SEQUENTIALITY OF PRODUCT REVIEW INFORMATION PROVISION: AN INFORMATION FORAGING PERSPECTIVE[1]

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The literature highlights the importance of product review information to a consumer, but limited knowledge exists on the provision of such information in a shopping website. This research uses information foraging theory (IFT) to determine how to provide product reviews. Product reviews differ according to whether the content is mainly on product attributes (i.e., attribute-oriented product reviews) or usage experience (i.e., usage-oriented product reviews). Two empirical studies were conducted. Study 1 examined consumer information diet for product reviews using the think-aloud approach. Results showed that consumers use two different genres of product review information sequentially (1) to follow product attribute-oriented review information during the screening phase and (2) to forage for product usage-oriented review information during the evaluation phase. The findings were extended to Study 2 through a field experiment, in which different patches of product reviews were purposefully and sequentially given in accordance with the consumer information diet for product reviews. The results revealed that an online shopping website could offer varying genres of product reviews at different junctures to enhance consumers' decision-making performance. This research presents empirical evidence on the effectiveness of embedding product review information on a shopping website. This work further contributes to IFT, which is traditionally descriptive and conceptual in nature, by theorizing information provision and information-foraging behaviors of online consumers.

Keywords: Product review, information foraging theory, information diet, information patch, information sequentiality

Introduction

An online product review is an indispensable form of product-related information that can be found on shopping websites (Benlian et al. 2012; Chen and Xie 2008; Mudambi and Schuff 2010). Product reviews are growing in quantity; thus, a significant number of empirical studies have focused on how consumers could use indicators of product reviews to decipher critics. The indicators may include (1) the source (i.e., authorship of a review) (Benlian et al. 2012; Forman et al. 2008), (2) valence (i.e., a review with a positive or negative evaluation of a product) (Yin et al. 2014), (3) volume (i.e., number of reviews) (Park and Lee 2008), and (4) overall rating of the product review (Li et al. 2013; Mudambi and Schuff 2010). As consumers read product reviews despite these indicators (Weathers et al. 2015), shopping websites need to facilitate their appraisal. However, we have limited knowledge about the provision of such information on a shopping website. The current research builds on the notion that product reviews are content-based information that considers how product reviews, which differ in two genres, could be strategically organized and provided. One genre is the attribute-oriented product review, which is based on the attributes of a product (Chen and Xie 2008), and the other is the usage-oriented product review, such as product assessments based on consumption experience (Park et al. 2007; Schindler and Bickart 2012).

Research on organizing and presenting product reviews is rare in extant literature, and two essential inquiries are largely overlooked. The first inquiry is whether or not consumers use different product review genres discriminately during a website shopping process (Park et al. 2009), and if they do, what the order is in which they are used. The second question is how the product review genres should be organized to support consumer shopping decisions on a shopping website. The second inquiry is based on the following view. Consumers can forage any product review genre at any shopping juncture within a website, but they are still bound by the product review provision within that website (Lurie 2004). Thus, having a well-organized informational provision can help consumers manage their information-seeking behavior and support their shopping decision.

This research seeks to answer the two questions by understanding consumer information requirements for different product review genres (Pirolli 2009). The theoretical foundation rests on information foraging theory (IFT), which theorizes that an information forager engages in information-foraging behaviors to achieve a designated objective (Pirolli and Card 1999). These behaviors include using personal information diet and following the information scent to find the necessary information within or between information patches. *Information diet* refers to a set of information that has a certain perceived value to an information forager, while *information scent* refers to the approximate information or cue that helps an information forager determine the potential value of specific information. An *information patch* refers to a physical and/or conceptual space for information. Unlike other information-related theories, such as dual-processing theories (Epstein et al. 1996) and communication theories (Feng and MacGeorge 2010), IFT enables researchers to theorize about the interplay between consumer search behavior and information provision, and assimilate multiple genres of product reviews for purchase decision making (Pirolli and Card 1999).

As information foragers for product-related information, consumers must reveal an information diet for product reviews on a shopping website to build on IFT. Consumers then follow the information scent of each genre of product reviews based on their information diet for product reviews to seek useful information within or between product review patches. Consumers can make good shopping decisions if the successive presentation of product review patches on a website (i.e., different genres of product reviews) matches the information diet of consumers for the product review. The extent to which the successive presentation of product review patches matches consumers' information diet is defined as the *information sequentiality of product review provision* on a shopping website. A high level of information sequentiality denotes a provision of product review patches that matches the consumer information diet for a product review; otherwise, the product review provision holds a low level of information sequentiality.

Two consecutive empirical studies were conducted. Study 1 analyzed the consumer information diet for product reviews using the think-aloud approach. This study examined whether or not consumers exhibited an information diet for product reviews during the shopping process within a website (i.e., answering the first inquiry). A field study (Study 2) was then conducted to examine the influence of information sequentiality of product review provision on consumer shopping decision-making performance (i.e., answering the second inquiry). The two studies contribute to the product review literature by demonstrating that a shopping website can enhance consumers' decision-making performance by appropriately matching their information diet with specific product review genres at different shopping junctures.

Theoretical Foundations

Prior studies that are relevant to the product review research can be classified into two groups. One group involves the communication theories, and the other group includes information processing theories.

Scholars who adopt communication theories view product reviews as a communication medium between the past and potential consumers of a product (Bailey 2005). The product review characteristics that relate to communication concepts (i.e., author identity and product review valence) may have a significant influence on consumers' online shopping behavior (Brown et al. 2007; Godes and Mayzlin 2004). For example, consumers may refer to proxy indicators, such as the disclosed product reviewer identity–description information (Forman et al. 2008), and summative indicators, such as product valence (Yin et al. 2014), when making shopping decisions. This study's consideration of product review genres is different from the mentioned studies but shares a common theme of viewing product reviews as a communication medium between past and prospective consumers of a product.

This research proposes that the reaction to product review communication can differ based on the form in which past customers communicate with potential customers via product reviews that are attribute oriented or usage oriented (Chen and Xie 2008; Doh and Hwang 2009). Attribute-oriented product reviews are content characterized by the functionalities and features of an individual product, such as the actual exposure compensation and battery life of a digital camera for all-day use (Chen and Xie 2008). This genre of product review documents reviewers' assessment of a product based on its attributes. Usage-oriented product reviews focus on the content dominated by usage experience, such as personal experiences of a user in using a digital camera under bright light (Park et al. 2007). Such information enables consumers to assess product alternatives by making their judgment based on information that extends beyond the given product attributes (Xia and Bechwati 2008).

The second group of scholars approaches the context of product review based on information processing theories (Park and Kim 2008). They consider that consumers use dual routes to process product review information (Osman 2004). These dual processing routes are rooted in the theoretical lenses of the elaboration likelihood model (ELM) and the heuristic systematic model (HSM) (Tam and Ho 2003). ELM posits that consumers rely on their information processing ability and their motivation and use different routes (i.e., central and peripheral routes) to process product reviews (Park et al. 2009). The central route involves the deliberate information processing of the product review, whereas the peripheral route focuses on the usage of environmental cues from the product review to process information (Petty and Cacioppo 1986). HSM argues that consumers rely on the efficiency of seeking information and the sufficiency of the information obtained; consumers then decide on whether the heuristic or systematic route is used for information pro-

cessing (Chaiken 1980). The heuristic and environmental cues affect the evaluation of information if consumers use the heuristic route to process it. Otherwise, the systematic route causes the process to be scrutinized (Chaiken and Maheswaran 1994).

Thus, consumers may adopt different information-seeking strategies to obtain product-related information, make trade-offs that enable them to judge the utility of every alternative, and reach a decision that maximizes the return value of the product (Kulviwat et al. 2004). Consumers seem utilitarian and systematic but do not always conduct such a thorough processing of information, and they may not be aware of all information-seeking strategies that can be used (Sen et al. 2006). Thus, an information search can be considered as a dynamic process in which consumers spontaneously seek and constantly receive information until they complete their online shopping (Weenig and Maarleveld 2002). Information seeking is analogous to a series of problem-solving tasks (Ariely 2000). IFT functions under the same underlying notion of information seeking as a series of problem-solving tasks, which this research presents in the following subsection.

Information Foraging Theory

IFT provides a theory behind the adaptive interaction between an information forager and information provision, that is, how an individual searches for information in a given environment (Pirolli and Card 1999). Adipat et al. (2011) adopted IFT to examine the adaptive information presentation interface (i.e., tree-view-based information presentation) in mobile devices. Liu et al. (2010) used IFT to assess the interaction between users and a content-based image retrieval system. This research on product review considers that IFT mediates the ideological processing of product reviews and their actual spontaneous processing (Kiel and Layton 1981). IFT can provide an empirically verifiable explanation for the relationship between information seeking and product review provision (Adipat et al. 2011; Dennis and Taylor 2006) through the following three core concepts (see Table 1):

1. **Information scent** refers to the approximate information or cue that helps consumers determine the potential value of specific information (Pirolli and Card 1999). This concept establishes the foundation of information-foraging activities. An information scent can be a textual or a visual representation of the content (e.g., text labels, colors, and font).

2. **Information diet** is the combined set of information that has a certain perceived value to a consumer, who then

Table 1. Contextualization of IFT Constructs	
IFT Construct	**Contextualization in the Product Review Provision Within the Online Shopping Website**
Scent	The approximate information (or cue), such as a summary or keyword, helps consumers determine the potential value of a specific product review.
Diet	The combined set of product reviews has a certain perceived value to consumers to influence their shopping decision. For example, consumers need to read several attribute-oriented product reviews and some usage-oriented product reviews to make a good decision.
Patch	This is a collection of product reviews within the same genre, e.g., a collection of attribute-oriented product reviews. Consumers can search particular product reviews in the patch of product reviews to facilitate their shopping decision.

pursues the set of information and ignores the rest (Pirolli 2007). Unprofitable information is pursued if the consumer follows a generalized diet that includes every genre of information encountered. However, the consumer will then spend much time searching if the information diet is overly specialized, that is, only a few genres of information are included in the information diet.

3. **Information patch** represents a physical and/or conceptual space for information. An information patch can be a book, a magazine, a webpage, or a product review genre. Consumers search for information within an information patch or between information patches to fulfill their needs.

IFT views consumers as relatively systematic yet spontaneous when foraging for information, similar to predators hunting for their prey in the wild (Galletta et al. 2006; Pirolli 2009). Predators in every food-foraging activity enter an environment where potential prey can be found (i.e., information patch). Predators in the wild rely on the scent of potential prey to decide whether to stay or find another area where they can feed. The diet of individual predators influences them in selecting a certain type of prey (Pirolli 2007). Analogously, consumers depend on their information diet and follow the information scent to seek valuable product reviews within or between product review patches; thus, consumers are labeled as systematic (Pirolli 2009).

IFT does not assume that consumers have clear knowledge of which information diet they should be seeking before they look for the information; thus, consumers are labeled as spontaneous (Pirolli 2007). IFT argues that consumer information diet is largely determined by one's foraging activities. This argument is based on the understanding that consumers usually do not have well-constructed shopping goals and/or sufficient product information during online shopping (Bettman et al. 1998; Li et al. 2011). Thus, the online shopping process is seen as a set of foraging and cognitive processes

that assimilates incoming information to reach the final choice (Chau et al. 2000; Haubl and Trifts 2000).

Theoretical Proposition

On the basis of IFT, we propose the *information sequentiality of product review provision*, which posits that the order of the product review patches provided on an online shopping website influences the execution performance of consumers' online shopping decisions. Information sequentiality is defined as the extent to which the successive presentation of information patches matches the information diet of consumers. The information sequentiality of product review provision differs from other similar concepts, such as the order of information placement (Buda and Zhang 2000; Deng and Poole 2010). The main differences include the type of object provided and the interactive status between information provision and information need. In terms of the type of object, previous works focused on examining the placement order (i.e., relevancy or recency) of information within information patches (Buda and Zhang 2000), whereas the current research examines the provision order of information patches to support consumers' online shopping expeditions. In terms of the interaction between information provision and information need, this work sees the information sequentiality of product review provision as based on the information display and decision process literature (Schkade and Kleinmuntz 1994).

Previous research suggested that the way in which information is displayed could significantly affect the decision-making behavior of consumers (Coupey 1994) and that behavior could be attributed to the attempt by consumers to conserve cognitive effort and reduce costs (i.e., mental and/or physical cost) by arriving at a favorable decision. Therefore, consumers tend to use information-foraging strategies facilitated by information display (Payne et al. 1995). However, related studies on product review provision have yielded mixed findings. Some studies have posited that the product

reviews used in the screening phase are less important than those in the evaluation phase because the product screening agent encourages consumers to shift their emphasis from the information presented in the screening phase to that displayed in the evaluation phase (Chakravarti et al. 2006). Another research study has observed that the influence of a product review on consumers' tendency to purchase depends more on the provision of a product review in the screening phase rather than that in the evaluation phase (East et al. 2008). From the IFT perspective, the mixed findings in previous product review provision studies could be attributed to the act of ignoring the information diet for product reviews.

Sequential information provision should be based on consumers' information-foraging inclinations (Ariely 2000; Fitzsimons and Lehmann 2004). Central to IFT is the information diet and the information patch provision, which must be examined from a holistic perspective. Users with the information patch only may seek information aimlessly within or between patches. Users with the information diet only may wonder where to search for the information. Study 2 examines the synergy of information diet and information patch provision. An understanding of the information diet of consumers for online product review should first be established before examining this synergy. We achieve this by conducting Study 1.

Study 1: Discovering the Information Diets of Consumers

Study 1 is a controlled laboratory investigation that aims to discover consumers' information diets for online product reviews on a shopping website. This study adopts the think-aloud approach to observe consumers' information-foraging behaviors. The think-aloud approach requires individuals to verbalize their thoughts constantly while performing a task (Lundgren-Laine and Salantera 2010). This approach reveals outcomes affected by the antecedents without being restricted to a limited set of response measures, such as survey instruments. The think-aloud approach provides indications of the product review being accessed, the importance attached to the information, and the cognitive assessment methods used to analyze the information. These indications enable researchers to understand the thoughts and actions during the purchase decision-making process.

Experimental Design

Laboratory setup: The standard think-aloud study design principle examined in the previous literature was adopted (van

Someren et al. 1994). The study room was furnished with comfortable chairs, and the space was carefully designed to ensure a quiet environment. A sufficient supply of bottled water was also provided to the participants. Each participant was assigned to a cubicle equipped with a computer, a webcam, and a microphone. More design details are presented in Appendix A.

Simulated shopping website: A simulated shopping website was designed and developed to provide a pertinent online task environment where the participants could perform information-foraging behavior for shopping decision making. This simulated shopping website was designed on the basis of the design principle of Kumar and Benbasat (2006). A professional website designer was hired to build the simulated website and ensure a good replica of a conventional shopping website. Five information system (IS) researchers were invited to assess the quality of the simulated shopping website (e.g., interface design and navigation). The evaluation result indicated that the simulated website exhibited the typical purchasing process on a shopping website.

Product categories: Four electronic products (i.e., mp3 player, digital camera, laptop, and cellphone) were selected as the focal products available in the simulated shopping website. The four electronic products were chosen because the participants possessed mid-level previous knowledge about the items, and the products were relatively popular among the shopping websites patronized by these consumers. The participants could have different levels of familiarity with the product, and these levels have the potential to cause a difference in the manner in which the product information was processed (Johnson and Russo 1984). Thus, the participants' previous product knowledge was measured (Smith and Park 1992).

Product reviews: Related product reviews were downloaded from actual shopping websites based on four product categories. The downloaded product reviews were text based to minimize distractions caused by multimedia-based cues (Jiang and Benbasat 2007a). The pertinent information scents of the different genres of product reviews were provided on the simulated shopping website. IFT indicates that a single type of information scent for a product review can summarize the essential meaning of the product review (Pirolli and Card 1999). This information scent is usually placed at the top of the product review. Consumers can then click the "see more" button to access the full content of the product review. This feature was used in accordance with a previous study (Adipat et al. 2011). The participants were not restricted from viewing the product reviews at any time and could view the product as long as they wished during the shopping process.

Two fictional labels, PA review (i.e., attribute-oriented product review) and PE review (i.e., usage-oriented product review), were created to facilitate protocol coding. The labels were assigned to the different genres of product reviews (Lundgren-Laine and Salantera 2010). The labels did not carry additional meaning and were intended only to help participants name the product review when expressing their opinions (Pirolli 2009). The labels also helped the researchers identify the participants' thought processes during the verbal protocol analysis process. The different genres of product review were manually classified. First, the product reviews were studied and classified according to the definition of product review genres by four consumer volunteers. Product reviews with information scents other than the exclusive attribute-oriented or usage-oriented information scents were eliminated. The classified product reviews were then double-checked by the authors and the other IS researchers. Four IS researchers later evaluated a set of product review samples from the simulated shopping website to ensure that the product review genres were classified accurately.[2]

Participants: A total of 50 participants were recruited from a public university in China through posts on the university online forum. The size of the sample was more than double the typical 15 to 20 participants in previous think-aloud studies (Creamer and Schmitter-Edgecombe 2010). A large sample was chosen to minimize the effect of individual differences and ensure the recording of a comprehensive set of consumer information-foraging behaviors (Komiak and Benbasat 2008). The average age of the participants was 22 years old, and the participants comprised 20 males and 30 females. This demographic matched the main cohort of online consumers in China (CNNIC 2012). The participants were given monetary compensation equivalent to the wage for two days' work of an average junior staff (i.e., approximately USD 33).

Procedure

The think-aloud study was conducted in two stages: the pre-study training and the main study. A briefing on the procedures and general objectives of the study was conducted at the pre-study training stage. A nondisclosure agreement on the identities of the 50 participants was signed. The participants were asked to verbalize their thoughts spontaneously. A test was conducted after the training session to examine the participants' ability to provide solutions for a given task. The participants were identified whether or not they were qualified to participate in the main study.

The qualified participants were randomly assigned to terminals. A short tutorial on the use of the simulated shopping website was then conducted. The tutorial was followed by the think-aloud scenario, in which each participant pretended to make purchase decisions on behalf of their closest friends who recently secured their first jobs. Purchasing for close friends is commonly used in consumer behavior literature to maintain a good level of involvement in an experimental setting (Shafir et al. 1993; Simonson and Nowlis 2000; Wood and Lynch 2002). The participants were asked to purchase four products (i.e., one from each of the four product categories) through a purchasing sequence that was assigned randomly. They were also asked to verbalize their product choices. Finally, the participants completed a short questionnaire.

The four products were selected because the participants had mid-level knowledge about them. These products were also suitable for the consumer population being studied. The level of the participants' previous product knowledge was tested using a seven-point Likert scale (Smith and Park 1992). The participants were asked to rate their perception of the items by rating how strongly they agreed with statements such as "I feel very knowledgeable about this product" and "I could give my friends advice if they ask me about this product." The results indicated that the participants were neither familiar nor unfamiliar with the products (mean = 4.14, SD = 1.390, t = 1.37, p > 0.100). They had a high level of involvement (mean = 5.36, SD = 1.420), that is, they concentrated on the decision-making task, and their behavior was useful for evaluation (Park et al. 2007).[3] No significant differences were found among the participants in terms of online shopping experiences (F = 0.20, p > 0.100) and computer literacy (F = 0.64, p > 0.100). The participants were explicitly informed about the absence of time restrictions. The participants' facial expressions, keyboard and mouse use, website navigation patterns, and audio recordings were captured. The main objective was to triangulate the observations from their verbalized thoughts to physical actions.

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[2]Two additional analyses were also conducted between attribute-oriented product reviews and usage-oriented product reviews. The star rating between the two product review genres was compared. No significant difference in the star rating between them was observed ($F_{mp3\ player}$=1.33, p > 0.10; F_{camera} = 0.01, p > 0.10; F_{laptop} = 0.36, p > 0.10; $F_{cellphone}$ = 0.02, p > 0.10). The volume in terms of word count between the two genres was then compared. No significant difference was observed (t = 0.257, p > 0.10).

[3]A questionnaire from prior literature was adopted to measure the "involvement" (Dholakia 2001). The items include the following: (1) participating in the online shopping task is pleasurable and enjoyable for me; (2) participating in the online shopping task helps me express what I am interested in; (3) participating in the online shopping task is important for me; and (4) I am interested in participating in the online shopping task. The Cronbach's Alpha value is 0.945. The loading values indicate that all of the items are nicely loaded to one factor. The AVE value of involvement is 0.859, which is larger than the threshold requirement (Fornell and Larcker 1981).

Think-Aloud Protocol Analysis

The video-recorded think-aloud protocol data were transcribed verbatim using Makri et al.'s (2011) approach. As the think-aloud protocol language was Mandarin, two IS postgraduate students who were fluent in both Mandarin and English were recruited to perform the translation. The transcribed scripts were double-checked by a skilled researcher to identify any mismatch in the think-aloud protocol data. The transcribed scripts were modified immediately when a data error was encountered to ensure the reliability of the transcriptions.

After translation, we followed the systematic approach proposed by van Someren et al. (1994). This approach includes the following important aspects in identifying consumer information-foraging behavior: (1) coding scheme (which coding scheme to adopt), (2) coder (who is eligible to code), (3) coding process (how the coding proceeds), and (4) inter-coder reliability (evaluation of coding). A new coding scheme based on IFT was developed in the current study (Pirolli 2009). The verbal protocols of 20 participants were randomly selected for the coding scheme design. The details of the coding scheme design are presented in Appendix B.

Two coders were hired to perform the coding work. The university broadcasting system was used to recruit qualified coders. Five applicants applied for the task; they were interviewed separately and given a test to evaluate their coding ability. The two best applicants were hired. These applicants were not acquainted with each other and were unfamiliar with the research objectives. The qualified coders were asked to sign a nondisclosure agreement for the coding material.

The coding process followed the regular process of coding transcribed scripts (van Someren et al. 1994). The video-based think-aloud protocol data were used to triangulate the information-seeking behavior identified in the transcript. The webcam captured the participants' head and shoulder movements, and the computer screen data recorded the real-time computer screen video stream. In cases in which the participants mumbled during the think-aloud study, we would check the webcam and computer screen data to determine what they were focused on at that moment (i.e., if they directly looked at the screen) and how they used the simulated website. The computer screen data and the verbal protocol during that particular period were examined if the webcam records showed that a participant mumbled but did not focus on the screen. A verbal protocol unassociated with the computer screen data (e.g., the participant talked about product A but the computer screen showed product B) indicates a high likelihood that the participant was not fully focused on shopping. Thus, this clip of the verbal protocol was ignored.

Cohen's Kappa measurement was used to test inter-coder reliability (van Someren et al. 1994). This measurement is based on a correction for marginal frequencies. This measure also defines association as the relative proportion of a corresponding code.[4] Kappa values that range from 0.40 to 0.59 are considered moderate, those from 0.60 to 0.79 are substantial, and those with a value of 0.80 are outstanding. The Cohen's Kappa coefficient of inter-coder agreement in this study was 0.62 (p < 0.001), which indicates a substantial inter-coder agreement (Cohen and Reed 2006).

Findings

The verbal protocols of the remaining 30 participants who completed the main study were analyzed, and the shopping task was given focus. The results of the analysis of the verbal protocol consisted of two parts: (1) general coding result and (2) detailed information on participants' information-foraging behaviors in the online shopping process. Table 2 illustrates the coding scheme, in which each code appears as an "o*verb phrase" or "g*verb phrase." The "o" or "g" (first letter of each code) indicates whether the verbal protocol script is an "**o**perator" or a "**g**oal." The "operator" label means that the participants actually exhibited the behavior, and the "goal" label indicates the thoughts of a participant toward the conduct of a behavior. For example, the code "o*formulate" means that a participant performed *formulate* behavior, and the "g*formulate" represents the thoughts of a participant toward performing the *formulate* behavior. The theory of reasoned action (Bagozzi et al. 2014) mentioned that human behavioral intention leads to actual behavior. Therefore, the code "o*verb phrase" and code "g*verb phrase" are paired. However, participants may not verbalize their thoughts completely in some instances (van Someren et al. 1994). Therefore, a small departure between the counts of these two types of code is acceptable. The "verb" in each code represents a behavior, such as awareness, stopping, and following. A "phrase" that indicates the purpose/consequence/objective of a behavior appears. For example, the code should be "o*be aware of task" if the verbal protocol indicates a participant who performs a behavior/thought about the awareness of an online shopping task.

A total of 2,984 codes were generated in the verbal protocols and subsequently analyzed. Table 3 presents an example of the process of how a participant traversed between different genres of product reviews during the shopping process, and

[4]Kappa = (corresponding proportion – expected corresponding proportion)/ (1 − expected corresponding proportion). Note that the expected corresponding proportion is calculated by multiplying and adding marginal frequencies.

Table 2. Coding Scheme		
Code	**Explanation**	**Details**
o*be aware of task	Indicates when a participant is aware of the existence of the task and the purpose	–
g*formulate *need-type from*	Indicates the means through which the participant is aware of the information need (e.g., prior experience and information hints)	If a participant is aware of searching for information about market information based on his/her previous knowledge, the code should be as follows: *g*formulate market information from his prior knowledge*.
o*formulate *need-type from*	Indicates the actual behavior/thought that occurs after becoming aware of the information needed	The code is for the actual behavior of the information. For example, in the case of a participant who searches for some market information based on his/her previous knowledge, the code should be *o*formulate market information from his prior knowledge*.
o*note *exploration-type content*	Indicates the content as the focus of attention	If a participant focuses on reading the PE review, the code should be *o*note PE review*.
g*locate-information info-need info-purpose	Indicates the goal of the information search, the corresponding information needed, and whether the search is explorative or focused.	If a participant wants to search for general product information, the code should be *g*locate-information general product information explorative*. For example, the code of actual behavior is *o*locate-information general product info explorative*.
o*locate-information *info-need info-purpose*	Indicates the actual behavior of the information search and whether the search is explorative or focused	The info-purpose has two levels: 1. Explorative means that the participant does not have a specific information-searching target. 2. Focused means that the participant has a specific information-searching target.
g*go-to structure-type	Indicates that the information is followed by the patch	If a participant wants to see the PA review, the code should be *g*go-to PA review*.
o*go-to *structure-type*	Indicates the actual behavior to proceed to the information patch	The code for actual behavior should be *o*go-to PA review*.
g*follow structure-type	Indicates that the participant intends to follow.	If the participant wants to check the product review or the participant wants to look into the PA review, the code should be *g*follow PA review*.
o*follow *structure-type*	Indicates the actual behavior of the participant.	The code for actual behavior should be: *o*follow PA review*.
o*stop	Indicates that the participants should stop the search behavior	–
o*evaluate *structure-type score*	Indicates the evaluation behavior of the information patch and the value of information scent	If a participant says that the information patch (PA review) is useful/helpful, the code should be *o*evaluate PA review high*. The score has four levels: 1. High: This information is useful or promising. 2. Low: This information has some content related to the goal but does not come in a large amount. 3. None: This information is unrelated to the goal. 4. Null: No evaluation is explicitly given.
o*present	Indicates the actual behavior at the conclusion of the overall information-foraging process	–

| **Table 3. An Example of Information Foraging during the Shopping Process** |
Seq.	Verbal Protocol	Code
**Screening Phase**
1	The laptop … what should I buy …	o*be aware of task
2	Maybe I can find (a laptop) here …	
3	I have no idea … I'd like to see the ASUS laptop …	o*formulate product information from brand
4	ASUS is the professional motherboard manufacturer …	
5	I would like to see … this one (the ASUS laptop)?	o*note brand
6	What about this one? It looks slim …	o*locate-information product feature explorative
7	I will look at this review … it seems that thermolysis is critical for the laptop …	g*go-to PA review
8	The thermolysis … I should be aware of this issue …	o*go-to PA review
9	How about the thermolysis problem of this one … (the subject looks at another laptop)	o*note product features
10	Emm … not really good …	
11	I will look at the Acer laptop …	o*note brand
12	Check whether this laptop has the thermolysis problem …	g*go-to PA review
13	Not good at (thermolysis). I will not consider it …	o*go-to PA review
14	The Lenovo laptop … I don't think the quality is better than that of the ASUS laptop …	o*note brand
15	But it is better than others (laptop) …	
16	Check this review …emm …the design is good …	g*go-to PA review
17	It says the Y450 model has good quality … I will check it …	o*go-to PA review
18	Well …this review says the quality of Y450 is not as good as expected …	o*note product features
19	Poor CPU … I don't know what it is …	
20	It has good thermolysis ability. … Great!	
21	How about the other users … what did they say?	g*go-to PE review
22	Emm … battery life is not long … I have no idea …	o*go-to PE review
23	(Looks at another PE review) What is the meaning of the light leaking? I'm confused …	
24	I should go back to the review with …	g*go-to PA review
25	It (PA review) says this laptop is good for watching movies … I like it …	o*go-to PA review
26	So the graphic card is important … I will pay attention to this feature …	
**Evaluation Phase**
27	I will check the Lenovo laptop and the ASUS laptop …	g*locate-information product feature focused
28	Both laptops are OK for me …	o*locate-information product feature focused
29	Difficult to compare …. Check this review …	g*go-to PE review
30	It says the ASUS laptop is good for playing games … Does it mean the graphics card is good?	o*go-to PE review
31	It does not mention the thermolysis issue (the ASUS laptop) …	o*note product features
32	What about the Lenovo laptop?	g*go-to PE review
33	More powerful graphics card? That is interesting …	o*go-to PE review
34	"I use this laptop for three hours. The thermolysis ability is awesome …" (The subject reads the PE review)	
35	I think the Lenovo laptop is better …	o*note product features
36	But it seems (its) quality is not as good as that of the ASUS laptop …	
37	I feel that the thermolysis ability and the graphics card are important for laptops …	
38	Maybe I'll have better luck (to get a good quality Lenovo laptop) …	
39	OK, I will buy it.	o*present
**End**

Table 4. Overall Coding Results					
Goal (g)			**Operator (o)**		
Code	**Screening***	**Evaluation***	**Code**	**Screening***	**Evaluation***
–			o*be aware of task	120 (4.02%)	0 (0.00%)
g*formulate	**137 (4.59%)**	**7 (0.23%)**	**o*formulate**	**135 (4.52%)**	**7 (0.23%)**
–			o*formulate preference from brand	1 (0.03%)	0 (0.00%)
g*formulate performance price from elsewhere	1 (0.03%)	0 (0.00%)	–		
g*formulate performance price from product review	1 (0.03%)	0 (0.00%)			
g*formulate product features	1 (0.03%)	0 (0.00%)	o*formulate product features from product description	1 (0.03%)	0 (0.00%)
g*formulate product information from brand	81 (2.71%)	4 (0.13%)	o*formulate product information from brand	81 (2.71%)	4 (0.13%)
g*formulate performance product type	1 (0.03%)	0 (0.00%)	o*formulate performance product type	1 (0.03%)	0 (0.00%)
g*formulate product information from product type	9 (0.30%)	0 (0.00%)	o*formulate product information from product type	10 (0.34%)	0 (0.00%)
g*formulate product information from product review	3 (0.10%)	0 (0.00%)	o*formulate product information from product review	3 (0.10%)	0 (0.00%)
g*formulate product information from market information	27 (0.90%)	0 (0.00%)	o*formulate product information from market information	26 (0.87%)	0 (0.00%)
g*formulate product information from PE review	5 (0.17%)	1 (0.03%)	o*formulate product information from PE review	5 (0.17%)	1 (0.03%)
g*formulate product information from PA review	8 (0.27%)	0 (0.00%)	o*formulate product information from PE review	7 (0.23%)	0 (0.00%)
g*formulate product information from else where	0 (0.00%)	2 (0.07%)	o*formulate product information from PE review	0 (0.00%)	2 (0.07%)
–			**o*note**	**276 (9.25%)**	**240 (8.04%)**
			o*note brand	117 (3.92%)	59 (1.98%)
			o*note PE review	1 (0.03%)	0 (0.00%)
			o*note PA review	0 (0.00%)	0 (0.00%)
			o*note product features	151 (5.06%)	161 (5.40%)
			o*note product information	6 (0.20%)	18 (0.60%)
			o*note price	1 (0.03%)	2 (0.07%)
g*locate-information	**31 (1.04%)**	**80 (2.68%)**	**o*locate-information**	**26 (0.87%)**	**80 (2.68%)**
g*locate-information general product information explorative	1 (0.03%)	0 (0.00%)	–		
g*locate-information general product information explorative	1 (0.03%)	0 (0.00%)			
g*locate-information product feature focused	8 (0.27%)	51 (1.71%)	o*locate-information product feature focused	9 (0.30%)	61 (2.04%)
g*locate-information product feature explorative	9 (0.30%)	15 (1.71%)	o*locate-information product feature focused	17 (0.57%)	19 (0.64%)
g*locate-information product information focused	4 (0.13%)	10 (0.34%)	–		
g*locate-information product information explorative	8 (0.27%)	4 (0.13%)			
g*go-to	**575 (19.27%)**	**217 (7.27%)**	**o*go-to**	**575 (19.27%)**	**216 (7.24%)**
g*go-to PA review	359 (12.03%)	73 (2.45%)	o*go-to PA review	364 (12.20%)	68 (2.28%)
g*go-to PA review	216 (7.24%)	142 (4.76%)	o*go-to PE review	211 (7.07%)	146 (4.89%)
g*go-to product features	0 (0.00%)	2 (0.07%)	o*go-to product features	0 (0.00%)	2 (0.07%)
g*follow	**18 (0.60%)**	**4 (0.13%)**	**o*follow**	**18 (0.60%)**	**4 (0.13%)**
g*follow PA review	15 (0.50%)	1 (0.03%)	o*follow PA review	15 (0.50%)	1 (0.03%)
g*follow PA review	3 (0.10%)	2 (0.07%)	o*follow PE review	3 (0.10%)	2 (0.07%)
g*follow brand	0 (0.00%)	1 (0.03%)	o*follow brand	0 (0.00%)	1 (0.03%)
–			**o*stop**	**15 (0.50%)**	**10 (0.34%)**
			o*evaluate	**59 (1.98%)**	**14 (0.47%)**
			o*evaluate PE review high	2 (0.07%)	9 (0.30%)
			o*evaluate PE review low	16 (0.54%)	1 (0.03%)
			o*evaluate PA review high	40 (1.34%)	3 (0.10%)
			o*evaluate PA review low	1 (0.03%)	1 (0.03%)
			o*present	**0 (0.00%)**	**120 (4.02%)**

*The numbers are presented as counts (%), and the percentage (%) denotes the relative ratio of each code against the total coding counts.

Table 4 provides the overall coding results. The product reviews that consumers should pursue and those that should be ignored were indicated when exhibiting an information diet (Pirolli 2009). The consumers' decision-making processes were used, and the screening and evaluation phases were given focus to observe the consumers' information diet by describing the coding results (Edwards and Fasolo 2001; Todd and Benbasat 1992). The screening phase refers to the time used by consumers to search for product-related information and generate product alternatives. The evaluation phase refers to the time spent by consumers to forage for information and to judge and choose a product based on the resultant product alternatives (Olson and Widing 2002; Tan et al. 2010). These phases are in accordance with the consumer information process model for decision-making behavior, which includes attention, cognitive processing (screening), and judgment (evaluation) (Huber and Seiser 2001). Each code in the two phases has a different count. For example, the participants exhibited a more formulated behavior in the screening phase (o*formulate, 135 counts) than in the evaluation phase (o*formulate, 7 counts) (Table 4).

We followed Ward's code classification method to understand the consumer information diet for product reviews (Morrin et al. 2002). The set of extracted codes is presented in Table 5. A salient pattern of the participants' information diets for product reviews in the simulated shopping website was observed. The participants in the screening phase had a higher tendency to forage for attribute-oriented product reviews (o*go-to PA review, 364, 12.20%) than for usage-oriented product reviews (o*go-to PE review, 211, 7.07%). The participants in the evaluation phase foraged for usage-oriented product reviews (o*go-to PE review, 146, 4.89%) rather than for attribute-oriented product reviews (Table 5).

Protocol analysis was further conducted to emulate the information-foraging process by focusing on the consumers' order of information-processing for their decision making in each of the two phases (Kuhlthau 1991; O'Reilly 1982) instead of using code frequency. The participants in the screening phase had shopping awareness (o*be aware of task, 120, 4.02%) (Table 6). This awareness could have come from the experimental scenario, in which the participants were asked to shop for gifts for a close friend and then started to forage for product-related information to make shopping decisions. The brand of a product can serve as a visible, symbolic expression of the competitive economy and is often used as a surrogate attribute of quality (Sullivan 1998). The results added empirical evidence to this argument (o*formulate product information from brand, 81, 2.71%), that is, the participants engaged in a preliminary search for available product-related information upon identifying their product-

related information needs (Payne et al. 1995). Moreover, they showed a tendency to forage information mainly from product attribute-oriented reviews (o*go-to PA review, 364, 12.20%) and sought other information such as that from usage-oriented reviews (o*go-to PE review, 211, 7.07%), manufacturer-provided product information (o*note product features, 151, 5.06%), and product brand information (o*note brand, 117, 3.92%). The participants also had a high tendency to source attribute-oriented product review information in the screening phase. They foraged for product-related information purposefully rather than arbitrarily sought information in the evaluation phase to evaluate the potential focus product (o*locate-information product feature focused, 61, 2.04%). They had a higher tendency to forage usage-oriented information (o*go-to PE review, 146, 4.89%) than attribute-oriented product review information (o*go-to PA review, 68, 2.28%) in the evaluation phase.

Study 1 demonstrates that consumers are inclined to forage for attribute-oriented product reviews in the screening phase and for usage-oriented product review in the evaluation phase. This report is the first in which researchers observed the consumer information diet for online product reviews in the decision-making process for shopping.

Study 2: Information Sequentiality �;███

Study 2 investigates the effect of information sequentiality of product review provision on consumers' purchase decision-making performance. The information sequentiality of product review provision has two levels: high- and low-level information sequentiality. High-level information sequentiality refers to the sequential presentation of information patches that matches the information diet of people. Given the information from Study 1, the present study posits that the provision of attribute-oriented and usage-oriented product reviews in the screening and evaluation phases, respectively, has high-level information sequentiality. Low-level information sequentiality denotes the sequential presentation of information patches that do not match the information diet of a consumer. We further posit that the provision of usage-oriented and attribute-oriented product reviews in the screening and evaluation phases, respectively, has low-level information sequentiality. Thus, the following is proposed:

> *The product review provision with high-level information sequentiality imposes a significantly positive influence on consumers' purchase decision-making performance in the within-website online shopping process compared with that with low-level information sequentiality.*

Table 5. Most Frequently Appearing Codes in the Information-foraging Analysis		
Codes	**Count (%)**	**Phase**
o*go-to PA review	364 (12.20%)	Screening
g*go-to PA review	359 (12.03%)	Screening
g*go-to PE review	216 (7.24%)	Screening
o*go-to PE review	211 (7.07%)	Screening
o*note product features	161 (5.40%)	Evaluation
o*note product features	151 (5.06%)	Screening
o*go-to PE review	146 (4.89%)	Evaluation
g*go-to PE review	142 (4.76%)	Evaluation
o*be aware of task	120 (4.02%)	Screening
o*present	120 (4.02%)	Evaluation
o*note brand	117 (3.92%)	Screening

Note: The codes are sorted in descending order based on the counts.

Table 6. Coding Result Analysis According to Phase			
Screening Phase		**Evaluation Phase**	
Code	*Count (%)*	*Code*	*Count (%)*
o*be aware of task	120 (4.02%)	g*locate-information product feature focused	51 (1.71%)
g*formulate product information from brand	81 (2.71%)	o*locate-information product feature focused	61 (2.04%)
o*formulate product information from brand	81 (2.71%)	o*note brand	59 (1.98%)
g*go-to PA review	359 (12.03%)	o*note product features	161 (5.40%)
o*go-to PA review	364 (12.20%)	g*go-to PE review	142 (4.76%)
g*go-to PE review	216 (7.24%)	o*go-to PE review	146 (4.89%)
o*go-to PE review	211 (7.07%)	g*go-to PA review	73 (2.45%)
o*note product features	151 (5.06%)	o*go-to PA review	68 (2.28%)
o*note brand	117 (3.92%)	o*present	120 (4.02%)

Figure 1 shows the research framework used in this study. IFT was employed to assess consumer decision-making performance by examining (1) the effort expended in processing the purchase decision and (2) the ultimate utility derived from making the purchase decision (Lilien et al. 2004). The effort expended in processing the purchase decision can be reflected in three variables related to consumer requirements for making this decision: (1) decision time, (2) average number of products viewed during the shopping process, and (3) cognitive effort devoted to shopping. Decision time refers to the period from the final point of the screening phase to the point when consumers make their purchasing decision (Gupta and Harris 2010). The average number of products viewed during a shopping process can represent consumers' information processing abilities during the screening and evaluation of product alternatives

(Payne et al. 1993). A more effective product review provision that aids consumers to process product-related information corresponds to a large number of products viewed during the shopping process (Lilien et al. 2004). The cognitive effort devoted to shopping refers to consumers' effort to make a reasonable shopping decision (Cooper-Martin 1994; Etkin and Ratner 2012). The ultimate utility derived from making the purchase decision is reflected by the perceived satisfaction in the decision made (Armstrong et al. 2005). Perceived decision satisfaction indicates how consumers view their decisions (i.e., satisfactory or not). The quantity of attribute-oriented and usage-oriented product reviews was also controlled to enable the assessment of decision time by objectively reflecting the influence of the information sequentiality of product review provision.
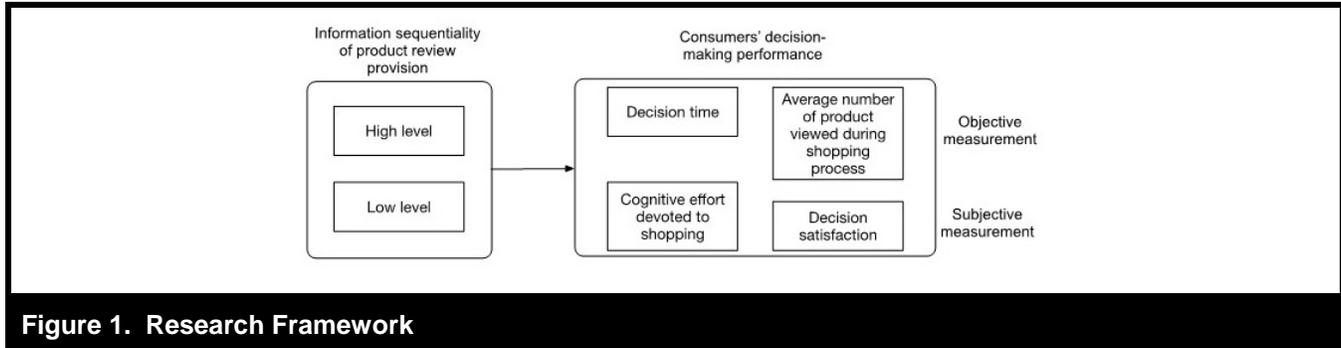
Figure 1. Research Framework

Hypothesis Development

Effect on Decision Time

On the basis of IFT, this research argues that the provision of product review patches that match consumers' information diets for product reviews enhances the overall performance of the decision task (Fitzsimons and Lehmann 2004; Mishra et al. 2008; Pirolli and Card 1999). Thus, the product review provision with high-level information sequentiality can lead to a shorter decision time than that occurring with low-level information sequentiality for two reasons.

First, consumers cannot precisely express the product they need during the screening phase (Darley et al. 2010). Consumer actions typically involve reading some easily accessible information; consumers connect with known information to create a mental representation (Kuhlthau et al. 2008). This mental representation is integral to consumers' decision outcomes because a more comprehensive mental representation corresponds to the achievement of a more successful decision outcome (e.g., less decision time is required) (Punj 1987). Attribute-oriented product reviews presented in the screening phase help consumers create a concrete and comprehensive mental representation of product alternatives than usage-oriented product reviews. Usage-oriented product reviews convey diverse experience-based information about the product (e.g., personal opinion or assessment). Providing experience-based information at the initial stage of the decision-making process can induce confusion that may hamper the consumers' construction of the mental representation of product alternatives (Chen et al. 2007). Attribute-oriented product reviews contain attribute-based information that enables consumers to gain an overall understanding of the product features. Consumers can easily compare product alternatives (Reinstein and Snyder 2005), thus leading to shorter decision time to make purchases.

Second, consumers can form a constructed and direct product alternative searching preference based on their mental repre-

sentation of the product obtained during the screening phase (Bettman et al. 1998). The presentation of product alternatives during the evaluation phase helps consumers focus on product alternatives and justify their ultimate choice (Dervin 1998; Ford 2004). The focus of foraging information sources shifts from the construction of a mental representation of product alternatives in the screening phase to the justification of the choice made among the target product alternatives during the evaluation phase. The protocol analysis results in Study 1 support this argument (i.e., the observation of code "g*locate-information product feature focused" in Table 6). The usage-oriented product review presented in the evaluation phase provides complementary information that facilitates the assessment of product alternatives (Chevalier and Mayzlin 2006). Usage-oriented reviews serve as an outlet for experience-based information of previous users, that is, consumers can easily determine whether previous users provided a positive or negative assessment of a product. Thus, consumers' choices are justified and decision time is reduced (Herr et al. 1991). Therefore, the following hypothesis is posited:

H1: *The product review provision with high-level information sequentiality results in a shorter decision time than the product review provision with low-level information sequentiality.*

Effect on the Average Number of Products Viewed during the Shopping Process

Consumers have bounded cognitive capacity to process product-related information during the online shopping process (Sasaki et al. 2011). Attribute-oriented product reviews can help consumers generate a mental representation of the product (Pirolli and Card 1999). This mental representation helps consumers construct a fine-grained mental sketch of the product and leads to a cognitive shortcut to product alternatives (Sanfey and Hastie 1998). Attribute-oriented product reviews with high-level information sequentiality also match

consumers' information diet for product reviews during the online shopping process. Consumers do not need to alter their search strategy to fulfill their information requirements by providing the appropriate genre of product reviews (Sen et al. 2006). Consumers can search and view product alternatives within the bounded cognitive capacity.

Product review provision with low-level information sequentiality provides usage-oriented product reviews in the screening phase. Such product reviews cannot provide sufficient attribute-based product information for the construction of a mental representation (Chen et al. 2007). Thus, consumers experience difficulty in generating a fine-grained mental sketch of the product, thus leading to the large consumption of cognitive capacity in altering search strategy and processing unprofitable product-related information (O'Reilly 1982). Thus, the number of products viewed by consumers is limited during the online shopping process. The effective conveyance of attribute-based information from attribute-oriented product reviews can be conducive to maximize consumers' acquisition of product information. This method leads directly to a larger number of product alternatives viewed by consumers as expressed in the following hypothesis:

H2: *The product review provision with high-level information sequentiality leads to a larger average number of products viewed during the shopping process than the product review provision with low-level information sequentiality.*

Influence on Cognitive Effort Devoted to Shopping

The cognitive effort consumers devote to shopping is an important variable that is positively associated with purchase decision making (Todd and Benbasat 1999). Consumers' shopping decision performance is enhanced if they are willing to exert effort in making a reasonable decision (e.g., to study the product reviews) (Etkin and Ratner 2012; Libby and Luft 1993). This research postulates that the product review provision with high-level information sequentiality can lead to high cognitive effort devoted to shopping. IFT argues that consumers select information provision that aids them in accomplishing a task. The low-level information sequentiality of product review provision cannot provide a suitable information foraging environment to consumers in online shopping websites. Thus, the efficiency and effectiveness of information foraging for the product review content and the decision-making activity can be severely impaired (Connaway et al. 2011; Tan et al. 2010) and can lead to the feeling of fatigue and the termination and/or abandonment of information processing (Browne et al. 2007). Thus, consumers are

unwilling to devote effort to shopping on a website that provides product reviews with low-level information sequentiality.

The provision of product reviews with high-level information sequentiality can provide direct and suitable product review information to consumers for processing during the shopping process. The efficiency of information foraging and its processing for the related shopping decision is significantly enhanced. That is, consumers prefer to devote effort to shopping on websites where the product review provision matches their information diet (Connaway et al. 2011). Therefore, the following hypothesis is posited:

H3: *The provision of product reviews with high-level information sequentiality yields a higher cognitive effort devoted to shopping than the provision of product reviews with low-level information sequentiality.*

Influence on Decision Satisfaction

The product review provision with high-level information sequentiality can lead to increased decision satisfaction. According to IFT, consumers tend to perceive a decision as satisfactory if they achieve an informed purchase decision in the online shopping process. Consumers use their information diets and either alter their information search strategy to explore profitable information from other information patches or further investigate existing information patches (Pirolli 2009). Consumers will make informed decisions during the information-foraging process if they can easily forage for the appropriate information for decision making. Thus, consumers have a high level of decision satisfaction.

Therefore, a satisfactory decision outcome can be attained if the product review provision matches the consumers' information diet for product reviews (Pirolli and Card 1999). The product review provision with high-level information sequentiality provides attribute-oriented product reviews in the screening phase. Attribute-oriented product reviews deliver sufficient product attribute-based information for the construction of mental representations of product alternatives. As consumers are likely to discover their preferred products during the screening stage, they perceive the decision outcome as satisfactory (Reutskaja and Hogarth 2009). The product review provision with high-level information sequentiality also provides usage-oriented product reviews during the evaluation phase, and thus consumers can easily distinguish between the advantages and disadvantages in terms of usage experience of the focal products (Mitchell et al. 1985). Accordingly, consumers perceive their decision as satisfactory. Thus, this research posits the following:

H4: *The product review provision with high-level information sequentiality yields greater decision satisfaction than that with low-level information sequentiality.*

Study Design

A field study was conducted to test the hypotheses. This research collaborated with a Chinese startup e-commerce company and implemented the information sequentiality of product review provision on an online shopping website. Three instances of the online shopping website were created. The first instance adopted the product review provision with high-level information sequentiality, the second instance adopted the product review provision with low-level information sequentiality, and the third instance served as a baseline and adopted the same product review provision as conventional online shopping websites do. Attribute- and usage-oriented product reviews were provided on the product description webpage similar to the product review provision on Amazon.com. The conceptual basis for including this baseline website is to examine whether or not the consumers' decision performance in the high-level information sequentiality of product review provision (the first instance) is better than that in the instance of a baseline website (the third instance). If this is the case, then the pragmatic value of this study is proven. All three instances have the same interface design, product database, and product review.

Dependent variables (DVs) were measured with both subjective and objective measurements (see Table 7). An IS postgraduate student fluent in both Mandarin and English was hired to translate the questionnaire for measuring the subjective DVs. The translation was checked by two IS scholars to avoid any misinterpretation. The detailed measurements of DVs are provided in Appendix C.

Shopping Website Setup

The shopping website was developed by the startup company. Several meetings were held with the managers and development engineers to derive an effective approach for implementing the three versions of the website. The objective of the website setup was to successfully implement the manipulated product review provision without sacrificing the company's image, profit, or other benefits. The following methods were adopted to achieve this objective.

First, a central database was created to store product information, product reviews, and sales information for all three versions of the website. The creation of a central database ensured that the same information would be displayed in all three versions to secure the integrity of the company's image. JavaScript was used to randomly distribute consumers' visits to each of the three versions of the website.

Second, the following activities were conducted to manage the genre, volume, and valence of product reviews. Six types of products were available for purchasing on the website. The product alternatives consisted of both the search products (e.g., SD memory card, power bank, and USB memory stick) and the experience products (e.g., instant drinks, personal hygiene products, and laundry detergent) (Klein 1998). The product database contained information on 80 products of these 6 product types. Five consumers voluntarily searched for the appropriate reviews for these products from the product review database and classified them into the two genres. An author of the current study verified the legitimacy of the classification. Ten reviews were then randomly selected from each of the genres, and several interviews with five IS scholars were conducted to further verify the classification. The interview results showed that the attribute- and usage-oriented product reviews could be clearly differentiated from each other.

The volume of the product reviews was controlled in terms of the quantity of product reviews for each product and the overall word count of the attribute-oriented and usage-oriented product reviews. About 20 product reviews (i.e., 10 attribute-oriented product reviews and 10 usage-oriented product reviews) were provided to each product alternative to control the quantity. The total number of words between the two forms of product reviews was balanced to control the overall word count. The result of one-way ANOVA analysis indicated the lack of a significant difference in the overall number of words (i.e., $F_{SD\,memory\,card} = 0.77$, $p > 0.100$; $F_{power\,bank} = 1.49$, $p > 0.100$; $F_{USB\,memory\,stick} = 0.46$, $p > 0.100$; $F_{instant\,drinks} = 0.69$, $p > 0.100$; $F_{personal\,hygiene\,products} = 1.15$, $p > 0.100$, and $F_{laundry\,detergent} = 0.84$, $p > 0.100$) for each product category. The valence of product reviews was also controlled using star indicators, in which a one-star rating represented a strong negative attitude toward the product and a five-star rating denoted a strong positive attitude toward the product. The verification of the product review valence indicated the presence of slightly positive attitudes toward the given products, which were representative of an actual online shopping website.

Procedure

The field study was conducted from January 1, 2015, to April 30, 2015. The online shopping website was launched and maintained to ensure that consumers had a good shopping experience. Upon reaching the website, consumers shopped,

Table 7. Operationalization of the Dependent Variables		
Dependent Variables		**Operational Methods**
Objective measures	Decision time	Use of decision time recorded by the system
Subjective measures	Cognitive effort devoted to shopping	Use of a questionnaire (source: Cooper-Martin 1994)
Objective measures	Average number of products viewed during the shopping process	Use of system records
Subjective measures	Decision satisfaction	Use of a questionnaire (source: Armstrong et al. 2005)

searched for product-related information, decided, and then paid for their order by credit card or online banking transfer. Consumers who had paid answered a post-purchase questionnaire that was presented as an online service quality survey. They could cancel their shopping at any time during the shopping process; however, if they closed the website, they would not be able to resume their shopping or return at the point where they were previously. Consumers were free to visit other websites during the shopping process. Screenshots of the online shopping website are provided in Figure D1, Appendix D.

Field Data Description

A field dataset was retrieved from the administrative system of the shopping website. The dataset contained the following data items: website analytical statistics (e.g., unique visitor (UV), bounce rate, and conversion rate). Figure 2 illustrates the UV distribution during the period of the field study. Table 8 shows the details of the website analytical statistics.

Analysis and Findings

A total of 390 consumers ordered and paid. The sales records among the three website versions and deleted records that had the same IP address were cross-checked to eliminate duplication of data from the same consumer that would lead to the inaccurate measurement of DVs. A total of 237 unique consumers were collected in the sample set (79 consumers per website instance) (Table 9). The analysis focused on these 237 consumers who completed the purchases.

A series of tests were conducted to validate whether or not all of the three website versions shared a similar base for comparison. Any biases existing among the three website instances would result in misinterpretation of the data analysis result. Thus, the contingent effect of consumers' age, gender, brand effect, and previous product knowledge was examined (see Table 10). These assessments provided a sound and unbiased basis for subsequent data analysis given that the results indicated no contingent effect of these factors.

Two DVs, the cognitive effort devoted to shopping and the decision satisfaction, were measured through consumers' responses in the post-purchase questionnaire. Four items were used to measure the consumer cognitive effort devoted to shopping. The composite reliability value of this construct was 0.80, which indicated robust item reliability. The composite reliability value of decision satisfaction was 0.88, which indicated good item reliability. Factor analysis and discriminant validity analysis were performed (see Tables 11 and 12). The proper measurement of these two subjective DVs was confirmed by examining the results.

Table 13 provides a list of the descriptive statistics. The statistical tests were conducted at the 5% level of significance. The objective of the data analysis was to examine whether or not the three types of product review provisions (i.e., high level of information sequentiality, low level of information sequentiality, and baseline) have significantly different effects on the DVs. Thus, multivariate analysis of variance (MANOVA) was conducted to assess the effects of the manipulated variables on the DVs. The results from the MANOVA testing were as follows: Wikes' $\Lambda = 0.936$, $F = 2.21$, $p < 0.05$, and partial eta squared $= 0.034$. The power to detect the effect was 0.895. The Box's M test results indicated significant differences among the DVs in the covariance matrices ($F = 2.153$, $p < 0.01$). However, the partial eta square associated with the main effect was 0.034, and the power to detect the main effect was 0.895. These results helped in the interpretation of the MANOVA results. A reanalysis by MANOVA with a significance level of 0.001 revealed the significant main effects of the different types of product review provisions. Further univariate tests by ANOVA were conducted separately for each DV, and the results indicated a significant effect of the information sequentiality of the product review provision (Table 14).

Separate t-tests were conducted to compare the differences among the three website versions (see Table 15). H1 posits that the decision time spent on the provision of product review with high-level information sequentiality is shorter than that spent on the provision of product review with low-level information sequentiality. The results revealed that consumers used less decision time to make a purchase decision ($t = -2.52$, $p < 0.05$). Therefore, H1 is supported.

Website instance with a high-level information sequentiality of product review provision

Website instance with low-level information sequentiality of product review provision

Baseline website instance

Figure 2. UV Distribution of the Three Website Instances (Unit: 10 visits/unit)
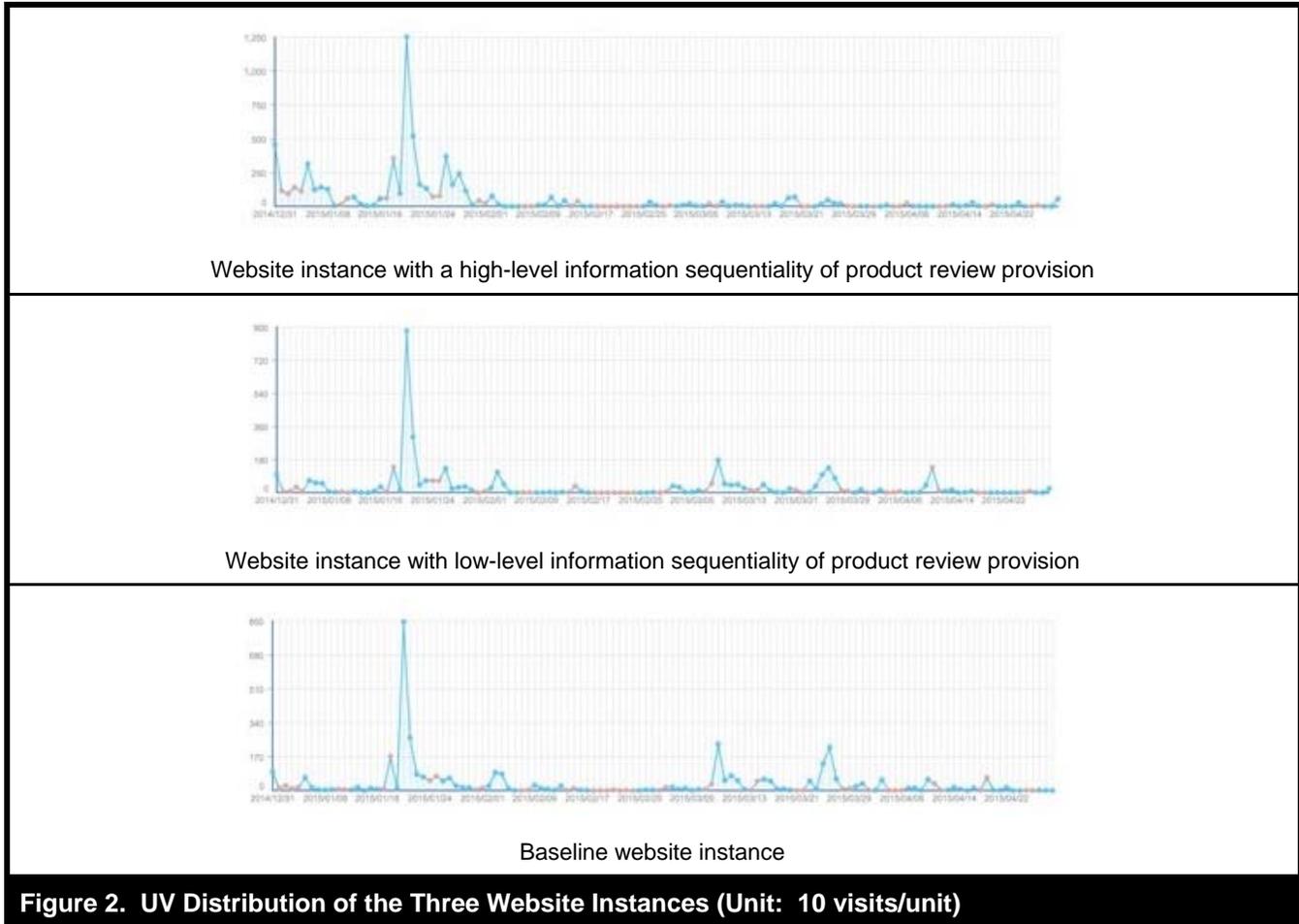
Table 8. Website Analytical Statistics

	UV	Bounce Rate	Conversion Rate
Website instance with high-level information sequentiality of product review provision	6874	28.35%	2.6%
Website instance with low-level information sequentiality of product review provision	6712	22.88%	1.8%
Baseline website instance	6409	42.35%	1.4%

Table 9. Descriptive Statistics of the Field Dataset

	Baseline (N = 79)	Low Level of Information Sequentiality (N = 79)	High Level of Information Sequentiality (N = 79)
Top sales price	RMB 268	RMB 527	RMB 268
Bottom sales price	RMB10	RMB 11	RMB 18
Average amount of money spent per person	RMB 57.8	RMB 62.8	RMB 60.3
Average number of products procured per person	4.6	4.1	4.1
Mean value of consumers' age	22.91 (4.80)	23.05 (3.93)	22.04 (1.98)

Table 10. Contingent Effect Test

	Test Method	Value	Sig.
Age	ANOVA	F = 1.68	0.188
Gender ratio	Kruskal–Wallis test	χ^2 = 2.62	0.270
Prior product knowledge	ANOVA	F = 1.56	0.212
Brand effect	ANOVA	F = 2.14	0.120

Table 11. Cross Loading

		1	2
Cognitive effort devoted to shopping	CE1	0.698	−0.063
	CE2	0.636	0.365
	CE3	0.730	0.350
	CE4	0.798	0.227
Decision satisfaction	DS1	0.206	0.747
	DS2	0.293	0.815
	DS3	0.426	0.766

Table 12. Correlation between Constructs

	1	2
Cognitive effort devoted to shopping	**0.72**	
Decision satisfaction	0.55	**0.78**

Notes: The values in the diagonal cells are square roots of the average variance extracted.

Table 13. Means (Standard Deviations) of the Dependent Variables

Dependent Variables	Product Review Provision with a High Level of Information Sequentiality	Product Review Provision with a Low Level of Information Sequentiality	Baseline
Decision time (second)	177.83 (77.52)	205.11 (65.28)	260.26 (26.15)
Cognitive effort devoted to shopping	4.72 (1.19)	4.27 (1.23)	4.16 (1.19)
Average number of products viewed during the shopping process	3.74 (1.36)	2.78 (1.05)	2.51 (1.88)
Decision satisfaction	5.69 (1.09)	5.41 (1.01)	5.19 (0.91)

Table 14. ANOVA Results

DVs	F value	Sig.
Decision time	6.32	0.012
Cognitive effort devoted to shopping	4.72	0.010
Average number of products viewed during the shopping process	8.14	0.001
Decision satisfaction	4.95	0.008

Table 15. T-test Results			T Value	Sig.
	Compartment A	**Compartment B**		
Decision time	High level of information sequentiality	Low level of information sequentiality	−2.52	0.012
		Baseline	−3.40	0.001
	Low level of information sequentiality	Baseline	−2.70	0.007
Cognitive effort devoted to shopping	High level of information sequentiality	Low level of information sequentiality	2.33	0.021
		Baseline	2.93	0.004
	Low level of information sequentiality	Baseline	0.56	0.577
Average number of products viewed during the shopping process	High level of information sequentiality	Low level of information sequentiality	3.18	0.001
		Baseline	3.40	0.001
	Low level of information sequentiality	Baseline	1.24	0.285
Decision satisfaction	High level of information sequentiality	Low level of information sequentiality	1.69	0.093[a]
		Baseline	3.14	0.002
	Low level of information sequentiality	Baseline	1.44	0.153

[a]Considering the nature of field experiments, we argue that the difference in decision satisfaction between a high level of information sequentiality and a low level of information sequentiality is significant at 0.1.

H2 posits that the presence of product review information with high-level information sequentiality leads to a large number of products viewed during the shopping process. The results showed that consumers visited additional product alternatives (t = 3.18, p < 0.01) in the website version equipped with a product review provision with high-level information sequentiality. Therefore, H2 is supported.

H3 posits that the provision of a product review with high-level information sequentiality leads to a high cognitive effort devoted to shopping. The results showed that consumers would be willing to devote cognitive effort to shopping (t = 2.33, p < 0.05) if the product review provision was in accordance with the consumers' information diets for product reviews. Therefore, H3 is supported.

Finally, H4 posits that the presence of a product review with high-level information sequentiality leads to high decision satisfaction. The data analysis results support this hypothesis (t = 1.69, p < 0.10).

The data analysis results support the overarching proposition on the effect of information sequentiality of product review provision on a shopping website. Three key conclusions can be made based on the findings. First, information sequentiality is a salient feature for product review provision. Second, a conventional product review provision does not provide an effective information repository mean to facilitate consumers' online shopping. The consumers' decision per-

formance in the website with high-level information sequentiality of product review provision was significantly better than that in the baseline website (see Table 15). Thus, the pragmatic value of implementing high-level information sequentiality of product review provision in shopping websites was demonstrated. The results suggest that the product review provision with high-level information sequentiality could lead to a higher purchase decision performance than that with low-level information sequentiality. Third, an information patch, such as a collection page of the specific genre of product reviews, can be adaptively manipulated to facilitate consumer information-foraging behavior.

General Discussion

The findings from the two studies suggest that a shopping website can strategically offer varying genres of product reviews by enhancing the level of information sequentiality. Study 1 used the qualitative research method (i.e., think-aloud study) instead of the quantitative research method (i.e., clickstream data analysis) to investigate consumers' information diets for product reviews. Although clickstream data analysis is widely used to predict online consumer search and choice behaviors (Moe 2006), this method cannot be used to investigate the underlying cognitive headspring of a particular behavior. Study 2 used the quantitative research method (i.e., field study) instead of the qualitative research method (i.e.,

case study) to examine the influence of information sequentiality of product review provision. The field study research method was more appropriate for obtaining answers to the research question than other qualitative research methods given that a field study can generate realistic results. Although the multimethod research design was suited to the research purpose because of "critical multiplism" (Cook 1985), the limitations of the multimethod research design were acknowledged, and attempts were made to alleviate these limitations. Morse (2003) argued that the multimethod research design is often challenged by the rigor of each study and the saturability of the data involved. The present study followed the systematic approach to conduct the think-aloud study and the field study (Kumar and Benbasat 2006; van Someren et al. 1994). The data saturability levels of the qualitative and quantitative data were sufficiently rich for the analysis (Komiak and Benbasat 2008; Rabe-Hesketh and Skrondal 2008).

Theoretical Contributions

This research has four key theoretical contributions. First, this study is one of the first to empirically observe consumer information diet for product reviews in the online shopping environment. Previous studies mainly used the information scent of product reviews to examine consumers' search behavior by considering several product review indicators, such as information source (Li et al. 2013), information label, valence, and volume (Zhang et al. 2010). These studies helped in understanding the effect of online product reviews but neglected the change in consumers' information requirements during the online shopping process. The findings indicate that a specific genre of product review is highly valued by consumers at the beginning stages of online shopping, but consumers pay little attention to this genre of product review at the later stages of online shopping. This finding implies that consumers' information diet influences the choice of information search strategies and that information features affect consumer decision-making performance.

Second, this research develops the understanding of online product review provision from a multiple information patch perspective. This research empirically conceptualizes and demonstrates that information sequentiality of product review provision is a viable concept that depicts the synergy of information requirements of a product review and its provision. This study contrasts with and complements previous studies on product reviews (Deng and Poole 2010). Previous studies focused on several product review indicators (Park et al. 2007), and many others presented mixed findings on the influence of product review provision on consumer decision-making behaviors (Chatterjee 2001; East et al. 2008). This

research contributes to the discussion by suggesting that the mixed findings may be attributed to the unconformity of product review provision and information diet for product reviews at specific stages of the decision-making process.

Third, this research contributes to the literature on online consumers' decision making by theoretically proposing and empirically demonstrating that having an orchestrated informational environment, through a careful provision of different types of information sequentiality can contribute to the improvement of decision-making performance. This contribution is made on the basis of two fields of thoughts. First, providing many (rather than less) alternatives during the shopping process usually result in an improved decision performance (Payne et al. 1992; Scheibehenne et al. 2010). However, the second field of thought suggests that subjecting consumers to excessive product options could deplete their cognitive capacity, which could confuse and overwhelm consumers rather than facilitate their decision-making process (Pappas 2015). Our research findings suggest that having an appropriate information sequentiality of product review provision could attenuate the concern on the depletion of the consumers' cognitive capacity, which results in an improved decision performance. Moreover, they are willing to extend their edge by viewing additional alternatives during the shopping process. This observation can be explained by the adopted lens of IFT, which advocates that information search is a balance between the cost and gain for achieving a good performance (Pirolli 2007). Consumers can expand their information search when processing information is made conducive for them. How far such an extension of information search could be fostered could be explored in the future by identifying the tipping point of the number of products displayed with different types of information sequentiality of the informational environment.

Fourth, this study contributes to the development of IFT. Previous studies used IFT to (1) investigate the effectiveness of website navigation (Galletta et al. 2006), (2) examine the influence of website structure on browsing behavior (Adipat et al. 2011), (3) investigate information seeking in the workplace (Xu et al. 2006), and (4) design a user interface for searching/browsing information (Dennis and Taylor 2006). However, few studies have utilized IFT to investigate the design of product review provision, which is also an important part of the website structure of most commercial websites. Previous studies have treated information needs as an inherent, static characteristic of a task (e.g., decision task) (Wu 2012). However, the current study demonstrates that this research setting can be considered oversimplified and may generate inferior outcomes. For example, the modification of consumers' information-foraging strategies may not always result in good performance without considering the changes

in consumers' information needs. This finding echoes the standpoint with empirical evidence that the sequential information provision should be based on consumers' information-foraging behaviors (Ariely 2000; Fitzsimons and Lehmann 2004).

Practical Contributions

This research provides valuable insights for practitioners as well. The findings can be applied as executable guidelines in designing product review provision strategies and informing practitioners on how to provide online product reviews efficiently and successfully.

Many conventional online shopping websites provide attribute- and usage-oriented product reviews. Website managers should understand the relationship among the different forms of product reviews and consumers' online purchasing decision behaviors. Such knowledge can help managers create reasonable and executable strategies to integrate product reviews and other information that can facilitate online shopping. The most carefully designed and fine-tuned website interfaces, content, and shopping experiences can be leveraged to enhance the purchasing decision performance and satisfaction of consumers in their online shops.

Prescriptive suggestions on the provision of product reviews on shopping websites can also be drawn from this study. Website managers should design an online shopping facilitation system that would provide an entire set of shopping experiences supported by product reviews throughout the within-website online shopping process. The product review provision in this system should match consumers' information diets. Consumers can shift from a screening stage to an evaluation stage with activities of narrowing down the alternative set, such as using selection aid tools to apply more selection criteria in a shopping website. Website managers may deploy different types of product reviews to these stages to ensure that the overall product review provision is aligned with consumers' information diet. Practitioners can also apply other techniques, such as click trace analysis, to construct a refined consumer behavior model to guide information provision in websites.

Online shopping website managers should also restructure their respective website interfaces for consumers to distinguish attribute-oriented reviews from usage-oriented product reviews. This process increases the confidence of consumers in their choices and presents an understanding of the usage experience, which increases their awareness of the genuine specifications of the product.

Finally, this research provides inputs to the development of online analytic techniques. Practitioners can adopt the findings of this paper to develop the fine-grained analytical tools (or methods) needed (e.g., the conjoint analysis of consumers' online behavior within the shopping website and the consumers' prior behavior of using the device). Some IT companies attempt to achieve this objective. Google ads can deliver pertinent and personalized advertisements to each consumer by analyzing his/her prior behavior using the device (e.g., what words have been entered into the search engine, what apps have been used, and what webpages have been visited and for how long). This research may inspire developers of online shopping websites to use advanced techniques to further investigate consumers' information needs.

Limitations and Future Research

This study has several limitations that serve as suggestions for future research. First, only product review information and the influence of its provision on consumers' decision-making performance within a shopping website were considered. Considering the cross-website foraging of information is beyond the scope of this research. Moreover, expanding the research endeavor beyond a focal website increases the generalizability of the theoretical implication.

Second, the data analysis in Study 2 was based on the data of consumers who made purchases. However, collecting behavioral data from consumers who purchased and did not purchase products can lead to additional investigation on the effects of product review provision within a shopping website. The comparison of behavioral data, such as click-through data and perception of online shopping abandonment, between these two types of consumers may lead to the discovery of interesting factors that moderate the effects of product review provision (Kukar-Kinney and Close 2010). Future studies may conduct more related studies.

Third, this research used search and experience products in the field study, but the effects of product review provision between these two types of products were not differentiated. An ideal solution could be the development of two sets of websites. The search (or experience) product and the three types of product review provisions could be implemented for each set. However, we failed to implement this ideal solution because of the development time and budget constraints of the startup e-commerce company. Nevertheless, the field data show that the consumers usually purchased both search and experience products in one order. Therefore, the effects of product type on consumers' shopping decision-making performance may not be a critical issue.

Fourth, different genres of more than 3,000 product reviews were reviewed and classified manually by several volunteers. All classified product reviews were also double-checked by the authors and other scholars. This classification work significantly delayed the progress of this study. Future works could focus on how to use machine learning to automate product review classification by adopting this study's definition of the genre of product reviews. Future studies could also gain salient insights into investigating the effect of providing more sophisticated product review patches (e.g., amalgamation of attribute-oriented and usage-oriented product review) in a shopping website.

Fifth, this research focused on the text-based product review form because it is a widely used format in the online shopping context. An example is the product review section in Amazon.com. Other forms of product review presentation methods, such as image- and video-based reviews, are available (Jiang and Benbasat 2007b). However, multiple forms were not incorporated because the issue of when the product review information could be provided (i.e., sequentiality) was given focus. Considering multiple forms may also bring additional complexity to the investigation. Future studies may investigate if the findings can be applied in a multimedia review context.

Sixth, consumers' information-foraging behaviors between familiar and unfamiliar products were not compared. Moderately familiar products were used instead for two reasons.

(1) IFT and cognitive information-processing theory argue that participants who are familiar with the products tend to forage for information from the information patch of internal sources, such as mnemonic information or schematic information from their mind. Therefore, the effect of product review is undermined.

(2) The same theoretical foundations mention that participants who are not familiar with the products tend to forage for information from the information patch of an external source, such as recommendations from others. The use of unfamiliar products in a think-aloud study may signify the effect of an online product review provision in theory.

However, our on-ground experience indicated that the participants were reluctant to process the think-aloud study with unfamiliar products. The participants reported that this kind of shopping task was far from the real online shopping experience with which they were familiar. Moreover, requesting participants to process unfamiliar product information and verbalize their thoughts concurrently was deemed

impossible. The participants felt that "their head would blow up" when doing the think-aloud activity given the bounded cognitive processing capacity. They easily became tired, and most of the participants abandoned the study immediately after the start of the think-aloud part.

We employed two methods to attenuate the possible influence of product familiarity.

(1) The types of products used in the think-aloud study were carefully selected. A pre-test was conducted before commencing the think-aloud study to select the product with a mid-level of product knowledge and high willingness to purchase by consumers. A similar method was also applied to the product selection for the field study. The rationale for this method was to control/reduce the negative effect of an overly familiar/unfamiliar product on consumers' information search and choice behavior consistent with studies on product familiarity and consumers' choice (Johnson and Russo 1984).

(2) The individual participants' user shopping experiences and familiarity with the product (product knowledge) were measured in the think-aloud study. The data analysis results showed that participants were neither familiar nor unfamiliar with the products (mean = 4.14, SD = 1.39). No significant differences were observed among participants. This result agrees with the findings of Johnson and Russo (1984), who suggested that a moderate degree of product familiarity could build a good basis for consumers' information search on product choice. Product familiarity was also analyzed in the field study. Consumers had mid-level product familiarity with the products sold on the website (mean = 4.03, SD = 1.24). No significant differences were observed. Thus, product familiarity is not a critical confounding factor in this study. Nevertheless, future studies should to explore this issue using other methods, such as eye tracking and think-after method.

Seventh, no moderating or mediating effect was considered in the research framework. This research focused on interpreting an innovative explanation of the provision of useful product reviews on online shopping websites. Future studies could investigate any moderating and/or mediating effects, such as consumer heterogeneity (Becker et al. 2013).

Finally, the quantification of the importance of product reviews can be conducted in future studies (De et al. 2010). Some studies have demonstrated the importance of providing product reviews during the shopping process (Chen and Xie 2008; Zhu and Zhang 2010). However, quantifiable studies

on the importance of the provision of product reviews and other shopping facilitation aids warrant further examination.

In conclusion, consumers give significant attention to acquiring product reviews. This study achieved a theoretically sound understanding of how to strategically organize product reviews on online shopping websites to enhance consumers' choice performance.

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SEQUENTIALITY OF PRODUCT REVIEW INFORMATION PROVISION: AN INFORMATION FORAGING PERSPECTIVE

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Appendix A

Design of Think-Aloud Study

The successful implementation of the think-aloud method requires addressing four main design issues (van Someren et al.1994), namely, the (1) simulated shopping website, (2) focal products for shopping, (3) think-aloud training and work environment, and (4) administration of the study.

First, consumers have various experiences when it comes to online shopping websites. These websites may differ in terms of their specific implementations (e.g., features that restrict the viewing of a product review to certain segments of the website). These differences can potentially add ambiguity to the understanding of consumer's shopping behaviors (Martin et al. 2005). To address this issue, we developed a simulated shopping website (Tan et al. 2010). Then, we used the approach of Kumar and Benbasat (2006) and studied the implementation of commercial shopping. The product content of commercial shopping websites (i.e., manufacturer-provided product description information) and product review information were considered to make the website design more realistic.

Second, prior product knowledge and type (search versus experience) of the chosen products in the shopping website can confound the results (King and Balasubramanian 1994). According to information foraging theory (IFT), consumers will forego foraging for product-related information (e.g., manufacturer-provided product information and product reviews) if they have sufficient prior knowledge of the product (Pirolli and Card 1999). Studies have reported that the information learning effect can influence the effectiveness of product information provision if consumers are not familiar with the product (Wood and Lynch 2002). Thus, a pre-test survey was conducted to negate these confounding factors. We randomly selected 10 consumers and asked them to rank their level of prior product knowledge and their willingness to purchase items using 20 product categories. The top four selected product categories had the highest willingness-to-purchase ratings and mid-level prior product knowledge of consumers. These products (i.e., mp3 player, digital camera, laptop, and cellphone) were regarded as

search products (Girard and Dion 2010). Prior product knowledge of the participants was tested during the think-aloud study. We did not obtain significant deviations from the pre-test results.

The third issue is environmental interference. To ensure that participants were able to verbalize well their thoughts with minimum interference, we meticulously designed the study room and conducted pre-study training. With respect to the study room setting, we partitioned the room into two segments. The first segment (close to the entrance) was used for the pre-study training, and the second segment was used for conducting the main study. In the training segment, we followed a rigorous and systematic approach proposed by earlier studies (e.g., van Someren et al. 1994). The training ensured the quality of the think-aloud protocol of the participants. In each session, the first half-hour was used for training, during which the participants were given several training tasks to practice thinking aloud. An example of a training task is responding to the following question: *A bottle of wine costs $5. The wine costs $4.50 more than the bottle. How much does the bottle cost?* The training enabled the participants to become accustomed to verbalizing, but not interpreting, their thoughts. After the training session, we conducted a mini-test on each participant in which they verbalized a decision task. We were confident that the participants were well equipped to proceed with the think-aloud approach. After the training session, participants proceeded to the main segment. Each participant was assigned a cubicle with a computer, webcam, and microphone. This setting minimized cross-participant interference. The webcam was equipped to capture the motions of the participants, and a screen image-capturing software was installed on the computer to capture website navigation. These two additional data inputs facilitated the triangulation of verbalized thoughts to obtain a more accurate depiction of the ideas that went through the minds of the participants.

The fourth issue involves the measure to address the concern that the administrators might reveal the actual research objectives. Thus, we hired two independent administrators who were not cognizant of the research objectives to conduct the entire experiment. The administrators were trained to implement the think-aloud study based on the approach adopted by Johnson (1988).

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Appendix B

Designing the Coding Scheme

We deployed two successive steps in designing the coding scheme (Figure B1). In Step 1, we adopted the tentative coding scheme of the information-foraging behavior based on IFT. In Step 2, we conducted a pre-analysis test to refine the coding scheme. Specifically, we used three methods to refine the coding scheme: referring phase analysis (RPA), assertion analysis (AA), and script analysis (SA).
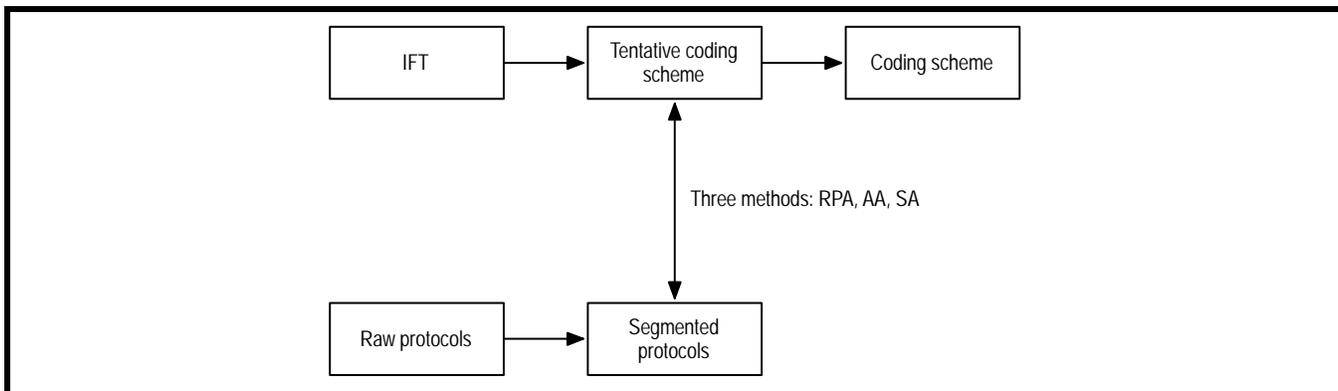
Figure B1. Designing the Coding Scheme

RPA: First, the coders examined all verbs and verbal phases in the transcribed scripts. Next, the coders coded the verbalized words based on the index of concepts (Table B1). Such coding facilitated the identification and definition of the keywords of the concepts the participants focused on during the online shopping process. After each concept was identified, the coders defined the meanings of the coded concepts (Table B2). RPA continued until all the concepts in all the transcribed scripts were coded and defined. The transcribed scripts were examined several times to ensure that undefined concepts did not remain. Eventually, all concepts in the transcribed scripts were coded.

AA: In the second method, the coder identified assertions to investigate the formation of relationships among the concepts during the shopping task. Once the purposes behind these assertions were identified, we determined the major concepts that the participants focused on during the online shopping task. This method could help in discovering the relationships among the concepts made by the participants.

SA: SA illustrated the overall thinking processes during the online shopping task. The output represented the type of information that participants intended to access, the approach with which they structured the task, the rationale for decisions, and the plan for shopping decision. RPA and AA are preliminary steps to SA.

A set of codes was identified at the beginning of SA. The codes explained the common predominant reasoning processes of the participants during the shopping task. A cyclical process was performed to ensure all codes could be reflected in the transcribed scripts. The process included re-reading the scripts several times; re-naming, merging, splitting, and re-coding parts of the data under a different code name; unlinking data from a particular code; and deleting codes entirely when they no longer seemed to be useful for describing the think-aloud protocol data.

In summary, the tentative coding scheme was modified by protocol analysis based on the pre-analysis test. New processes identified in the pre-analysis test were then added to complement the original coding scheme from IFT (Table B3).

Table B1. Examples of the Referring Phrase Analysis and Coded Concepts	
Segment	**Coded Concept(s)**
I will look at the HP laptop first … I am *not sure* if I can find a suitable one for me …	Search, uncertainty
I will *search* for the Lenovo laptop, Y450. *How about the PE review of this laptop.* …is good for playing games …	Search, acquire knowledge
I will *look at* the Thinkpad X200, I will *look at the PA review.* … has the Centrino 2 technology …it has 60% performance advantage … the battery can be used for 3 hours …	Search, acquire knowledge
HP is fine, but the heat dissipation problem is not good. I think I *should look at the product information* … the integrated graphics card is not good. I think the independent graphics card is good. 12.1-inch screen … it is small. I think the 13-inch is more suitable.	Search, acquire knowledge
I will *check* the HP laptop and *compare* … I feel that the HP and SONY laptops are both good. I will *look at the product information and reviews* …good business card recognition system …	Differentiate, acquire knowledge
Well, this one has good performance. I think the 14.1-inch laptop *is acceptable*; I can put it in my dormitory and don't need to move it around. I think I will *look for more laptops with 14.1-inch screen size* …	Formulate, search
I will *search for more details* about it. … the Lenovo laptop, the V550 seems to be good. Its CPU is good too. The Lenovo Y450 is also good. I will *look at the product information* …	Search, acquire knowledge
I think it the (Lenovo Y450) is good. I want to *know others' opinions* …	Verification, acquire knowledge
I find this one is also good … DELL 1427 … I will *find more information from the PA reviews* …	Acquire knowledge
Yes, it is the one I want. *I will buy it* …	Execute

Table B2. Definitions of Coded Concepts	
Concept(s)	**Definition**
Search	The willingness to search for a product in a shopping website.
Uncertainty	A feeling of loss, awareness of lack of knowledge and understanding.
Acquire knowledge	Seeking information from all available information sources, such as PA reviews, PE reviews, and product information provided by manufacturers.
Differentiate	Using known differences in information sources as a way of filtering the amount of information obtained.
Formulate	Identifying and selecting ideas in existing information from which to form a focused perspective of the topic.
Verification	Specifying the need for relevant and focused information.
Execute	Presenting the decision behavior.

Table B3. Tentative Coding Scheme	
Code	**Description**
(o*read-question)	Used when the user is reading the question.
(o*note question *text*)	Used when the user is reading a segment of text from the question. We include as an argument the text of the question read.
(o*question-task)	Used when the user asked a question regarding the task question, general procedures, task constraints, and so on.
(o*reformulate-task)	Used then the user comprehends a change in the task, including hints given by the experimenter. This should generally be followed by goals that indicate the new formulation of the task.
(o*recall-goal)	Used when the user attempts to remember the task goal without reading from the question. Re-reading the question to recall the goal should be coded as (o*read-question) above.
(g*formulate *need-type from*)	Example: (g*formulate URL "Louisiana state university"). Indicates a goal to reformulate one kind of information-need into some other target type of need. The example indicates that a URL needs to be formulated (guessed) from the name of the university. The *need-type* is a type of information need (question, need, query, URL) and *from* is the actual content.
(o*formulate *need-type from to*)	Example: (o*formulate URL "Louisiana state university" "www.lsa.edu"). The *need-type* is the kind of thing that has been formulated, the *from* is the content that has been reformulated, and the *to* is the result of the reformulation. This indicates that the user has formulated a new kind of information-need from some other kind of information-need. In the example, a new URL has been formulated (guessed) from the name of a university.
(o*note *need-type content*)	This is the reflexive version of "formulate."
(o*note *structure-type structure content*)	Similar to the above, and is a way to indicate that some content has been added or has become the focus of attention.
(o*note *structure-type structure content*)	Similar to the above, except that a greater inferential leap exists.
(g*locate-information *info-need info-structure*)	Example 1: (g*locate-information "Second city"). Example 2: (g*locate-information "second-city" www.lsa.edu). Indicates the goal to find some information, indicated by *info-need*. Optionally, the structure on which to find the information can be specified by *info-structure*. Thus, Example 1 indicates the goal to find something about "second city" and Example 2 sets a goal to find it on a particular page.
(o*locate-information *info-need info-structure*)	Indicates the action of finding info-need on info-structure.
(g*go-to *structure-type structure*)	Indicates the goal of navigating to some particular web structure, such as a URL.
(o*go-to *structure-type structure*)	Indicates the action of navigating to some particular web structure.
(g*search *structure-type structure need*)	Indicates the goal of using a search engine to search some kind of *structure-type* (e.g., the web; a page), the particular *structure* searched, and an indication of the *need*. Note: If info-need is implicit, and not directly stated by the user, use the placeholder "null" for that info-need.
(o*search *structure-type structure need query*)	Indicates the action of using a search engine, as well as the *query* used. See note above.
(o*wait *event*)	Indicates that the user is consciously waiting for some event to terminate.
(g*follow *link*)	Indicates that the user intends to follow a link.
(o*follow *link*)	Indicate that the user followed a link.
(g*go-back-in-stack)	Indicates that the user wishes to backtrack.

Table B3. Tentative Coding Scheme (Continued)	
Code	**Description**
(g*go-forward-in-stack)	Indicates that the user wishes to go forward in the history list.
(o*go-back-in-stack)	Indicates that the user clicked the back button.
(g*go-back-to-site *site*)	Indicates that user wishes to use the history to jump back to a specific site.
(o*go-back-to-site *site*)	Indicates that the user uses the history (menus or right-click on back button) to jump back to a specific site.
(o*go-forward-in-stack)	Indicates that the user clicked the forward button.
(o*refresh)	Indicates that the user refreshed the screen.
(o*stop)	Indicates that the user clicked the stop button.
(o*eval *structure-type structure* <u>*evaluation*</u>)*	Indicates the evaluation of some information structure, such as a page or link, and the evaluation that resulted. Evaluations are optional. When a link is evaluated implicitly (i.e., most of the time this means they only mention the link and move on), use the "null" evaluation.
(o*eval *process-type process* <u>*evaluation*</u>)	This includes processes, such as strategies employed by the user, and specific web processes, such as page loading.

Appendix C

Measurements of Dependent Variables in Study 2

| Table C1. The Items of the Measurements for Dependent Variables		
Constructs	**Items**	
Cognitive effort devoted to shopping	CE1	How much effort did you put into making this decision?
	CE2	I concentrated a lot while making this choice.
	CE3	I was careful about which product to choose.
	CE4	I thought very hard about which product to choose.
Decision satisfaction	DS1	I am satisfied that this is the decision I made.
	DS2	I expect to successfully carry out the decisions that I am making.
	DS3	The decisions that I am making are the best possible for me personally.

Appendix D

Screenshots of the Website
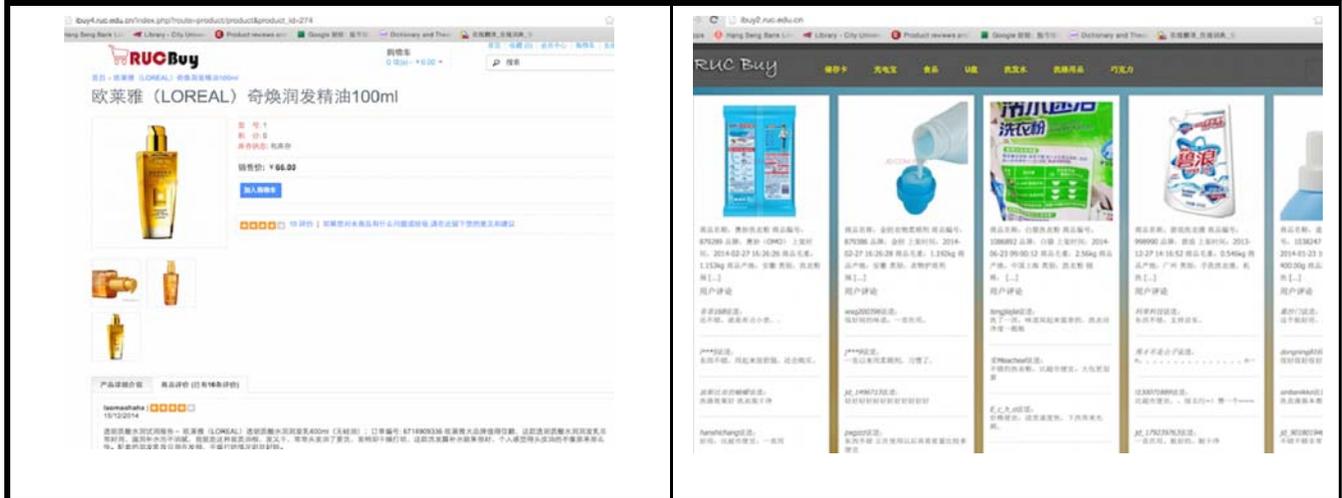
Figure D1. Screenshots of the Website Used for the Field Study
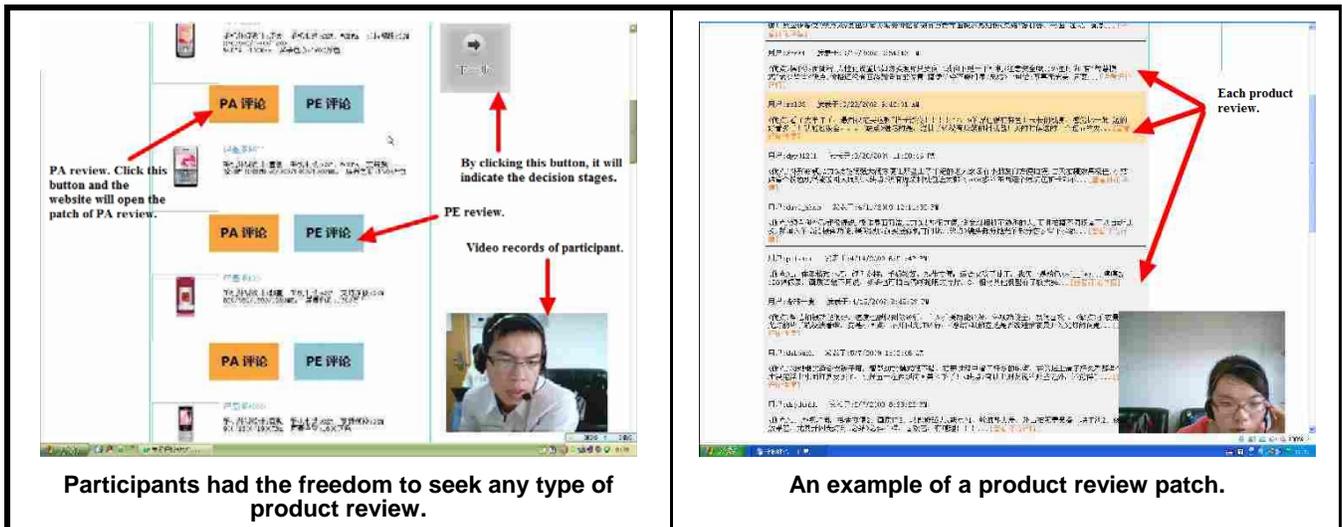
Participants had the freedom to seek any type of product review.

An example of a product review patch.

Figure D2. Screenshots of the Website Used for the Think-Aloud Study