007; Li, Hsieh, & Rai, 2009; Lim & Cyr, 2009; Sweetser & Wyeth, 2005). Differentiating between users' intrinsic and extrinsic motives—and the stimuli that fulfill these motives—is particularly relevant for encouraging positive user interactions (Davis, Bagozzi, & Warshaw, 1992). These ideas are also highly pertinent to the newer idea of gamification that is starting revolutionize systems design, which we can define as "enriching products, services, and information systems with game-design elements to positively influence motivation, productivity, and behaviour of users" (Blohm & Leimeister, 2013, p. 4; see also Harmari & Koivisto 2015).

To identify key differences between intrinsic and extrinsic motivations, several studies have extended extrinsic motivation models or created new models to address users' intrinsic motivations (Agarwal & Karahanna, 2000; Cyr et al., 2009a; Hsu & Lu, 2004; 2007; Hwang, 2005; Koufaris, 2002; Li et al., 2009; Lim & Cyr, 2009; Saade & Bahli, 2005; Venkatesh, 2000; Wakefield & Whitten, 2006). However, models predicting intrinsic motives of system use often ignore extrinsic motives (e.g., Chen, 2007; Cheng & Cairns, 2005; Choi & Kim, 2004; Hsu & Lu, 2004; McMahan, 2003; Sweetser & Wyeth, 2005; Yee, 2006). To our knowledge, no study has proposed a model that can generalize across normally conflicting motives for a user's satisfaction, continuance intentions, and evaluations of system performance. Additionally, most studies do not conceptualize the different types of intrinsic motivation (e.g., hedonic motives like play versus intrinsic motives like learning) and do not measure the successful fulfillment of intrinsic motivations independently of that of extrinsic motivations. These underdeveloped constructs potentially confound existing studies on system use and thus make such studies difficult to interpret or at least difficult to generalize across various types of systems. This gap also holds back the theoretical and empirical advancement of gamification.

Adding to this conversation is the firmly established relationship between motivations and expectations (Cyr & Head, 2008; Gnoth, 1997; Lazarus, 1982; Leventhal & Scherer, 1987; Lim & Cyr, 2009; Zeithaml, Berry, & Parasuraman, 1993). Motivations are a direct antecedent of expectations, and expectations are a key component of all interactions (Bonito, Burgoon, & Bengtsson, 1999; Burgoon, 1993; Burgoon & Le Poire, 1993). Thus, to address the issue of nomological completeness, researchers must also consider the role of expectations in system use. This has been done successfully for predicting continuance in an extrinsic-only context by Bhattacherjee & Premkumar (2004). Accordingly, we build on their model to propose a new theoretical model, the multimotive information systems continuance model (MISC), which explains and predicts the discrete cognitive processes through which systems fulfill a range of motives and expectations and how this fulfillment leads to continuance intentions. The MISC also accounts for design constructs that have the potential to contribute to or confound any study on system use: design aesthetics, perceived ease of use, and design-expectations fit.

In this study, we address these opportunities by developing and testing the MISC in a 3 × 3 experiment involving three primary motives and expectations: hedonic (via joy), intrinsic (via learning), and extrinsic (via usefulness). We tested them across three different information systems contexts: online gaming (hedonic), online learning (intrinsic), and online paid work (extrinsic). The MISC was largely supported across the various systems and motivations and, thus, provides several interesting implications for research and practice. Thus, our model has the potential to improve the understanding of relationships among motivations, expectations, design intent, design features, and user evaluations of multiple types of information systems.

2. The Multimotive Information Systems Continuance Model (MISC)

We first provide an in-depth theoretical background on the MISC's key components by explaining our theoretical foundation, which consists of expectations-disconfirmation theory (EDT)[1] and the Bhattacherjee & Premkumar (2004) model. Given this foundation, we propose two major extensions to the latter model that serve as the foundation of the MISC: (1) we add three additional predictors of disconfirmation: design-expectations fit, perceived ease of use, and design aesthetics; and (2) aside from extrinsic motivations, we include two possible intrinsic motivations, intrinsic-hedonic (i.e., "hedonic") and other intrinsic motivations (i.e., "intrinsic") and explain these in great detail in a systems-use context.

2.1 Expectations-Disconfirmation Theory (EDT)

A host of theories in the fields of communication, sociology, psychology, marketing, and management have incorporated principles of expectation confirmation (Brown, Venkatesh, Kuruzovich, & Massey, 2008; Burgoon, Le Poire, & Rosenthal, 1995; Oliver, 1980) and expectation disconfirmation (Baumgardner & Brownlee, 1987; Churchill & Surprenant, 1982; Neuberg, Judice, Virdin, & Carrillo, 1993; Oliver, 1977; Spreng, MacKenzie, & Olshavsky, 1996; Swann, 1987). Sometimes referred to as met-expectations theories (Brown et al., 2008), these theoretical models concern whether or not an experience conforms to one's expectations. Most studies using an expectancy-confirmation or expectancy-disconfirmation paradigm posit that an individual's expectations largely determine the overall satisfaction with a given object, person, service, or product.

"Expectations" refers to one's beliefs about future events (Bhattacherjee, 2001; Churchill & Surprenant, 1982; Oliver, 1977). By nature, the human mind projects and considers future scenarios to anticipate required actions, for both survival and social acceptance (Suddendorf & Busby, 2005; Suddendorf & Corballis, 2007). "Disconfirmation" is the extent to which an event is evaluated as either exceeding or falling short of expectations (Bhattacherjee, 2001; Churchill & Surprenant, 1982; Oliver, 1977).

2.2. Bhattacherjee and Premkumar's (2004) EDT-Based Model

Bhattacherjee & Premkumar (2004) developed an EDT-based model to explain changes in beliefs and attitudes toward information technology (IT) usage (we abbreviate this as "the B&P model"). We extend the B&P model and its measurement approach to build the MISC because the B&P model offers a parsimonious means of capturing and explaining expectations, disconfirmation, and related constructs across multiple periods. Unlike EDT, the focus of the B&P model is to explain continuance intentions, which is also our phenomenon of interest. The B&P model also measures and explains effects over multiple periods. In period t_1, the researchers provided an overview and training on a computer-based training (CBT) product and introduced students to one of its training modules. Before use, the researchers asked participants to express their attitudes about the CBT software product and its degree of likely usefulness. Importantly, the degree of likely usefulness was used as a surrogate for the users' extrinsic expectations of system use.

In period t_2 (after participants had used the CBT system), the researchers asked questions to ascertain the users' perceived level of disconfirmation regarding their initial attitude, anticipated satisfaction, expectations of usefulness, and usage intentions based on actual usage of the CBT system. Thus, usefulness$_{t2}$ in this model is essentially equivalent to beliefs about potential extrinsic performance. Figure 1 shows the basic model. In the remainder of this section, we explain the foundation of EDT and how the B&P model adapted EDT for its purposes in predicting continuance. We assume and build on these constructs and relationships for the MISC.

First, EDT explains that positive expectations increase positive disconfirmation. "Disconfirmation" is a cognitive process that results from comparing expectations to perceived performance (Brown et al., 2008). "Positive disconfirmation" results when perceived performance exceeds expectations, thereby causing

[1] Several studies in this line of research refer to related models as "expectancy disconfirmation" (Burgoon, 1993; Burgoon & Le Poire, 1993; Oliver, 1977).

satisfaction (Oliver, 1980; Spreng et al., 1996; Tversky & Kahneman, 1974). "Negative disconfirmation" occurs when performance falls below expectations, causing dissatisfaction (Spreng et al., 1996).

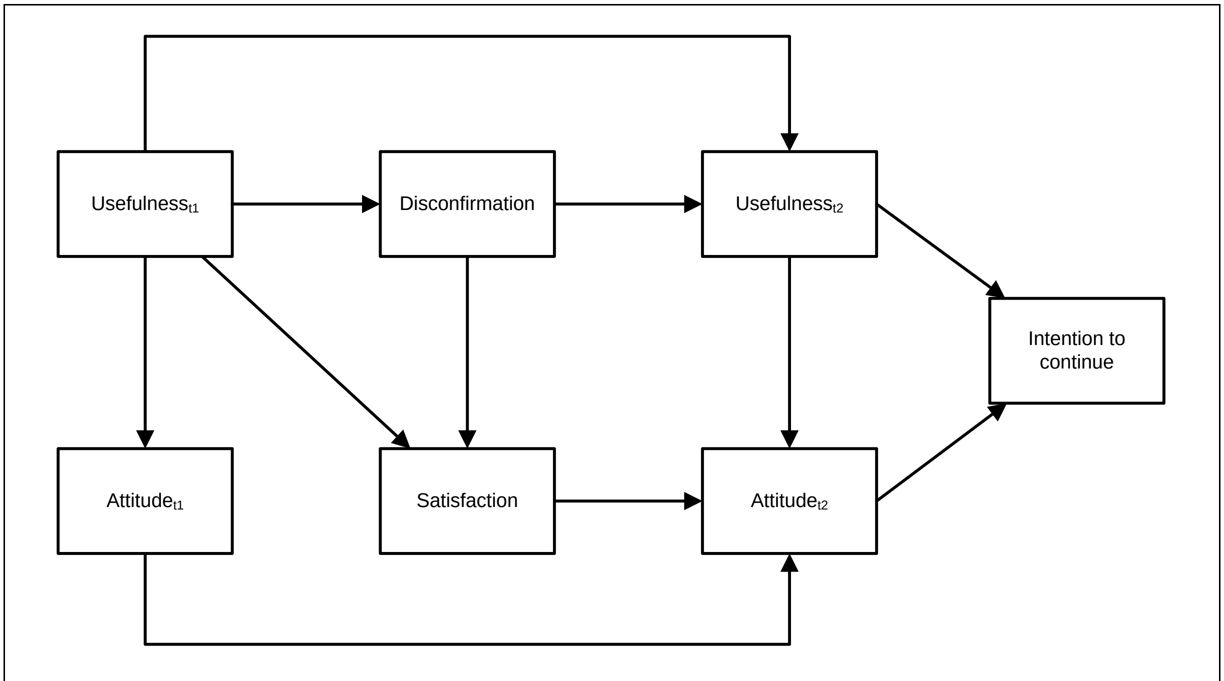

Figure 1. Bhattacherjee and Premkumar's (2004) Model

Second, EDT predicts that expectations increase performance evaluations. "Performance" refers to a user's beliefs about how a system actually performed (Bhattacherjee, 2001; Briggs, Reinig, & de Vreede, 2008; Spreng et al., 1996). EDT predicts that one's general expectations will positively influence one's performance beliefs (Oliver, 1980). The positive relationship between expectations and beliefs can be explained by anchoring theory (Tversky & Kahneman, 1974), which posits that one is likely to rely heavily on known information (i.e., the anchor) when making an assessment. Hence, expectations can act as an anchor and skew one's beliefs about performance toward the expectations (Oliver, 1980)[2].

EDT also predicts that disconfirmation positively affects satisfaction (Oliver, 1977; Oliver, 1980; Spreng et al., 1996). From a systems perspective, "satisfaction" is a positive cognitive and emotional evaluation—resulting in a sense of contentment and fulfillment—that represents the degree to which one's expectations of a systems experience are fulfilled based on how one perceives the system's performance (Au, Ngai, & Cheng, 2008; Bhattacherjee, 2001; Wixom & Todd, 2005). Thus, a person could have a pleasant experience or have positive emotions, but, if their expectations are not met (i.e., they expected much better performance and thus experienced negative disconfirmation), they might display dissatisfaction (Hunt, 1977; Oliver, 1977; 1980; Spreng et al., 1996). Several studies (e.g., Bhattacherjee, 2001; Liao, Chen, & Yen, 2007; Lowry, Romano, Jenkins, & Guthrie, 2009b; McKinney, Kanghyun, & Fatemeh, 2002; Wixom & Todd, 2005) have found a significant link between disconfirmation and satisfaction.

Departing from EDT, the B&P model adds the important theoretical construct of attitude, which we also incorporate. Formally, "attitude" is the degree to which a person likes or dislikes a behavior (Ajzen, 1991; Fishbein & Ajzen, 1975); thus, attitude naturally can have either a positive or negative valence. Attitude is a key addition because numerous studies have shown that it directly affects

[2] Similarly, an anchoring effect is likely present between expectations and positive disconfirmation. A seminal EDT study found that high expectations yielded higher ratings than low expectations at every disconfirmation level (Oliver, 1977). This relationship is correspondingly explained by social judgment theory (Sherif & Hovland, 1961; Spreng et al., 1996), which states that attitudes, perceptions, and expectations do not shift freely but are "sticky" (i.e., resistant to change).

system usage intentions, based on the theory of reasoned action and the theory of planned behavior (Ajzen, 1991; Fishbein & Ajzen, 1975).

Motivations and subsequent expectations should directly affect attitude. If a user is highly motivated to use a technology, the user will have more positive expectations and subsequently a more positive attitude toward using the technology. This highly interdependent link between motivations and attitude is well established (Gagne & Deci, 2005; Judge, Thoresen, Pucik, & Welbourne, 1999; Peak, 1955). For example, Gagne & Deci (2005) have found that an increase in motivation (and therefore expectations) is associated with improved attitudes toward work.

Given the influence of a positive attitude on intentions, as shown in literature on the theory of reasoned action and the theory of planned behavior (Ajzen, 1991; Fishbein & Ajzen, 1975), the B&P model links $attitude_{t1}$ to satisfaction, links satisfaction to $attitude_{t2}$, and anchors $attitude_{t1}$ to $attitude_{t2}$. Given the intertwined relationships between attitude and satisfaction, the B&P model reasons that, if expectations predict $attitude_{t1}$ and $attitude_{t1}$ predicts satisfaction, then expectations will likely predict satisfaction. Finally, the B&P model explains that disconfirmation drives beliefs about potential performance, which increases intentions to continue. Likewise, a positive belief improves $attitude_{t2}$, and a positive $attitude_{t2}$ increases intentions to continue.

2.3. How to Improve the B&P Model and EDT-Based System Continuance Models

Notably, the B&P model provides strong results and high R^2s in predicting continuance with technology usage based on extrinsic motivations (i.e., usefulness). Despite this strong foundation, the B&P model and EDT-based systems models in general have two important shortcomings. The first issue that arises from the B&P model is that its R^2s for predicting disconfirmation are very low (although the R^2s for the other constructs are high). For example, the B&P model's R^2 for disconfirmation for initial usage is only 0.09. The EDT literature is rife with related issues (Khalifa & Liu, 2004). Brown et al. (2008) compared three different kinds of expectation-confirmation models in an extrinsic context and concluded that expectations and disconfirmation were not relevant predictors and that, instead, satisfaction should be predicted by performance only, which is consistent with prior findings (e.g., Spreng et al., 1996). Similar to Bhattacherjee & Premkumar (2004), Brown et al. (2008) employed usefulness as the core extrinsic expectation predictor (and added perceived ease of use, assuming that it was a broadly held expectation). Liao et al. (2007) combined EDT with the theory of planned behavior (TPB) in a learning-systems continuance context. They measured disconfirmation but offered no predictors of it (i.e., expectations) and contradicted EDT and the model developed by Brown et al. (2008) by using disconfirmation as a predictor of usefulness and ease of use. Moreover, Lowry et al. (2009b) used EDT in an intrinsically motivated learning context but focused on performance as the key driver of satisfaction instead of measuring disconfirmation. Another study used cognitive absorption as a more focused expectation driver in a hedonic context and was able to increase the disconfirmation R^2 to 0.19 (Deng, Turner, Gehling, & Prince, 2010); however, this R^2 is still lower than the typically desirable thresholds of R^2 above 0.20.

These mixed results call into question the role of expectations as an important driver of these models in a systems context and the ability of the B&P model and similar models to adequately represent systems-related expectations. These problems inspire the two research questions that drive our model development and empirical testing:

> **RQ1:** *Are expectations and disconfirmation important drivers of system continuance, or should predictions be based solely on performance beliefs? If disconfirmation matters, what is the best way to represent and measure the underlying expectations that drive disconfirmation and continuance?*

> **RQ2:** *Should system continuance models be built for motivations other than extrinsic motivations? If so, which motivations should be accounted for, and how can a model be built that accounts for these but is still generalizable and succinct?*

We address these questions in turn in the next two sections.

2.4. Improvement #1: Adding Predictors of Disconfirmation to the B&P Model in the Form of Expectations

In adding predictors of disconfirmation to the B&P model, we are attempting to strengthen the model's ability to express and measure the user expectations that drive disconfirmation in the context of system use. In examining usefulness beliefs as an outcome, the B&P model expresses expectations in terms of likely usefulness. We reason that there is certainly more to a user's expectations in interacting with a system, even if the primary goal is usefulness. To address this issue further, we first turn to the literature on motivations and expectations.

An important theoretical detail not thoroughly explained in the B&P model, or in most EDT literature, is the source of expectations[3]. Thus, in this section, we explain the important link between motivations for using a system and expectations for using a system because this relates to how we manipulate expectations (see Section 3). "Expectations" are a user's beliefs about how a system ought to perform (e.g., a system's ease of use, usefulness, and ability to induce pleasure) (Bhattacherjee, 2001; Briggs et al., 2008; Spreng et al., 1996). The link between motivations and expectations is fundamentally a link between emotion and cognition (Gnoth, 1997; Lazarus, 1982; Leventhal & Scherer, 1987).

Initially, "motivations" are emotional responses to needs and desires concerning an anticipated experience (Leventhal & Scherer, 1987). As these emotions register cognitively, the individual begins to formulate expectations based on these motivations regarding the anticipated experience. Motivations are thus a direct antecedent of expectations at a fundamental level, and expectations reflect one's motivations. This relationship is intuitive because motivations are fundamentally driven by innate needs that a person expects to meet before moving on to higher-order needs (Deci & Ryan, 2002; e.g., Vallerand, 1997)[4]. In research practice, however, expectations instead of motivations are typically directly measured because expectations are closer to a person's cognition and can be more easily expressed (Bhattacherjee, 2001; Bhattacherjee & Premkumar, 2004). We follow this practice for the sake of theoretical succinctness.

Given this deeper understanding of expectations, we believe the B&P model inadequately addresses expectations a user might have for a system, even in cases where the user's interaction with the system is oriented primarily toward usefulness. We thus believe the B&P model has low R^2s for disconfirmation because usefulness is only one part of the user's interaction expectation. To investigate this possibility further, we scoured the information systems (IS) and human-computer interaction (HCI)-related literature for established constructs and studies related to system-interaction expectations that could apply to a broad range of system uses. In this section, we propose adding three constructs to the B&P model to capture these expectations better: design-expectations fit, perceived ease of use, and aesthetics. In keeping with the B&P model, we predict that these expectations will directly affect not only disconfirmation but also performance beliefs. Figure 2 depicts this extension of the B&P model. We now explain the added constructs in turn.

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[3] In the B&P model, these sources of expectations are summed up as communications and "other antecedents", explained as "second-hand information, such as vendor claims or industry reports, communicated via interpersonal or mass media channels", which were "beyond the scope of this study".

[4] To illustrate, when a user becomes aware of a potential interaction with a system, the user experiences an initial emotional response to that anticipated experience. For example, the user might have a positive emotional response if the anticipated experience is going to involve a useful and easy-to-use new software application. This positive emotional response motivates the user to desire the anticipated experience, and the user begins to form expectations regarding the experience. For example, the user could expect this new software application to make work simpler, more efficient, and more productive.

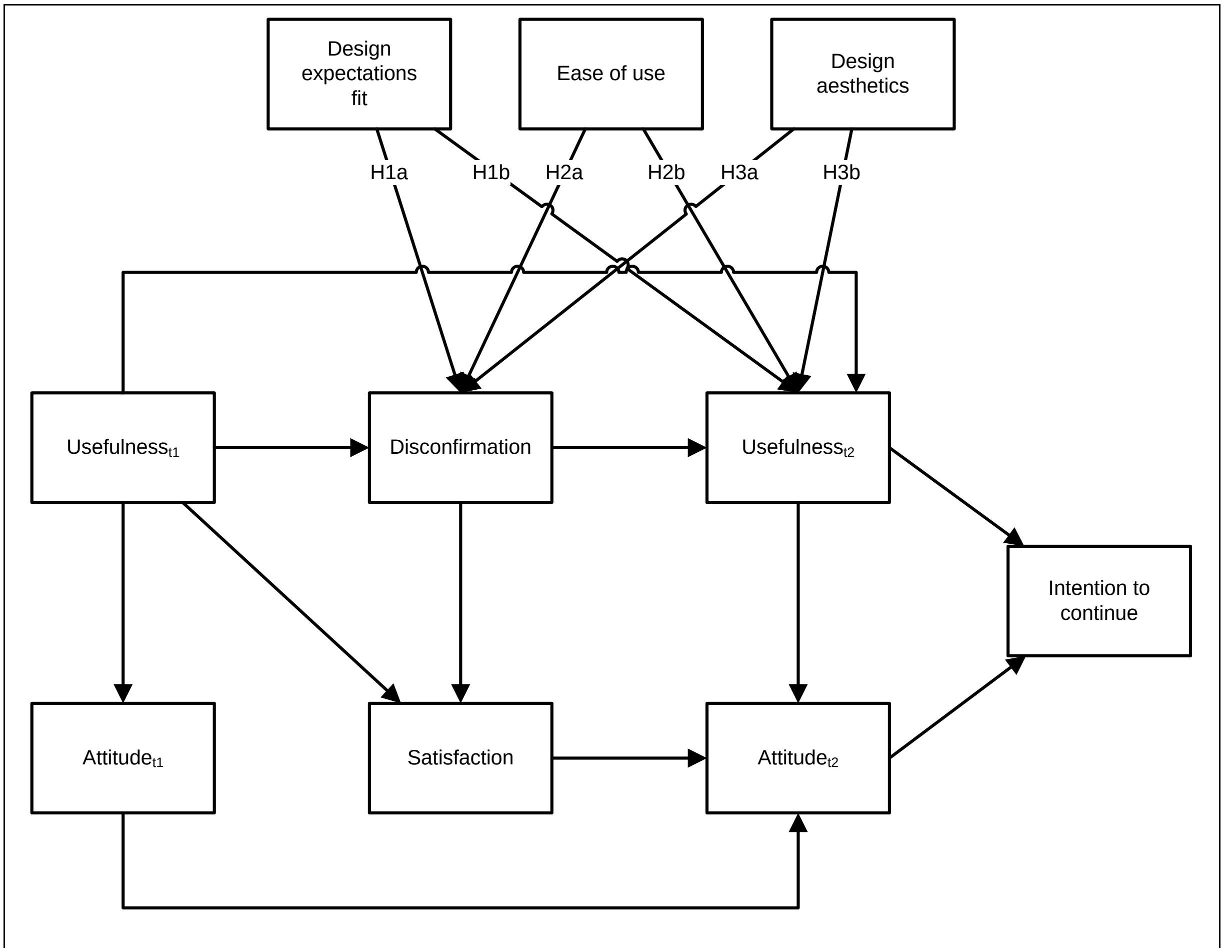

Figure 2. Extending the B&P Model for Three Additional Expectations Common to Many Kinds of System Use

2.5. Adding Design-Expectations Fit (DEF) as a Key Expectation in the B&P Model

Our discovery that previous system-related EDT models do not account for the relationship (or fit) between technology and task represents a central impetus for our extension of the B&P model. Task-technology fit (TTF) has been established as a potentially powerful construct in all systems-use research, and, if it is not accounted for, it might significantly confound the results (Goodhue, 2006). Thus, we believe it behooves us to measure and explain the likely effects of TTF on the disconfirmation process as a core expectation. In our context, we conceptualize the fit between technology and task as more specific than is typically found in the TTF literature. Namely, we focus on the fit between the design of the technology and the expected task, which we term "design-expectations fit" (DEF).

As an illustration of DEF, if a user expects to interact with a technology that will fulfill intrinsic motivations (e.g., a video game) when the design of the technology is geared toward satisfying extrinsic motivations (e.g., spreadsheet software), the associated DEF will be low. However, when expectations of the task match the design, DEF will be high. Based on this conceptualization, we posit that increases in DEF will correspond with increases in disconfirmation (whether intrinsic and/or extrinsic) because a positive disconfirmation will be much less restrained for higher levels of DEF.

For example, if a user expects to satisfy hedonic motivations when the technology is designed with that intent, then the interaction experience will not be inhibited by a mismatch between expectations and design, whereas the presence of such a mismatch will negatively influence the evaluation (disconfirmation) of the interaction experience. Consequently, we build on the well-established TTF literature and extend it to DEF to explain that when technologies have been designed to fit the use expectations of the user, the technology will be evaluated more favorably (Dishaw & Strong, 1999; Goodhue, 2006; Goodhue & Thompson, 1995; Jiang & Benbasat, 2007) and, thus, positively impact disconfirmation and performance beliefs. Accordingly, we hypothesize the following:

H1: *An increase in DEF leads to a corresponding increase in (1) disconfirmation and (2) performance beliefs.*

2.5.1. Adding Perceived Ease of Use as a Key Expectation in the B&P Model

Similarly, it is important to identify other rival predictors that could potentially serve as system-related expectations across a broad range of uses and, thus, affect disconfirmation judgments—especially in cases where the interaction is unusually good or bad. Widely known rival predictors include "perceived ease of use" (PEOU) and "design aesthetics" (Cyr, Head, & Ivanov, 2006; Li & Yeh, 2010). We address PEOU in this section and design aesthetics in the next section.

PEOU is defined as the degree to which the user perceives that using the system will be free of effort (Davis, 1989; Venkatesh, Morris, Davis, & Davis, 2003). Given the consensus on the importance of PEOU (e.g., Lowry, Gaskin, Twyman, Hammer, & Roberts, 2013a; Sun & Zhang, 2006; van der Heijden, 2004; Venkatesh, 2000), one can argue that PEOU is a basic expectation of system use. The reasoning behind this relationship is much the same as for DEF. Namely, if a technology is easy to use, then the design of the technology does not inhibit positive evaluations (disconfirmations) of the interaction, whereas if a technology is difficult to use, this difficulty inhibits the user from enjoying a positive interaction experience. For similar reasons, Brown et al. (2008) argue that PEOU, along with perceived usefulness, is a baseline expectation in their extrinsic EDT context.

In the context of e-service use, Liao et al. (2007) have found a significant relationship between PEOU and disconfirmation, although they hypothesize that the direction of causality is from disconfirmation to PEOU. Similarly, Thong, Hong, & Tam (2006) have found a significant relationship between disconfirmation and PEOU in the context of mobile Internet services and also posit that the direction of causality is from disconfirmation to PEOU. In contrast, we argue that causality originates from PEOU because disconfirmation can be assessed only after the perceived performance of the system is compared to recalled expectations. Because the PEOU of the system helps to determine performance beliefs, we argue that PEOU acts as an expectation that predicts disconfirmation. Thus, we hypothesize the following:

H2: *An increase in perceived ease of use leads to a corresponding increase in (1) disconfirmation and (2) performance beliefs.*

2.5.2. Adding Design Aesthetics as a Key Expectation in the B&P Model

Design aesthetics is the other promising rival predictor for expectations that we found, especially in more recent literature. "Design aesthetics" refers to the appropriateness and professionalism of the user interface (Cyr et al., 2006; Cyr, Head, Larios, & Pan, 2009b; Li & Yeh, 2010). A user interface that is aesthetically appealing and appropriately and professionally designed is, ceteris paribus, likely to be evaluated preferentially over one that is less appealing (Cyr et al., 2009b). For example, a website that is organized according to accepted norms (search box at the top right, contact information at the bottom center, etc.), uses neutral colors and tones, and displays information concisely will not inhibit positive user evaluations of the interaction experience (Palmer, 2002). However, distracting and unprofessional designs potentially prevent positive experiences with a website because the user focuses on the distracting (and potentially confusing) design elements (Cyr et al., 2006; Li & Yeh; McCoy, Everard, & Loiacono, 2009). This has been specifically shown in a study that examines how presentation flaws negatively affect quality, trust, and intentions with online stores (Everard & Galletta, 2005). In contrast, systems with high-quality design aesthetics are more likely to be perceived as useful, easy to use, and enjoyable (Cyr et al., 2006; Cyr et al., 2009a; Kim & Malhotra, 2005), which will affect users' beliefs about the potential performance of the system. Because previous research has found that design aesthetics impact the perceived performance and satisfaction of a system (Cyr et al., 2006; Cyr et al., 2009a), we expect that the aesthetics will also serve as an expectation that predicts disconfirmation:

H3: *An increase in design aesthetics leads to a corresponding increase in (1) disconfirmation and (2) performance beliefs.*

2.6. Improvement #2: Accounting for Different Motivations that Might Drive the B&P Model Other than Extrinsic Motivations

The other fundamental shortcoming we identified in the B&P model is that it was built solely for extrinsic motivations. Again, this is a common limitation of EDT-based models. Differentiating between users' intrinsic and extrinsic motives—and the stimuli that fulfill these motives—is particularly relevant for encouraging positive user interactions (Davis et al., 1992). Several studies have extended extrinsic motivation models or created new models to address users' intrinsic motivations (Agarwal & Karahanna, 2000; Cyr et al., 2009a; Hsu & Lu, 2004; 2007; Hwang, 2005; Koufaris, 2002; Li et al., 2009; Lim & Cyr, 2009; Saade & Bahli, 2005; Venkatesh, 2000; Wakefield & Whitten, 2006). However, models that predict intrinsic motives of system use often ignore extrinsic motives as a possibility (e.g., Chen, 2007; Cheng & Cairns, 2005; Choi & Kim, 2004; Hsu & Lu, 2004; McMahan, 2003; Sweetser & Wyeth, 2005; Yee, 2006).

Consequently, in proposing the MISC, we make the key improvement of accounting for and measuring three dominant forms of motivations and performance beliefs: (1) intrinsic hedonic (which we term "hedonic" for brevity), (2) all other intrinsic motivations other than hedonic (which we term "intrinsic" for brevity), and (3) extrinsic. This final extension, depicted in Figure 3, completes our proposed model. Importantly, the expectations and disconfirmation will follow only one of these core routes (hedonic, intrinsic, or extrinsic)—not all three at the same time. However, for all motivation scenarios, we separately consider the three different kinds of possible performance beliefs (hedonic, intrinsic, and extrinsic) to consider all rival predictors, which has not been previously done in EDT research. Finally, none of these constructs is used in a formative manner. The remainder of this section explains in detail the theoretical background for these extensions[5].

Behavioral scholars traditionally refer to two types of human motivation: intrinsic and extrinsic. "Intrinsic motivation" can be generally cast in terms of what people will do without external inducement, and, conversely, "extrinsic motivation" can be generally cast in terms of what people will do as a result of external inducement (Malone, 1981; Malone & Lepper, 1987). Being intrinsically motivated does not mean, however, that a person fails to seek external rewards. It simply means that external rewards are not sufficient to keep a person motivated to persevere with a task in the absence of supplemental intrinsic motivations.

As a wide body of research has demonstrated, intrinsic motivations are closely tied to intrinsically related processes, expectations, and outcomes (e.g., Cyr & Head, 2008; Deci, 1975; Deci & Ryan, 1991a; 1991b; Li et al., 2009; Lim & Cyr, 2009; Lowry et al., 2013a; Shang, Chen, & Shen, 2005). Whereas extrinsic motivations are focused more on the outcome than on the process that leads to the outcome, intrinsic motivations are more concerned with the process that leads to the outcome (Deng et al., 2010). For example, a person who is intrinsically motivated to shop online is much more likely to want to savor and enjoy the experience and not just focus on the outcome of ordering goods (Childers, Carr, Peck, & Carson, 2001; Lim & Cyr, 2009; Mathwick, Malhotra, & Rigdon, 2001; Pentina, Prybutok, & Zhang, 2008; Shang et al., 2005).

[5] Note that DEF, PEOU, and design aesthetics are not motivations of system use but are general expectations held across all kinds of motivations for system use. Thus, all three should be relevant, regardless of whether a user's motivation is enjoyment, learning, or usefulness.

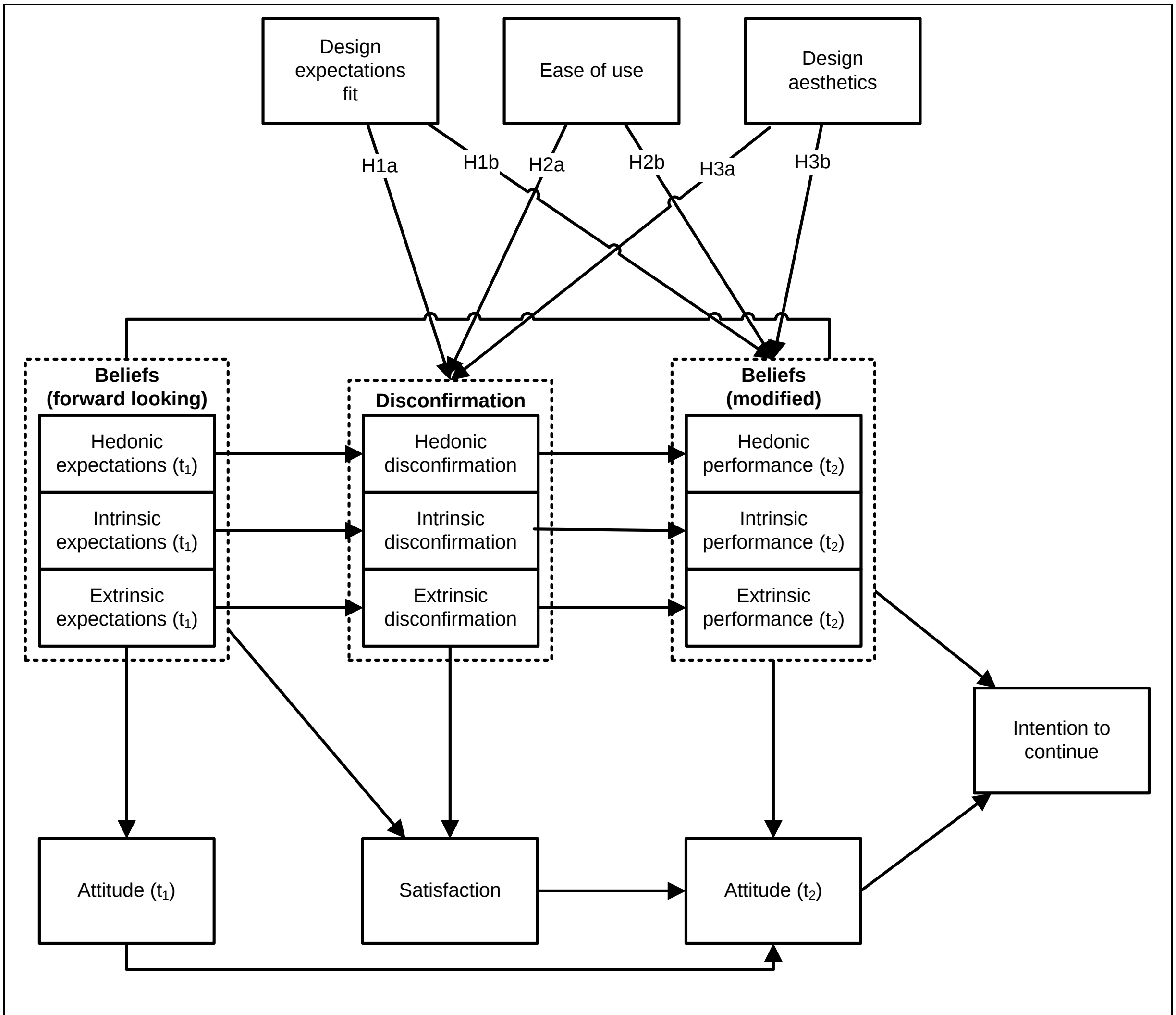

Figure 3. Final Proposed Multimotive Information Systems Continuance Model (MISC)

Importantly, classifying motivations and expectations as "intrinsic" or "extrinsic" does not adequately capture the array of motivations that drive expectations of system use. Those who specialize in this type of research—from the inception of research on extrinsic versus intrinsic motivations (e.g., Descartes & Voss, 1989; James, 1890; Maslow, 1943; McDougal, 1908; Murray, 1938) to the present day (e.g., Bishop, 2007; Lowry et al., 2013a; Olson, 2007; Reiss, 2004; Reiss, 2009)—have recommended a comprehensive and nuanced view of motivations (and consequently, expectations as well) rather than a simple dichotomy. However, such a comprehensive view conflicts with the need for theoretical succinctness and practicality in creating a generalizable model. Thus, as a middle ground, the MISC distinguishes between many sources of user motivations and expectations that can be summarized into three main types derived from an extensive literature review of the motivation research stream (a taxonomy is presented in Appendix A): (1) hedonic, (2) intrinsic, and (3) extrinsic.

"Hedonic" refers to behavior motivated by the mere feeling of pleasure and arousal (Lowry et al., 2013a; van der Heijden, 2004). Outside of hedonic motivations, "intrinsic" refers to behaviors induced by seeking satisfaction for other reasons, such as accomplishment, learning or enlightenment, and socialization (Bock, Zmud, Kim, & Lee, 2005; Son, 2011). Although fulfilling intrinsic motivations can provide some degree of pleasure and arousal, these feelings are not the primary goal of these motivations (Reiss, 2004). "Extrinsic" refers to behavior induced through a desire for an external outcome or avoidance of an undesired consequence (Bock et al., 2005), including desires to increase productivity or performance, to receive pay or benefits, to avoid threat or injury, to fulfill obligations, and to manipulate others.

Appendix A provides a detailed taxonomy of motivations and expectations, which we summarize in Table 1. Table 1 shows that hedonic motivations can be subcategorized as those dealing with (1) system pleasure and (2) system arousal. Intrinsic motivations are more varied and are categorized into three major groups: (1) system accomplishment, (2) system learning, and (3) system socialization. Finally, we found that extrinsic motivations could be grouped into two major categories: (1) positive extrinsic motivations and (2) negative extrinsic motivations. For the MISC, we do not account for negative intrinsic motivations for two primary reasons: (1) institutional human-subjects guidelines make this problematic for an experimental study, and (2) self-reported negative motives are less reliable than positive motives.

Table 1. Proposed Taxonomy of the Major Motivations for System Use

Motivation category	General motivation (desire for)	Specific motivation (desire for)
Hedonic	System pleasure	Play/enjoyment/fun
		Entertainment
		Sex/lust/pleasure
		Escape/relaxation
	System arousal	Challenge
		Satisfy curiosity/pique interest
		Explore/discover
		Stimulate utilitarian experience
		Sex/lust/arousal
Intrinsic	System accomplishment	Influence others
		Altruism
		Improve reputation/receive approval
		Leading effective/successful experiences
		Gaming achievement
		Autonomy/freedom
	System learning	Knowledge acquisition
		Knowledge sharing
		Computer-skill acquisition
		To be informed
	System socialization	Affiliation with community of interest
		Social communication
		Collaboration
		To play with others
		Romance/dating

Table 1. Proposed Taxonomy of the Major Motivations for System Use (cont.)

Motivation category	General motivation (desire for)	Specific motivation (desire for)
Positive extrinsic	System personal gain	Receive treatment/therapy
		Win tournaments for monetary gain and image enhancement
		Make money
	System transact	Buy products or services
		Fulfill obligations/requirements
	System improve work	Advertise/promote company
		Be more productive/increase performance
		Collaborate/communicate remotely
		Enhance decision making
Negative extrinsic	System self-preservation	Avoid threat or injury
	System harm others	Manipulate/extort others
		Cause injury
		Pursue revenge
		Carry out fanatical political agenda
	System misbehavior	Access proprietary information illegally
		Make mischief
		Computer abuse/noncompliance

To summarize this section, we conclude that, although the B&P model provides an excellent foundation that we build on to propose the MISC, it does not properly represent the range of system motivations users may have. The B&P model was designed specifically for the solitary extrinsic motivation of usefulness. In contrast, we show that systems literature demonstrates a great variety of motivations for system use, which we broadly categorize in this section as hedonic, intrinsic, and extrinsic motivations. The MISC takes the first step in accounting for these motivations by representing them in the model. If the MISC is an effective theoretical improvement, it should thus hold in these three major contexts. In this section, we lay out a detailed taxonomy of actual motivations demonstrated by the literature that can be further studied and operationalized to test the MISC in the three major motivational contexts. In Section 3, we propose a specific operationalized model to do just that.

3. Methodology

To test our model, we used a free-simulation experiment in which we gave participants different treatments in terms of systems or websites they were to interact with; the interactions, however, were much freer and much less controlled than they are in laboratory experimentation and without strict expectations on resulting manipulation levels (Burton-Jones & Straub, 2006; Gefen, Karahanna, & Straub, 2003a; Gefen, Karahanna, & Straub, 2003b). This approach has been established and widely used in the IS and HCI literature to increase realism and generalizability, as opposed to strict experimental controls that would make the research unrealistic in the given context (e.g., Burton-Jones & Straub, 2006; Gefen et al., 2003a; Gefen et al., 2003b; Lowry et al., 2012; Lowry, Vance, Moody, Beckman, & Read, 2008; Vance, Elie-Dit-Cosaque, & Straub, 2008). A key decision in free-simulation experiments is to retain all participant data—regardless of the actual direction of their manipulations—to simulate realistic system interaction. Thus, this approach is also not normally used with traditional experimental analysis techniques used for strict manipulation and treatment checks, such as ANOVA and MANOVA; instead, these studies virtually always test the results with path models that more naturally exhibit the participants' naturally formed exogenous and endogenous model variables—accounting for the natural variation that occurs in normal system use. We employed the same. To ensure sufficient variation to test our model, we provided the participants with a 3 × 3 manipulation, an approach also commonly used with free-simulation experimentation. At the first level of manipulation, we randomly primed participants to expect a hedonic, intrinsic, or extrinsic system interaction regardless of their starting motivation for the study. At the second level of manipulation, we gave participants, at random, an actual online experience oriented toward hedonic, intrinsic, or extrinsic motivations. Thus, nine treatments were possible (Table 2 summarizes). For each first-level manipulation, we ran the corresponding operational model from the MISC (enjoyment, learning, or usefulness) (Figure 4 summarizes).

Table 2. Treatments for Experimental Design

Treatment #	Primed expectations	Experimental design interface
1	Hedonic	Hedonic
2	Hedonic	Intrinsic
3	Hedonic	Extrinsic
4	Intrinsic	Hedonic
5	Intrinsic	Intrinsic
6	Intrinsic	Extrinsic
7	Extrinsic	Hedonic
8	Extrinsic	Intrinsic
9	Extrinsic	Extrinsic

3.1. Measures

Appendix B summarizes all measurement details. We asked the participants their gender, age, years of college completed, and years of computer experience as covariates and demographic variables. In terms of the main constructs of the MISC, we drew attitude$_{t1}$, attitude$_{t2}$, forward-looking beliefs (usefulness$_{t1}$), extrinsic disconfirmation (usefulness disconfirmation), satisfaction, and modified beliefs (usefulness$_{t2}$) from Bhattacherjee & Premkumar (2004). Intention to continue usage came from Galletta, Henry, McCoy, & Polak (2004); and Galletta, McCoy, Henry, & Polak (2006). We based DEF on the information fit-to-task construct by Kim & Stoel (2004). PEOU came from Venkatesh (2000). Design aesthetics came from Cyr et al. (2006).

We also added DEF, PEOU, and aesthetics as rival predictors of continuance intentions—aside from their roles in predicting disconfirmation. Regardless of the motivation context, we used the other two performance belief (PB) measures outside of the context as rival predictors of intention and attitude (we refer to these as PB-secondary and PB-tertiary in the operational model). For example, in the hedonic context, we used not only enjoyment as the main PB variable but also learning and usefulness as rival predictors. We added these rival predictors to explore the possibility that PBs outside of the baseline expectations might also affect attitudes and continuance.

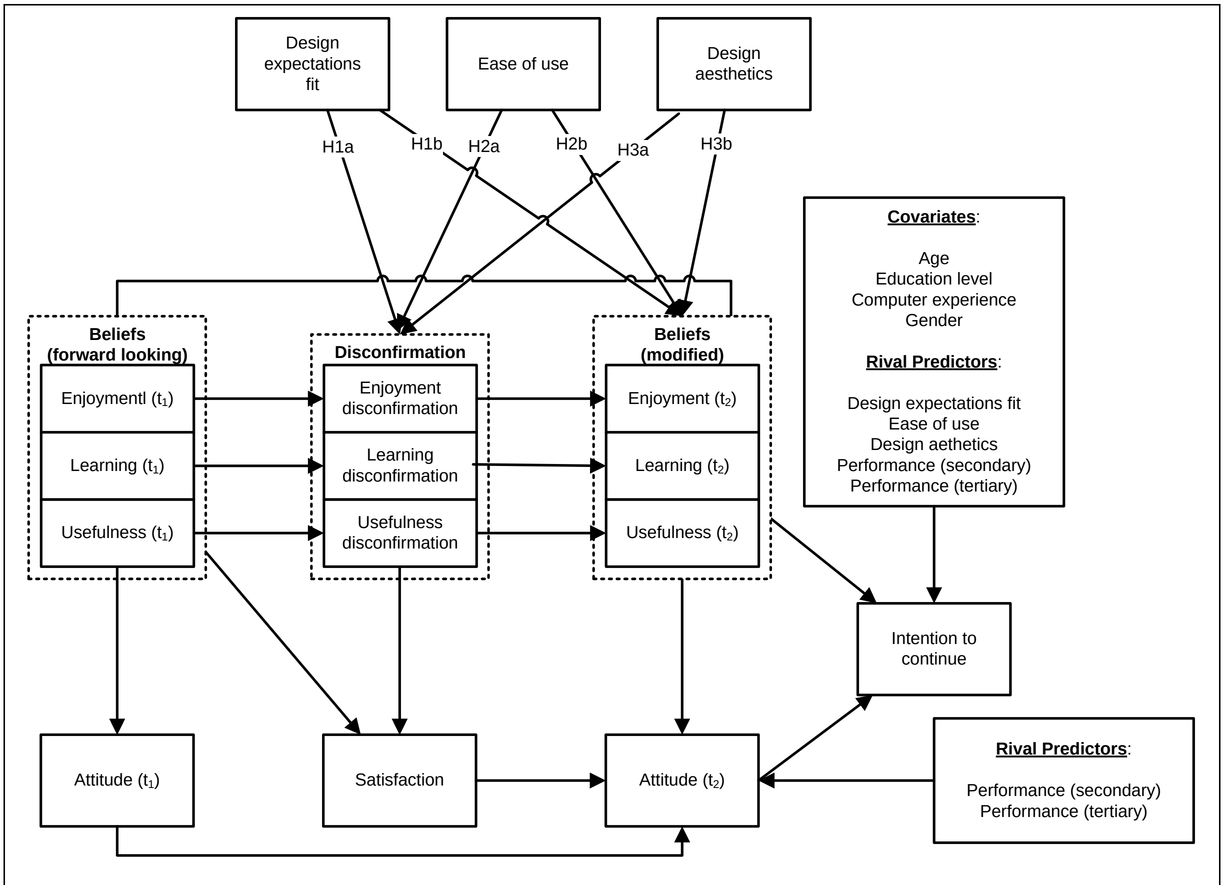

Figure 4. Operational Model to Test the MISC in Three Different Motivation Contexts

Many measures could have been used as surrogates for the main constructs in the MISC. However, we intentionally kept these choices simple to make the experiment more reasonable for the participants and to provide a straightforward test of the MISC. Accordingly, we took the baseline hedonic measure directly from van der Heijden (2004) in the form of enjoyment. Likewise, the baseline extrinsic measure was usefulness, the core extrinsic construct from Bhattacherjee & Premkumar (2004). We decided to root the intrinsic conditions, which could have been the most varied, in learning (knowledge growth), a measure developed by Chang, Yen, & Cheng (2009).

3.2. Participants

A total of 550 students enrolled in an introductory information systems course, required of all business school majors, at a large public university in Hong Kong participated in the experiment for extra credit. Human-subjects approval was granted, with all required protocols followed, including informed consent. Of the 550 responses, we removed 73 either for incompleteness or for not passing “attention trap” questions designed to see whether the participants were carefully reading and answering all the questions. Thus, we processed a total of 477 valid responses. Of these, the average age of the respondents was 20.37 years (1.29 years SD), average computer experience was 10.16 years (9.38 years SD), and average years of education was 14.42 years (2.88 years SD). A total of 232 (48.6%) of the participants were male; 245 (51.4%) were female. A total of 447 (93.7%) were from Hong Kong, mainland China, or Taiwan. Likewise, 94.3 percent considered themselves to be ethnically Chinese. All participants were fluent in English, and the experiment was conducted in English.

3.3. Procedures and Controls

We gave each participant a personalized link to the experimental site where they were allowed to complete the experiment only once. After entering demographic information, the participants were randomly assigned to one of the expectations-priming conditions: hedonic, intrinsic, or extrinsic. In each condition, the participants were told to imagine a specific scenario in which they were desiring to relax and have fun (hedonic condition), wanting to learn something new (intrinsic condition), or wanting to do something productive with a lot of free time (extrinsic condition). They were then told that they were about to be directed to a website that was designed to meet the expectations they had been given.

After introducing the basic scenario and priming the participants' expectations, we asked them about their attitude$_{t1}$ toward this situation, and then we asked for their expectations$_{t1}$, which matched their assigned system condition. At this point, the participants were randomly given a set of tasks to accomplish that involved hedonic, intrinsic, or extrinsic motivations. For the hedonic scenario, the participants were required to go to a specific gaming website, where they were required to play at least two games for five minutes each. On completing the games, the participants were then required to name and rate the games and report the amount of time they had spent playing each one. For the intrinsic scenario, the participants were required to go to Wikipedia to examine predictions by Ray Kurzweil. The participants were instructed to research the answers to three specific predictions. On completing their research, the participants were required to answer the three questions and report how much time they had spent on the website. For the extrinsic scenario, the participants were required to complete two jobs on Amazon Mechanical Turk and then report on the job types, amount paid, and time spent.

After completing their task, the participants were then asked to complete the disconfirmation measure that directly corresponded to their original primed expectations regardless of the randomly assigned system interaction. Those with hedonic expectations were asked to fill out a joy-disconfirmation measure, those with intrinsic expectations were asked to fill out a learning-disconfirmation measure, and those with extrinsic expectations were asked to fill out a usefulness-disconfirmation measure. After completing their assigned disconfirmation measure, the participants then completed the remainder of the post hoc experimental measures, which were the same for all treatments.

3.4. Pilot Test

Before running the full experiment with the 550 Chinese participants, we conducted a pilot test using 54 students at a large public university in the United States. The pilot allowed us to refine the experimental procedures, validate that the manipulations went in the intended direction, and help establish the validity and reliability of our instruments.

4. Analysis and Results

4.1. Manipulations

Our design was intended to manipulate each participant toward one set of expectations (hedonic, intrinsic, or extrinsic) and, based on this assignment, to then examine the disconfirmation of this specific expectation for three possible PB assignments (hedonic, intrinsic, or extrinsic). This means that there are nine treatments, and the forward-looking and modified belief manipulations match for only three of them. Again, this was done as a free-simulation experiment; thus, strict levels of manipulation were not crucial for testing our model or achieving our research results. Another reason for our use of a free-simulation experiment is that expectations and disconfirmations could not be fully controlled because the respondents still brought their own inner motivations and expectations to the experiment (this point is later demonstrated in the empirical results). Thus, telling a respondent that they were about to have a lot of fun and giving them games to play did not mean that, in reality, the respondent actually had fun or wanted to have fun. We simply tried to lead the respondents in a direction that would provide meaningful variation to test the efficacy of our model. Research on "priming" participants supports this approach (e.g., Dou, Lim, Su, Zhou, & Cui, 2010).

Tables 3–5 summarize our nine treatments and manipulations. Table 3 provides evidence that all three priming treatments are effective at producing above-average expectations of the primed motivation prior to participants' interactions with the actual system. We measured all expectation variables on 7-point Likert-type scales; thus, all average expectations for the primed expectation were well above neutral (all averages between *agree* and *strongly agree*), indicating successful priming.

Tables 4 and 5, however, indicate that the actual system-interaction treatments were successful only for the hedonic and intrinsic treatments. The extrinsic system interaction failed to produce both the highest levels of perceived usefulness and the highest disconfirmation of usefulness. Instead, the intrinsic interaction (designed for learning) was perceived to be more useful. This is further evidence that a human subject's motivations and outcomes can only be manipulated to a certain extent.

Table 3. Summary of Nine Treatment Manipulations via Expectations

Treat #	Scripted/ primed expectations	Motivation for which system is designed	Number of subjects per cell (n = 477)	Joy T1 (SD)	Learning T2 (SD)	Usefulness T2 (SD)
1	Hedonic	Hedonic	47	5.30 (1.30)		
2	Hedonic	Intrinsic	51	5.16 (1.13)		
3	Hedonic	Extrinsic	39	5.57 (1.12)		
4	Intrinsic	Hedonic	53		5.14 (0.96)	
5	Intrinsic	Intrinsic	52		5.46 (0.69)	
6	Intrinsic	Extrinsic	48		5.28 (0.86)	
7	Extrinsic	Hedonic	74			5.36 (0.90)
8	Extrinsic	Intrinsic	58			5.24 (0.99)
9	Extrinsic	Extrinsic	55			5.46 (0.86)

Table 4. Summary of Nine Treatment Manipulations via Performance Belief

Treat #	Scripted/ primed expectations	Motivation for which system is designed	Number of subjects per cell (n = 477)	Joy T2 (SD)	Learning T2 (SD)	Usefulness T2 (SD)
1	Hedonic	Hedonic	47	4.86 (1.01)	3.89 (1.46)	3.48 (1.37)
2	Hedonic	Intrinsic	51	4.32 (1.54)	4.84 (1.24)	4.40 (1.58)
3	Hedonic	Extrinsic	39	4.03 (1.44)	4.83 (1.37)	4.24 (1.37)
4	Intrinsic	Hedonic	53	4.80 (1.11)	4.30 (1.21)	4.00 (1.21)
5	Intrinsic	Intrinsic	52	4.65 (1.32)	4.97 (1.00)	4.85 (1.09)
6	Intrinsic	Extrinsic	48	3.82 (1.52)	4.33 (1.63)	4.15 (1.34)
7	Extrinsic	Hedonic	74	5.08 (1.00)	3.89 (1.39)	3.95 (1.35)
8	Extrinsic	Intrinsic	58	4.57 (1.26)	5.05 (0.98)	4.72 (1.17)
9	Extrinsic	Extrinsic	55	4.00 (1.48)	4.32 (1.33)	3.99 (1.46)

Table 5. Summary of Nine Treatment Manipulations via Disconfirmation

Treat #	Scripted/ primed expectations	Motivation for which system is designed	Number of subjects per cell (n = 477)	Joy-disconfirm. mean (SD)	Learning-disconfirm. mean (SD)	Usefulness-disconfirm. mean (SD)
1	Hedonic	Hedonic	47	4.57 (.790)	n/a	n/a
2	Hedonic	Intrinsic	51	4.03 (1.43)	n/a	n/a
3	Hedonic	Extrinsic	39	3.96 (1.36)	n/a	n/a
4	Intrinsic	Hedonic	53	n/a	4.28 (1.07)	n/a
5	Intrinsic	Intrinsic	52	n/a	4.53 (1.27)	n/a
6	Intrinsic	Extrinsic	48	n/a	4.25 (1.47)	n/a
7	Extrinsic	Hedonic	74	n/a	n/a	4.09 (1.11)
8	Extrinsic	Intrinsic	58	n/a	n/a	4.42 (1.11)
9	Extrinsic	Extrinsic	55	n/a	n/a	4.07 (1.23)

4.2. Preanalysis and Data Validation

Before testing our model, we conducted preanalysis and data validation according to the latest standards for several purposes: (1) to establish the factorial validity of the instrument through convergent and discriminant validities, (2) to establish that multicollinearity was not a problem for this model, (3) to check for common-methods bias, and (4) to establish strong construct reliabilities. Appendix C reports the details of these analysis procedures. To establish factorial validity, we had to run three separate sets of data analyses based on our three core expectation manipulations: hedonic, intrinsic, and extrinsic. Because all the data were reflective, we could not analyze one unified model (because there would be missing expectation and disconfirmation data points). We thus analyzed one model for each expectation that was manipulated. Our results show that our data exhibit strong factorial validity, little multicollinearity, strong reliabilities, and a lack of monomethod bias. In sum, the results of our validation procedures show that our model data meets or exceeds the rigorous validation standards expected in IS research (e.g., Cenfetelli & Bassellier, 2009; Diamantopoulos & Siguaw, 2006; Lowry & Gaskin, 2014; MacKenzie, Podsakoff, & Podsakoff, 2011; Petter, Straub, & Rai, 2007).

To establish reliability, we computed a composite reliability score for each latent factor. This score is a more accurate measurement of reliability than Cronbach's alpha because the score does not assume that the loadings or the error terms of the items are equal (Chin, Marcolin, & Newsted, 2003). However, as a conservative check, Cronbach's alpha can also be used as a basis of comparison (Fornell & Larcker, 1981; Nunnally & Bernstein, 1994). We thus applied the two most conservative criteria to establish the reliability of our reflective subconstructs: the composite reliability and the Cronbach's alpha coefficients should be greater than or equal to 0.7 (Fornell & Larcker, 1981; Nunnally & Bernstein, 1994). Explanations of convergent and discriminant validity analyses are offered in Appendix C. All criteria were met or exceeded. Table 6 summarizes the computed reliability statistics for all three reflective models.

4.3. Final Model Analysis

We analyzed our theoretical model using maximum likelihood parameter estimation in covariance-based structural equation modeling. We used Amos v20 to conduct this analysis. To do so, we ran three separate models, one for each motivation type: hedonic, intrinsic, and extrinsic. Table 7 shows the results for each model. Figures 5–7 visually depict these findings[6]. Overall, we found support for the MISC and the baseline model. We further summarize and discuss these results in the next section.

[6] To account for potential correlations between the antecedents of disconfirmation, we covaried these three variables. However, the figures in this paper include only theorized paths. The three antecedents were all significantly correlated in each of the three models (correlation values ranged from 0.50–0.65, with all *p*-values below 0.001).

Table 6. Reliability Statistics for All Three Models

Constructs	Hedonic model		Intrinsic model		Extrinsic model	
	Cronbach's α	Composite reliability	Cronbach's α	Composite reliability	Cronbach's α	Composite reliability
Design fit	0.835	0.888	0.868	0.909	0.895	0.927
PEOU	0.838	0.892	0.863	0.906	0.849	0.895
Aesthetics	0.888	0.922	0.862	0.906	0.901	0.931
$Attitude_{t1}$	0.895	0.928	0.862	0.907	0.913	0.939
$Attitude_{t2}$	0.962	0.973	0.946	0.961	0.956	0.968
Intention to continue	0.955	0.968	0.938	0.955	0.946	0.961
Satisfaction	0.938	0.956	0.940	0.957	0.928	0.949
Joy_{t2}	0.951	0.962	0.944	0.958	0.942	0.956
$Learning_{t2}$	0.908	0.942	0.910	0.944	0.884	0.928
$Usefulness_{t2}$	0.937	0.960	0.902	0.939	0.939	0.961
Joy_{t1}	0.961	0.970	n/a	n/a	n/a	n/a
Joy disconfirmation	0.954	0.965	n/a	n/a	n/a	n/a
$Learning_{t1}$	n/a	n/a	0.764	0.863	n/a	n/a
Learning disconfirmation	n/a	n/a	0.936	0.959	n/a	n/a
$Usefulness_{t1}$	n/a	n/a	n/a	n/a	0.872	0.921
Usefulness disconfirmation	n/a	n/a	n/a	n/a	0.923	0.951

5. Discussion

With this paper, we extend research on IS continuance by expanding the B&P model (Bhattacherjee & Premkumar, 2004) to include hedonic and intrinsic contexts in addition to its baseline extrinsic context. In doing so, we propose a new model called the MISC. The MISC also accounts for key system-design constructs that we have proposed in order to capture other expectations common across various kinds of systems contexts: design aesthetics, PEOU, and DEF. We next summarize the results of our test of the MISC. We then discuss contributions to research and practice and conclude with a discussion of some limitations and of future research opportunities.

Table 7. Path Estimates for All Three Models

Model part	Relationships and hypotheses	Hedonic (n = 137)	Intrinsic (n = 153)	Extrinsic (n = 187)
Base model (unique)	Belief (FL) → AttT1	0.681***	0.394***	0.657***
	Belief (FL) → Disconfirmation	−0.041(ns)	0.163*	0.037(ns)
	Belief (FL) → Satisfaction	0.250***	0.068(ns)	0.120(ns)
	Belief (FL) → PB (primary)	0.041(ns)	0.147**	0.090(ns)
	PB(primary) → AttT2	0.332***	0.267***	0.118(ns)
	PB (primary) → IntCon	0.097(ns)	0.120(ns)	0.125*
	Disconfirmation → PB (primary)	0.455***	0.399***	0.244***
	Disconfirmation → Satisfaction	0.659***	0.600***	0.625***
Base model (common)	Satisfaction → AttT2	0.409***	0.407***	0.437***
	AttT1 → AttT2	0.144**	0.023(ns)	0.157**
	AttT2 → IntCon	0.388***	0.385***	0.231***
MISC extension (unique)	H1a. DEF → Disconfirmation	0.251**	0.476***	0.510***
	H1b. DEF → PB (primary)	0.345***	0.426***	0.472***
	H2a. PEOU → Disconfirmation	0.080(ns)	−0.082(ns)	0.226***
	H2b. PEOU → PB (primary)	0.089(ns)	−0.052(ns)	0.056(ns)
	H3a. Aesthetics → Disconfirmation	0.297***	0.100(ns)	0.000(ns)
	H3b. Aesthetics → PB (primary)	0.095(ns)	0.138*	0.046(ns)
Covariates and alternative hypotheses (common)	PB (secondary) → IntCon	0.014(ns)	−0.071(ns)	0.242***
	PB (secondary) → AttT2	0.006(ns)	0.137(ns)	0.227***
	PB (tertiary) → AttT2	0.242**	0.174*	0.137**
	PB (tertiary) → IntCon	0.271**	0.109(ns)	0.231***
	PEOU→ IntCon	0.101(ns)	0.207**	0.065(ns)
	DEF → IntCon	−0.044(ns)	0.065(ns)	0.099(ns)
	Aesthetics → IntCon	0.107(ns)	0.114(ns)	0.069(ns)
	Experience → IntCon	0.175**	0.074(ns)	0.021
	Gender → IntCon	0.073(ns)	−0.041(ns)	−0.058
	Age → IntCon	−0.066(ns)	0.009(ns)	−0.092*
	Education → IntCon	0.133*	0.051(ns)	−0.016

p < 0.05, **p < 0.01, ***p < 0.001, (ns) = not significant

5.1. Summary of Results

Our results for the baseline model generally conform to the findings of Bhattacherjee & Premkumar (2004). Notably, however, expectations had inconsistent and rather weak effects on disconfirmation and performance beliefs (significant only for intrinsic) and on satisfaction (significant only for hedonic). Performance beliefs also had weak effects on intention to continue (significant only for extrinsic).

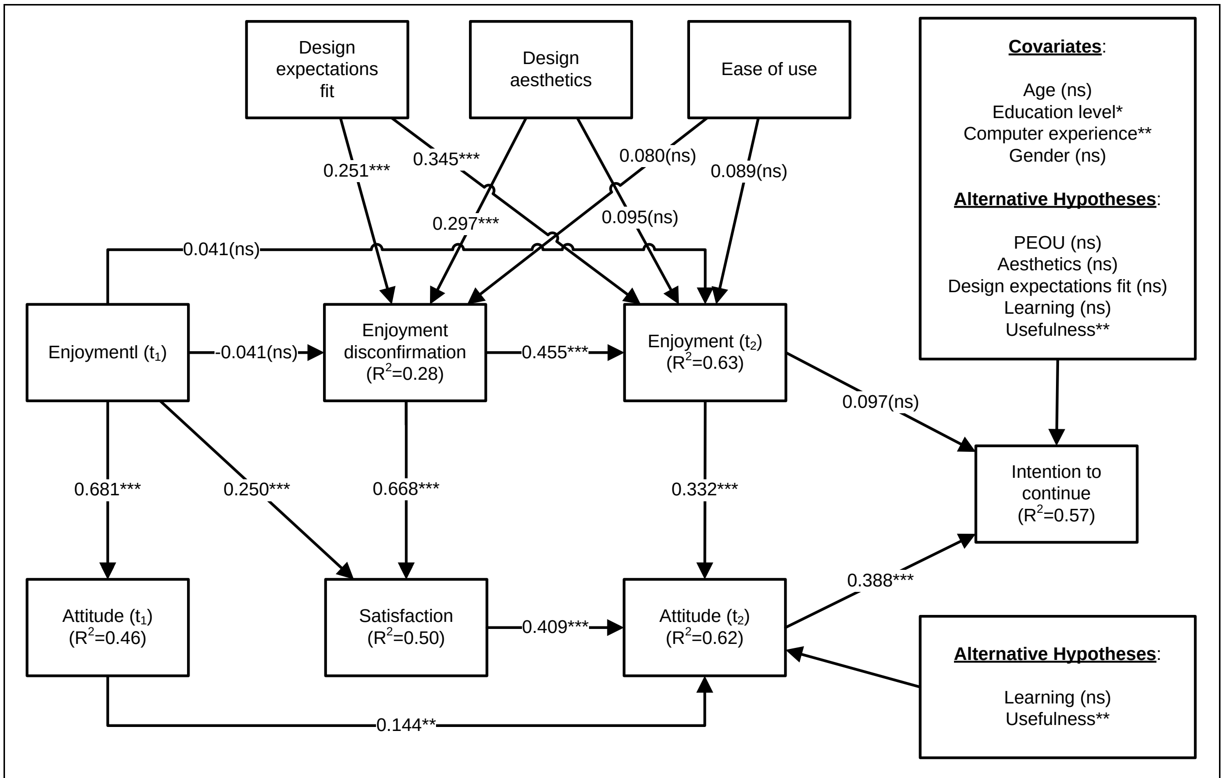

Figure 5. Tested Hypotheses and Covariates for the Hedonic Model

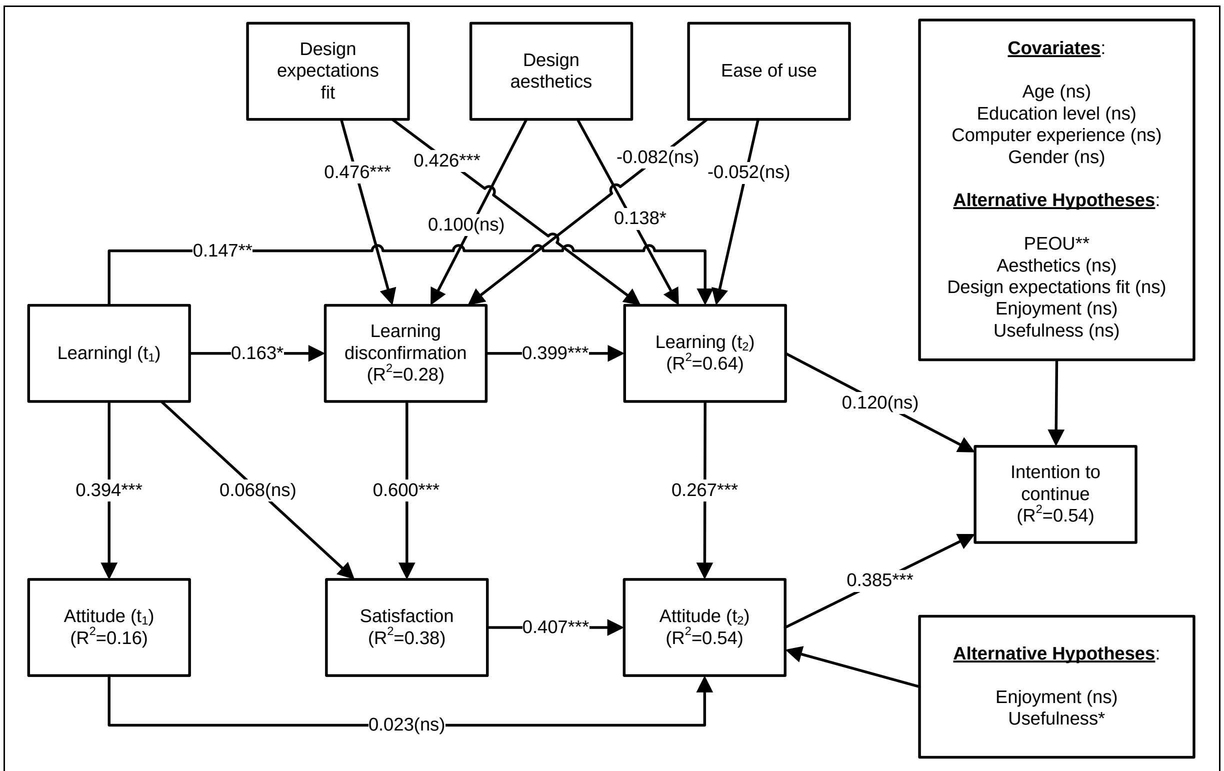

Figure 6. Tested Hypotheses and Covariates for the Intrinsic Model

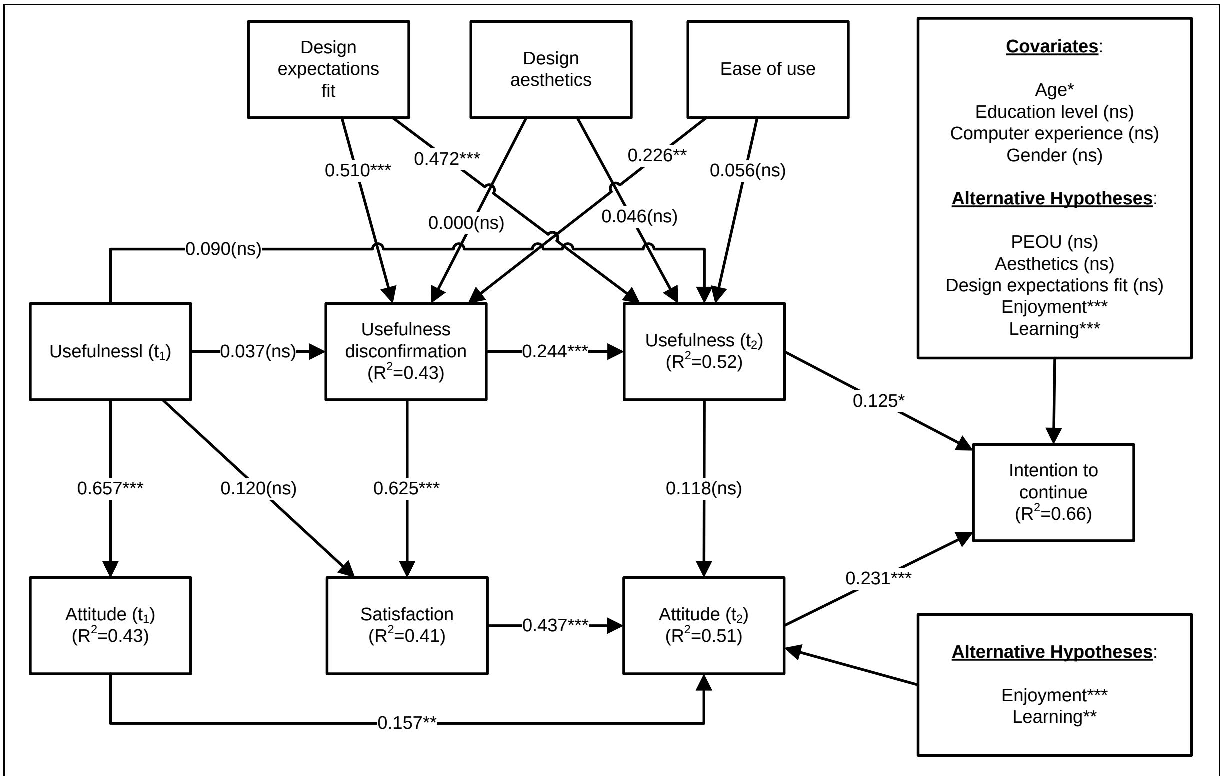

Figure 7. Tested Hypotheses and Covariates for the Extrinsic Model

Specific to the MISC extension of the B&P model, we found that PEOU affects disconfirmation only for extrinsically motivated systems, whereas aesthetics affects disconfirmation only for hedonically motivated systems. Aesthetics may be most vital to positive disconfirmation in hedonic experiences because aesthetics are concerned with pleasing the senses just as hedonism is about pleasure seeking. PEOU may be most vital to positive disconfirmation in intrinsic (nonhedonic) experiences because such experiences (as we have modelled them) are concerned with self-directed learning, which would be difficult if a system were not easy to use. DEF has a strong positive effect on disconfirmation and on performance beliefs for all three system types, although the strongest effect is for extrinsically motivated systems. Aesthetics has a generally weak effect on performance beliefs, but we did find a significant positive effect for intrinsically motivated systems. PEOU has no effect on performance beliefs. Finally, the variance explained for disconfirmation is substantially greater in our MISC extension: between 0.28 and 0.43 for the MISC versus 0.09 and 0.20 in the B&P model.

5.2. Contributions to Research and Practice

In this section, we first frame our contributions to research and practice in terms of answering the two research questions that drove this study. We start with our first research question:

> **RQ1:** *Are expectations and disconfirmation important drivers of system continuance, or should predictions be based solely on performance beliefs? If disconfirmation matters, what is the best way to represent and measure the underlying expectations that drive disconfirmation and continuance?*

In all three contexts (hedonic, intrinsic, and extrinsic), we found that disconfirmation had a strong positive influence on both satisfaction and performance beliefs. In an interesting contrast, we actually found little support for a direct link between performance beliefs and continuance in our models and that, instead, attitude is a strong predictor of intentions to continue. We thus conclude that disconfirmation is a necessary component of predicting system continuance, and we see no evidence that a performance-only model, as advocated by Brown et al. (2008), is an efficacious approach for our data and three contexts.

Although we found disconfirmation to be important, we found the traditional use of expectations to be lacking in predicting disconfirmation in all three of our contexts. However, the MISC's expanded conceptualization of expectations to include DEF, PEOU, and aesthetics was highly promising. As noted, the predictive power between expectations and disconfirmation has largely been weak in previous studies, so it is also notable that our predictors yielded greater R^2s in disconfirmation than is seen in the literature. Most importantly, we found that DEF was a strong predictor of both disconfirmation (H1a supported) and performance beliefs (H1b supported) in all three contexts. Our study provided only mixed support for PEOU and design aesthetics positively affecting disconfirmation and performance beliefs (mixed support for H2a, H2b, H3a, and H3b).

Overall, this is a particularly exciting finding because it suggests that, compared to PEOU and design aesthetics, DEF can serve as a more effective surrogate of underlying expectations across virtually any kind of expectation scenario. We thus identify a key means by which explanation and prediction can be increased in adapting expectation-disconfirmation theory to the IS context: by including DEF. This is particularly useful because DEF is not context specific, whereas traditional expectations measures are (e.g., enjoyment, learning, and usefulness). Our findings regarding DEF are also exciting because, in contrast, PEOU is a known predictor of satisfaction and other "IS success" outcome variables (DeLone & McLean, 2004); design aesthetics has also received recent attention as a powerful antecedent of key variables like usefulness, ease of use, and enjoyment (Cyr et al., 2006). Less is known about DEF, and it appears to be a novel addition to the literature that merits further research. We thus suggest that researchers and practitioners in this area use DEF as a key expectations surrogate while continuing to consider aesthetics and PEOU because these might be more system specific. We now turn to addressing our second research question:

> **RQ2:** *Should system continuance models be built for motivations other than extrinsic motivations? If so, which motivations should be accounted for, and how can a model be built that accounts for these but is still generalizable and succinct?*

We argue that motivations play an essential role in understanding users' intentions and expectations regarding system use (Davis et al., 1992; Hirschfeld & Lawson, 2008; Malhotra, Galletta, & Kirsch, 2008), and, thus, by including a broader, more realistic range of motivations, our model can increase the practical relevance of theory. Given our review of the motivations literature and the extensive taxonomy of systems motivations summarized in Table 1 and detailed in Appendix A, we conclude in proposing the MISC that a more useful EDT-based continuance model must be designed to account for motivations other than simple extrinsic motivations based on usefulness. We thus propose the MISC to better account for various motivations; namely, hedonic, intrinsic, and extrinsic motivations. Our literature review and empirical evidence demonstrate that these are the three main motivations that should be included in a model for generalizability purposes. We show that virtually all other motivations can be seen as specific examples of these. Importantly, our distinction between the forms of intrinsic motivations is grounded in the psychology literature (e.g., Descartes & Voss, 1989; Olson, 2007; Reiss, 2004; 2009; Russell, 2003) and encourages system designers to identify user needs that can be fulfilled by generalizable and measurable design features (like design aesthetics, PEOU, and DEF). Examples of how differentiation between types of intrinsic motivation can influence future research include rethinking the influence of both types of intrinsic motivation on system use (Venkatesh, 2000), system adoption (Venkatesh et al., 2003), trust (Dunn & Schweitzer, 2005), and so forth.

Importantly, our empirical findings show that the MISC is even more generalizable than we expected, although additional research to assess this generalizability is certainly warranted. This is because the traditional expectations measures are shown to be fairly weak predictors, and yet our more generalizable, less context-specific variables are shown to be fairly strong predictors in the model. This is a key strength in our modeling and empirical approach, which depends on the initial modeling of three different systems-continuance contexts. Our approach thus adds to previous models that account only for extrinsic or intrinsic motivators (e.g., Chen, 2007; Cheng & Cairns, 2005; Choi & Kim, 2004; e.g., Davis, 1989; Hsu & Lu, 2004; Kim & Kankanhalli, 2009; Lim & Cyr, 2009; McMahan, 2003; Sweetser & Wyeth, 2005; Yee, 2006) and to models that propose an indirect effect of intrinsic motivation (e.g., Agarwal & Karahanna, 2000; Hwang, 2005; Saade & Bahli, 2005; Venkatesh, 2000). Based on our overall findings, in Figure 8, we newly propose a modified version of the MISC to serve as the baseline for further research in this area. Notably, DEF, PEOU, and design aesthetics would serve as baseline expectations regardless of users' motivations for system use and continuance.

Aside from directly answering the research questions that guided our study, we likewise show that the design of a system does not necessarily fully predict expectations, disconfirmation, and performance beliefs. Traditionally, the literature has held that motivations to use systems vary depending on the general intent or spirit of the system

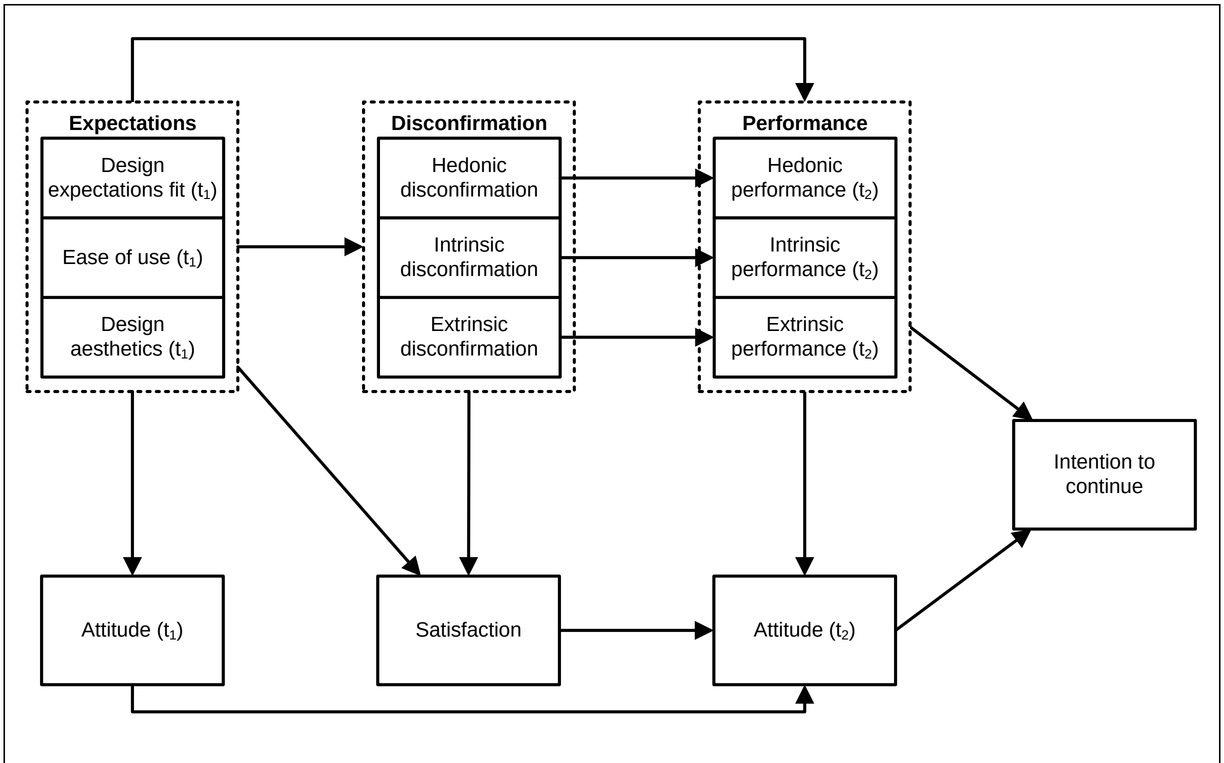

Figure 8. Final Proposed Version of the MISC for Ongoing Research

(DeSanctis & Poole, 1994). For example, systems such as online video games are generally intended for pleasure and arousal, with users seeking those systems for that intent (Vorderer, Hartmann, & Klimmt, 2003; Yee, 2006). Although the link between "system-design purpose" and "motivation purpose" can be a useful generalization, the spirit of a system does not fully predict users' motivations and subsequent expectations and disconfirmation. This was particularly evident in our scenario, in which we tried to inspire extrinsic motivations with an extrinsic system. For example, online video games can be used to satisfy extrinsic motivations as when monetary rewards are offered in online video game tournaments or when a player feels obligated to continue playing a game with friends—to avoid the guilt of saying no—even after the fun of playing has diminished (Hsu, Wen, & Wu, 2009). Likewise, systems that are generally intended to satisfy extrinsic motivations, such as desires to increase productivity or performance, can also satisfy intrinsic motivations such as the desire to learn, to be in control, or to engage in a challenge. For this reason, we found that performance belief measures outside the designed spirit of the systems in our study involved mixed uses. Thus, labeling systems as either "intrinsic systems" or "extrinsic systems" as prior research has done (Lin & Bhattacherjee, 2007; Rosen & Sherman, 2006; van der Heijden, 2004) is probably not the most accurate approach in many cases of systems use.

Moreover, we make several potential contributions to practice. An essential system-design goal is to strive for an appropriate match between system functionality and user needs (Goodhue & Thompson, 1995), which, in our context, we newly conceptualized as DEF. Failing to achieve DEF results in costly postrelease maintenance and patches or even in failed products. For example, Microsoft Word is a popular word processing tool often used to fulfill extrinsic (e.g., completing a report) or intrinsic (e.g., expressing oneself) motivations. From 1998 to 2003, releases of Microsoft Word included an animated assistant called "Mr. Clippy" as a novel design feature intended to make word processing more fun. However, in the popular press, Mr. Clippy was sharply criticized and voted one of the biggest technology flops. Several factors likely contributed to Mr. Clippy's failure (Whitworth, 2005): one of these may have been that the design feature was not appropriately matched with users' motivation to use a word processor (i.e., extrinsic or intrinsic motivations) but was aimed at fulfilling hedonic motives. This mismatch between design and motivation likely decreased positive disconfirmation—especially because the feature was often disruptive when it unexpectedly appeared. For example, a typical annoyed user commented, "I hated that clip. It hung around watching you with that nasty smirk. It wouldn't go away when you wanted it to. It interrupted rudely and broke your train of thought" (Whitworth, 2005).

It is now common knowledge that users do not always use technology for the reasons intended by the technology designers (DeSanctis & Poole, 1994; Fuller & Dennis, 2009; Majchrzak, Rice, Malhotra, Nelson, & Ba, 2000; Poole & DeSanctis, 1989). This matching between design and user motivations offers an immediate recommendation for system design. Systems could have different modes, such as play, learning, and work. When the system starts (whether it be an entire operating system, an application, or even a website), the user could be prompted with a choice to play, learn, or work. The user interface would then adjust to the user's motivation. This match between design and motivation is more likely to result in perceived higher performance, satisfaction, and continuance intentions.

5.3. Limitations and Future Research

Perhaps the most evident limitation of our experiment is that the extrinsic system interaction failed to produce both the highest levels of perceived usefulness and the highest disconfirmation of usefulness. Instead, the intrinsic interaction (designed for learning) was perceived to be more useful. This is further evidence that the ability to manipulate a human subject's motivations and outcomes through priming is limited. This interesting phenomenon may also be due to our use of student participants whose current "occupation" is learning. Thus, learning is perceived to be more useful to them than performing tasks for nominal financial incentives. It is likely that this finding would change if nonstudent participants were sampled or if the financial incentives were more substantial.

Another key limitation of our study is that the motivation portion of the underlying theory remains untested. This limitation is common to EDT models in IS research and to the B&P model. As noted, motivations are a direct antecedent of expectations at a fundamental level—a relationship that is well established in the literature but untested in extant models of motivation for system usage or satisfaction in IS (Gnoth, 1997; Lazarus, 1982; Leventhal & Scherer, 1987). This situation exists despite abundant evidence in the literature indicating that motivations lead directly to expectations (e.g., Cyr & Head, 2008; Lim & Cyr, 2009; Zeithaml et al., 1993). Although the ontological differences between motivations and expectations are fairly obvious, empirically establishing the differences between these two levels of conceptualization is exceptionally problematic because they are so closely intertwined. Measuring each distinctly and separately through a perceptual survey is not likely to be fruitful because the respondent is not likely to be able to distinguish conceptually between them. Meanwhile, we are not aware of any physiological or neurological methods of capturing motivations and expectations that might lead to concrete distinctions. Providing such measurements (if in fact it is possible to do so) would be a useful research contribution.

A separate limitation of our study is that, for simplicity, we followed extant literature (e.g., van der Heijden, 2004) by operationalizing the hedonic constructs as joy rather than taking the potentially more accurate approach of using separate constructs of pleasure and arousal as defined earlier. Cognitive psychology has established that, although pleasure and arousal are related, they are distinct, orthogonal constructs that combine to enhance the fulfillment of hedonic motivations through their resulting positive affect (e.g., Bradley, Greenwald, Petry, & Lang, 1992; Russell, Weiss, & Mendelsohn, 1989). Thus, replacing joy with pleasure and arousal in future empirical tests of the MISC would likely be useful, especially when trying to advance the research of gamification (e.g., Blohm & Leimeister, 2013; Hamari & Koivisto, 2015).

A related research possibility is that, by separating hedonic constructs into pleasure and arousal, we may be able to better predict various outcomes of pleasure and arousal combinations based on Russell et al.'s (1989) affect grid. Russell et al.'s research shows that, depending on the level of these two affective constructs, they combine to create different affective outcomes: high arousal combined with high pleasure results in "excitement" (the ideal combination for fulfilling hedonic motivations); high arousal combined with high displeasure results in "stress"; low arousal combined with high pleasure results in "relaxation"; and low arousal combined with high displeasure results in a "depressed" state (Russell et al., 1989). Similarly, future research could account for the degree of affect infusion experienced by the user (Lowry, Twyman, Pickard, Jenkins, & Bui, 2014b).

Another key limitation of our study is that we studied whole systems without isolating specific design features. For further research development and application to practice, it would be useful as a next research step to prototype and isolate design features that are intended to fit certain task motivations and expectations. For example, consider the design feature of appropriate challenge. "Appropriate challenge" is defined as the degree to which the perceived positive challenge of an activity matches the perceived skills of the user (Chung & Tan, 2004). It has been shown to be a significant predictor of intrinsic interest (e.g., Amory, Naicker, Vincent, & Adams, 1999; Gottfried, 1985) and deeper levels of attention and engagement. If stimuli from an experience are either too challenging or not challenging enough, interest and curiosity decline (Chung & Tan, 2004; Koufaris, 2002; Mandryk, Atkins, & Inkpen, 2006; Novak, Hoffman, & Yiu-Fai, 2000). In a gaming scenario, appropriate challenge can be manipulated by having the level of difficulty (e.g., number of obstacles, aggressiveness of virtual combatants, etc.) increase as the user successfully completes a level, mission, challenge, and so on. In a learning scenario, it can be manipulated by adaptive computer testing and training, where more difficult questions or problems are selected from a test bank when the user answers correctly and less difficult ones are selected when the user answers incorrectly.

Appropriate challenge is just one of many design-related constructs that can have meaningful effects on the MISC. Based on our review of systems literature (Appendix A summarizes), we propose several other design-related constructs that future research could usefully consider: atmospheric cues, audio and visual richness, captivating animation, haptic richness, mystery, navigation, personalization/customization, play, presence, spontaneity, and two-way communication. In Table 8, we define each of these constructs and explain how they might be manipulated in future research and practice.

Our covariates and alternative hypotheses point toward additional opportunities for future research. For example, we found that the secondary and tertiary performance belief variables were consistent positive predictors of attitude and continuance intentions for the extrinsic system but not as consistent for the hedonic and other intrinsic systems. Additionally, PEOU was a significant predictor of continuance intentions only for other intrinsic systems. Future research could usefully explore the reasons for these findings.

Finally, research could determine which individual and contextual variables further affect the MISC relationships. For instance, recent research has shown that individual characteristics, such as playfulness (Ahn, Ryu, & Han, 2007), social computing expertise (Fun & Wagner, 2008), and hedonic beliefs (Premkumar, Ramamurthy, & Liu, 2008), influence system evaluations. Other areas of interest include how computer anxiety (Fuller, Vician, & Brown, 2006) or prior affective states moderate the input effects of the MISC.

6. Conclusion

Building on work by Bhattacherjee & Premkumar (2004), we develop and test the MISC as a comprehensive model for explaining and predicting how a range of motives and expectations influences user satisfaction and continuance intentions for multiple types of information systems that have been designed with various intents. We theorize about the effects on expectations and disconfirmation of three major types of user motives: hedonic (via joy), intrinsic (via learning), and extrinsic (via productivity). Among many other findings, our analysis reveals that design constructs affect performance beliefs differently depending on system intent and user motives and expectations. This suggests that system designers can leverage the MISC to learn where to focus their efforts as they design specific systems with specific intents. Nevertheless, we show that a user's motives do not always match the intent of a system's design, which increases the need for systems to be designed to accommodate multiple motives. Additionally, many findings are consistent across all types of systems, suggesting that certain design constructs are universally essential. The MISC also provides a foundation for extending a wide range of research in human-computer interaction and for revisiting prior research to examine the effects of multiple types of motivation in established systems-use theories.

Table 8. Design Constructs That Can Be Manipulated in Future MISC Research

Construct	Definition	Example of design feature to manipulate
Appropriate challenge	The degree to which the challenge of an activity matches the skills of the user (Chung & Tan, 2004)	• *In gaming*: increase number of obstacles and aggressiveness of AIs when the user successfully completes a level of difficulty. • *In learning*: ask/present more difficult questions or problems when the user answers correctly and pose less difficult questions when the user answers incorrectly.
Atmospheric cues	GUI design features intended to affect the user's perception of the system environment (Eroglu, Machleit, & Davis, 2003)	• *All systems*: make colors, graphics, and layout conducive to ease of use and aesthetic appeal. • *In e-commerce*: make navigation obvious and visuals efficient (not cluttered). • *In gaming*: use appropriate environmental background sounds and realistic graphics.
Audio and visual richness	The degree to which auditory and visual design features are used in interactive media (Bundesen, Habekost, & Kyllingsbæk, 2005; Johnston & Dark, 1986)	• *All systems*: use cleaner graphics and, where appropriate, high-quality sound.
Captivating animation	Sensible and relevant image motion, change, or manipulability, often used in gaming and other Web applications (Fasolo, Misuraca, McClelland, & Cardaci, 2006)	• *All systems*: endow traditionally static images with some meaningful animation. • *In gaming*: apply subtle motion for greater realism. • *In e-commerce*: allow users to manipulate product images (rotate them, flip them, see full 360-degree views, or change their color). • *In productivity systems*: use subtle and unobtrusive animation, like window state change animation or animating user actions.
Haptic richness	Tactile sensation (Feintuch et al., 2006; Mukai, Onishi, Odashima, Hirano, & Luo, 2008; Robineau, Boy, Orliaguet, Demongeot, & Payan, 2007)	• *All systems*: add touchscreens, controllers, motion control, etc.
Mystery	The degree of *opportunity* to learn more information (Rosen & Purinton, 2004)	• *In gaming*: release tools, plots, characters, quests, etc., on a gradual basis. • *In productivity systems*: include optional functionality that users can learn over time as they become more advanced.
Navigation	The self-directed movement through a medium (Childers et al., 2001; Fang & Holsapple, 2007; Hoffman & Novak, 1996)	• *In gaming*: allow more autonomy in movement and order of gameplay. • *All systems*: make available paths of use more visible to users.

Table 8. Design Constructs That Can Be Manipulated in Future MISC Research (cont.)

Construct	Definition	Example of design feature to manipulate
Personalization /customization	The degree to which information or an interface is or can be tailored to meet the needs and character of the user (Daft & Lengel, 1986; Davis, Murphy, Owens, Khazanchi, & Zigurs, 2009; Komiak & Benbasat, 2006; Kumar, Smith, & Bannerjee, 2004)	• *All systems*: allow users to make preferential changes to the system interface and operations. • *In gaming*: allow the user to name a character and choose the character's appearance. • *Other systems*: allow the user to change layout and appearance.
Play	A construct consisting of intrinsic motivation, positive affect, nonliterality, process-focus (rather than outcome-focus), and flexibility (Smith & Vollstedt, 1985)	• *In gaming*: include humor and multiple modes of play. • *Other systems*: include quips instead of error messages and humor where appropriate.
Presence	"The sense of being in an environment" (Davis et al., 2009, p. 93)	• *In gaming*: use virtual atmospheric cues, more realistic graphics/sounds, and two-way communication between characters and players. • *In communication systems*: improve the clarity of audio/video, synchronicity of communication, and interface invisibility. • *In entertainment systems*: use 3-D video, surround sound, or 360-degree displays.
Spontaneity	The degree of impromptu cognition and variety in computer interactions (Chen & Yen, 2004; Chung & Tan, 2004) or the degree of surprise experienced during an interaction with a system (Blythe, Overbeeke, Monk, & Wright, 2004)	• *Hedonic systems*: create novel and unexpected experiences. • *All systems*: enable optional paths of use. • *In gaming*: present optional missions/adventures as the player progresses. • *In productivity systems*: use smart software to recommend alternate methods of accomplishing a sequence of tasks repeatedly performed by the user. • *In e-commerce*: make limited-time offers.
Two-way communication	Reciprocal communication where one or more senders and one or more receivers (human or system) communicate with each other (e.g., Burgoon et al., 2000; Burgoon et al., 2002; Lowry et al., 2009b)	• *In gaming*: create seamless character interaction and feedback. • *In search engines*: provide relevant results to a query. • *All systems*: ensure that system communication responses match user expectations by using consistent design norms across the system.

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Appendices

Appendix A. Detailed Taxonomy of Types of Motivation in System Use and Continuance

As the high-level start to our taxonomy, we categorized system use and continuance motivations as hedonic, intrinsic, and extrinsic. After a thorough search of the literature, we found multiple subcategories in each of these three main categories. In this appendix, we outline these findings as support for our motivation taxonomy.

Our taxonomy begins with specific hedonic motivations for system use. Based on cognitive psychology research (Russell et al., 1989), we found that these hedonic motivations could be further categorized into two subcategories derived from core affect: (1) *system pleasure* and (2) *system arousal. Pleasure* is a rudimentary state of gratification that results from a sensory stimulus and can have mental and physiological components (Aaker & Lee, 2001; Cabanac, 1979; Cabanac & Ferber, 1987; Leknes & Tracey, 2008). We thus define *system pleasure* as gratification derived from sensory stimulus resulting from system use. Experiencing pleasure creates a basic positive feedback mechanism that is subjectively determined by a person's intrinsic desires, which encourage an individual to engage in the pleasure-producing experience again (Snyder & Lopez, 2007). Pleasure is a lower-order factor that may or may not create enjoyment on its own (Gustafson, 1991; Meadows, 1975; Russell & Mehrabian, 1975; Vrana, 1993). Like pleasure, *arousal* is a primitive affective response that is a psychological and physiological reaction to a stimulus (Larsen & Buss, 2008). We thus define *system arousal* as a primitive affective response that occurs during system use. Cognitive psychology has established that although pleasure and arousal are related, they are distinct, orthogonal constructs that combine to enhance the fulfillment of hedonic motivations through their resulting positive affect (e.g., Bradley et al., 1992; Russell et al., 1989).

Reviewing the hedonic systems-use literature with these two categories in mind, we found the following specific motivations to reflect system pleasure: (1) **play/enjoyment/fun**: to engage in a system activity for pure enjoyment, such as playing in a virtual world (Wu, Li, & Rao, 2008b), a video game (Hsu & Lu, 2004), or online gaming (Lowry et al., 2013a); (2) **entertainment**: to engage in a system activity for passing time through amusement, such as online shopping (Shang et al., 2005) or surfing as pastimes (Katz & Aspden, 1997); (3) **sex/lust/pleasure:** to engage in a system activity for prurient sexual pleasure motives, such as pornography (Hald & Malamuth, 2008) or cybersex (Albright, 2008); and (4) **escape/relaxation:** to engage in a system activity simply to relax or escape from stress, such as using informational sites (Joines, Scherer, & Scheufele, 2003) or gaming (Yee, 2006) as stress relief.

Likewise, we found that the following specific motivations reflect system arousal: (1) **challenge**: to engage in a system activity for challenging stimulation, like gaming (Yee, 2006) or hacking (Foltz, 2004); (2) **satisfying curiosity/piquing interest**: to engage in a system activity to satisfy one's curiosity, such as looking at video sites (Kim, Na, & Ryu, 2007) or general browsing about a topic (Katz & Aspden, 1997); (3) **exploring/discovering**: to engage in a system activity to enjoy a sense of exploration, such as discovering new virtual worlds (Barnes, 2007); (4) **stimulating utilitarian experience**: to engage in an otherwise utilitarian experience but because doing so is stimulating, such as finding stimulation in discovering business intelligence patterns (Li et al., 2009); and (5) **sex/lust/arousal:** to engage in a system activity for prurient sexual arousal motives, such as pornography (Hald & Malamuth, 2008) or cybersex (Albright, 2008). Interestingly, sex/lust/arousal was the one fundamental hedonic motivation that bridged both pleasure and arousal, which may explain its inherent addictive affinity.

Intrinsic motivations were more varied and we categorized them into three major groupings: (1) system accomplishment, (2) system learning, and (3) system socialization. We define *system accomplishment* as the intrinsic motivation to experience achievement in using a system. We define system learning as the intrinsic motivation to experience acquiring new knowledge while using a system. We define *system socialization* as the intrinsic motivation to use a system to communicate and feel connected with others.

In reviewing the systems literature with these three categories in mind, we found that the following specific motivations reflect *system accomplishment*: (1) **influencing others**: to engage in a system activity to influence other people, such as political blogging (Nardi, Schiano, & Gumbrecht, 2004) and online opinion leadership (Raghupathi, Arazy, Kumar, & Shapira, 2009); (2) **altruism**: to engage in a system activity for altruistic service purposes, such as helping others learn (Chen & Hung, 2010); (3) **improving reputation/receiving approval**: to engage in a system activity to improve one's reputation or gain approval from others, such as blogging (Hsu & Lin, 2008) or hacking (McClure, Scambray, & Kurtz, 2009); (4) **leadership**: to engage in a system activity to lead others, such as creating effective collaboration in a virtual team (David, Chand, Newell, & Resende-Santos, 2008); (5) **gaming achievement**: to engage in a system gaming activity for a sense of achievement itself, such as winning an online tournament (Griffiths, Davies, & Chappell, 2003); and (6) **autonomy/freedom**: to engage in a system activity to greater fulfill one's sense of autonomy, such as expressing oneself freely in a blog (Nardi et al., 2004).

We found that the following specific motivations reflect *system learning:* (1) **knowledge acquisition**: to use a system to learn something new, such as Internet-based learning (Lee, Cheung, & Chen, 2005); (2) **knowledge sharing**: to use a system for learning through mutual knowledge sharing, such as sharing with professional virtual communities (Chen & Hung, 2010); (3) **computer-skill acquisition**: to use a system primarily to learn a new computer skill, such as the desire for system competence (Gravill, Compeau, & Marcolin, 2006); (4) **staying informed**: to use a system to stay informed on topics that are current, such as current politics (Nardi et al., 2004).

Our third intrinsic category, system socialization, was reflected in the following specific system motivations: (1) **affiliation with community of interest**: to use a system for a sense of belonging to a community of interest, such as open-source development communities (Au, Carpenter, Chen, & Clark, 2009); (2) **social communication**: to use a system to communicate with others in a social manner, such as social networking (Ridings & Gefen, 2004); (3) **collaboration**: to use a system primarily to collaborate with others in solving problems, such as problem solving in virtual teams (Lowry, Roberts, Dean, & Marakas, 2009a); (4) **playing with others**: to use a system to play with others collaboratively, such as massively multiplayer online games (MMOGs) (Meredith, Hussain, & Griffiths, 2009; Putzke, Fischbach, Schoder, & Gloor, 2010); and (5) **romance/dating**: to use a system primarily to improve one's love life, such as online dating sites (Couch & Liamputtong, 2008).

Finally, turning to extrinsic motivations, we found that these could be categorized into two major groups: (1) *positive extrinsic motivations*, which is the desire for a useful outcome; and (2) *negative extrinsic motivations*, which is the desire to produce or avoid a harmful outcome. We further categorized positive extrinsic motivations into the following three general categories: (1) *system personal gain*, which is the desire to use a system for personal gain; (2) *system transact*, which is the desire to use a system to complete a transaction; and (3) *system improve work*, which is the desire to use a system to improve one's career or business.

The specific positive extrinsic motivations we found in the literature under *system personal gain* include the following: (1) **receiving treatment/therapy**: using a system for the primary purpose of therapy, such as using a therapy site in a virtual world (Gorini & Riva, 2008); and (2) **making money**: using a system to make money, such as through video game tournaments (Griffiths et al., 2003) or e-commerce (Katz & Aspden, 1997; Lee, Pi, Kwok, & Huynh, 2003). The specific positive extrinsic motivations we found in the literature under *system transact* include the following: (1) **buying products or services**: using a system to buy goods or services, such as online purchasing (Jiang, Chan, Tan, & Chua, 2010); (2) **fulfilling obligations**: using a system to fulfill an obligation (or "sense of obligation"), such as paying a debt or arranging a funeral for a deceased family member (Hu, Zhao, Hua, & Wong, 2012). Finally, the positive extrinsic motivations we found in the literature under *system improve work* include the following: (1) **advertising/promoting company**: using a system to create more business for a company, such as advertising in virtual worlds (Wu, Cheng, & Yen, 2008a); (2) **being more productive**: using a system to improve one's work productivity, such as general personal computer use for this purpose (Becker, 2000); and (3) **collaborating/communicating remotely**: improve one's ability to communicate and work remotely, such as use of metaverses (Davis et al., 2009) and virtual collaboration (Lowry & Nunamaker, 2003; Lowry et al., 2009a).

Meanwhile, negative extrinsic motivations under system *self-preservation* include the following: **avoiding threat of injury** by system use, such as preventive hacking (Van Beveren, 2000), firewalling (Liang & Xue, 2010), system security scans (Chen, Kataria, & Krishnan, 2011), and protective motivation behaviors (Posey, Roberts, Lowry, Bennett, & Courtney, 2013; Boss, Galletta, Lowry, Moody, & Pollack, 2015). Negative extrinsic motivations under *system harm others* include the following: (1) manip**ulating/extorting others:** using a system to manipulate or extort others into a desired behavior, such as through hacking (Barber, 2001); (2) **causing injury**: using a system to cause direct or indirect injury to another party, such as creating viruses (Voiskounsky & Smyslova, 2003) and cyberterrorism (Furnell & Warren, 1999); (3) **pursuing revenge**: to use a system to exact revenge on another person or organization, such as through cyberstalking (Hancock, 2000), cyberbullying (Kshetri, 2011), or reactance against a company's policies (Lowry & Moody, forthcoming; Lowry, Posey, Bennett, & Roberts,2015); (4) **carrying out fanatical political agenda**: to use a system for fanatical political purposes that are harmful in nature, such as cyberterrorism (Furnell & Warren, 1999).

Finally, negative extrinsic motivations under *system misbehavior* include the following: (1) **accessing proprietary information illegally**: to intentionally access information illegally through a system, such as by use of hacking (Barber, 2001) or conducting social engineering (Karjalainen & Siponen, 2011) (2) **making mischief**: to use a system for the purpose of general troublemaking whether legal or illegal, such as entering a system through hacking but not accessing any information (Foltz, 2004) and creating nonharmful viruses (Galbreth & Shor, 2010); (3) **computer abuse/noncompliance:** to intentionally use a system to render harm to the system, its data, or to not comply with computer policies in general (Lowry, Posey, Roberts, & Bennett, 2014a), such as sending spam (Cukier, Ngwenyama, & Nesselroth-Woyzbun, 2008), using pornography at work (Berente, Hansen, Pike, & Bateman, 2011; Cameron, 2012), surfing at work (Griffiths, 2010), and generally deviating from organizational policy with computer use.

Table A-1. Examples of Intrinsic Motivation for System Use

Motivation category	General motivation (desire for)	Specific motivation (desire for)	Examples of this motivation found in particular systems-use context
Hedonic	System pleasure	Play/ enjoyment/ fun	• Instant messaging (Li, Chau, & Lou, 2005; Premkumar et al., 2008) • Music sites (Chu & Lu, 2007) • Social networking/blogging (Wasko & Faraj, 2000) • Console gaming (Hsu & Lu, 2004) • Video sites (Kim et al., 2007) • Virtual reality (Wu et al., 2008b) • Virtual worlds (Wu et al., 2008b) • Voice over IP conferencing (Lin, Tai, & Fang, 2008b) • Commercial websites (Stafford & Stafford, 2002) • ERP use (Hwang, 2005) • Texting (cell phones) (Ran & Lo, 2006) • Online games (Lowry et al., 2013a)

Table A-1. Examples of Intrinsic Motivation for System Use (cont.)			
Motivation category	**General motivation (desire for)**	**Specific motivation (desire for)**	**Examples of this motivation found in particular systems-use context**
		Entertainment	• Video sites (Trammell, Tarkowski, Hofmokl, & Sapp, 2006) • Internet (Katz & Aspden, 1997) • Commercial websites (Stafford & Stafford, 2002) Online shopping (Lim & Cyr, 2009; Shang et al., 2005)
		Sex/lust/pleasure	• Online pornography (Hald & Malamuth, 2008; Paul, 2009; Paul & Shim, 2008; Stack, Wasserman, & Kern, 2004) • Cybersex (Albright, 2008; Daneback, Cooper, & Månsson, 2005; Delmonico & Griffin, 2008; Hertlein & Piercy, 2008; Hertlein & Piercy, 2006) • Seeking sexual partners online for the real world (Albright, 2008; Couch & Liamputtong, 2008; Sowell & Phillips, 2010)
		Escaping/relaxing	• Informational sites (Joines et al., 2003) • Console gaming (Yee, 2006) • Virtual reality (Yee, 2006) • Social networking/blogging (Trammell et al., 2006) • Online gaming (Lowry et al., 2013a)
	System arousal	Challenge	• Console gaming (Vorderer et al., 2003) • Hacking tools (Foltz, 2004)
		Satisfying curiosity/piquing interest	• Video sites (Kim et al., 2007) • Virtual reality (Agarwal & Karahanna, 2000) • Internet (Katz & Aspden, 1997) • Hacking tools (Barber, 2001; McClure et al., 2009; Van Beveren, 2000)
		Exploring/ discovering	• Virtual worlds (Barnes, 2007) Console gaming (Yee, 2006)
		Stimulating utilitarian experience	• Customer support systems (Li et al., 2009), • Business intelligence systems (Li et al., 2009).
		Sex/lust/arousal	• Online pornography (Hald & Malamuth, 2008; Paul, 2009; Paul & Shim, 2008; Stack et al., 2004) • Cybersex (Albright, 2008; Daneback et al., 2005; Delmonico & Griffin, 2008; Hertlein & Piercy, 2008; Hertlein & Piercy, 2006)

Table A-1. Examples of Intrinsic Motivation for System Use (cont.)			
Motivation category	**General motivation (desire for)**	**Specific motivation (desire for)**	**Examples of this motivation found in particular systems-use context**
Intrinsic	System accomplishment	Influencing others	• CMC (King, Hartzel, Schilhavy, Melone, & McGuire, 2010; Zhang, Lowry, Zhou, & Fu, 2007) • Texting (Oksman & Turtiainen, 2004; Ran & Lo, 2006) • Group gaming (Yee, 2006) • Open-source development (Au et al., 2009; Hahn, Moon, & Zhang, 2008; Hertel, Niedner, & Herrmann, 2003; Ke & Zhang, 2009; Ye & Kishida, 2003) • Political blogging (Nardi et al., 2004) • Online opinion leadership (Raghupathi et al., 2009) • Social influence online (Guo & Barnes, 2009; Posey, Lowry, Roberts, & Ellis, 2010) • Influencing customer decisions (Wagner & Majchrzak, 2007) • Motivating virtual teams (Wang, Fan, Hsieh, & Menefee, 2009) • Increased negotiation power (Bendahan, Camponovo, Monzani, & Pigneur, 2005; Johnson & Cooper, 2009b)
		Altruism	• Altruistic knowledge creation and sharing (Prasarnphanich & Wagner, 2009) • Increasing altruistic image through blogging (Hsu & Lin, 2008) • Helping others improve knowledge (Chen & Hung, 2010)
		Improving reputation/ receiving approval	• Improving reputation through blogging (Hsu & Lin, 2008) • Social networking/blogging (Butler, Sproull, Kiesler, & Kraut, 2002) • Open-source development (Ye & Kishida, 2003) • Hacking tools (Foltz, 2004; McClure et al., 2009) • Group gaming (Vorderer et al., 2003; Yee, 2006) • Texting (Oksman & Turtiainen, 2004; Ran & Lo, 2006) • Internet use (Katz & Aspden, 1997)
		Leadership	• Creating an effective virtual-team experience (Lin, Standing, & Liu, 2008a) • Creating effective virtual-team collaboration (David et al., 2008) • Successful completion of virtual-team tasks (Dennis, Fuller, & Valacich, 2008) • Helping distributed development team be more effective (Thomas & Bostrom, 2010) • Improving creativity in virtual teams (Wang et al., 2009)

Table A-1. Examples of Intrinsic Motivation for System Use (cont.)			
Motivation category	**General motivation (desire for)**	**Specific motivation (desire for)**	**Examples of this motivation found in particular systems-use context**
		Gaming achievement	• General achievement in online gaming (Yee, 2006) • Power in online gaming (Yee, 2006) • Winning gaming tournaments for image enhancement (Griffiths et al., 2003; Wai-ming, 2001)
		Autonomy/ freedom	• Political blogging (Nardi et al., 2004) • Texting (Oksman & Turtiainen, 2004) • Virtual worlds (Barnes, 2007) • Online multiplayer games (Ryan, Rigby, & Przybylski, 2006) • Hacking tools (Van Beveren, 2000)
	System learning	Knowledge acquisition	• Internet-based learning (Lee et al., 2005) • Learning through virtual worlds (Dreher, Reiners, Dreher, & Dreher, 2009; Eschenbrenner, Nah, & Siau, 2008) • Personal computer (Becker, 2000) • Internet use (Katz & Aspden, 1997) • Commercial websites (Stafford & Stafford, 2002) • Hacking tools (Embar-Seddon, 2002) • Online multiplayer games (Ryan et al., 2006) • Computer-assisted language learning (Alm, 2006) • Online learning discussions (Shroff, Vogel, & Coombes, 2008)
		Knowledge sharing	• Knowledge sharing through professional virtual communities (Chen & Hung, 2010) • Knowledge sharing through blogs (Hsu & Lin, 2008) • Knowledge sharing through wikis (Prasarnphanich & Wagner, 2009) • Motivation to participate in online learning discussions (Shroff et al., 2008) • Virtual organizational learning through open-source software (Au et al., 2009)
		Computer-skill acquisition	• Self-motivated desire to develop system competence (Gravill et al., 2006) • Desire for computer-skill acquisition (Yi & Davis, 2003).
		Staying informed	• Fantasy sports sites (Joines et al., 2003) • Learning information sites (Joines et al., 2003) • Social networking/blogging (Butler et al., 2002) • Internet use (Katz & Aspden, 1997) • Commercial websites (Stafford & Stafford, 2002) • Political blogging (Nardi et al., 2004)

Table A-1. Examples of Intrinsic Motivation for System Use (cont.)

Motivation category	General motivation (desire for)	Specific motivation (desire for)	Examples of this motivation found in particular systems-use context
	System socialization	Affiliation with community of interest	• Open-source development communities (Au et al., 2009; Hahn et al., 2008; Ke & Zhang, 2009) • Virtual teams (Bjørn & Ngwenyama, 2009; David et al., 2008; Dubé & Robey, 2009; Lin et al., 2008a; Lowry et al., 2009a; Schweitzer & Duxbury, 2010; Wakefield, Leidner, & Garrison, 2008) • Affiliation through blogging (Hsu & Lin, 2008; Silva, Goel, & Mousavidin, 2009; Zhang, Lee, Cheung, & Chen, 2009) • Social networking (Butler et al., 2002; Ridings & Gefen, 2004) • Virtual communities (Chen & Hung, 2010; Lin, 2008; Pentina et al., 2008; Posey et al., 2010) • Virtual worlds (Chesney, Coyne, Logan, & Madden, 2009; Davis et al., 2009; schenbrenner et al., 2008; Messinger et al., 2009; Pinkwart & Olivier, 2009; Putzke et al., 2010)
		Social communication	• Instant messaging (Cummings, Espinosa, & Pickering, 2009; Johnson & Cooper, 2009a; Luo, Gurung, & Shim, 2010; Premkumar et al., 2008) • Virtual communities (Chen & Hung, 2010; Lin, 2008; Pentina et al., 2008; Posey et al., 2010) • Massively multiplayer online games (MMOGs)(Meredith et al., 2009; Putzke et al., 2010) • Texting (Oksman & Turtiainen, 2004; Ran & Lo, 2006) • Virtual worlds (Chesney et al., 2009) • Social networking (Butler et al., 2002; Posey et al., 2010; Ridings & Gefen, 2004)
		Collaboration	• Computer-mediated communication (King et al., 2010; Zhang et al., 2007) • Wikis (Majchrzak, 2009; Prasarnphanich & Wagner, 2009; Wagner & Majchrzak, 2007) • Open-source development communities (Au et al., 2009; Hahn et al., 2008; Ke & Zhang, 2009) • Virtual teams (Bjørn & Ngwenyama, 2009; David et al., 2008; Dubé & Robey, 2009; Lin et al., 2008a; Lowry et al., 2009a; Schweitzer & Duxbury, 2010; Wakefield et al., 2008) • Cooperative virtual worlds (Pinkwart & Olivier, 2009)

Table A-1 Examples of Intrinsic Motivation for System Use (Cont.)

Motivation category	General motivation (desire for)	Specific motivation (desire for)	Examples of this motivation found in particular systems-use context
		Playing with others	• Massively multiplayer online games (MMOGs) (Meredith et al., 2009; Putzke et al., 2010) • Virtual worlds (Davis et al., 2009; Messinger et al., 2009; Pinkwart & Olivier, 2009; Putzke et al., 2010) • Group gaming (Yee, 2006) • Texting (cell phones) (Oksman & Turtiainen, 2004; Ran & Lo, 2006) • Virtual worlds (Barnes, 2007; Overby, 2008) • Metaverses (Davis et al., 2009)
		Romance/dating	• Texting (Lin & Tong, 2007) • Virtual worlds (Barnes, 2007) • Online dating (Couch & Liamputtong, 2008)
Positive extrinsic	System personal gain	Receiving treatment/therapy	• Virtual worlds (Gorini & Riva, 2008) • Online chat (Barak & Wander-Schwartz, 2000; Golkaramnay, Bauer, Haug, Wolf, & Kordy, 2007)
		Making money	• Internet (Katz & Aspden, 1997) • Hacking tools (McClure et al., 2009) • Video game tournaments (Griffiths et al., 2003; Wai-ming, 2001)
	System transact	Buying products or services	• Internet (Katz & Aspden, 1997) • E-commerce and online consumer transactions (Dimoka, Hong, & Pavlou, 2012; Jiang et al., 2010; Lee et al., 2003; Lowry et al., 2012)
		Fulfilling obligations/ requirements	• Internet (Katz & Aspden, 1997) • Hacking tools (Van Beveren, 2000) • Paying debts (Hu et al., 2012) • Adhere to organizational security and privacy policies (Hsu et al. 2015; Vance et al., 2015)
	System improve work	Advertising/ promoting company	• Virtual worlds (Barnes, 2007; Wu et al., 2008b) • Internet (Katz & Aspden, 1997)
		Being more productive/ increasing performance	• Virtual worlds (Brown, Hobbs, & Gordon, 2006) • Personal computer (Becker, 2000) • Agile development (Barlow et al., 2011)

Table A-1 Examples of Intrinsic Motivation for System Use (Cont.)

Motivation category	General motivation (desire for)	Specific motivation (desire for)	Examples of this motivation found in particular systems-use context
		Collaborating/ communicating remotely	• Metaverses (Davis et al., 2009; Rutkowski, Vogel, Van Genuchten, Bemelmans, & Favier, 2002) • Personal computer (Becker, 2000) • Internet (Katz & Aspden, 1997) • Instant messaging (Lowry, Cao, & Everard, 2011) • Commercial websites (Stafford & Stafford, 2002) • Virtual-team collaboration (Lowry, Roberts, & Romano Jr., 2013c)
		Enhancing decision making	• Decision support systems (Bui & Lee, 1999; Jensen, Lowry, Burgoon, & Nunamaker Jr., 2010; Jensen, Lowry, & Jenkins, 2011) • Group decision support (DeSanctis & Gallupe, 1987; Zhang et al., 2007) • Automated decision agents (Bui & Lee, 1999; Lee, 2004)
Negative extrinsic	System self-preservation	Avoiding threat or injury	• Hacking tools (Crossler et al., 2013; Van Beveren, 2000) • Firewalling (Liang & Xue, 2010) • Security scanning (Chen et al., 2011; Crossler et al., 2013) • Protection motivation behaviors (Crossler et al., 2013; Posey et al., 2013; Boss et al. 2015) • Online whistle-blowing (Lowry, Moody, Galletta, & Vance, 2013b)
	System harm others	Manipulating/ extorting others	• Hacking tools (Barber, 2001; Crossler et al., 2013) • Cyberstalking (Hancock, 2000) • Cyberbullying (Kshetri, 2011)
		Causing injury	• Code editors (for virus development) (Voiskounsky & Smyslova, 2003) • Hacking tools (Barber, 2001; Crossler et al., 2013) • Cyberterrorism (Embar-Seddon, 2002; Foltz, 2004; Furnell & Warren, 1999; Hansen, Lowry, Meservy, & McDonald, 2007; Weimann, 2005)
		Pursuing revenge	• Cyberterrorism (Furnell & Warren, 1999; Hansen et al., 2007) • Denial of service attacks (Loukas & Öke, 2010)
		Carrying out fanatical political agenda	• Cyberterrorism (Embar-Seddon, 2002; Foltz, 2004; Furnell & Warren, 1999; Weimann, 2005) • Disclosing confidential information (Barnard-Wills, 2011) • Vigilantism (Chua, Eng, Wareham, & Robey, 2007)

Table A-1 Examples of Intrinsic Motivation for System Use (Cont.)

Motivation category	General motivation (desire for)	Specific motivation (desire for)	Examples of this motivation found in particular systems-use context
	System misbehavior	Accessing proprietary information illegally	• Hacking tools (Barber, 2001; Crossler et al., 2013) • Social engineering (Crossler et al., 2013; Karjalainen & Siponen, 2011)
		Making mischief	• Hacking tools (Foltz, 2004) • Making and distributing viruses (Galbreth & Shor, 2010)
		Computer abuse/ noncompliance	• Spamming (Cukier et al., 2008) • Viewing pornography at work (Berente et al., 2011; Cameron, 2012) • Internet surfing at work (Griffiths, 2010) • General computer abuse (Crossler et al., 2013; Lowry et al., 2014a; Posey, Bennett, Roberts, & Lowry, 2011)

Table A-2. Examples of Users' Intrinsic and Extrinsic Motivation for Using Different Systems

System	Examples	Possible intrinsic motivations	Possible extrinsic motivations
Accounting systems	• Quicken • SAS	• Accomplishment: self-organization • Learning	• Facilitating decision making for business • Governing organization • Performing job duties
Collaboration systems	• GroupSystems • Skype • Telepresence systems • Video conferences	• Pleasure • Socialization • Socialization: friendship • Socialization: self-expression	• Completing team projects • Completing training • Finding new customers • Increasing work productivity
Corporate training websites	• IBM business center on Second Life • Training models	• Accomplishment: self-improvement • Arousal: curiosity • Learning • Socialization	• Complete certification • Complete work-related tasks
Dating sites	• eHarmony.com • Match.com	• Arousal • Pleasure: romance • Socialization • Socialization: friendship	• Malicious agenda • Manipulating others • Marketing
E-commerce	• Amazon.com • Newegg.com • Target.com	• Learning: finding the best deals • Pleasure: browsing	• Conducting business • Purchasing a product • Saving money
E-mail	• Exchange servers • Gmail.com • Yahoo.com	• Accomplishment • Pleasure • Socialization • Socialization: friendship	• Cooperative communications • Team collaboration

Table A-2. Examples of Users' Intrinsic and Extrinsic Motivation for Using Different Systems (Cont.)			
System	**Examples**	**Possible intrinsic motivations**	**Possible extrinsic motivations**
Exploration applications	• Google Earth • Google Maps/Street	• Arousal: curiosity • Learning • Pleasure: enjoyment • Pleasure: escapism	• Destination finding
Fantasy sports applications/ sports sites	• Cbssports.com • Espn.com	• Accomplishment: competition • Pleasure: enjoyment • Pleasure: gambling for "fun" • Pleasure: relaxation • Socialization: friendship	• Information motivation • Professional gambling (for-profit gambling)
Folksonomies (social tagging)	• Delicious • Flickr	• Accomplishment: desire to be recognized • Accomplishment: desire to contribute • Socialization: desire to be a part of an intellectual community	• Professional networking
Group gaming	• Group games for Xbox, PlayStation, Wii, etc. (e.g., Mario Kart, Halo, Guitar Hero, etc.) • Massively multiplayer online role-playing games (MMORPGs) • Online networked games (e.g., World of Warcraft)	• Accomplishment: teamwork • Arousal • Pleasure • Socialization: relationship/friendship • Socialization: social competition	• Advertising • Gaming competitions with reward • Selling virtual products (e.g., clothes, characters)
Instant messaging	• Google Chat • MSN Messenger • Skype	• Pleasure: enjoyment • Pleasure: recreation • Socialization • Socialization: connectedness/involvement • Socialization: friendship	• Professional communication
Knowledge management systems	• IBM FileNet • Interspire	• Accomplishment: self-development • Learning	• Improving job performance • Obtaining information to complete a task

Table A-2. Examples of Users' Intrinsic and Extrinsic Motivation for Using Different Systems (Cont.)

System	Examples	Possible intrinsic motivations	Possible extrinsic motivations
Learning/ informational sites	• Beauty/fashion • Genealogy research sites • News feeds • News sites • Wikipedia.com • Disney.com • Nasa.gov	• Arousal: curiosity • Learning • Pleasure: relaxation • Pleasure: social escapism	• Desire to get information • Intentional disinformation against competitors • Promotion of one's company • Promotion of one's research • Research
Metaverses	• Second Life • World of Warcraft	• Accomplishment: challenge • Arousal: social presence • Pleasure: escapism • Pleasure: fun • Pleasure: relaxation • Socialization	• Team collaboration
Music sites	• iTunes store • Napster.com • Rhapsody.com	• Arousal • Learning: new song discovery • Pleasure: enjoyment • Pleasure: escapism • Pleasure: relaxation	• Motivated music search for utilitarian purposes (presentations, disc jockey, etc.)
Political blogging	• Politicalticker.blogs.cnn.com/ • Yeswecan.com	• Learning • Pleasure: venting • Socialization: develop sense of community/belonging • Socialization: self-expression	• Campaigning/politicking • Professional lobbying
Project management systems	• Microsoft Project • Open Work Bench	• Accomplishment: self-organization • Learning: pattern discovery	• Coordinating projects with team • Resource allocation • Scheduling
Social networking/ blogging	• BlogSpot.com • Facebook.com • MySpace.com • Twitter.com	• Accomplishment: achievement/creative self-expression • Accomplishment: satisfaction • Learning: documentation of life/virtual journal • Pleasure: enjoyment • Pleasure: passing time • Socialization • Socialization: attention/visibility • Socialization: friendship	• Desire for information • Monetary compensation • Multilevel marketing • Networking for marketing • Professional advancement • Seeking/providing advice

Table A-2. Examples of Users' Intrinsic and Extrinsic Motivation for Using Different Systems (Cont.)

System	Examples	Possible intrinsic motivations	Possible extrinsic motivations
Standalone gaming	• Online games (miniclip.com) • Single-player games for Xbox, PlayStation, Wii, etc.	• Accomplishment: achievement/satisfaction • Arousal: discovery • Arousal: flow • Pleasure: challenge • Pleasure: enjoyment • Pleasure: escapism/relaxation	• Gaming competitions with reward
Texting	• Cell phones	• Arousal: romance • Pleasure: enjoyment • Pleasure: gratification • Pleasure: romance • Socialization: friendship • Socialization: self-expression • Socialization: social connectedness • Socialization: strengthen relationships	• Advertisements • Appointment reminders • Business correspondence
Video sites	• Video.aol.com • Youtube.com	• Accomplishment: achievement/creative self-expression • Arousal: curiosity • Learning: interest • Pleasure: enjoyment • Pleasure: entertainment	• Building reputation/branding • Getting support materials for presentations
Virtual reality	• Google Earth • RealTourVision • Virtually Anywhere	• Arousal: curiosity • Arousal: immersion • Learning: desire to explore • Pleasure: enjoyment • Pleasure: escapism/relaxation • Socialization: telepresence •	• Augmented surgical procedures • Flight training • Formal learning/instruction • Health care instruction • Phobia treatments • Rehabilitation • Urban planning and design
Virtual worlds	• Kaneva • Second Life • The Sims Online	• Accomplishment • Arousal: romance • Pleasure: enjoyment • Pleasure: escapism • Pleasure: relaxation • Pleasure: romance • Socialization • Socialization: friendship • Socialization: self-expression	• Advertising • Business collaboration • E-commerce • Formal learning/instruction • Formal therapy • Increasing group work productiveness • Selling virtual products (e.g., clothes, characters) • Tourism

Table A-2. Examples of Users' Intrinsic and Extrinsic Motivation for Using Different Systems (Cont.)

System	Examples	Possible intrinsic motivations	Possible extrinsic motivations
Voice over IP/ conferencing	• Adobe Connect • Skype • Tokbox	• Arousal: curiosity • Pleasure: enjoyment • Pleasure: romance • Socialization • Socialization: friendship	• Business communication • Distributed learning • Formal distributed meetings

Appendix B. Instrumentation

Table B-1. Instrumentation	
Construct (source)	**Items**
Attitude$_{t1}$ (Bhattacherjee & Premkumar, 2004)	All things considered, using the website will be a … 1. bad idea … good idea. 2. foolish move … wise move. 3. negative step … positive step. 4. ineffective idea … effective idea.
Enjoyment$_{t1}$ (hedonic) expectations based on van der Heijden (2004)	All things considered, using the website will be … 1. enjoyable … unenjoyable. 2. pleasant … unpleasant. 3. interesting … tedious. 4. arousing … boring. 5. fun … not fun.
Learning$_{t1}$ (intrinsic) expectations adapted from Chang et al. (2009)	1. The website will help me learn new things. 2. The website will help me master new concepts. 3. The website will help me acquire innovative ideas.
Usefulness$_{t1}$ (extrinsic) expectations (Bhattacherjee & Premkumar, 2004)	All things considered, using the website will … 1. improve my performance. 2. increase my productivity. 3. enhance my effectiveness.
Enjoyment (hedonic) disconfirmation based on van der Heijden (2004)	We now want to know whether your website interaction was the same, better, or worse than what you were expecting. "Compared to my initial expectations, the ability of the website to be … 1. enjoyable was (much worse than expected … much better than expected)." 2. pleasant was (much worse than expected … much better than expected)." 3. interesting was (much worse than expected … much better than expected)." 4. arousing was (much worse than expected … much better than expected)." 5. fun was (much worse than expected … much better than expected)."
Learning (intrinsic) disconfirmation adapted from Chang et al. (2009)	We now want to know whether your website interaction was the same, better, or worse than what you were expecting. "Compared to my initial expectations, the ability of the website to help me … 1. learn new things was (much worse than expected … much better than expected)." 2. master new concepts was (much worse than expected … much better than expected)." 3. acquire innovative ideas was (much worse than expected … much better than expected)."
Usefulness (extrinsic) disconfirmation (Bhattacherjee & Premkumar, 2004)	We now want to know whether your website interaction was the same, better, or worse than what you were expecting. "Compared to my initial expectations, the ability of the website to … 1. improve my performance was (much worse than expected … much better than expected)." 2. increase my productivity was (much worse than expected … much better than expected)." 3. enhance my effectiveness was (much worse than expected … much better than expected)."

Table B-1. Instrumentation (Cont.)	
Construct (source)	**Items**
Enjoyment$_{t2}$ (hedonic) (van der Heijden, 2004)	How much fun did you have using the website? All things considered, using the website was … 1. enjoyable … unenjoyable. 2. pleasant … unpleasant. 3. interesting … tedious. 4. arousing … boring. 5. fun … not fun.
Learning$_{t2}$ (intrinsic) (Chang et al., 2009)	How much did you learn using the website? All things considered, the website helped me … 1. learn new things. 2. master new concepts. 3. acquire innovative ideas.
Usefulness$_{t2}$ (extrinsic) (Bhattacherjee & Premkumar, 2004)	How useful is this website for your free time? All things considered, using the website … 1. improves my performance. 2. increases my productivity. 3. enhances my effectiveness.
Satisfaction (Bhattacherjee & Premkumar, 2004)	I am ___ with my use of the website. 1. extremely displeased … extremely pleased 2. extremely frustrated … extremely delighted 3. extremely discontented … extremely contented 4. extremely dissatisfied … extremely satisfied
Design-expectations fit—based on information fit-to-task (Kim & Stoel, 2004)	1. I can interact with the website in order to accomplish goals specific to my needs. 2. The website has interactive features, which help me accomplish my task. 3. The website allows me to interact with it to receive content tailored to my needs. 4. The website adequately meets my needs.
Design aesthetics (Cyr et al., 2006)	1. The website design (i.e., colors, boxes, menus, etc.) is attractive. 2. The site looks professionally designed. 3. The graphics are meaningful. 4. The overall look and feel of the site is visually appealing.
Attitude$_{t2}$ (Bhattacherjee & Premkumar, 2004)	All things considered, using the website was a … 1. bad idea … good idea. 2. foolish move … wise move. 3. negative step … positive step. 4. ineffective idea … effective idea.
Intention to continue (Galletta et al., 2004; Galletta et al., 2006)	1. I would recommend this site to others. 2. I would recommend that others use this site. 3. I would visit this site again. 4. I would use this site again.
Note: All items had Likert-type scales from 1 to 7, representing very strongly disagree (1) to very strongly agree (7).	

Appendix C. Preanalysis Construct Validity and Final Analysis Details

Establishing Factorial Validity

Factorial validity is established through both convergent and discriminant measures, which are two highly interrelated concepts that must coexist. *Convergent validity* is the basic idea that measurement items that should be related are related. It is established "when items thought to reflect a construct converge, or show significant, high correlations with one another, particularly when compared to the convergence of items relevant to other constructs, irrespective of method" (Straub, Boudreau, & Gefen, 2004, p. p, 391). *Discriminant validity* is the basic idea that items that should not be related are in fact not related. Thus, it can be established when items thought to diverge show nonsignificant, low correlations with one another, particularly when compared to items in other constructs (Straub et al., 2004).

Convergent Validity

All item loadings were significant and were above 0.700, which is a conservative threshold for convergent validity (see Table C-1). As a second check, we correlated the latent variable scores against the indicators as a form of factor loadings, and then examined the indicator loadings and cross-loadings to establish convergent validity. Although this approach is typically used to establish discriminant validity (Gefen & Straub, 2005), convergent validity and discriminant validity are interdependent and help establish each other (Straub et al., 2004). Convergent validity is also established when each loading for a latent variable is substantially higher than those for other latent variables. This approach established high levels of convergent validity for all items. Tables C-2, C-3, and C-4 summarize the loadings, shown in gray. A more recent criterion for assessing convergent validity is that the AVE for the latent variable must exceed 0.50 (Kline et al., 2011). See Tables C-5, C-6, and C-7. All the latent variables meet these criteria. Overall, the latent variables achieve convergent validity.

Discriminant Validity of Reflective Constructs

We used two approaches to establish discriminant validity, as described in Gefen & Straub (2005); and Lowry & Gaskin (2014) and demonstrated in Lowry et al. (2009b); and Lowry et al. (2008). First, as with convergent validity, we examined the factor loadings, but we ensured that significant overlap did not exist between the constructs (again, see Tables C-2, C-3, and C-4). Second, to establish discriminant validity, we used the Fornell-Larcker test, in which the square root of the AVE for each construct must be greater than any interconstruct correlations (Fornell & Larcker, 1981). The basic standard followed here is that the square root of the AVE for any given construct (latent variable) should be higher than any of the correlations involving the construct (Fornell & Larcker, 1981; Staples, Hulland, & Higgins, 1999). The numbers are shown in the diagonal for constructs (bolded and underlined). Strong discriminant validity was shown for all constructs except where noted (see Tables C-5, C-6, and C-7).

Establishing Lack of Monomethod Bias

We also tested for common-methods bias (aka "monomethod bias") to establish that it is not a likely negative factor in the data remaining for our analysis. However, we acknowledge there is increasing debate as to how serious this bias is (Bagozzi, 2011). To test for this bias, we used two approaches. The first approach was a simple Harman's single factor analysis test, which is the traditional approach but is considered to be the least valid (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). For the hedonic model, this approach produced 49 factors, the largest accounting for 41% of the variance; for the intrinsic model, 45 factors were produced, the largest accounting for 46% of the variance; for the extrinsic model, 45 factors were produced, the largest accounting for 44% of the variance. The second approach was to examine a correlation matrix of the constructs to determine whether any of the correlations were above 0.90, which is evidence that common-methods bias might exist (Pavlou, Liang, & Xue, 2007). These correlations are presented in the measurement model statistics in Tables C-5, C-6, and C-7, and all are below the 0.90 threshold. Overall, these two results indicate that common-methods bias is likely not a serious concern for the models.

Establishing That Multicollinearity Is Not a Problem

Recent studies have noted that multicollinearity is a greater threat to SEM models than is common-methods bias. We thus assessed the degree of multicollinearity in our models. Variance inflation factors (VIFs) less than 10 are traditionally viewed as justification for a model's lack of multicollinearity, with 5.0 being ideal for reflective constructs (Cenfetelli & Bassellier, 2009; Diamantopoulos & Siguaw, 2006; Petter et al., 2007). All VIFs for all three models were below the ideal threshold of 5.0, as summarized in Table C-8. (ATT_1 was used as the DV in all these analyses). Hence, we can conclude that multicollinearity was not a problem with our data.

Table C-1. Outer Model Weights to Establish Convergent Validity

Indicators	Hedonic model		Intrinsic model		Extrinsic model	
	Loadings	Critical ratio	Loadings	Critical ratio	Loadings	Critical ratio
aesthet1	0.856	56.12	0.858	68.94	0.882	104.41
aesthet2	0.849	51.32	0.856	92.03	0.876	71.70
aesthet3	0.846	61.86	0.780	38.59	0.859	59.61
aesthet4	0.909	108.44	0.867	75.25	0.893	95.44
att_t1_1	0.798	26.85	0.744	27.59	0.892	80.65
att_t1_2	0.916	104.96	0.888	78.98	0.917	119.16
att_t1_3	0.903	96.57	0.878	69.34	0.870	59.20
att_t1_4	0.872	46.29	0.853	60.58	0.884	90.99
att_t2_1	0.920	76.28	0.931	124.69	0.924	89.14
att_t2_2	0.953	196.74	0.939	146.91	0.945	176.81
att_t2_3	0.963	311.38	0.923	143.71	0.957	265.95
att_t2_4	0.956	212.65	0.918	95.49	0.935	124.28
des_fit1	0.816	40.02	0.899	126.88	0.843	48.73
des_fit2	0.847	52.33	0.822	54.86	0.905	130.37
des_fit3	0.796	46.10	0.853	60.71	0.878	98.58
des_fit4	0.802	44.79	0.807	44.23	0.861	85.41
int_t2_1	0.937	151.26	0.919	133.29	0.928	152.37
int_t2_2	0.937	173.73	0.908	112.24	0.926	150.40
int_t2_3	0.935	154.15	0.917	148.08	0.927	139.76
int_t2_4	0.948	220.34	0.926	195.48	0.928	139.37
joy_t2_1	0.925	117.95	0.930	153.19	0.931	143.83
joy_t2_2	0.911	109.12	0.922	131.35	0.940	171.68
joy_t2_3	0.908	115.27	0.926	144.67	0.909	115.31
joy_t2_4	0.895	97.03	0.798	33.14	0.811	48.32
joy_t2_5	0.932	150.35	0.943	203.34	0.914	91.11
learn_t2_1	0.919	114.63	0.917	125.18	0.899	93.03
learn_t2_2	0.928	110.44	0.944	206.10	0.909	84.39
learn_t2_3	0.910	97.94	0.901	101.98	0.895	104.55
peou1	0.823	47.07	0.835	50.11	0.754	25.54
peou2	0.856	48.58	0.869	61.58	0.831	38.31
peou3	0.766	36.78	0.822	48.91	0.844	52.39
peou4	0.835	47.85	0.836	68.95	0.870	78.61

Table C-1. Outer Model Weights to Establish Convergent Validity (Cont.)

Indicators	Hedonic model		Intrinsic model		Extrinsic model	
	Loadings	Critical ratio	Loadings	Critical ratio	Loadings	Critical ratio
sat_t2_1	0.919	119.87	0.921	103.58	0.890	73.17
sat_t2_2	0.918	85.86	0.914	95.72	0.911	100.06
sat_t2_3	0.920	100.39	0.921	124.89	0.917	99.93
sat_t2_4	0.917	89.12	0.927	113.32	0.908	96.79
use_t2_1	0.936	128.37	0.905	113.75	0.937	182.99
use_t2_2	0.934	98.87	0.920	108.69	0.945	139.29
use_t2_3	0.958	264.15	0.919	123.57	0.950	203.16
joy_t1_1	0.940	106.79	n/a	n/a	n/a	n/a
joy_t1_2	0.932	100.77	n/a	n/a	n/a	n/a
joy_t1_3	0.938	149.91	n/a	n/a	n/a	n/a
joy_t1_4	0.923	137.25	n/a	n/a	n/a	n/a
joy_t1_5	0.915	73.67	n/a	n/a	n/a	n/a
joy_discon_1	0.918	131.22	n/a	n/a	n/a	n/a
joy_discon_2	0.939	144.85	n/a	n/a	n/a	n/a
joy_discon_3	0.926	185.92	n/a	n/a	n/a	n/a
joy_discon_4	0.896	98.19	n/a	n/a	n/a	n/a
joy_discon_5	0.919	111.93	n/a	n/a	n/a	n/a
learn_t1_1	n/a	n/a	0.776	19.08	n/a	n/a
learn_t1_2	n/a	n/a	0.838	53.16	n/a	n/a
learn_t1_3	n/a	n/a	0.853	51.16	n/a	n/a
learn_disc_1	n/a	n/a	0.950	199.16	n/a	n/a
learn_disc_2	n/a	n/a	0.943	174.19	n/a	n/a
learn_disc_3	n/a	n/a	0.932	127.35	n/a	n/a
use_t1_1	n/a	n/a	n/a	n/a	0.895	85.95
use_t1_2	n/a	n/a	n/a	n/a	0.888	57.96
use_t1_3	n/a	n/a	n/a	n/a	0.894	59.94
use_disc_1	n/a	n/a	n/a	n/a	0.927	146.37
use_disc_2	n/a	n/a	n/a	n/a	0.934	147.70
use_disc_3	n/a	n/a	n/a	n/a	0.931	133.31

Note: All critical ratios were significant at $p < 0.001$.

Table C-2. Correlations of Latent Variable Scores against the Indicators (Hedonic Model)

Indicators	Aesthetics	Att$_{t1}$	Att$_{t2}$	Des. Fit	Intent	Joy disc.	Joy$_{t1}$	Joy$_{t2}$	Learn$_{t2}$	PEOU	Satisfaction	Use$_{t2}$
aesthet1	**0.856**	0.102	0.522	0.491	0.400	0.503	0.104	0.562	0.187	0.441	0.493	0.295
aesthet2	**0.849**	0.057	0.447	0.448	0.379	0.299	0.090	0.426	0.208	0.441	0.397	0.318
aesthet3	**0.846**	0.000	0.411	0.400	0.414	0.293	0.069	0.350	0.180	0.381	0.365	0.355
aesthet4	**0.909**	0.042	0.556	0.450	0.486	0.518	0.119	0.499	0.186	0.485	0.503	0.343
att_t1_1	0.048	**0.798**	0.290	0.219	0.176	0.064	0.642	0.198	0.247	0.150	0.248	0.169
att_t1_2	0.022	**0.916**	0.299	0.215	0.120	0.191	0.618	0.248	0.265	0.137	0.310	0.134
att_t1_3	0.052	**0.903**	0.400	0.225	0.207	0.162	0.580	0.302	0.310	0.097	0.333	0.175
att_t1_4	0.078	**0.872**	0.324	0.201	0.163	0.182	0.546	0.222	0.309	0.127	0.291	0.172
att_t2_1	0.590	0.335	**0.920**	0.643	0.737	0.540	0.334	0.680	0.524	0.560	0.749	0.607
att_t2_2	0.520	0.349	**0.953**	0.629	0.690	0.538	0.292	0.744	0.515	0.553	0.761	0.600
att_t2_3	0.527	0.377	**0.963**	0.654	0.678	0.541	0.317	0.715	0.480	0.537	0.748	0.595
att_t2_4	0.492	0.370	**0.956**	0.640	0.686	0.512	0.273	0.660	0.554	0.521	0.703	0.601
des_fit1	0.415	0.253	0.570	**0.816**	0.439	0.378	0.236	0.501	0.368	0.522	0.559	0.447
des_fit2	0.478	0.139	0.528	**0.847**	0.397	0.390	0.161	0.559	0.393	0.450	0.496	0.454
des_fit3	0.403	0.219	0.476	**0.796**	0.395	0.305	0.198	0.525	0.464	0.273	0.435	0.496
des_fit4	0.394	0.192	0.602	**0.802**	0.592	0.377	0.101	0.540	0.476	0.539	0.559	0.626
int_t2_1	0.495	0.136	0.664	0.522	**0.936**	0.364	0.146	0.534	0.475	0.442	0.583	0.577
int_t2_2	0.460	0.204	0.734	0.582	**0.937**	0.354	0.197	0.559	0.531	0.444	0.608	0.611
int_t2_3	0.438	0.175	0.666	0.530	**0.935**	0.396	0.101	0.576	0.443	0.444	0.566	0.558
int_t2_4	0.441	0.200	0.700	0.533	**0.949**	0.424	0.141	0.590	0.465	0.472	0.594	0.542
joy_discon_1	0.525	0.165	0.537	0.433	0.392	**0.918**	0.037	0.626	0.214	0.403	0.615	0.253
joy_discon_2	0.482	0.137	0.528	0.423	0.368	**0.939**	0.013	0.636	0.199	0.381	0.614	0.277
joy_discon_3	0.339	0.141	0.513	0.393	0.390	**0.926**	0.064	0.623	0.249	0.281	0.614	0.305
joy_discon_4	0.396	0.226	0.527	0.413	0.359	**0.896**	0.099	0.641	0.320	0.366	0.625	0.363
joy_discon_5	0.429	0.117	0.479	0.395	0.371	**0.919**	0.030	0.620	0.209	0.261	0.614	0.299
joy_t1_1	0.164	0.640	0.347	0.252	0.193	0.062	**0.940**	0.193	0.268	0.122	0.283	0.221
joy_t1_2	0.180	0.664	0.360	0.242	0.210	0.066	**0.932**	0.211	0.273	0.165	0.304	0.241
joy_t1_3	0.090	0.637	0.260	0.176	0.153	0.037	**0.938**	0.110	0.171	0.099	0.248	0.175
joy_t1_4	0.040	0.613	0.274	0.173	0.095	0.036	**0.923**	0.122	0.227	0.109	0.267	0.192
joy_t1_5	0.034	0.623	0.243	0.105	0.068	0.043	**0.915**	0.091	0.133	0.005	0.220	0.134
joy_t2_1	0.564	0.192	0.677	0.580	0.536	0.648	0.081	**0.925**	0.333	0.522	0.704	0.447
joy_t2_2	0.510	0.233	0.630	0.615	0.498	0.612	0.143	**0.911**	0.414	0.428	0.695	0.487
joy_t2_3	0.444	0.270	0.737	0.582	0.597	0.623	0.119	**0.908**	0.464	0.451	0.713	0.529
joy_t2_4	0.437	0.341	0.653	0.603	0.551	0.603	0.224	**0.895**	0.525	0.411	0.654	0.537
joy_t2_5	0.476	0.238	0.673	0.606	0.561	0.640	0.160	**0.932**	0.422	0.443	0.739	0.489
learn_t2_1	0.129	0.268	0.491	0.457	0.447	0.191	0.197	0.398	**0.919**	0.215	0.455	0.649
learn_t2_2	0.254	0.319	0.542	0.542	0.494	0.310	0.191	0.487	**0.928**	0.309	0.564	0.710
learn_t2_3	0.216	0.304	0.471	0.449	0.464	0.206	0.255	0.411	**0.910**	0.275	0.449	0.679
peou1	0.383	0.030	0.462	0.436	0.389	0.297	0.072	0.419	0.205	**0.823**	0.444	0.259
peou2	0.370	0.133	0.442	0.519	0.410	0.313	0.036	0.426	0.206	**0.856**	0.472	0.281
peou3	0.394	0.203	0.473	0.473	0.348	0.341	0.149	0.406	0.354	**0.766**	0.451	0.315
peou4	0.509	0.122	0.506	0.422	0.423	0.267	0.110	0.374	0.209	**0.835**	0.443	0.253
sat_t2_1	0.503	0.378	0.783	0.609	0.602	0.631	0.296	0.755	0.540	0.552	**0.919**	0.609
sat_t2_2	0.463	0.244	0.708	0.572	0.559	0.642	0.252	0.696	0.494	0.487	**0.918**	0.537
sat_t2_3	0.440	0.334	0.711	0.586	0.556	0.580	0.267	0.657	0.464	0.511	**0.920**	0.534
sat_t2_4	0.467	0.284	0.660	0.571	0.582	0.607	0.228	0.706	0.462	0.466	**0.917**	0.533
use_t2_1	0.360	0.239	0.650	0.596	0.577	0.380	0.241	0.526	0.721	0.336	0.603	**0.936**
use_t2_2	0.353	0.122	0.512	0.560	0.537	0.245	0.167	0.471	0.664	0.266	0.505	**0.934**
use_t2_3	0.359	0.159	0.620	0.636	0.605	0.288	0.178	0.538	0.704	0.339	0.591	**0.958**

Table C-3. Correlations of Latent Variable Scores against the Indicators (Intrinsic Model)

Indicators	Aesthetics	Att_{t1}	Att_{t2}	Des. fit	Intent	Joy_{t2}	Learn disc	$Learn_{t2}$	$Learn_{t2}$	PEOU	Satisfaction	Use_{t2}
aesthet1	**0.858**	0.190	0.559	0.584	0.463	0.582	0.384	0.281	0.489	0.501	0.469	0.417
aesthet2	**0.856**	0.150	0.584	0.570	0.565	0.521	0.276	0.199	0.469	0.463	0.457	0.400
aesthet3	**0.780**	0.122	0.540	0.608	0.502	0.492	0.297	0.206	0.467	0.483	0.473	0.464
aesthet4	**0.867**	0.216	0.568	0.549	0.489	0.628	0.435	0.297	0.543	0.487	0.479	0.469
att_t1_v1	0.086	**0.744**	0.057	0.095	0.060	0.066	0.081	0.349	0.129	0.120	0.148	0.054
att_t1_v2	0.203	**0.888**	0.210	0.240	0.102	0.116	0.169	0.324	0.217	0.280	0.195	0.122
att_t1_v3	0.163	**0.878**	0.141	0.131	0.085	-0.002	0.039	0.289	0.101	0.192	0.127	0.068
att_t1_v4	0.210	**0.853**	0.150	0.152	0.057	0.182	0.179	0.370	0.235	0.171	0.171	0.105
att_t2_1	0.660	0.098	**0.931**	0.724	0.659	0.659	0.533	0.280	0.640	0.581	0.696	0.654
att_t2_2	0.649	0.185	**0.939**	0.680	0.695	0.601	0.553	0.270	0.660	0.479	0.664	0.647
att_t2_3	0.618	0.187	**0.923**	0.705	0.668	0.633	0.539	0.270	0.683	0.518	0.711	0.626
att_t2_4	0.560	0.155	**0.918**	0.693	0.678	0.549	0.541	0.298	0.628	0.502	0.656	0.587
des_fit1	0.628	0.165	0.747	**0.899**	0.710	0.649	0.524	0.358	0.710	0.563	0.636	0.655
des_fit2	0.508	0.102	0.577	**0.822**	0.451	0.588	0.376	0.274	0.569	0.491	0.555	0.541
des_fit3	0.558	0.128	0.581	**0.853**	0.518	0.545	0.428	0.192	0.576	0.456	0.561	0.561
des_fit4	0.614	0.227	0.616	**0.807**	0.551	0.653	0.473	0.231	0.578	0.615	0.596	0.551
int_t2_1	0.549	0.081	0.666	0.660	**0.919**	0.541	0.407	0.251	0.573	0.550	0.570	0.547
int_t2_2	0.571	0.003	0.687	0.649	**0.908**	0.559	0.453	0.243	0.571	0.539	0.579	0.597
int_t2_3	0.534	0.126	0.653	0.582	**0.917**	0.488	0.396	0.308	0.570	0.532	0.494	0.550
int_t2_4	0.562	0.124	0.665	0.585	**0.926**	0.494	0.405	0.265	0.570	0.534	0.498	0.556
joy_t2_1	0.587	0.065	0.573	0.644	0.523	**0.930**	0.572	0.280	0.549	0.568	0.673	0.520
joy_t2_2	0.608	0.093	0.619	0.690	0.486	**0.922**	0.567	0.251	0.602	0.596	0.656	0.547
joy_t2_3	0.616	0.122	0.628	0.689	0.544	**0.926**	0.591	0.349	0.636	0.532	0.689	0.554
joy_t2_4	0.530	0.167	0.576	0.565	0.490	**0.798**	0.632	0.295	0.666	0.479	0.607	0.606
joy_t2_5	0.636	0.071	0.583	0.673	0.523	**0.943**	0.586	0.292	0.615	0.541	0.658	0.585
learn_disc_1	0.405	0.154	0.557	0.559	0.460	0.644	**0.950**	0.315	0.671	0.346	0.603	0.555
learn_disc_2	0.385	0.161	0.564	0.507	0.407	0.587	**0.943**	0.290	0.652	0.274	0.593	0.557
learn_disc_3	0.367	0.094	0.529	0.457	0.410	0.609	**0.932**	0.300	0.629	0.300	0.578	0.496
learn_t1_1	0.211	0.336	0.203	0.306	0.221	0.196	0.148	**0.776**	0.255	0.264	0.187	0.259
learn_t1_2	0.187	0.372	0.178	0.199	0.182	0.211	0.200	**0.838**	0.372	0.184	0.161	0.290
learn_t1_3	0.302	0.288	0.339	0.284	0.300	0.368	0.402	**0.853**	0.390	0.304	0.273	0.343
learn_t2_1	0.501	0.164	0.632	0.691	0.568	0.596	0.616	0.382	**0.917**	0.365	0.588	0.717
learn_t2_2	0.533	0.232	0.647	0.676	0.592	0.590	0.622	0.411	**0.944**	0.399	0.600	0.728
learn_t2_3	0.578	0.178	0.664	0.642	0.559	0.685	0.669	0.362	**0.901**	0.478	0.652	0.698
peou1	0.478	0.272	0.390	0.469	0.386	0.468	0.153	0.220	0.342	**0.835**	0.420	0.364
peou2	0.478	0.160	0.462	0.544	0.479	0.488	0.262	0.244	0.359	**0.869**	0.495	0.427
peou3	0.440	0.160	0.463	0.559	0.480	0.513	0.333	0.282	0.424	**0.822**	0.510	0.456
peou4	0.525	0.193	0.538	0.537	0.586	0.536	0.315	0.277	0.382	**0.836**	0.503	0.421
sat_t2_1	0.514	0.178	0.721	0.660	0.571	0.658	0.602	0.220	0.599	0.539	**0.921**	0.612
sat_t2_2	0.517	0.208	0.639	0.620	0.532	0.709	0.567	0.278	0.617	0.537	**0.914**	0.613
sat_t2_3	0.509	0.184	0.666	0.611	0.511	0.623	0.543	0.223	0.623	0.537	**0.921**	0.615
sat_t2_4	0.515	0.141	0.677	0.674	0.534	0.685	0.599	0.229	0.617	0.518	**0.927**	0.658
use_t2_1	0.464	0.133	0.627	0.595	0.571	0.588	0.601	0.363	0.746	0.451	0.662	**0.905**
use_t2_2	0.482	0.119	0.603	0.632	0.560	0.579	0.475	0.340	0.717	0.468	0.611	**0.920**
use_t2_3	0.479	0.038	0.629	0.660	0.552	0.537	0.484	0.298	0.665	0.452	0.587	**0.919**

Table C-4. Correlations of Latent Variable Scores against the Indicators (Extrinsic Model)

Indicators	Aesthetics	Att$_{t1}$	Att$_{t2}$	Des. Fit	Intent	Joy$_{t2}$	Learn$_{t2}$	PEOU	Use disc.	Satisfaction	Use$_{t1}$	Use$_{t2}$
aesthet1	**0.882**	0.127	0.422	0.523	0.525	0.656	0.275	0.503	0.375	0.497	0.214	0.375
aesthet2	**0.876**	0.147	0.581	0.575	0.565	0.605	0.426	0.423	0.390	0.502	0.181	0.464
aesthet3	**0.859**	0.125	0.530	0.552	0.535	0.620	0.426	0.537	0.392	0.482	0.152	0.477
aesthet4	**0.893**	0.108	0.512	0.553	0.513	0.606	0.302	0.510	0.419	0.550	0.141	0.422
att_t1_v1	0.209	**0.892**	0.321	0.151	0.279	0.224	0.216	0.080	0.184	0.211	0.684	0.179
att_t1_v2	0.096	**0.917**	0.257	0.050	0.220	0.137	0.157	0.061	0.169	0.178	0.557	0.158
att_t1_v3	0.129	**0.870**	0.272	0.071	0.244	0.196	0.151	0.013	0.197	0.184	0.490	0.123
att_t1_v4	0.070	**0.884**	0.259	0.100	0.199	0.139	0.160	0.069	0.141	0.161	0.633	0.129
att_t2_1	0.602	0.288	**0.924**	0.665	0.638	0.616	0.503	0.455	0.550	0.645	0.243	0.551
att_t2_2	0.510	0.316	**0.945**	0.652	0.664	0.559	0.494	0.413	0.583	0.662	0.251	0.570
att_t2_3	0.571	0.287	**0.957**	0.631	0.671	0.573	0.483	0.421	0.542	0.659	0.238	0.535
att_t2_4	0.514	0.288	**0.935**	0.602	0.640	0.541	0.504	0.400	0.543	0.636	0.265	0.550
des_fit1	0.479	0.112	0.544	**0.843**	0.553	0.509	0.496	0.496	0.558	0.517	0.097	0.564
des_fit2	0.567	0.113	0.633	**0.905**	0.647	0.668	0.583	0.451	0.590	0.564	0.214	0.650
des_fit3	0.617	0.092	0.588	**0.878**	0.603	0.605	0.505	0.504	0.536	0.553	0.183	0.586
des_fit4	0.525	0.064	0.595	**0.861**	0.656	0.536	0.524	0.480	0.532	0.477	0.146	0.614
int_t2_1	0.596	0.234	0.684	0.679	**0.928**	0.633	0.590	0.493	0.505	0.578	0.238	0.674
int_t2_2	0.536	0.253	0.684	0.678	**0.926**	0.623	0.620	0.467	0.525	0.558	0.258	0.675
int_t2_3	0.580	0.245	0.608	0.634	**0.927**	0.651	0.569	0.498	0.488	0.537	0.217	0.630
int_t2_4	0.551	0.254	0.598	0.631	**0.928**	0.637	0.557	0.500	0.501	0.537	0.204	0.608
joy_t2_1	0.678	0.203	0.524	0.630	0.625	0.931	0.390	0.602	0.428	0.562	0.300	0.545
joy_t2_2	0.651	0.214	0.566	0.615	0.611	**0.940**	0.343	0.581	0.414	0.588	0.316	0.516
joy_t2_3	0.632	0.138	0.540	0.569	0.659	**0.909**	0.417	0.561	0.374	0.536	0.234	0.547
joy_t2_4	0.566	0.192	0.572	0.591	0.559	**0.811**	0.418	0.470	0.471	0.542	0.238	0.543
joy_t2_5	0.663	0.143	0.544	0.601	0.634	**0.914**	0.386	0.566	0.410	0.554	0.264	0.556
learn_t2_1	0.322	0.166	0.447	0.536	0.557	0.352	**0.899**	0.270	0.499	0.425	0.107	0.677
learn_t2_2	0.357	0.208	0.462	0.541	0.558	0.359	**0.909**	0.271	0.485	0.427	0.151	0.687
learn_t2_3	0.421	0.153	0.512	0.558	0.586	0.454	**0.895**	0.310	0.463	0.481	0.163	0.671
peou1	0.325	-0.029	0.228	0.306	0.250	0.331	0.151	**0.754**	0.286	0.274	0.041	0.298
peou2	0.395	0.061	0.376	0.473	0.421	0.513	0.252	**0.831**	0.437	0.402	0.143	0.450
peou3	0.519	0.068	0.380	0.501	0.463	0.514	0.302	**0.844**	0.441	0.456	0.109	0.361
peou4	0.550	0.077	0.440	0.491	0.527	0.608	0.293	**0.870**	0.494	0.535	0.143	0.424
perf_disco_1	0.447	0.121	0.541	0.596	0.547	0.468	0.496	0.500	**0.927**	0.605	0.104	0.550
perf_disco_2	0.353	0.200	0.509	0.559	0.479	0.376	0.475	0.474	**0.934**	0.572	0.132	0.543
perf_disco_3	0.448	0.217	0.593	0.616	0.495	0.450	0.520	0.475	**0.931**	0.619	0.210	0.581
sat_t2_1	0.617	0.224	0.679	0.641	0.632	0.620	0.506	0.523	0.605	**0.890**	0.193	0.602
sat_t2_2	0.498	0.189	0.600	0.502	0.529	0.522	0.402	0.463	0.609	**0.911**	0.204	0.496
sat_t2_3	0.472	0.185	0.604	0.491	0.492	0.525	0.466	0.455	0.570	**0.917**	0.184	0.493
sat_t2_4	0.499	0.148	0.620	0.551	0.499	0.565	0.413	0.464	0.546	**0.908**	0.222	0.489
use_t1_1	0.179	0.646	0.239	0.161	0.202	0.255	0.111	0.089	0.119	0.204	**0.895**	0.164
use_t1_2	0.104	0.599	0.162	0.126	0.173	0.202	0.128	0.102	0.132	0.140	**0.888**	0.195
use_t1_3	0.242	0.550	0.308	0.210	0.291	0.346	0.184	0.191	0.184	0.248	**0.894**	0.250
use_t2_1	0.514	0.089	0.547	0.658	0.679	0.579	0.698	0.506	0.573	0.558	0.141	**0.937**
use_t2_2	0.426	0.204	0.552	0.645	0.645	0.552	0.714	0.413	0.565	0.519	0.264	**0.945**
use_t2_3	0.464	0.182	0.563	0.662	0.654	0.569	0.721	0.416	0.562	0.553	0.236	**0.950**

Table C-5. Construct Correlation Matrix for Discriminant Validity (Hedonic Model)

Construct	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Attitude$_{t1}$ (1)	5.31	1.02	**.873**											
Joy$_{t1}$ (2)	5.32	1.19	.681	**.930**										
Joy disc. (3)	4.20	1.24	.170	.051	**.920**									
Joy$_{t2}$ (4)	4.42	1.38	.278	.154	.683	**.914**								
Learning$_{t2}$ (5)	4.51	1.42	.324	.229	.256	.471	**.919**							
Usefulness$_{t2}$ (6)	4.04	1.50	.182	.203	.320	.542	.737	**.943**						
Satisfaction (7)	4.38	1.17	.335	.281	.669	.765	.531	.597	**.918**					
Design fit (8)	4.50	1.08	.245	.206	.443	.651	.521	.620	.627	**.816**				
PEOU (9)	4.72	1.12	.143	.107	.365	.495	.293	.332	.547	.549	**.821**			
Aesthetics (10)	4.36	1.25	.060	.105	.465	.533	.218	.378	.508	.519	.503	**.865**		
Attitude$_{t2}$ (11)	4.70	1.28	.378	.317	.560	.739	.545	.628	.776	.668	.573	.559	**.948**	
Intent (12)	4.29	1.50	.191	.150	.410	.602	.508	.606	.625	.561	.478	.484	.734	**.939**

Table C-6. Construct Correlation Matrix for Discriminant Validity (Intrinsic Model)

Construct	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Attitude$_{t1}$ (1)	5.61	0.87	**.843**											
Learning$_{t1}$ (2)	5.29	0.85	.394	**.823**										
Learning disc. (3)	4.36	1.27	.139	.309	**.942**									
Joy$_{t2}$ (4)	4.44	1.38	.105	.317	.649	**.905**								
Learning$_{t2}$ (5)	4.54	1.32	.203	.412	.690	.674	**.921**							
Usefunessl$_{t2}$ (6)	4.33	1.26	.105	.362	.568	.618	.776	**.915**						
Satisfaction (7)	4.51	1.13	.189	.255	.628	.726	.666	.678	**.921**					
Design fit (8)	4.61	1.10	.185	.314	.531	.721	.718	.681	.694	**.846**				
PEOU (9)	4.76	1.16	.235	.303	.314	.594	.445	.494	.571	.625	**.841**			
Aesthetics (10)	4.37	1.16	.204	.289	.414	.661	.583	.517	.556	.679	.571	**.841**		
Attitude$_{t2}$ (11)	4.87	1.18	.170	.295	.583	.657	.703	.678	.734	.744	.550	.669	**.928**	
Intent (12)	4.46	1.46	.094	.289	.451	.564	.622	.612	.580	.653	.573	.597	.726	**.918**

Table C-7. Construct Correlation Matrix for Discriminant Validity (Extrinsic Model)

Construct	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Attitude$_{t1}$ (1)	5.48	1.00	**.891**											
Usefulness$_{t1}$ (2)	5.35	0.92	.657	**.892**										
Usefulness disc. (3)	4.18	1.15	.192	.161	**.931**									
Joy$_{t2}$ (4)	4.61	1.31	.193	.302	.461	**.902**								
Learning$_{t2}$ (5)	4.38	1.34	.190	.157	.535	.429	**.901**							
Usefulness$_{t2}$ (6)	4.20	1.37	.166	.231	.599	.599	.753	**.944**						
Satisfaction (7)	4.29	1.09	.203	.222	.641	.613	.489	.571	**.906**					
Design fit (8)	4.60	1.13	.103	.186	.634	.665	.605	.693	.601	**.872**				
PEOU (9)	4.80	1.09	.050	.135	.501	.594	.299	.461	.501	.534	**.826**			
Aesthetics (10)	4.37	1.23	.138	.198	.446	.709	.401	.492	.573	.626	.541	**.878**		
Attitude$_{t2}$ (11)	4.70	1.19	.310	.266	.588	.606	.525	.587	.689	.677	.430	.580	**.940**	
Intent (12)	4.35	1.41	.263	.249	.544	.686	.627	.695	.590	.705	.502	.608	.691	**.927**

Table C-8. Multicollinearity Diagnostics

Hedonic model			Intrinsic model			Extrinsic model		
Constructs	Collinearity statistics		Constructs	Collinearity statistics		Constructs	Collinearity statistics	
	Tolerance	VIF		Tolerance	VIF		Tolerance	VIF
Joy_{t1}	.816	1.226	$Learning_{t1}$	.794	1.260	$Usefulness_{t1}$	.883	1.132
Joy disc.	.430	2.327	Learning disc.	.410	2.437	Usefulness disc.	.436	2.293
Joy_{t2}	.290	3.452	Joy_{t2}	.295	3.393	Joy_{t2}	.315	3.171
$Learning_{t2}$	.415	2.410	$Learning_{t2}$	.247	4.050	$Learning_{t2}$	.378	2.645
$Usefulness_{t2}$	.331	3.025	$Usefulness_{t2}$	.329	3.044	$Usefulness_{t2}$	.295	3.391
Satisfaction	.251	3.985	Satisfaction	.308	3.251	Satisfaction	.389	2.570
Design fit	.402	2.485	Design fit	.281	3.555	Design fit	.315	3.170
PEOU	.550	1.820	PEOU	.468	2.135	PEOU	.542	1.846
Aesthetics	.560	1.784	Aesthetics	.409	2.442	Aesthetics	.421	2.374
$Attitude_{t2}$	.232	4.318	$Attitude_{t2}$	.263	3.797	$Attitude_{t2}$	.360	2.777
Intent	.405	2.468	Intent	.400	2.501	Intent	.318	3.141

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