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ABSTRACT

Several IS studies have investigated the concept of flow. Among the many antecedent factors leading to flow experience, an individual's cognitive factors require further exploration, because flow was reported in previous studies more than three times as often in work as in leisure and most frequently associated with online cognitive information processing activities. Following Finneran and Zhang's call for investigating the effects of personality factors on flow, the current study examines the relationship of need for cognition (NFC) and five dimensions of flow experience. Based on 156 responses from a student sample, High NFC group was found to have higher levels of focused attention, perceived control, and curiosity than Low NFC group. The differences of temporal dissociation and perceived enjoyment between the two groups were not significant. Implications for human-computer interaction research and the practice of online personalization are discussed.

Keywords

Flow, Need for Cognition, Online Behavior, Human-Computer Interactions

INTRODUCTION

Several recent studies in computer-mediated environments and information systems research (e.g., Agarwal & Karahanna, 2000; Finneran & Zhang, 2003; Koufaris, 2002; Novak et al., 2000) have investigated the concept of flow, "the holistic sensation that people feel when they act with total involvement" (Csikzentmihalyi, 1975 p.36). These studies have not only advanced our knowledge of the concept of flow in virtual environments, but have also enriched our understanding of people's online navigation, online shopping, and other general experiences in human-computer interactions.

Many antecedent factors of flow experience have been proposed and tested in previous empirical studies. For example, computer self-efficacy and personal innovativeness in information technology are closely related to flow (Agarwal & Karahanna, 2000). An individual's general skill with computers and challenges required by the task at hand are also important determinants of flow (Ghani et al., 1994; Koufaris, 2002; Novak et al., 2000; Trevino & Webster, 1992). Recently, Finneran and Zhang (2003) have proposed a unified model of flow experience, which captures the major components of flow antecedents in computer-mediated environments. The model is composed of three distinct components, i.e., personal, artifact, and task. The model also explains the two-way and three-way interactions between these three components. A set of propositions has also been developed that may provide some general guidelines for empirical studies on flow in the future (Finneran & Zhang, 2003).

Following Finneran and Zhang (2003), the current study is focused on the effect of personal factors on flow experience. Csikzentmihalyi (1988) has pointed out that the flow experience may be attributed to such personal traits as autotelic personality, in addition to the match between people's skills and the challenges from the activity. This study aims to investigate the effect of need for cognition, which explains individual differences in the intrinsic enjoyment of effortful cognitive activities (Cacioppo & Petty, 1982). To our knowledge, little research has examined the effect of NFC in computer-mediated environments. We hypothesize that people with different levels of NFC should experience flow differently in terms of scope, frequency, and strength.

It is important to study need for cognition in the online flow experience. A better understanding of the relationship between effortful thinking (NFC) and effortless flow could make contributions to the research community and practitioners. In a recent study, Chen et al. (1999) showed that information processing activities such as researching online and information retrieval were rated as the most frequent activities associated with flow experience. Csikzentmihalyi and LeFevre (1989)

found that flow experience was reported more than three times as often in work as in leisure, and that managers spent more time in the flow state at work than either clerical workers or blue-collar workers.

The rest of the paper is organized as follows. A literature review of flow and need for cognition is presented, followed by the development of research hypotheses. The paper then discusses the research method and presents the results of data analyses. We conclude with potential implications for theory and practice.

LITERATURE REVIEW

Flow

Flow is conceptualized as an optimal experience state in which an individual's perceived skills are matched with the perceived challenges of a task or activity under certain circumstances (Csikzentmihalyi, 1975). A flow state is composed of and associated with several distinct features, in which individuals are believed to "shift into a common mode of experience when they become absorbed in their activity. This mode is characterized by a narrowing of the focus of awareness, so that irrelevant perceptions and thoughts are filtered out, by loss of self-consciousness, by a responsiveness to clear goals and unambiguous feedback, and by a sense of control over the environment" (Csikzentmihalyi, 1975 p.72). A literature review by Chen et al. (1999) has shown that there are nine dimensions or stages in a flow state and that these dimensions can be generally categorized into flow antecedents, flow experiences, and flow consequences in computer-mediated environments (Chen 2000).

Flow consequences are often positive. For example, flow is positively associated with computer users' satisfaction (Trevino & Webster, 1992; Webster et al., 1993; Woszczynski et al., 2002), consumers' exploratory behavior concerning products or services (Ghani & Deshpande, 1994; Novak et al., 2000; Webster et al., 1993), users' behavioral intention of returning to a website, (Agarwal & Karahanna, 2000; Koufaris, 2002), and business communication-related variables such as effectiveness, quality, and barrier reduction (Trevino & Webster, 1992). Flow experience is multidimensional rather than unidimensional (Csikzentmihalyi, 1975; Trevino & Webster, 1992), including such cognitive and emotional concepts as temporal dissociation, attention focus, intrinsic enjoyment, control, and curiosity (e.g., Agarwal & Karahanna, 2000; Koufaris, 2002).

As mentioned above, various studies have examined antecedent factors of flow (e.g., Finneran & Zhang, 2003). The current study extends this stream of literature by focusing on one particular type of personal trait factor: need for cognition.

Need for Cognition

According to Cacioppo and Petty (1982), individuals are different in terms of the degree to which they engage in and enjoy effortful cognitive activities. This variation is generally represented in terms of Need for Cognition (NFC). People with different levels of NFC (low vs. high) have different attitudinal, cognitive, and behavioral patterns in their daily lives. People with high NFC tend to depend on themselves for searching, retrieving, acquiring, and processing information to understand and accommodate the world. On the other hand, people with low NFC are more likely dependent on other people and social comparison processes (Cacioppo et al., 1996). High NFC individuals have more positive attitudes toward external stimuli and tasks that require effortful thoughts and processes, are more likely to interact with and experience effortful resources and technologies, and have higher levels of effectiveness in the process of problem solving. High NFC individuals are characterized by "active, exploring minds and, through their senses and intellect, reach and draw out information from their environment" (Cacioppo et al., 1996, p. 199).

The concept of need for cognition has been thoroughly investigated in many fields, including social psychology, marketing, and education. According to the synthesis from Cacioppo et al. (1996), NFC is positively associated with cognitive innovativeness (an individual's desire for new experiences and stimulants that activate his thinking), desire for control (an individual's motivation to maintain and exert control over his immediate environment and social context), self-esteem (an individual's overall positive evaluation and perception of himself), sensation seeking (the tendency to search for and experience tasks and activities that are associated with high levels of sensation, such as rock climbing), intrinsic motivation (an individual's motivation to seek out tasks and information without regard for extrinsic rewards for performing the activity). On the other hand, NFC is negatively associated with various types of anxiety and stress, such as those experienced during academic examinations at school or during social interactions with other people.

RESEARCH HYPOTHESES

In this section, we expand our literature review of need for cognition and use it to generate research hypotheses for the effects of need for cognition on the five dimensions of flow experience, i.e., focused attention, enjoyment, control, curiosity, and temporal dissociation.

Focused Attention

Focused attention describes the experience of an individual engaging his total attention into his current activity while ignoring other demands and distractions from the environment (Agarwal & Karahanna, 2000; Koufaris, 2002). This definition follows the notion of absorption, "a state of total attention…entirely dedicated to experiencing and modeling the attentional object" (Tellegen & Arkinson, 1974, p. 274). In the online environment, individuals who focus their effortful thoughts on intellectual activities may be more inclined to direct their attention to cognitive tasks while ignoring other distractions such as the unrelated information, icons, and animation. Without this focused attention, it is difficult to achieve the desired results from searching online, given people's limited cognitive processing capacity. In a study that asked students about their ability to focus on problem-solving tasks, Osberg (1987) found a significant positive correlation between absorption and need for cognition. Thus, we hypothesize

H1: In their interactions with the Web, individuals with High NFC are more focused than those with Low NFC.

Enjoyment

Enjoyment captures the notion of intrinsic motivation in flow experience (Agarwal and Karahanna 2000). An individual's intrinsic motivation or enjoyment is an important factor for using information technologies (Davis et al. 1992) and in online behavior (e.g., shopping) (Koufaris 2002). Need for cognition measures an individual's level of enjoyment of thinking (Cacioppo and Petty 1982); the higher the need for cognition, the more enjoyable the thinking experience and cognitive processing. Empirical studies have shown that people with higher NFC rated tasks as more enjoyable than people with lower NFC (e.g., Amabile et al. 1994; Thompson et al. 1993). Thus, we hypothesize

H2: In their interactions with the Web, individuals with High NFC feel more enjoyment than those with Low NFC.

Control

Control represents an individual's perception of being in charge of an activity and his interactions with the online environment (Agarwal & Karahanna, 2000; Koufaris, 2002). As a type of intrinsic motivation, control may be positively associated with need for cognition. If an individual has a higher desire for controlling his activities and the environment, he may need to engage in effortful thinking about the best strategy required to control the environment. If the outcome of control is positive and successful, the individual may attribute the success to his own cognitive efforts in determining the strategy (Thompson et al., 1993). On the other hand, people with higher need for cognition need to have control over the environment to fully focus their attention and cognition on the current activity and environment. Without a higher level of control over the activity at hand, they may be easily distracted or disrupted. Previous empirical studies have shown support for the positive association between need for cognition and control (Fletcher et al., 1986; Thompson et al., 1993). Thus, we hypothesize

H3: In their interactions with the Web, individuals with High NFC have more control than those with Low NFC.

Curiosity

Curiosity can be defined as the extent to which the human-computer interactive experience arouses an individual's sensory and cognitive interest (Agarwal & Karahanna, 2000; Trevino & Webster, 1992). Curiosity captures an individual's innate desire for information and a passion for learning (Loewenstein, 1994). It may work as a useful construct to investigate individual differences in online behavior such as information search and cognitive responses to various stimuli implemented online. Olson et al. (1984) reported significant positive correlations between need for cognition and curiosity, which was measured in terms of several different scales. Significant positive correlation was also found between need for cognition and sensation seeking, which is a construct closely correlated with curiosity (Olson et al., 1984). Thus, we hypothesize

H4: In their interactions with the Web, individuals with High NFC are more curious than those with Low NFC.

Temporal Dissociation

Temporal dissociation suggests that an individual is unable of keeping track of the approximate passage of time in the human-computer interactive experience (Agarwal & Karahanna, 2000). Unaware of time passing quickly is an important element in Csikzentmihalyi's original conceptualization of flow (1975). Although time is objectively measured as clock time, the experience of time is highly subjective. Ornstein (1969) suggested that psychological time perception is a function of the amount of memory used to process information during an activity. Time perception also depends on the amount of

information required to be processed (Coren et al., 1984). If cognitive resources available match task requirements, time perception is longer than if resources are not matched (Mantel & Kellaris, 2003). This relationship holds regardless of whether the resources available and the resources required are both high or the resources available and the resources required are both low. This notion of resource matching is similar to that of skill-challenge matching (Csikzentmihalyi, 1975). Given that resource availability and resource matching in interactions with websites is likely to be randomly distributed, we hypothesize

H5: In their interactions with the Web, the perception of time passage of individuals with High NFC is not different from that of individuals with Low NFC.

RESEARCH METHOD

Design and Participants

Based on the problem we chose to investigate and the nature of the hypotheses, we utilized a survey for the research method in the current study. The respondents were undergraduate students enrolled in different sections of an introductory business course at a public university in the midwestern U. S. With instructors' agreement, bonus course credits were given for successful completion of the survey to motivate responses.

Of a total of 220 questionnaires distributed to different instructors of the course, 179 questionnaires were returned. Among the returned questionnaires, 23 were identified as incomplete responses and excluded from the sample, resulting in a total of 156 responses in the final sample. The respondents were very experienced with computers (mean=11.16 yrs, sd= 4.95), web sites (mean=7.28 yrs, sd= 4.66), and e-mail (mean=6.45 yrs, sd= 4.72).

Measures

All research variables were measured using multiple-item scales from prior studies, with "strongly disagree" at one end and "strongly agree" at the other. Except for the measure of NFC, which used a 5-point Likert scale, all measures used a 7-point scale. Items for NFC were from the original 18-item short form from Cacioppo et al. (1984). The scale included such items as "I would prefer complex to simple problems," "Thinking is not my idea of fun," and "I only think as hard as I have to." The reliability of NFC measured by Cronbach's alpha was 0.80 in the current study, which is consistent with previous empirical studies (see Cacioppo et al., 1996). Focused attention, enjoyment, control, curiosity, and temporal dissociation were all measured using the scales from Agarwal and Karahanna (2000). These scales had been developed based on previous studies such as Webster et al. (1993). The reliability of these several dimensions of flow measured by Cronbach's alpha was 0.89, 0.89, 0.78, 0.91, and 0.94, respectively, in the current study.

RESULTS

Construct means, standard deviations, and pearson correlations are shown in Table 1. The correlations between the dependent variables, i.e., focused attention, enjoyment, control, curiosity, and temporal dissociation, were all significantly correlated with each other at the 0.01 level, indicating that these variables are the several dimensions of the flow experience construct.

Construct	Mean	Std. Dev.	NFC	FA	En	Co	Cu	TD
Need for Cognition(NFC)	3.29	0.43	1	0.204*	0.129	0.259**	0.295**	0.113
Focused Attention(FA)	4.08	1.23		1	0.477**	0.518**	0.612**	0.614**
Enjoyment(En)	4.87	1.14			1	0.486**	0.596**	0.492**
Control(Co)	4.17	1.16				1	0.536**	0.410**
Curiosity(Cu)	4.44	1.27					1	0.569**
Temporal Dissociation(TD)	4.7	1.28						1

p<0.05, ** p<0.01

Table 1. Descriptive Statistics and Interconstruct Correlations

To test the research hypotheses, a multivariate analysis of variance (MANOVA) was first performed, with NFC as the independent variable and the five dimensions of flow experience as dependent variables. The MANOVA result showed an

overall significant main effect of NFC ($F_{(5,150)}$ = 2.59, p = 0.03) on flow experience. Next, several univariate ANOVA tests were performed to test the main effects of NFC on each dependent variable to reveal group differences. The results are summarized in Table 2.

As shown in Table 2, the mean score of focused attention for the High NFC group (4.30) was higher than that for the Low NFC group (3.87) ($F_{(1,154)}$ = 4.80, p = 0.03). Thus Hypothesis 1 was supported. Hypothesis 2 was not supported (p > 0.05), indicating there was no significant difference of perceived enjoyment between the High NFC group and Low NFC group. The mean of perceived control for the High NFC group (4.41) was higher than that for the Low NFC group (3.96) ($F_{(1,154)}$ = 6.01, p = 0.02); Thus Hypothesis 3 was supported. Hypothesis 4 was also supported, with 4.72 as the mean score of curiosity for the High NFC group and 4.17 for the Low NFC group ($F_{(1,154)}$ = 7.51, p = 0.01). No significant difference was found between the two NFC groups in terms of temporal dissociation (p = 0.09). Thus Hypothesis 5 was supported.

Dependent Variable	Low NFC		High NFC		F	p
	Mean	SD	Mean	SD		
Focused Attention(FA)	3.87	1.21	4.30	1.22	4.80	0.03
Enjoyment(En)	4.84	1.19	4.91	1.10	0.15	0.70
Control(Co)	3.96	1.16	4.41	1.13	6.01	0.02
Curiosity(Cu)	4.17	1.25	4.72	1.24	7.51	0.01
Temporal Dissociation(TD)	4.54	1.24	4.89	1.30	2.94	0.09

Table 2. Mean Differences and Hypotheses Testing

DISCUSSION

The purpose of this study was to examine the effect of need for cognition, an individual trait variable, on the flow experience of online navigation. Based on a literature review of need for cognition and flow, five research hypotheses were developed and tested using a student sample. Four of the five research hypotheses were supported based on the analysis of the data. A detailed discussion of these results follows.

First, NFC was found to be positively associated with focused attention. Consistent with what we have hypothesized, individuals with High NFC were more focused than those with Low NFC in their interaction with the website during their online navigation (H1). As stated elsewhere, High NFC people are more engaged in their cognitive activities and thus may have a higher tendency or ability to automatically filter out surrounding noises and prevent them from interfering with cognitive tasks.

Second, contrary to our hypothesis, individuals with High NFC were not found to experience greater enjoyment in online interactions than those with Low NFC (H2). As discussed before, in the studies that have investigated the relationship between NFC and intrinsic motivation, respondents were often given a particular type of task to perform. They were then asked to evaluate their enjoyment derived from performing the task (Amabile et al., 1994; Thompson et al., 1993). Our study, however, did not consider the effect of task on flow experience, and thus our different conceptualization may have influenced the findings. The enjoyment individuals reported about their online interactions may also result from their entertainment-related navigations rather than cognitive-related activities. As Chen et al. (1999) reported, entertainment and social activities are also major reasons that might help explain an individual's flow experience online.

Third, consistent with our hypothesis, individuals with High NFC perceived that they had more control than those with Low NFC when they were online (H3). Without conscious control, High NFC individuals could not be fully involved in their current navigation activities.

Fourth, consistent with previous findings, NFC was found to be positively associated with curiosity. Individuals with High NFC were more curious than those with Low NFC when they navigated online (H4). This finding also supports the role of curiosity in human-computer interactions (Trevino & Webster, 1992). A higher level of curiosity is closely associated with enjoyment and playfulness when using a computer. On the other hand, the unique structure of the internet and its hyperlinks has made it easier to link together relevant material, which may increase people's curiosity level when browsing online.

Finally, individuals with High NFC were not different from those with Low NFC in the perception of time passage (H5). As mentioned above, we did not consider the effect of task in our study. Without measuring the challenges of tasks, we might have missed one of the important antecedents of an individual's time perception and estimation. As suggested by Ornstein (1969), the accuracy of time perception depends on whether a person's cognitive resources match the challenges of the task.

CONCLUSION

Before we discuss the research and practical implications of the study, we need to point out several limitations of this study. First, the data were collected from a student sample; students may differ from other online user groups. One important factor accounting for the difference is that the level of NFC among students may be higher than other groups of users. Thus, the generalization of the findings of the present study to business practices and general social groups should be made with caution. Second, the types of tasks and activities performed by students when they navigated online were not revealed. Students use the internet for both social (communication and entertainment) and non-social (information search and processing) purposes. The two different types of tasks have different challenges and require different involvement for people with different NFC. Our research findings might have been different if the task factor had been taken into account. Third, the current study asked students' general perceptions of online experiences. Without focusing on a particular website, the effect of website design or the features of the artifact in general might have introduced variance. Different results might have been obtained if we had selected one particular website for students to evaluate.

Implications for Research

From a research standpoint, this study is a first effort to explore the effect of need for cognition on online flow experience. The results of this study provide empirical evidence for the usefulness of need for cognition and cognitive factors in general when investigating flow experience. Further, need for cognition may be examined together with other personality factors, such as self-efficacy, sensation seeking, and an individual's mood when navigating online. Social psychology research on need for cognition has reported many interaction effects of need for cognition and other variables. Finneran and Zhang (2003) and Koufaris (2002) have also called for further examination of individual characteristics. Investigating need for cognition may also expand our understanding of other research questions in human-computer interactions and information systems in general, such as computer anxiety, privacy concern, burnout, and so on.

The limitations discussed above also suggest several directions for future research concerning online flow experiences. First, additional subject populations would be worthwhile to investigate. Second, the effect of task should be considered. We agree with Finneran and Zhang (2003) that ignoring the effect of task in previous flow studies may have ignored a connection between flow experience and tasks. Further, the common classification of tasks as goal-directed or experiential may be too broad to be useful. Thus, following the empirical studies of Chen et al. (1999) and Chau et al. (2002), we suggest classifying tasks as either information search-related or entertainment-related. Third, the research hypotheses could be tested with a specific website rather than investigating users' general perceptions of websites. Taking these last two points together, it would be useful to investigate flow experience in a controlled experiment.

Implications for Practice

Findings of the present study may also shed light on several concerns of website designers. The significant differences of flow experience between the high and low NFC groups reveal the importance of considering NFC as a factor in website personalization design. As mentioned above (Cacioppo et al., 1996), individuals with High NFC tend to derive clear meanings and avoid ambivalent positions in their judgments, perceptions, and behavior when faced with various stimuli from the environment. On the other hand, individuals with Low NFC tend to use short-cuts and heuristics and are more likely to be influenced by others, such as celebrities and experts. Thus, the web pages for High NFC individuals should focus on providing clear, detailed, and comprehensive information and leave the individuals themselves to make final judgments and decisions. On the other hand, online customer endorsement and expert opinions may work better for Low NFC individuals. In terms of building online trust, third-party referrals and online communities may work better for Low NFC individuals, while a clearly stated privacy policy may work adequately for High NFC individuals. For Low NFC people, personalized web pages might include more control functions, such as event notifications and timers. Finally, High NFC individuals seem more likely to respond to requests for online feedback than people with Low NFC.

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