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Beyond the Test of the Four Channel Model of Flow in the Context of Online Shopping

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Abstract:

In this study we investigate the effects of user skill and task challenge on online shoppers' experiences. We use a model suggested by flow theory in which shoppers are grouped into four categories (flow, anxiety, boredom, and apathy) based on their perceptions of task challenge and their skill in performing an online shopping task. Results show that anxious shoppers have lower perceptions of the dimensions of flow, believe online shopping Web sites are less useful, and believe they are less likely to use the system in the future compared to the other three groups of online shoppers. In addition to challenge and skill, having a clear goal and fast feedback also contribute to the flow experience.

Keywords: anxiety, boredom, flow, Internet, online shopping

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I. INTRODUCTION

Designers of brick and mortar stores generally hope to: draw potential customers into stores; capture the attention of potential customers once they are in the store; encourage shoppers to spend time browsing and selecting items to purchase; and, finally, to encourage shoppers to purchase items. Likewise, designers of online shopping systems hope to create systems that online shoppers will find engaging and that will lead to frequent visits and the purchase of items. Since a great deal of progress has been made to improve the usability of online shopping Web sites, they are now fairly easy to use. Shopping online has become such a commonplace activity many people no longer find it an exciting activity.

On the other hand, compared to brick and mortar stores, online shopping systems present shoppers with new challenges and demand different types of skills. If there is a mismatch between the challenges posed by an online shopping system and the skills of an online shopper, the purchasing behavior of the shopper may be affected. In the extreme case, the shopper may simply stop using the online shopping system.

This paper aims to increase our understanding of online shoppers' experiences. The theory of flow is used first to examine the type of positive experiences that occur when shoppers engage in simple online shopping activities with Web sites that are easy to use. Second, we look at the effect of challenge and skill on user perceptions and beliefs about the online shopping experience. Finally, goal clarity and feedback, two theoretical precursors of flow, are examined in relation to the flow experience. Answers to these questions will provide us guidance for practice and research in the future. The following sections of the paper discuss the theoretical framework for the study, the research question and the hypotheses, the methodology of the study, and the results.

II. THEORETICAL FRAMEWORK

Imagine that you are sitting in your office reading this paper. While reading, without even trying hard, you are able to focus intensely on the paper. You are barely aware that you are reading the paper, and are entirely unaware that two of your colleagues are chatting right outside your office door. Although it is nearly time for lunch, you do not notice that your stomach is growling. As you finish the paper, you look up at your clock and are shocked to see that half an hour has passed. The time has really flown by. You have been in a state of flow.

The theory of flow provides a theoretical lens for understanding human behavior in a variety of task contexts. Csikszentmihalyi [1975] introduced the idea of flow in a landmark book published in 1975. He proposed that humans can enter into a state of "flow" in which they are in a state of intense concentration and experience a shift in their perception of control over the activity. They also feel a merging of their conscious awareness and the activity in which they are engaged. Csikszentmihalyi [1975] also argues that people in a state of flow perceive time differently than normal, with time generally seeming to fly by while the person is engaged in the activity. They also experience a "loss" of self and forget their everyday concerns temporarily [Csikszentmihalyi 1975].

Csikszentmihalyi [1975] argues that human performance in a wide variety of tasks is enhanced when a person enters into a state of flow. People experience flow while engaged in many activities. Since the theory was developed, it has been used in a variety of fields including chess, rock climbing, and surgery [Csikszentmihalyi 1975]. Since the late 1980s, information technology researchers have used the theory of flow to explain the usage of software [Pilke 2004] such as email [Trevino and Webster 1992], the Internet [Agarwal and Karahanna 2000; Li and Browne 2006], e-learning [Choi et al., 2007], and online shopping [Korzaan 2003].

Characteristics of Flow Activities

The theory of flow suggests that in order for flow to occur, the task should have a clear goal and a quick, unambiguous feedback mechanism [Csikszentmihalyi 1975]. These two factors are apparent in tasks such as chess and basketball. A third precursor to flow is said to be a perceived balance of challenge and skill [Csikszentmihalyi 1975]. If challenges exceed skills, people feel overwhelmed and *anxious*. On the other hand, if the activity is too easy, people get *bored*. Results of prior studies suggest that both challenge and skill must exceed a threshold in order for flow to occur, otherwise the person experiences *apathy* toward the task [Csikszentmihalyi 1975; Csikszentmihalyi and Csikszentmihalyi 1988a]. A four channel model of flow was developed to highlight the fit between perceptions of task challenge and the level of skill brought to the task (see Figure 1) [Csikszentmihalyi and

Csikszentmihalyi 1988a]. When these three characteristics (a clear goal, feedback mechanism, and perceived balance of challenge and skill) are present, people are more likely to experience flow.

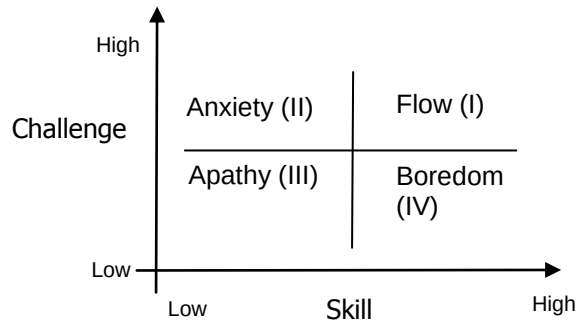

Figure 1. Channel Model of Flow

Dimensions of Flow

Csikszentmihalyi [1988] also introduced a set of dimensions of flow which can be used to assess whether a person is in flow while performing a task. These dimensions include focused concentration (C), merging of activity and awareness (M), perceived control (CON), transformation of time (TT), and transcendence of self (TS). A sixth factor recognizes that tasks performed while in a state of flow are intrinsically rewarding, or autotelic (AE). Table 1 shows the definitions of the dimensions of flow.

Table 1. Dimensions of Flow

Dimension of Flow	Definition
Focused concentration (C)	"A centering of attention on a limited stimulus field" [Csikszentmihalyi 1975 p. 40]
Merging of activity and awareness (M)	"People become so involved in what they are doing that the activity becomes spontaneous, almost automatic; they stop being aware of themselves as separate from the actions they are performing." [Csikszentmihalyi 1990 p. 53]
Perceived control (CON)	"There is the sense that the outcomes of the activity are, in principle, under the person's own control." [Csikszentmihalyi and Csikszentmihalyi 1988b p. 33]
Transformation of time (TT)	"Time no longer seems to pass the way it ordinarily does." [Csikszentmihalyi 1990 p. 66]
Transcendence of self (TS)	"The loss of the sense of a self separate from the world around it is sometimes accompanied by a feeling of union with the environment." [Csikszentmihalyi 1990 p. 63]
Autotelic experience (AE)	"The key element of an optimal experience is that it is an end in itself." [Csikszentmihalyi 1990 p. 67]

Several qualitative studies focusing on flow in tasks involving the use of computers have been conducted [Kiili 2005; Pace 2004; Pilke 2004; Rettie 2001; Shoham 2004]. The results of these studies suggest that perceived balance of challenge and skill, goal clarity, and feedback affect flow in the information systems (IS) context. In addition, the subjects who participated in these studies described the flow experience as a highly focused state. When users reported that they were in flow, they also described themselves as reacting automatically to Web sites and feeling in full control of Web site navigation. They lost track of time when in flow and sometimes even forgot about their other concerns. The results of these studies suggest that all of the characteristics of flow activities and the dimensions of the flow experience in the original flow model are present to some degree when people experience flow in computer mediated environments. However, except for a few studies [Chan and Ahern 1999; Chan and Repman 1999; Chen 2006; Chen and Nilan 1999], most of the model testing studies of flow in IS research do not include all of the characteristics of flow activities and the dimensions of flow [Finneran and Zhang 2005].

Outcomes of Flow

Prior studies have demonstrated that both emotional and cognitive outcomes are associated with flow states. Since flow is an engrossing, highly enjoyable experience, it is only natural for people to develop positive emotions when in flow [Csikszentmihalyi and LeFevre 1989; Hoffman and Novak 1996; Huang 2003]. Pleasure is an aspect of emotional response that has been found to be associated with flow in prior studies [Csikszentmihalyi and LeFevre 1989]. In computer mediated environments, positive affect and attitude have been related to flow in several studies as well [Hoffman and Novak 1996; Huang 2003; Koufaris 2002; Senecal et al., 2002]. In addition to pleasure, perceived usefulness of a technology and intention to use a technology are two cognitive outcomes associated with flow in prior studies. Cognitive absorption, a concept similar to flow, was found to positively influence the perceived usefulness of Web technology [Agarwal and Karahanna 2000]. Similar results were found in online shopping and online learning contexts [Saade and Bahli 2005; Shang et al., 2005]. Perceived usefulness has a significant relationship with the intention to return to a Web site in the future [Koufaris 2002]. Another frequently studied outcome of flow is behavioral intention, including: return intention, intention to purchase, and continued usage. Flow is positively related to purchase intention and return intention in Web usage [Lin et al., 2005; Moon and Kim 2001] and online shopping [Nel et al., 1999; Siekpe 2005]. In online gaming, flow is related to repetitive play behavior and intention to play [Chou and Ting 2003; Hsu and Lu 2004]. Other outcomes that have been studied include increased learning, change in attitude, perceived ease of use, and satisfaction [Ghani 1995; Saade and Bahli 2005; Shang et al., 2005; Skadberg and Kimmel 2004; Webster and Martocchio 1995].

In IS research there are over 60 studies of flow using a quantitative, model testing approach. As observed by Finneran and Zhang [2005], there are challenges when studying flow in computer mediated environments. One of the conceptual challenges is "the discrepancies of constructs and their structure within each model" [Finneran and Zhang 2005 p.89]. Among the models tested, the majority include three groups of constructs: flow antecedents, flow experience, and flow consequences (e.g., Skadberg and Kimmel [2004]). However, there is no consistency in the constructs included in each model. This inconsistency leads to differences in the operationalization of flow in different studies which hinders the advancement of flow research in IS [Finneran and Zhang 2005]. In our study, we start from the original flow theory described by Csikszentmihalyi [1975, 1988] and incorporate the findings of prior studies in IS. We include all of the precursors and dimensions of flow proposed by Csikszentmihalyi [1975, 1988]. We first test the four channel model (see Figure 1), which has been studied in both IS and non-IS contexts. We then further investigate the effects of the characteristics of flow activities on the flow experience.

Prior Flow Studies Using Channel Models

Different approaches have been taken to investigate the flow experience in various contexts. One approach is to compare experiences according to perceived challenge and skill. Basically, this approach applies the channel model to further study the dynamics of situational factors on flow experiences. For example, in a study of 78 working adults reporting their experiences for a week using the experience sampling method, people's experiences in flow were contrasted with non flow experiences. Flow contexts were defined as those with high challenge and high skill, while non flow contexts included anxiety, boredom, and apathy contexts. It was found that people experience flow in both work and leisure activities. When people are in flow they experience higher affect, concentration, and potency [Csikszentmihalyi and LeFevre 1989]. Studies further examined employees' experiences and performance in two categories: flow context with high challenge and high skill combinations and non flow context with other challenge and skill combinations [Eisenberger et al., 2005]. It was found that among achievement oriented employees, high challenge and skill were associated with greater positive mood, task interest, and performance. However, this was not the case among those with low achievement need.

Among over 60 empirical studies examining the flow experience during interactions with information technologies, a few studies employed the channel model approach. Researchers have used channel models of flow to study online browsing [Chen et al., 1998], online learning [Konradt et al., 2003; Konradt and Sulz 2001], and online shopping [Mathwick and Rigdon 2004]. In this section, we provide a brief summary of these studies in Table 2.

The results of these studies provide mixed support for the theory in terms of channel models, which suggests the need for more research. However, the channel models do not consider other characteristics of activities, such as goal clarity and feedback. It has been suggested that the dynamics of activities are more complex [Delespaul et al., 2004]. Researchers have further proposed that outcomes are affected by both artifact and task characteristics [Finneran and Zhang 2003]. In this research we continue this stream of research by first testing a four channel model and then investigating the effect of the characteristics of flow activities on the flow experience in the context of online shopping.

Table 2. Summary of Flow Studies Using Channel Model

Study	Context and Sample Size	Channel Determination	Main Findings
Chen et al., [1998]	• Web browsing • 201 data points	If both challenge and skill were above 5 on an 11-point Likert scale and the difference between them was less than 2, the subject was categorized as in-flow, otherwise as not-in-flow.	• 55 observations in flow, 146 observations not in flow • In-flow users have higher challenge, lower skill, lower goal clarity, lower enjoyment and attention
Konradt and Sulz [2001]	• Online learning • 60 subjects	Based on reported challenge and skill, subjects were categorized into four groups: flow (high challenge and high skill), anxiety, boredom, and apathy.	• Subjects with high challenge and high skill had the best affect, satisfaction, and motivation. Apathetic and bored subjects were lower than subjects in flow on these measures, and the anxious users had the lowest scores. • Learning in terms of content knowledge, structural knowledge, and transfer performance was not improved for students in flow
Konradt et al., [2003]	• Learning via a multimedia training program • 66 subjects	Based on reported challenge and skill, subjects were categorized into four groups: flow (high challenge and high skill), anxiety, boredom, and apathy.	• Positive affect, concentration, contentment, and motivation were highest for flow subjects, while lowest scores were observed during apathy • Significant differences among the four different groups were found on the dimensions of concentration and contentment, but not on motivation and affect • No direct association between flow and training success, but positive affect and moods were correlated with content knowledge and total knowledge respectively
Mathwick and Ridgon [2004]	• Online search task with high involvement and low involvement products • 110 subjects	Used challenge and skill to segment subjects into four groups: flow (high challenge and high skill), anxiety, boredom, and apathy.	• 44 subjects in flow, 26 subjects in boredom, 16 subjects in apathy, and 24 subjects in anxiety • Respondents in flow had heightened experience of play in terms of intrinsic enjoyment and escapism compared to respondents in boredom and in apathy, but not in anxiety

III. RESEARCH QUESTIONS AND HYPOTHESES

The main purpose of this research is to investigate the flow experience in online shopping. Several questions are addressed. First, since online shopping is not normally considered a challenging task, do people experience flow while shopping online? Second, does the four channel model predict users' experiences while shopping online? Third, what are the effects of other factors, such as goal clarity and quick feedback, on the flow experience? Answers to these questions will improve our understanding of the phenomenon of flow in computer mediated environments and provide insights into the design of systems to facilitate the flow experience in online shopping and other IS tasks.

In the current study, we examine all six dimensions of flow as articulated by Csikszentmihalyi [1988]. In IS research, the dimensions of concentration, perceived control, transformation of time, and enjoyment have been frequently studied, while merging of activity and awareness and transcendence of self figure in only a handful of studies [Chen 2006; Davis and Wiedenbeck 2001; Moon and Kim 2001; van Schaik and Ling 2003]. Thus, there is a discrepancy

between these models in IS and the original flow model. This results in differences in the operationalizations of flow and in inconsistent flow models in the IS field, as Finneran and Zhang [2005] observed. This, in turn, makes it difficult to generalize and to pin down the mechanisms through which flow is influenced by information systems and technologies. In an effort to overcome this difficulty, we include all six dimensions of flow in our study.

The four channel model proposes that individual experiences of flow are affected by differences in perceived skill and challenge levels. For example, one study examined people's experiences and found that individuals in flow (with balanced high challenge and skill) reported higher quality of experience in terms of concentration, creativity, control, and satisfaction than individuals in the other three groups [Massimini and Carli 1988]. In IS research, studies have found similar differences [Konradt et al., 2003; Konradt and Sulz 2001; Mathwick and Ridgon 2004]. This study examines whether these differences exist when people engage in online shopping activities. Thus, the first hypothesis examines differences in the dimensions of flow among the four groups of online shoppers suggested by the four channel model of flow (flow, anxiety, apathy, and boredom) based on the match between challenge and skill. There are six sub hypotheses, one for each dimension of flow.

Hypothesis 1: There will be differences in the flow experience (i.e., focused concentration (C), merging of activity and awareness (M), perceived control (CON), transformation of time (TT), transcendence of self (TS), autotelic experience (AE)) among four-channel shopper groups.

If the flow experience differs among the four groups of shoppers, the outcomes should differ as well. The outcomes measured in this study include pleasure, perceived usefulness, and behavioral intentions. All three have been related to the flow experience in prior studies of flow in online shopping [Koufaris 2002; Siekpe 2005]. Flow experience is autotelic; in other words, intrinsically rewarding. People experience pleasure and enjoyment as a result of the flow experience. Other outcomes with particular interest for practice include perceived usefulness of a Web site and behavioral intentions to return, to purchase, and to recommend the site to others. Thus, the second hypothesis examines differences in the outcomes of flow among the four groups of online shoppers. There are three sub hypotheses, one for each outcome.

Hypothesis 2: There will be differences in the outcomes of flow (pleasure (P), perceived usefulness (PU), behavioral intentions (BI)) among four-channel shopper groups.

In addition to challenge and skill, two other factors are thought to be important to the flow experience. They are goal clarity and feedback. Activities with a clear goal and a fast, unambiguous feedback mechanism are more likely to be associated with flow. A clear goal enables actors to focus on the essentials of an activity, and a fast and clear feedback mechanism shows the individual his or her progress in achieving the goal. However, these two factors have been infrequently investigated in IS research. Both goal clarity and feedback have been included in six studies. Feedback has been studied by Chan and Ahern [1999], Chan and Repman [1999], Chen [2006], Davis and Wiedenbeck [2001], van Schaik and Ling [2003], and Webster and Ho [1997]. Goal clarity has been studied by Chan and Ahern [1999], Chan and Repman [1999], Chen [2006], Chen et al. [1998], Davis and Wiedenbeck [2001], and van Schaik and Ling [2003]. In the current study, we examine the effect of these two factors on the flow experience. The next two hypotheses are:

Hypothesis 3: Goal clarity (GC) affects the flow experience (i.e., focused concentration (C), merging of activity and awareness (M), perceived control (CON), transformation of time (TT), transcendence of self (TS), autotelic experience (AE)).

Hypothesis 4: Feedback (FB) affects the flow experience (i.e., focused concentration (C), merging of activity and awareness (M), perceived control (CON), transformation of time (TT), transcendence of self (TS), autotelic experience (AE)).

The hypotheses investigated in this study are depicted in Figure 2. The next sections of the paper discuss the methodology and the results of the study.

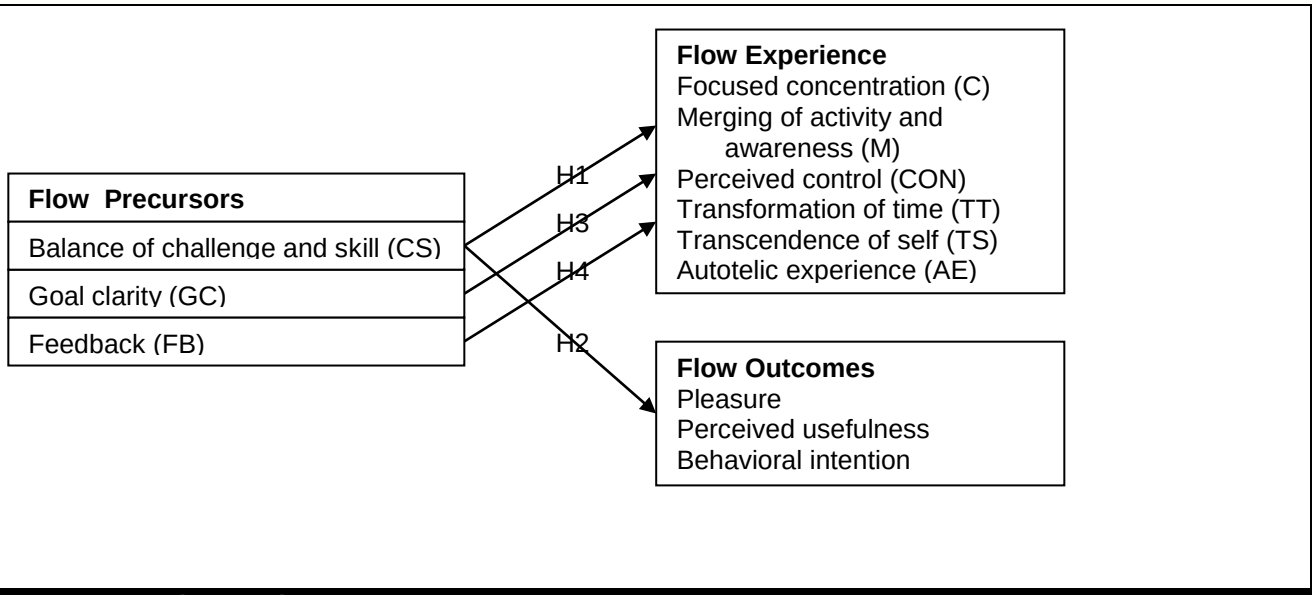

Figure 2. Research Hypotheses

IV. METHODOLOGY

A study was conducted to collect data on key flow and outcome measures. Subjects with various majors were recruited from undergraduate courses in a major American university. Upon agreeing to participate in the study, subjects were randomly assigned to one of eight preselected commercial Web sites. Web sites used in the study were Amazon.com, Barnes&Noble, Buy.com, Booksamillion.com, J&R music and computer, Newegg.com, Gateway.com, and Pcconnection.com.

A package of documents and instructions was given to subjects when they arrived. After finishing a pre-shopping survey including demographic questions, subjects were directed to go to the Web site assigned to them and find something they were interested in purchasing. There were no requirements for the amount of time subjects had to spend shopping or what product they had to view. They were not required to purchase a product, but could make a purchase at their own expense. A seven point Likert scale questionnaire measuring the dimensions of flow, outcomes of flow, perceived challenge of the task, perceived skills, goal clarity, and feedback appeared six to eight minutes after subjects started shopping. Prior pilot studies showed that six to eight minutes was long enough for individuals to get into flow. Subjects were instructed to complete the questionnaire at once when it appeared on the screen; however, they did not know when the questionnaire would appear. They were instructed not to "wait for it." Once they completed the questionnaire, subjects were asked to continue shopping. No data used in this study were collected at the end of the shopping task. All of the experimental manipulations and measures were conducted online, and all measures were captured by computers.

Flow State Scale [Jackson and Marsh 1996], a validated instrument based on the theory of flow, was used to measure goal clarity (GC), feedback (FB), focused concentration (C), merging of activity and awareness (M), perceived control (CON), transformation of time (TT), transcendence of self (TS), and autotelic experience (AE). This instrument has been adapted to the context of human computer interaction [Guo 2004]. Additional measures based on previously validated instruments were used to measure pleasure (P) [Mehrabian and Russell 1974], perceived usefulness (PU) [Koufaris 2002], and behavioral intentions (BI) [Donovan and Rossiter 1982; Koufaris 2002; Wan and Nan 2001]. Perceived challenge (PC) and perceived skill (PS) were each measured with five items adapted from prior research [Koufaris 2002]. Appendix A presents the survey items used in the study.

V. RESULTS

A total of 354 subjects, including 211 female and 143 male subjects, participated in the study. The average age of the subjects was 21.2 years.

The analysis of the data began with an assessment of the reliability of the measures used in the study. One item was dropped from the perceived challenge and the perceived skill constructs, and two items were dropped from merging of activity and awareness to improve the measurement properties of the measures. All of the study constructs exhibit acceptable reliability, as shown in Table 3.

Table 3. Measurement Properties			
Constructs	**# of items**	**Reliability (Cronbach's α)**	**Mean**
Perceived challenge (PC)	4	.76	2.6
Perceived skills (PS)	4	.84	5.5
Feedback (FB)	4	.88	4.8
Goal clarity (GC)	4	.93	4.7
Concentration (C)	4	.90	5.1
Merging of activity and awareness(M)	2	.73	5.1
Perceived control (CON)	4	.90	5.6
Transformation of time (TT)	4	.80	3.5
Transcendence of self (TS)	4	.83	5.8
Autoletic experience (AE)	4	.91	3.7
Pleasure (P)	6	.85	4.7
Perceived usefulness (PU)	4	.81	4.2
Behavioral intentions (BI)	4	.93	4.1

Correlations of the constructs are listed in Table 4. Several observations provide support for the validity of our measures. First, all of the correlations are smaller than the Cronbach's α values of the constructs. Second, and unsurprisingly, the perceived challenge construct has negative correlations with all but one of the other constructs. Third, the two groups of constructs, measures for flow (dimensions and factors) and measures for outcomes, have higher correlations among themselves (except transformation of time and autoletic experience) than with the constructs in the other group.

To examine common method bias, Hartmon's one factor test was used. In this approach, confirmatory factor analysis was conducted on a model of one factor. All measured variables were set to load onto this common measurement factor. The model showed poor fit to the data (chi-square= 7902.8, df=1274, chi-square/df=6.2, NFI=.443, NNFI=.464, CFI=.485, RMSEA=.12). This means that the measures were not affected significantly by common method bias, which is always a concern when a questionnaire is used to collect data.

Did Flow Occur?

An examination of Table 3 above and a scatter chart of perceived challenge and perceived skill scores revealed that online shopping was not considered a challenging task, and that subjects believed they had considerable skills for the task. This is not surprising as this is a common perception, and using a sample of college students may have made it more so.

The first question addressed in the study is whether subjects experience flow during shopping even if it is an easy task. Descriptive statistics of the key constructs of the flow experience are shown in Table 5 below. In the questionnaire, all items regarding flow were measured using a seven point Likert scale (1 = strongly disagree; 7 = strongly agree). For example, one item measuring concentration was, "My attention was focused entirely on what I was doing." The middle point, 4, was neutral. The mean values of all of the flow dimensions were significantly different than 4, and all of the constructs except transformation of time and autoletic experience were greater than 4 (on a two tailed t-test). This means that the experience of the subjects during the shopping task was positive overall and that flow occurred. An analysis of the correlations presented in Table 4 shows significant correlations among the flow dimensions, except for transformation of time. This suggests that high concentration, a sense of being in control, merging of activity and awareness, and transcendence of self are the four most prominent characteristics of the flow experience in the shopping activity of our study.

Table 4. Correlations of Constructs

		PC	PS	GC	FB	C	M	CON	TS	TT	AE	P	PU
PS	Pearson Correlation	-.615**											
	Sig. (2 tailed)	.000											
GC	Pearson Correlation	-.470**	.585**										
	Sig. (2 tailed)	.000	.000										
FB	Pearson Correlation	-.505**	.550**	.580**									
	Sig. (2 tailed)	.000	.000	.000									
C	Pearson Correlation	-.428**	.454**	.481**	.603**								
	Sig. (2 tailed)	.000	.000	.000	.000								
M	Pearson Correlation	-.421**	.491**	.411**	.555**	.556**							
	Sig. (2 tailed)	.000	.000	.000	.000	.000							
CON	Pearson Correlation	-.515**	.615**	.415**	.631**	.689**	.586**						
	Sig. (2 tailed)	.000	.000	.000	.000	.000	.000						
TS	Pearson Correlation	-.233**	.413**	.218**	.436**	.463**	.412**	.644**					
	Sig. (2 tailed)	.000	.000	.000	.000	.000	.000	.000					
TT	Pearson Correlation	.076	-.114*	-.020	.078	-.072	-.010	-.037	.025				
	Sig. (2 tailed)	.152	.032	.706	.142	.177	.847	.490	.633				
AE	Pearson Correlation	-.437**	.327**	.440**	.542**	.482**	.440**	.429**	.244**	.232**			
	Sig. (2 tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.000			
P	Pearson Correlation	-.498**	.361**	.375**	.465**	.451**	.445**	.396**	.205**	.034	.692**		
	Sig. (2 tailed)	.000	.000	.000	.000	.000	.000	.000	.000	.528	.000		
PU	Pearson Correlation	-.429**	.244**	.269**	.320**	.277**	.249**	.227**	.020	.117*	.616**	.584**	
	Sig. (2 tailed)	.000	.000	.000	.000	.000	.000	.000	.714	.028	.000	.000	
BI	Pearson Correlation	-.494**	.332**	.378**	.454**	.364**	.380**	.305**	.133*	.091	.708**	.667**	.763**
	Sig. (2 tailed)	.000	.000	.000	.000	.000	.000	.000	.012	.088	.000	.000	.000

** Correlation is significant at the 0.01 level (2 tailed)

* Correlation is significant at the 0.05 level (2 tailed)

Table 5. Descriptive Statistics of the Constructs of the Flow Experience

	Mean	Std. Deviation	t-value (2 tailed)	P-value
Concentration	5.1	1.36	14.81	<.001
Merging of activity and awareness	5.1	1.38	14.57	<.001
Perceived control	5.6	1.20	25.29	<.001
Transformation of time	3.5	1.32	-7.1	<.001
Transcendence of self	5.8	1.21	27.93	<.001
Autoletic experience	3.7	1.37	-3.5	.001

A Test of the Four Channel Model

To answer the second question of whether the four channel model can be used to predict users' experience, we first assigned subjects to one of the four groups of online shoppers (i.e., Flow group, Anxiety group, Boredom group, and Apathy group) based on the relationship between perceived challenge (PC) and perceived skill (PS) (see Figure 1). We used a split based on the mean values of perceived challenge and perceived skill to segment subjects into the four groups, as in prior studies. If perceived challenge or perceived skill exceeded or was equal to its mean, it was coded as 1; otherwise it was coded as 0. The results are presented in Table 6.

Table 6. Results of Segmentation					
PC		PS		Group	# of cases
Value	Code	Value	Code		
>=2.6	1	>=5.5	1	Flow	37
>=2.6	1	<5.5	0	Anxiety	111
<2.6	0	<5.5	0	Apathy	53
<2.6	0	>=5.5	1	Boredom	153

The mean values of perceived challenge are: 3.5 for the Flow group, 3.9 for the Anxiety group, 2.0 for the Apathy group, and 1.7 for the Boredom group. The mean values of perceived skill are: 6.2 for the Flow group, 4.3 for the Anxiety group, 5.0 for the Apathy group, and 6.5 for the Boredom group.

The mean values of the flow dimensions for each of the four groups of online shoppers are shown in Table 7. The Boredom group has the highest mean value on all of the dimensions except transformation of time, while the Anxiety group has the lowest. An examination of the differences among the four groups of online shoppers using ANOVA reveals that the mean values on all dimensions of flow are significantly different (Table 7). Thus, Hypothesis 1 is supported.

Table 7. Mean Values for the Flow Dimensions							
Group		C	M	CON	TT	TS	AE
Flow		5.2	5.4	5.9	3.9	6.1	3.9
Anxiety		4.2	4.2	4.7	3.6	5.3	3.0
Apathy		5.1	5.1	5.5	3.6	5.4	3.9
Boredom		5.6	5.6	6.2	3.3	6.2	4.2
ANOVA	*F*	27.94	32.19	51.15	2.66	15.86	22.42
	p-value	<.001**	<.001**	<.001**	.048*	<.001**	<.001**
** The mean difference is significant at the 0.01 level * The mean difference is significant at the 0.05 level							

A Scheffe test was used to make pairwise comparisons of the four groups. The results are shown in Table 8. Except for the transcendence of self (TS) dimension compared with the Apathy group and the transformation of time (TT) dimension compared with the other three groups, the Anxiety group shoppers have significantly lower scores on the dimensions of flow compared to each of the other three groups of shoppers.

Tables 8 shows that shoppers in the Anxiety group report lower scores on the dimensions associated with flow. While the Apathy group and the Boredom group are generally not at a disadvantage compared to shoppers in the Flow group, anxious shoppers fare significantly worse than the other three groups. This effect is found even though anxious shoppers report an average perceived skill of 4.3 on a seven point scale.

Additionally, the significant differences among the other three groups are as follows: The shoppers in the Flow group score higher on the transcendence of self measure than the shoppers in the Apathy group (significant at $p < .05$). The shoppers in the Bored group score higher than the shoppers in the Apathy group on the dimensions of perceived control (significant at $p < .01$), merging of activity and awareness (significant at $p < .05$), and transcendence of self (significant at $p < .01$).

Table 8. Pairwise Comparisons of Flow Dimensions					
	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	p-value
C	Flow	Anxiety	.97	.23278	.001**
		Boredom	-.42	.22465	.316
		Apathy	.075	.26270	.994
	Anxiety	Boredom	-1.39	.15289	<.001**
		Apathy	-.90	.20474	<.001**
	Boredom	Apathy	.42	.22465	.316
CON	Flow	Anxiety	1.23	.19092	<.000**
		Boredom	-.30	.18425	.440
		Apathy	.38	.21546	.380
	Anxiety	Boredom	-1.53	.12540	<.001**
		Apathy	-.85	.16792	<.001**
	Boredom	Apathy	.68	.16030	.001**
AE	Flow	Anxiety	.92	.23861	.002**
		Boredom	-.35	.23028	.507
		Apathy	.017	.26928	1.000
	Anxiety	Boredom	-1.27	.15672	<.001**
		Apathy	-.90	.20987	<.001**
	Boredom	Apathy	.37	.20034	.337
M	Flow	Anxiety	1.24	.23342	<.001**
		Boredom	-.24	.22527	.772
		Apathy	.32	.26343	.687
	Anxiety	Boredom	-1.48	.15331	<.001**
		Apathy	-.92	.20531	<.001**
	Boredom	Apathy	.56	.19599	.045*
TS	Flow	Anxiety	.83	.21678	.002**
		Boredom	-.054	.20921	.995
		Apathy	.70	.24464	.042*
	Anxiety	Boredom	-.89	.14238	<.000**
		Apathy	-.13	.19066	.926
	Boredom	Apathy	.76	.18201	.001**
TT	Flow	Anxiety	.34	.24856	.600
		Boredom	.62	.23988	.085
		Apathy	.34	.28051	.688
	Anxiety	Boredom	.28	.16325	.402
		Apathy	.00068	.21862	1.000
	Boredom	Apathy	-.28	.20870	.617
** The mean difference is significant at the 0.01 level * The mean difference is significant at the 0.05 level					

The shoppers in the Anxiety group are the only ones whose skills do not match the challenge of the task and in which there is a skill deficit. The combination of the skill mismatch and the skill deficit appears to negatively affect the dimensions associated with flow. The three groups reporting higher scores for the dimensions of flow have either a match between levels of task challenge and skill (the Flow and Apathy groups) or a surplus of skills needed for the task (the Boredom group). It appears that either a match between task challenge and skills or a surplus of skills is sufficient to generate higher scores on the dimensions of flow in the context of the online shopping task.

The mean values of the measures of pleasure (P), perceived usefulness (PU), and behavioral intention to use the online shopping system (BI) for each of the four groups of online shoppers are shown in Table 9. The Boredom group has the highest mean values on the three measures of outcomes, while the Anxiety group has the lowest. An examination of the differences among the four groups of online shoppers using ANOVA shows that there are significant differences in pleasure, perceived usefulness, and behavioral intention to use the online shopping system. Thus, Hypothesis 2 is supported.

Table 9. Mean Values for the Outcome Measures

Group		P	PU	BI
Flow		4.5	4.1	3.9
Anxiety		4.0	3.5	3.1
Apathy		4.8	4.6	4.4
Boredom		5.2	4.6	4.9
ANOVA	*F*	32.27	17.88	30.82
	p-value	<.001**	<.001**	<.001**

** The mean difference is significant at the 0.01 level
* The mean difference is significant at the 0.05 level

A Scheffe test was run to compare each group to the other three groups along the three outcomes. The results are shown in Table 10. The shoppers in the Anxiety group have significantly lower scores on the three outcomes compared to shoppers in the Boredom group and the Apathy group. Although shoppers in the Anxiety group have lower scores than shoppers in the Flow group, the differences are not statistically significant. Additionally, the shoppers in the Boredom group score higher on pleasure (significant at $p < .01$) and behavioral intention (significant at $p < .01$) than the shoppers in the Flow group.

Table 10. Pairwise Comparisons of Outcome Measures

	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	p-value
P	Flow	Anxiety	.49	.19008	.088
		Boredom	-.72	.18344	.002**
		Apathy	-.39	.21451	.354
	Anxiety	Boredom	-1.1	.12484	<.001**
		Apathy	-.88*	.16718	<.001**
	Boredom	Apathy	.33	.15959	.231
PU	Flow	Anxiety	.53	.23695	.169
		Boredom	-.55	.22868	.127
		Apathy	-.50	.26741	.316
	Anxiety	Boredom	-1.08*	.15563	<.001**
		Apathy	-1.04	.20841	<.001**
	Boredom	Apathy	.04	.19895	.997
BI	Flow	Anxiety	.83	.29831	.053
		Boredom	-1.03	.28790	.006**
		Apathy	-.51	.33666	.508
	Anxiety	Boredom	-1.86	.19593	<.001**
		Apathy	-1.34	.26238	<.001**
	Boredom	Apathy	.514	.25047	.241

** The mean difference is significant at the 0.01 level
* The mean difference is significant at the 0.05 level

Similarly to the analysis of the six dimensions of flow, the results for the measures of pleasure, perceived usefulness, and behavioral intention to use the online shopping system show that anxious online shoppers are at a disadvantage compared to the other groups of shoppers. Again, the skill deficit shown by the anxious shoppers appears to lead to lower levels of the three outcome measures compared to the online shoppers with either a match between levels of challenge and skill or a surplus of skills needed to complete the task.

In summary, the test results of the four channel model show that the four groups of online shoppers, based on challenge and skill matches, have differences in their experience and outcomes. The worst group is the Anxiety group, whose mean values are lower than most other groups on the flow dimensions and outcomes. However, the best group, in terms of absolute mean values on the flow dimensions and outcomes, is not the Flow group, as might be expected, but rather the Boredom group.

Effects of Goal Clarity and Feedback

We used regression models to investigate the effect of goal clarity and feedback, two theoretical precursors of the flow experience. The results are shown in Table 11 and Table 12. Both goal clarity and feedback have significant coefficients with all of the dimensions of flow except transformation of time. Thus, Hypotheses 3 and 4 are generally supported. This shows that goal clarity and feedback play an important role in flow.

Table 11. Effects of Goal Clarity on Flow Experience

Independent Variable	Dependent Variable	Standard Coefficient	t-value (p-value)	Adj r-square
Goal Clarity	Concentration	.48	10.30 (<.001) **	.299
	Merging of activity and awareness	.41	8.45 (<.001) **	.166
	Perceived control	.42	8.56 (<.001) **	.170
	Transformation of time	-.02	-.377 (.706)	-.002
	Transcendence of self	.22	4.19 (<.001) **	.045
	Autoletic experience	.44	9.19 (<.001) **	.191

Table 12. Effects of Feedback on Flow Experience

Independent Variable	Dependent Variable	Standard Coefficient	t-value (p-value)	Adj r-square
Feedback	Concentration	.60	14.18 (<.001) **	.362
	Merging of activity and awareness	.56	12.52 (<.001) **	.306
	Perceived control	.63	15.28 (<.001) **	.397
	Transformation of time	.08	1.47 (.14)	.003
	Transcendence of self	.44	9.09 (<.001) **	.188
	Autoletic experience	.54	12.11 (<.001) **	.292

VI. DISCUSSION

The overall goal of this study is to improve our understanding of the flow experience by answering three questions related to users' experiences in online shopping. Our results show interesting findings and provide insights for future research and practice.

The first research question is whether positive aspects of the flow experience occur with tasks as simple as online shopping. The answer is yes. Four of the six dimensions of the flow experience are positive (i.e., greater than 4.0) in this study. The four positive dimensions are concentration, perceived control, merging of activity and awareness, and transcendence of self. The two other dimensions, transformation of time and autoletic experience, were below the neutral level. In part, this may be due to the task and study setting. The study was conducted in a computer lab. Although we allowed subjects some freedom to browse the products they were interested in, we limited the Web sites they could go to. The subjects who participated in the study may not have had a genuine interest in the task and may have been eager to finish the task and leave. Nonetheless, the flow experience, at least in part, occurred.

The second question is whether the four channel model of perceived challenge and skill could be used to predict the users' experiences. In this regard, we found mixed results. The four channel model relies solely on the balance between challenge and skill, which is one of the characteristics described by Csikszentmihalyi [1988]. Researchers in IS have also paid more attention to it than to other factors. Our findings show different experiences among user groups based on (mis)matches of challenge and skill, which supports the notion that perceived challenge and skill play a role in the users' experiences. However, contrary to the theory and the findings of most prior studies, the group that had the best experience in the study was the group with low challenge and high skill (labeled the Boredom group) rather than the group with high challenge and high skill (the Flow group) in that the Boredom group had the highest absolute values on most of the measures used in the study. The worst group in our study was the Anxiety group (with high challenge and low skill), which is consistent with a prior study investigating flow in IT usage [Konradt and Sulz 2001]. The users in the Anxiety group have a deficit of skills compared to task demands, which seems to negatively affect their experience, while the bored users have a surplus of skills compared to task

demands, which seems to enhance the experience. Contrary to the expectations of flow theory, the fit between skills and task challenges in the Flow group does not lead to the very best experience in our study.

In terms of the outcomes of flow, Konradt and Sulz [2001] and Konradt et al., [2003] found that users in the Flow, Apathy, Boredom, and Anxiety groups did not have statistically significant differences in learning outcomes. In our case, differences were found among the four groups in the outcomes of the shopping task. Flow theory and prior empirical studies using the theory have tended to view people in the Boredom group less favorably than people in flow. However, an unexpected result of this study is that, contrary to the original flow theory, the bored shoppers have the best outcomes and the anxious shoppers have the worst outcomes.

So the answer to the second question is not a simple one. The essence of the four channel model is that a match of high challenge and high skill leads to a better experience. In quite a few activities this is true. For other tasks, the levels of challenge and skill seem to matter in an unexpected way in that users may have a low tolerance for challenge in accomplishing tasks. The flow experience when interacting with technology is complex in that it involves a person with skills and other individual traits, as well as tasks and artifacts with different features [Finneran and Zhang 2003]. Users' skills have been thought to affect people's perceptions of tasks and artifacts, making skills part of the interaction among person, artifact, and task. It is posited that, if users feel a technology is easy to use they are more likely to experience flow. In online shopping, challenges come from the technology and the shopping task itself. Using a technology, the Web, is merely a means to shop, which is the central task. It seems that in this case, a surplus of skill provides users the freedom to accomplish what they really want with no need to worry about technological difficulties. Our results show that the boredom state posited by flow theory may not be entirely bad in all situations. This is consistent with Finneran and Zhang [2003], who argue that systems that are easy to use tend to encourage a flow experience. It may also be that people labeled "bored" by flow theory could be more appropriately labeled "super users" in the context of IT based tasks. In either case, additional results are needed to either confirm the original theory for IT based tasks or confirm our results.

A third research question addresses the effects of two other precursors of the flow experience (goal clarity and feedback). Our results show a positive relationship between these two factors and the flow experience. These two factors have received little attention in prior flow studies in IS. It is evident that these two factors are relevant to IT based tasks and should be investigated more in the future.

The PAT (person-artifact-task) model of flow for computer mediated environments [Finneran and Zhang 2003] provides a systematic road map to conduct research, evaluate studies, and compare results. In our study, we incorporated all important aspects of the model. We examined individual differences in terms of perceived challenge and skill. Goal clarity is a factor related to both the person and the task. Feedback is mainly a design issue of the artifact. Our research shows that the person, artifact, and task are all crucial factors and need to be considered when studying flow in computer mediated environments.

Practical Implications

The level of skills that users bring to the online shopping task appears to be very important. Users reporting a surplus of skills fare well in the study, while users reporting a skill deficit fare poorly. It is not possible to say how generalizable this result is across other IT based tasks. It is interesting to note, however, that relatively low skill levels with respect to the task have negative implications, even when those skills levels are not all that low in an absolute sense. If this result is found across additional studies using different tasks and technologies, the implication will be that investments in the development of user skills are quite valuable even when users already have some level of skill. It will be important to determine whether the results hold up when levels of task challenge and the technology are varied.

If additional studies confirm the results found here, the organizational implication will be that users' skills are an important influence on users' experiences. Although the issue of users' skills is a repeated theme in IS research, its importance cannot be over emphasized. There are two general approaches to reducing discrepancies between user skills and task demands. The first is to design systems to be as simple as possible in order to minimize user skill requirements. This approach aims to reduce anxiety and may be appropriate in situations in which organizations have little control over users, as is often the case with online shopping systems. Second, investments in the development of user skills may be worthwhile, especially when systems are inherently complex. Some online shopping systems may benefit from this approach. Because the users of online shopping systems are not easily targeted by organizational training efforts, organizations may consider embedding user training support in online shopping systems, at least as an option for users who need it. Organizations would be wise to bear in mind that the users most in need of this training are anxious users who will likely be best served by training modules that are relatively easy to use. If the results are generalizable across other types of information systems, managers should be encouraged to invest in user training even when skill levels are already relatively high. It appears that the

development of "super users" may be a good investment. Organizations should target the user skill issue with a combined strategy of the two approaches.

In addition, the role played by fast and clear feedback mechanisms should not be ignored. Feedback is associated with all of the flow dimensions except transformation of time. Feedback clearly promoted users' concentration on the task since they did not need to spend unnecessary time to figure out what was going on. It also gave users the sense of being in control. The user-system interaction became smooth and automatic, to some extent. This result reminds practitioners of the importance of providing feedback cues in the design of online shopping systems. For example, clear displays of the content of shopping carts will provide shoppers with feedback about whether their "add to cart" action was successful. For more complicated online tasks, such as setting up recurring direct payments, it is likely that feedback is even more important,

Goal clarity is also important. If we have a good understanding of the goals of online visitors or system users, we can design Web sites and systems differently, according to their goals. For example, online fashion shoppers typically have one of two goals. First, they may be oriented toward purchasing a particular product. Second, they may be less focused while browsing to view a new fashion trend. Shoppers may, of course, pursue both of these goals simultaneously. It may be possible to design a Web site that can adapt to the different goals of shoppers in order to help shoppers accomplish their goals via different paths.

Limitations and Future Research

Future studies are suggested to better understand the results of this study. In particular, more research is needed to investigate the validity of the four channel model in computer mediated environments. The operationalization of the channel determinant – "balance of challenge and skill" – is a methodological issue which should be investigated in future studies. Some questions that arise from the current study are: "should we measure challenge and skill separately (as in the current study) or should we measure the balance of challenge and skill directly?" and "should we use the sample average of challenge and skill to classify subjects into the four channels of the four channel model (as in the current study), or classify subjects into the four channels on the basis of their individual relative levels of challenge and skill?" Future studies examining whether the conclusions drawn from flow studies change when subjects are classified into the four groups in these methodologically different ways would provide a contribution to the literature on flow.

The limitations of the current study suggest additional future research directions. First, the use of a sample consisting of college students raises the concern of generalizability. Research shows that such a sample is acceptable in research on online behavior because college students are similar to the general online population and are often targeted by electronic marketers [Abdinnour-Helm et al., 2005; Han and Ocker 2002]. However, in the study of flow, different samples might yield different results since college students are generally skillful users of the Internet and the Web. The perception and tolerance of challenge using computers and the Internet are different across various online populations [Rettie 2001]. The use of a more diverse sample of subjects would allow us to investigate questions related to individual characteristics, such as the role played by high achievement orientation in the flow experience [Eisenberger et al., 2005].

Second, in IS research, other characteristics of flow, such as curiosity and telepresence, have been proposed and studied [Hoffman and Novak 1996; Webster et al., 1993]. It is possible that these characteristics affect the online experience due to the nature of computer mediated environments and IT-related tasks. While these characteristics are not the focus of the current paper, further investigation is needed to understand whether including other dimensions, such as telepresence and curiosity, in the conceptualization of flow in online environments is appropriate.

Third, the current study uses a single task of a fairly simple kind. More complex, job related tasks, such as using spreadsheet software or using the Internet to fulfill job requirements, may affect the relationship between perceived challenge, perceived skill, and outcomes. Further, the goal and feedback mechanism may be different in job related tasks. Future research using job related tasks is suggested.

VII. CONCLUSION

In this study we have investigated the experience of online shoppers using flow theory. We tested a model suggested by flow theory, in which shoppers are grouped into four categories based on their perceptions of task challenge and their skill in performing an online shopping task. Shoppers perceiving high challenge and low skill were found to have the lowest perceptions of the dimensions of flow and the poorest outcomes among the four groups. Given that prior research has shown that users with computer anxiety are less likely to continue using a technology [Thatcher and Perrewe 2002], this is a particularly important finding. The question of how to design Web sites and other computer systems to facilitate the flow experience and other positive outcomes is of interest to IS researchers and practitioners. Flow theory provides guidance for design features, such as quick and clear feedback and adaptive mechanisms catering to differences in user skills and goals.

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APPENDIX A. MEASURES USED IN THE STUDY

Perceived Challenge
Shopping on this site was a challenge for me.
It was hard to do what I wanted to do.
I found it was hard for me to make a decision based on the information on the site.
Overall, I felt shopping on this site was pretty easy. (reversed)

Perceived Skills
I knew how the site works.
I understood the information on the site well.
I had enough skills to do what I intended to do.
I was competent to carry out the shopping activity.

Goal Clarity
I knew clearly what I wanted to do.
I had a strong sense of what I wanted to do.
I know what I wanted to achieve.
My goals were clearly defined.

Feedback
It was really clear to me that I was doing well.
I was aware of how well I was performing.
When shopping, I had a good idea about how well I was doing.
I could tell by the way I was surfing how well I was doing.

Focused Concentration
My attention was focused entirely on what I was doing.
It was no effort to keep my mind on what was happening.
I had total concentration.
I was completely focused on the task at hand.

Merging of Activity and Awareness
I reacted to the website automatically.
I did things spontaneously and automatically without having to think.

Perceived Control
I felt in total control of what I was doing.
I felt like I could control what I was doing.
I had a feeling of total control.
I felt in total control of my action.

Transformation of Time
Time seemed to alter (either slowed down or speeded up).
The way time passed seemed to be different from normal.
It felt like time stopped while I was shopping.
At times, it almost seemed like things were happening in slow motion.

Transcendence of Self
I was not concerned with what others may have been thinking of me.
I was not worried about my performance during shopping.
I was not concerned with how I was presenting myself.
I was not worried about what others may have been thinking of me.

Autotelic experience
I really enjoyed the experience.
I loved the feeling experienced and I want to capture it again.
The experience left me feeling great.
I found the experience extremely rewarding.

Pleasure
Unhappy/Happy
Annoyed/Pleased
Satisfied/Unsatisfied (reversed)
Contented/Melancholic (reversed)
Hopeful/Despairing (reversed)
Bored/Relaxed

Perceived Usefulness
Using the site improve my shopping performance.
Using the site can increase my shopping productivity.
Using the site can increase my shopping effectiveness.
I find the site is not very useful. (reversed)

Behavioral Intention
Given the chance, I'd like to return to the site in the future.
Given the chance, I'd like to make purchase on this site in the future.
I would like to explore more of the site.
I will recommend this site to my friends.

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