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13. Transaction-Driven Personalization: The Moderating Effects of Personality Traits

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Abstract

With transaction-driven personalization engines online merchants can use knowledge gained from an individual customer's past transactions to match web content to the customer's individual interests and preferences. Prior research in this area has focused on how to maximize knowledge mined from transaction logs to generate recommendations which are highly similar to the individual's past preferences. However, it remains an empirical question as to whether a recommendation closely matched with previous transactions is most likely to influence choice behavior? In this study, we postulate that a recommendation closely matched with previous transactions may not be the most efficient in biasing an individual. In the consideration and choice process, an individual's personality traits play a pivotal role in moderating the effect of personalized content. Drawing on prior work in marketing, we examine two key personality traits, need for cognition and variety seeking, and explore their effects on choice behavior in the context of transaction-driven personalization. Research hypotheses are tested using 2,294 pre-selected subjects in an online field experiment based on a ring tone download website. Our findings establish that personality traits of an individual moderate content consideration and choice. Theoretical and practical implications of the findings are discussed.

Keywords: Web personalization, personality traits, need for cognition, variety seeking, user behavior

Introduction

As competition intensifies, online retailers have to continuously provide better offerings and unique web experiences to their customers. To remain competitive, online retailers have sought differentiating strategies to attract and retain users (Bakos 1991). One such strategy has been to incorporate a personalization agent to model and adapt to web visitors' objectives and facilitate their navigation/buying process (Albert 2004). Different types of personalization agents are available. For instance, transaction-driven personalization systems customize web layout and content depending on users' preferences as inferred from transaction logs (Reiter and Rubin 1999). In contrast, real time personalization systems adapt the webpages presented based on observations of user click streams in a given session in an attempt to be sensitive to context of interaction (Mulvenna et al. 2000). Alternatively, the personalization systems studied in prior research can be distinguished based on whether they seek to personalize the content (e.g., a set of product offerings) or peripheral cues (e.g, the manner in which the webpage is presented). Figure 1 provides a taxonomy of personalization

systems and prior research based on data collection method (clickstream or transaction log) and the nature of the personalization (content or peripheral). In this study we focus on transaction-driven personalization of content (i.e., the upper left quadrant of Figure 1). While prior studies have been conducted in this area, the issue of the effect of personality traits is underinvestigated, despite the importance of personality in purchasing behavior evidenced in the marketing literature (e.g. Chintagunta 1999; Homburg and Giering 2001; van Trijp et al. 1996).

Data Collection by Personalization Agents	Transactions	Customization of web content based on the analysis of user's transactions and search queries in the previous logon sessions . <i>Examples:</i> Fan et al . (2000) ; Smyth and Cotter (2000) ; Vinaja et al . (2000)	Customization of web layout based on the analysis of user's transactions and search queries in the previous logon sessions . <i>Examples:</i> Billsus et al . (2002) ; Moon (2002)
	Click Streams	Customization of web content based on the observation of user's click streams and search queries in the current logon session . <i>Examples:</i> Bums and Stollak (1998) ; Fazlollahi et al . (1996)	Customization of web layout based on the observation of user's click streams and search queries in the current logon session . <i>Examples:</i> Andre and Rist (2002)
		Content	Peripheral

Nature of Personalization

Figure 1: An Overview of Personalization Systems

Providing an effective personalization service is non-trivial. Although there are many software tools aimed at assisting in personalization (e.g. customer relationship management, data mining, collaborative filtering, and click stream analysis software), Jupiter Research (2003) reported that only 14% of users believe that personalized recommendations on shopping websites lead them to purchase more frequently. In an effort to achieve greater success in personalization, prior research has focused on investigating how to maximize the knowledge from transaction logs to generate a recommendation highly matched with previous transactions. However, it remains an empirical question as to whether *a recommendation closely matched with previous transactions is most likely to influence choice behavior*.

Prior research evidences that personality traits significantly influence choice behavior, (Benbasat and Dexter 1982; Hunt et al. 1989; Nutt 1993; Lu et al. 2001). Recent research in the marketing literature shows that the effect of personalization on consumer behavior may be influenced by personality traits (Andre and Rist 2002; Moon 2002). The context of this prior research was personalization of peripheral cues (e.g. presentation styles and animation), rather than personalization of content (offers and recommendations), and consequently provide insufficient guidance to online retailers seeking to battle fierce price competition through the personalization of offers and recommendations. Nonetheless the prior work suggests that personality traits may prove to be an important moderator of the effect of personalized content (offers and recommendations) on choice behavior. Recommendations that consider both previous transactions and personality traits may thus be the most likely to

influence choice behavior. Consequently, this study is aimed at examining personality and personalization of content rather than peripheral cues. In particular, we consider the effects of two of the most widely studied personality traits examined in the prior literature: need for cognition and variety seeking. More generally, this study seeks to address the question: *what is the effect of personality traits on choice behavior in response to personalized offers generated from a transaction-driven agent?*

From a theoretical perspective, the results of this study contribute to the development of a more comprehensive theory of the effects of personalization on consumer choice behavior. From a practical perspective, it offers the potential to improve the success online retailers achieve with personalization agents, providing redress against the disappointing performance reported by Jupiter Research. Pragmatically, we will also provide preliminary evidence demonstrating how relevant personality traits can be derived automatically from observation of behavior, without the necessity of directly questioning the user.

The structure of the paper is as follows. Section 2 presents the theoretical background and the hypotheses. This is followed by an online study in Sections 3 and 4. Section 5 discusses the findings and Section 6 concludes the paper.

Theoretical Development and Hypotheses

Choice Behavior: Consideration Set Theory

We employ Consideration Set Theory (Howard 1989; Howard and Sheth 1969) to structure our examination of the effects of personalization and personality traits on choice behavior (see Finn and Louviere 1990; Gensch 1987; Roberts and Lattin 1997 for more recent analyses). Consideration Set Theory views the choice process as being based on four hierarchical sets: the universal set, the awareness set, the consideration set, and the final choice outcome (see Figure 2).

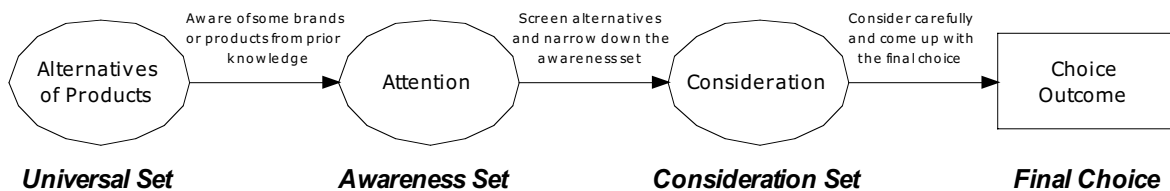


Figure 2: Decision Making Stage

The *universal set* refers to all possible alternatives that could be purchased by users. With limited cognitive resources, users cannot process all alternatives in the universal set. They can only be aware of a few products. A subset of the items forms their *awareness set*. Variables, such as expertise and processing capacity, influence the content of the awareness set. After gathering much information, users identify and select a set of acceptable alternatives from what is available. Their *consideration set* is then formed (Punj and Brookes 2001). This set consists of alternatives that users would consider carefully, and limit their purchases to these alternatives (Roberts and Lattin 1997). The average size of a consideration set may vary (Roberts 1989) reflecting the search costs involved in identifying and selecting the alternatives for inclusion in the consideration set. After eliminating alternatives from their consideration set, users arrive at their *choice outcome* subsequently. That is, they evaluate each alternative in the consideration set carefully to select the best alternative(s).

In this study we focus our attention on choice behavior which we define as active evaluation of the alternatives in the consideration selection of a final choice. In the context of the typical transaction-driven personalization system, transaction log data is analyzed to make recommendations to users in an attempt to ensure their consideration set includes items that are likely to be chosen for purchase. Our interest then is on how personality traits influence the active evaluation of alternatives recommended into the consideration set and ultimately the final choice made. Consequently our primary dependent variables of interest are content consideration (whether or not a user actively considers a recommended alternative), and the choice outcome (whether or not a user chooses a recommended alternative).

Personalization: Preference Matching

In characterizing transaction-driven personalization systems that seek to manipulate content (recommendation or offers) the goal is to maximize “preference matching”. In this context, preference matching refers to the similarity of personalized content with previous transactions. It is the extent to which recommendations are consistent with previous transactions by an individual or by other “like-minded” people (e.g., those who exhibit substantially similar transaction histories). Prior research has shown that consumers give greater consideration, and ultimately are more likely to choose highly preference-matched personalized content (although the Jupiter Research finding suggests the practical value of this is less significant than desired). Thus as a confirmation of prior work we hypothesize:

Hypothesis H1a: Preference matching will positively influence consideration set size (the number of alternatives actively considered).

Hypothesis H1b: Preference matching will positively influence final choice outcomes.

Our concern here is not simply with differential effects of high versus low preference matching in personalization – an issue which has been subject to substantial prior research. Rather our concern is with how the effect of preference matching is moderated by the personality traits of need for cognition and variety seeking.

Personality Traits and Personalization

We consider two of the most widely studied personality traits in choice behavior: need for cognition and variety seeking. Need for cognition (NFC) is defined as an individual’s “tendency to engage in and enjoy thinking” (Cacioppo and Petty 1982, p. 119). Even intuitively it seems obvious that NFC may influence choice behavior as it reflects an individual’s propensity to engage in effortful comparison of alternatives within a consideration set, and thus ultimately choice. Likewise variety seeking, defined as a consumer motivation to look for or accept novelty (McAlister and Pessemier 1982) intuitively influences choice behavior as it reflects an individual’s desire to look for different items in consideration set, and the propensity to choose something different from what has previously been chosen. We now discuss in detail the effects of each of these personality traits on the Preference Matching-Choice Behavior relationship.

2.3.1 Need for Cognition and Personalization

In general, individuals with high NFC are intrinsically motivated to engage in cognitive endeavors (Cacioppo and Petty 1982; Haugtvedt et al. 1992; Larsen et al. 2004). They search for more information when making decisions (Verplanken 1993); and engage in more effortful processing of persuasive messages (Haugtvedt et al. 1992; Roehm and Sternthal

2001). Compared with individuals with low NFC, they are more open-minded (Cacioppo and Petty 1982), and enjoy more effortful cognitive tasks and develop more complex causal explanations for the behavior of others (Fletcher et al. 1986). Also, they hold attitudes that are more persistent over time and resistant to persuasion attempts (Haugtvedt et al. 1992). Assuming the arguments in a message are valid, high-NFC individuals tend to make greater and longer-lasting attitude changes (Haugtvedt et al. 1992). Thus, we anticipate that high-NFC individuals will actively consider a larger number of alternatives than low-NFC individuals (i.e. they will have a large consideration set). More formally, we hypothesize:

Hypothesis H2a: High NFC individuals will have a larger consideration set size (i.e. actively consider more alternatives) than low NFC individuals.⁶

Since prior work suggests that NFC individuals are more discerning and careful (Haugtvedt et al. 1992; Petty and Cacioppo 1986). This suggests they will be more sensitive to the level of preference matching of personalized content in their choice behavior than low-NFC individuals. Consequently we hypothesize:

Hypothesis H2b: Preference matching will have a greater effect on consideration set size (i.e. the number of alternatives actively considered) for high-NFC individuals as opposed to low-NFC individuals.

The final choice of an individual is heavily influenced by the merits of the alternatives in the consideration set. As high-NFC users are likely to more sensitive to the level of preference matching of the personalized content, we expect the choices of high-NFC users to be more polarized between highly-matched and lowly-matched content than those of low-NFC users. Thus, we postulate:

Hypothesis H2c: Preference matching will have a greater effect on choice outcome for high NFC individuals as opposed to low NFC individuals.

Variety Seeking and Personalization

Variety seeking is a consumer motive to accept novelty (for a review, see McAlister and Pessemier 1982). It has acted as a determinant in many marketing models with the outcome variables, including impulse purchase (van Trijp et al. 1996), purchasing timing (Chintagunta 1999), brand loyalty (Homburg and Giering 2001), brand switching (Chintagunta 1999) and customer satisfaction (Homburg and Giering 2001).

According to the theory of Optimal Stimulation Level (Berlyne 1960; Zuckerman 1979), every individual prefers an ideal level of stimulation, and the level is determined by novelty, change, surprise, ambiguity, uncertainty, complexity, and incongruity that are associated with a stimulus. When a stimulus provides stimulation below the optimal level, the individual feels bored and desire an increased stimulation. This leads to greater exploration. Personalized

⁶ We choose to categorize individuals as high and low NFC rather than examining NFC as a continuous variable, as matter of pragmatics. In practice, it is likely to be substantially easier for online retailers to profile an individual as low or high NFC based on observed behavior (i.e., without directly measuring NFC through a questionnaire) than it is to develop such an automated continuous measure.

content that deviates from past transactions (i.e. lowly-matched content) thus provide a greater degree of stimulation. Variety seekers have a greater desire for this stimulation and thus are likely to exhibit a greater propensity to explore the lowly matched, different, personalized content. On the contrary, variety non-seekers prefer content similar to their past preferences – they desire highly matched content.⁷ Thus we hypothesize:

Hypothesis H3a: Variety seekers will consider much lowly-matched personalized content than highly-matched personalized content, whereas variety non-seekers will consider much highly-matched personalized content than lowly-matched content. (The interaction of variety seeking and preference matching will have negative effect on consideration set size).

Variety seekers prefer stimulation and excitement. Thus, they desire to switch to something different to raise stimulation and excitement. Therefore, we anticipate that they are more likely to make a choice in the context of lowly-matched content, than variety non-seekers who prefer the familiarity of highly-matched content.

Hypothesis H3b: Variety seekers are more likely to choose lowly-matched personalized content than variety non-seekers who prefer highly-matched personalized content as their final choice.

Figure 3 summarizes the research model.

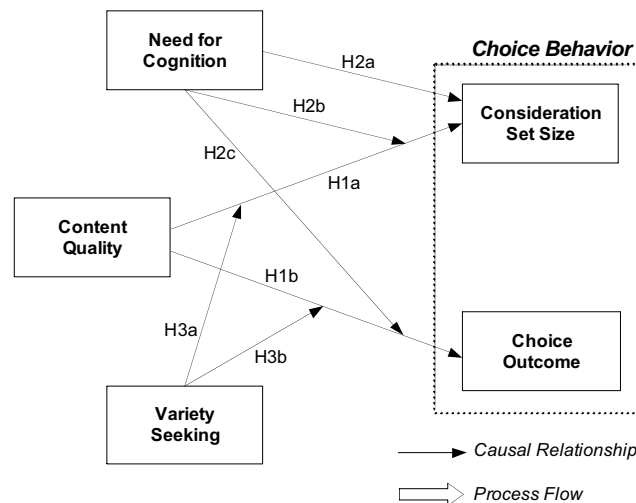


Figure 3: Research Model

⁷ Note variety seeking is only relevant to choice behavior in the context of the preference matching of the consideration set, consequently we do not hypothesize any main effect for variety seeking.

Research Method

An online field experiment was conducted to test the hypothesized relationships. The experimental design comprised three independent variables and two dependent variables. The independent variables were preference matching which was manipulated using a transaction-driven personalization agent, need for cognition and variety seeking. The dependent variables were consideration set size (the number of alternative actively considered from personalized content) and the final choice outcome. The context for our experiment was shopping for ring tones for mobile phones. Since ring tones were hedonic products, users would be subject to situational and contextual factors which lend themselves to manipulation by a personalization agent.

Participants

We cooperated with a major mobile data services content provider, which offered ring tones, games and other content to mobile users in Hong Kong to conduct the studies. Emails were sent to 40,000 registered users of the content provider to recruit subjects. Subjects were randomly streamed into the two treatments (high vs. low preference matching). Demographic checks were carried out to assess the effectiveness of the random assignment of subjects to treatment conditions. We received 3,267 responses in total. Among them, 2,294 (=70.22%) completed the entire experiment. As a token of appreciation, these subjects were given a free ring tone for their mobile handsets and a chance to join a lucky draw for a special gift. To provide further incentive for subjects to provide accurate responses to questionnaires on personality traits, subjects who successfully completed the experiment received a free individualized personality report. The study lasted for six weeks from mid-November 2003 to early January 2004.

Experimental Procedures

The study was divided into three parts. First, the subjects were asked to fill in a questionnaire about their demographic information and complete a personality test. Second, we asked subjects to indicate their preferences for rhythms and musicians. They chose and ranked their three favorite musicians from a list of 18. Information from the Hong Kong Music Billboard allowed us to determine which songs were popular from the musicians' latest albums. Finally, all participants entered a webpage with 12 ring tone alternatives. The subjects could choose to download only one ring tone free of charge. After they confirmed to download a ring tone, the selected ring tone was sent to the participant's mobile handset via a short message service. A pretest with 56 subjects was conducted to validate the instruments employed and to test the ring tone download system performance. Subjects were able to complete the whole process in 25 minutes. All subjects confirmed that the selection task was smooth.

Manipulation of Preference Matching

To determine the list of ring tones for the experiment, we studied the transaction log provided by the mobile service provider to obtain a list of musicians. This log contained the actual ring tone purchases of 7,858 distinct users. There were 66,795 transactions dated from August 2002 to November 2003. These users downloaded ring tones from 175 distinct musicians. We chose the top 18, who accounted for 32,869 (49.21%) out of 66,795 download transactions. These transactions were conducted by 6,474 (82.39%) distinct users. We then formed a pool of 72 ring tones from 18 musicians (4 ring tones per musician). Most musicians had two ring tones with fast rhythms, and the other two with slow rhythms. The ring tones in the same

rhythm category were assigned a recommendation priority based on the information obtained from the Hong Kong Music Billboard.

There were two levels of manipulation of preference matching: highly-matched and lowly-matched. Under the highly-matched condition, the list of recommended ring tones matched with the subject's previous transactions. If the subjects downloaded ring tones from many different musicians, or from the musicians who were not included on the 18-musician list, then we could not determine the best recommendations. In this case, we relied on their responses in the questionnaire (i.e. Step 2 in the experiment) to generate highly-matched recommendations. Under the lowly-matched condition, the list of ring tones was randomly extracted from the ring tone pool. All subjects received a list of 12 ring tones from which to choose.

User Interface Design

All 12 ring tones were presented to a subject on a single page. Under a 1024×768 resolution, no page scrolling was needed for viewing the ring tones. Ring tones were presented on the right of the page under Personalized Recommendations, whereas ring tones on the left were Other Offers. There was no other link on the page. The title of the song associated with each ring tone was used as a label and the musician of the song was also indicated. All titles and musicians were labeled in Chinese. For each ring tone, there were two buttons. One labeled as "Trial Listen" and the other as "Download". When a subject pressed on the "Trial Listen" button, an audio file of the selected ring tone was streamed to the subject's client machine. There was no restriction on the number of trial listenings. All mouse clicks of a subject were logged. When a subject pressed the "Download" button of a ring tone, the selected ring tone was sent to the subject's mobile phone.

Measurements

(a) Dependent Variables

Consideration set size was measured by the number of personalized ring tones sampled by the subjects during the field experiment. At the end of field study, all subjects had to choose a ring tone either from the personalized list or from the other list. We recorded their final choice (1=download from personalized list; 0=otherwise).

(b) Need for Cognition

Need for cognition was measured using an instrument taken from Cacioppo et al. (1984). Participants indicated the extent to which each statement was the characteristic of themselves on a 7-point scale anchored by 1 (strongly disagree) and 7 (strongly agree). This scale has been widely used in recent research (e.g. Tormala and Petty 2004; Wheeler et al. 2005). The questions are shown in Appendix I.

(c) Variety Seeking

Variety seeking was measured using an instrument taken from Baumgartner and Steenkamp (1996). This scale has been widely used in past research (e.g. Homburg and Giering 2001; Zhang and Krishnamurthi 2004). All questions were anchored on a 7-point scale, ranging from strongly disagree (1) to strongly agree (7). The questions are shown in Appendix I.

Data Analysis

Validity and Reliability

To assess convergent and discriminant validity, we factor-analyzed the items for the two personality trait instruments. Table 1 shows the results from factor analysis and reveals the item loadings were consistent with two factors and two distinct theoretical constructs. The Cronbach alpha values for need for cognition and variety seeking were 0.88 and 0.76 respectively. Consequently we concluded the instruments were statistically valid and reliable.

Table 1: Factor Analysis

	Comp1	Comp2
VS1	.056	.796
VS2	.028	.814
VS3	-.046	.841
NFC1	.828	.027
NFC2	.881	.018
NFC3	.735	.075
NFC4	.812	-.038
NFC5	.836	-.019

Hypotheses Testing

Table 2 and Table 3 summarize the descriptive statistics for the dependent variables.

Table 2: Descriptive Statistics on the Number of Trial Listens of Personalized Recommendations

	High NFC			Low NFC		
	N	Mean	S.D.	N	Mean	S.D.
Low Preference Matching	533	2.54	2.34	568	1.70	1.70
High Preference Matching	615	3.47	2.74	578	1.92	1.86
Total	1148	3.03	2.60	1146	1.81	1.78

	Variety Non-Seeker			Variety Seeker		
	N	Mean	S.D.	N	Mean	S.D.
Low Preference Matching	560	2.16	2.04	541	2.05	2.11
High Preference Matching	588	2.80	2.59	605	2.66	2.37
Total	1148	2.48	2.35	1146	2.37	2.27

Table 3. Descriptive Statistics on the Number of Downloads of Personalized Recommendations

	Need for Cognition (NFC)				Variety Seeking (VS)			
	High		Low		High		Low	
	N	Mean	N	Mean	N	Mean	N	Mean
Low Preference Matching	533	40.33%	568	47.59%	541	49.91%	560	38.57%
High Preference Matching	615	69.18%	578	68.26%	605	68.78%	588	68.70%
Total	1148	55.79%	1146	58.02%	1146	59.87%	1148	54.00%

We performed a median split (median=4.08, range=-0.15 to 9.07) to classify the 2,294 participants into high-NFC individuals or low-NFC individuals. Similarly, we performed another median split (median=4.62, range=-1.31 to 10.93) to classify the participants into variety seekers or variety non-seekers.

(a) Consideration Set Size

We conducted a three-way ANOVA with variety seeking, NFC and preference matching as the explanatory variables for consideration set size. The results confirmed prior research, supporting H1a ($F(2288, 5)=39.28, p<0.01$). A significant main effect was also evidenced for NFC supporting H2a ($F(2288, 5)=169.44, p<0.01$). A significant interaction effect between NFC and preference matching, was evidenced supporting H2b ($F(2288,5)=15.33, p<0.01$). Individuals with high NFC sampled more ring tones (mean=3.03) than individuals with low NFC (mean=1.81) (see Table 2a). As the similarity of personalized recommendations with previous transactions degraded, high-NFC individuals sampled fewer ring tones from a poor list (mean samplings dropping from 3.47 to 2.54). However, the number of samples by low-NFC individuals remained approximately constant (dropping from 1.92 to 1.70). Preference matching clearly exerts a larger influence on high-NFC individuals.

We found that the interaction effect between variety seeking and preference matching was not significant, evidence no support for H3a ($F(2288,5)=0.49, p>0.1$)⁸ (see Table 2a for details of the mean number of ring tones sampled).

(b) Choice Outcome

Choice outcome was coded as a binary variable (1=download from personalized list; 0=otherwise). A logistic regression was conducted to test the effects from variety seeking, NFC and preference matching on choice outcome. The results confirm the prior research evidencing a positive effect of preference matching, supporting H1b ($\chi^2(1)=53.24, p<0.01$). A significant interaction effect was found between NFC and preference matching, supporting H2c ($\chi^2(1)=3.88, p<0.05$). As shown in Table 2b, high-NFC individuals chose more highly-matched personalized offers (69%) and fewer lowly-matched personalized offers (40%). However, low-NFC individuals were less sensitive to preference matching. They took 68% of highly-matched offers and 48% of lowly-matched offers.

Similarly, there was a significant interaction effect between variety seeking and preference matching, supporting H3b ($\chi^2(1)=7.07, p<0.01$). With lower preference matching, variety seekers were still willing to chose a ring tone from the personalized list (mean=50%), whereas variety non-seekers tended to reject those recommendations (mean=39%).

Discussion and Implications

Our work enhances the understanding of the interaction effects between preference matching and an individual's personality traits, need for cognition (NFC) and variety seeking, on content consideration and decision outcome. Our findings reveal that, in general, individuals take more highly-matched content than lowly-matched content. However, individuals with low NFC or variety seekers will also consider and choose lowly-matched content. Personal traits appear to play a pivotal role in influencing choice behavior in interaction with preference matching. Generating recommendations closely matched with previous

⁸ Prior to conducting the experiment, we estimated that assuming a medium effect size, a sample size of around 500 could achieve a power of the statistical tests higher than the recommended value of 0.8 (Cohen, 1988). Our sample size was 2,294. Thus, there was no evidence that non-significant result in H2a was due to a small sample size.

transactions may not be the best approach. This study contributes to the existing literature in several ways.

First, individuals who have little motivation to exert cognitive effort to evaluate the merits of alternatives tend to rely on recommendations suggested by the personalization agent. These low-NFC individuals sampled fewer personalized ring tones, but also chose more personalized recommendations. They are less able to distinguish highly-matched from lowly-matched recommendations. If the cost of generating a personalized recommendation is high, a firm can consider providing fewer personalized options of average preference matching to low-NFC individuals.

Second, since high-NFC individuals are willing to process more information, more personalized content should be sent to these individuals. Otherwise, they might seek information from other sources and lose interest in the personalized list. Also, since they are more able to distinguish highly-matched recommendations from lowly-matched recommendations, unless the firm is confident that a recommended item matches the interests of a high NFC user, it should not offer the item to the person. That is, by knowing users' NFC, a firm can manipulate the merits of arguments for different users to maximize the pervasiveness of the content.

Third, since variety seekers have a stronger desire to look for stimulation, they are willing to explore personalized recommendations which deviate from their past revealed preferences. However, variety non-seekers prefer the familiarity of content closely-matched with their previous transactions. In addition to understanding the transaction history of individuals, it becomes equally important for online merchants to understand their traits. For variety non-seekers, providing recommendations matching their past preference is the most direct and simple way to influence their decisions. For variety seekers, it may be more effective have the personalization agent provide a list of offers which may not be closely aligned with a user's past preferences. With a higher level of novelty and surprise, variety seekers are willing to take alternatives from this list.

Fourth, the effects of different personality traits at different stages of information processing are different. According to our findings, the effect from variety seeking is not significant at the consideration stage, but is significant at the choice stage. This sheds light on the effectiveness of web personalization and highlights the pivotal role it plays in different information processing stages (i.e. consideration and choice) of a user.

Last, as suggested by Benbasat and Zmud (1999, p.5), the implications of empirical IS research should be "implementable". Thus, a major challenge for web service providers is to understand or derive the personality scores of their customers and prospects from observable web behavior. Unless they are known, strategies that leverage on this finding cannot be realized. The challenge becomes identifying observable web behavior that correlates with NFC and variety seeking scores. To probe further into the topic, we have derived click traits from the web server log and correlated this information with the participants' NFC and variety seeking scores. For example, correlations between NFC and the amount of repetitive listenings on the same ring tone and between NFC and browsing session time are 0.34 and 0.29, respectively. Correlation between variety seeking and the number of distinct sampled ring tones is 0.41. These findings, though preliminary, provide evidence that observable web behavior may form the basis of a scoring index for personality traits and it can serve as an

input for personalization systems. Consequently we believe our results can be incorporated into real world systems, beyond our experimental context.

Conclusion and Limitations

We studied the effects of transaction-driven personalization agents on individuals with different personality traits in terms of the user's content consideration and choice outcome. Generally, high-NFC individuals are more willing to explore personalized content, resulting in a great deal of information exploratory activities. And variety seekers are willing to explore the personalized content not totally aligned with their past preference. Thus, apart from data mining of past preferences, personalization agents should also adapt to individuals of different personality traits. Our study sheds light on the significance of personalization to online merchants in offering unique experiences to its users. Increasing investment in mining transaction logs may not generate the best outcome.

There are a variety of ways to extend our work. First, our subjects were invited to an artificial website to ensure that this was their first time to experience this personalized site. And they could experience this website only once. What would happen if the visitors returned to the site? Do variety seekers behave differently in the long run? A longitudinal field study might contribute much to this area of research. Second, our study focused on low-involvement hedonic products (i.e. ring tone). If the involvement of decision is high, would the individuals rely on personalization agents? Would the individuals take the recommendations deviated from their past transactions? With more resources, another field study using another product types can contribute to our knowledge about the effectiveness of personalization agents.

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Appendix I

(1) Variety Seeking

- VS1. I enjoy taking changes in buying unfamiliar things just to get some variety to me.
- VS2. I get bored with buying the same things even if they are good.
- VS3. I search around a lot just to find out something more about the latest styles.

(2) Need for Cognition

- NFC1. I don't like to have to do a lot of thinking [r]⁹.
- NFC2. I try to avoid situations that require thinking in depth about something [r].
- NFC3. I prefer to do something that challenges my thinking abilities rather than something that requires little thought.
- NFC4. I prefer complex to simple problems.

⁹ Items marked by [r] were reverse coded for statistical analysis.

NFC5. Thinking hard and for a long time about something gives me little satisfaction [r].