Journal of Business Research 62 (2009) 644–650

Contents lists available at ScienceDirect

Journal of Business Research

Information search and consideration set formation in a web-based store environment ☆

Girish Punj [a,*], Robert Moore [b]

[a] University of Connecticut, Storrs, United States
[b] Mississippi State University, United States

ARTICLE INFO

Article history:
Received 28 July 2005
Accepted 18 April 2007

Keywords:
Consumer behavior
Information search
Consideration set
E-commerce
Internet

ABSTRACT

The research reported here attempts to understand information search and consideration set formation in a web-based choice environment. A conceptual model is used to propose hypotheses that link information search and consideration set formation with two task environment influences that are typical of online settings. A study that simulates information search and consideration set formation in a web-based choice environment is conducted to test the hypotheses. The results offer insights into how the number of available alternatives and the amount of time available may have an effect on search and evaluation in a web-based store. The research has implications for understanding how consumers shop in online stores.

A recent U.S. Census report shows that e-commerce sales grew at almost four times the rate of sales through traditional retail channels (20.9% as compared to 6%) during the 3rd quarter of 2006 (http://www.census.gov/mrts/www/data/html/06Q3.html). The rapid growth of online sales and web-based stores has created a need to understand how consumers search for and evaluate products while shopping online. While web-based stores offer consumers immense choice and great convenience, finding products that fit needs can sometimes be a difficult task. Hence, most web-based stores now make a "recommendation agent" or "shopbot" available to facilitate the consumer purchase process.

Electronic decision aids can assist in a variety of decision-making tasks that may be automated. For instance, an electronic decision can help people search and evaluate products by screening and/or organizing information about available alternatives. Examples of these types of aids may be found at http://www.amazon.com and http://www.expedia.com. They enable consumers to use a preferred alternative screening strategy (e.g., select flights based on "lowest price", or books based on "publication date" *and* "title words").

Recent findings from Comscore and Jupiter research show a marked increase in online sales (Aksoy, 2006; Lipsman, 2006). Being able to consider a variety of options and being able to do so quickly are often mentioned as the main reasons for shopping online. An electronic decision aid that can match consumer specified criteria to the product assortment offered by the merchant can help consumers save time while also considering a wide variety of alternatives. Both consumers and merchants have an interest in making the search and evaluation process function effectively (Saranow, 2005). For consumers finding products that closely match needs boosts customer satisfaction. For merchants providing products that satisfy consumer needs creates loyal customers (Tedeschi, 2005).

Two important task environment influences that are present in an online shopping situation are the number of available alternatives in the relational database of alternatives searched by the recommendation agent and the amount of time available for the shopping task. Typically, the merchant has control over the first, while the second is under the control of the consumer. Both relate to the attractiveness of online shopping, namely, being able to search a variety of options, but also being able to do so quickly (Tamaki, 2005). The purpose of this research is to examine how these two influences may affect information search and consideration set formation in a web-based store environment.

1. Conceptual model development

We propose a conceptual model of information search and consideration set formation in a web-based store environment that includes key constructs that are known to affect consumer behavior in online settings and the task environment influences mentioned above. Two cognitive frameworks are used to guide the formulation of hypotheses relating to the two task environment influences of interest in this study. A review of the empirical studies that have examined consumer behavior in online settings shows that there are (at least) five key constructs that potentially influence information search and

☆ The financial assistance of the University of Connecticut Research Foundation is gratefully acknowledged.

* Corresponding author. Department of Marketing, University of Connecticut, 2100 Hillside Road, Storrs, CT 06269-9013, United States. Tel.: +1 860 486 3835.
E-mail address: Girish.Punj@business.uconn.edu (G. Punj).

0148-2963/$ – see front matter © 2008 Elsevier Inc. All rights reserved.
doi:10.1016/j.jbusres.2007.04.013

consideration set formation in a web-based environment, as depicted in Fig. 1. We discuss each of these influences and the empirical findings relating to them next.

1.1. Electronic decision aids

The electronic screening of information has been identified as the most important development in online shopping (Alba et al., 1997). The typical web-based environment includes some type of electronic decision aid (Redmond, 2002; Iacobucci et al., 2000). An electronic decision aid can influence search and evaluation in a web-based store because it can be used to reduce search costs (Johnson et al., 2004). Specifically, two important functions that can be performed by such an aid are information filtration (i.e., sorting) and information integration (West et al., 1999). Consumers seem to be willing to trust the product recommendations offered by an electronic decision aid (Haubl and Murray, 2003), particularly when it only filters or integrates information (West et al., 1999). The type of functions that can be performed by an electronic decision aid influences the type of screening strategies that may be employed to evaluate alternatives.

1.2. Screening strategies

More use of elimination-type screening strategies for evaluating alternatives (i.e., where selection criteria are used to exclude options) can be expected in a web-based environment, because they are more compatible with the use of a decision aid (Todd and Benbasat, 1994) and therefore easier to implement in an online setting. Additive-type screening strategies (e.g., where selection criteria may be used to both exclude and include alternatives) require making trade-offs between attributes, which is more difficult in a web-based environment (Todd and Benbasat, 1994). While elimination-type strategies can help rapidly narrow the set of available alternatives, they are relatively rigid (i.e., inflexible) in their application which could lead to the premature elimination of otherwise attractive alternatives (Widing and Talarzyk, 1993). A greater use of elimination-type strategies may also be observed because they are more congruent with the manner in which information is displayed in a web-based environment (Payne et al., 1988). The type of screening strategies employed influences information search in an online setting.

1.3. Product attributes

The distinction between digital vs. non-digital information is useful for understanding search and evaluation in an online store. Digital attributes are product attributes that can be readily communicated through an online shopping environment (e.g., price, size), whereas non-digital attributes can only be evaluated through physical inspection (e.g., freshness, taste).

More use of digital attributes can be expected in a web-based environment, because search costs for these attributes are lower (Lal and Sarvary, 1999). Previous research has found that electronic shopping can lower the cost of acquiring digital information (Lynch and Ariely, 2000). But, when a recommendation agent is made available the cost of acquiring non-digital information may be lowered as well (Diehl et al., 2003). The effect can be attributed to the information filtering (i.e., sorting) capability of the electronic decision aid (Diehl et al., 2003). Nevertheless, the findings suggest that consumers are more likely to use digital information in a web-based environment where an electronic decision aid is available.

1.4. Search costs

Consumers can be expected to encounter economic, physical and cognitive search costs while searching for information. Search costs are often assumed to be lower in a web-based store environment compared to traditional retail settings, due to lower economic (i.e., monetary, opportunity cost of time) and physical search costs. Yet, the evidence on whether consumers exploit the lower search cost to search more is mixed. While some studies provide (limited) evidence that search is increased in web-based store environments (Lynch and Ariely, 2000), the dominant finding is that consumers do not search more in these settings (Haubl and Trifts, 2000; Johnson et al., 2004). Whether search costs in a web-based store environment are lower

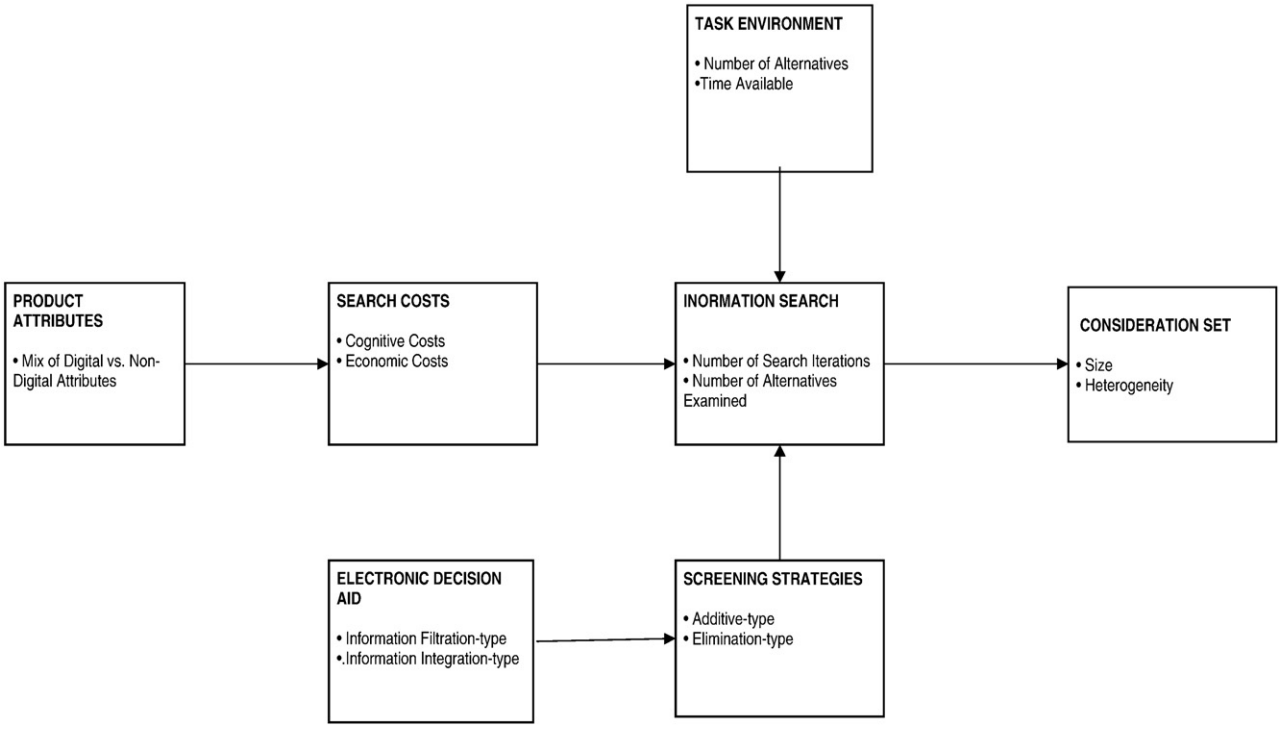

Fig. 1. A process model of information search and consideration set formation in a web-based environment.

may also depend on whether new (i.e., unexpected) cognitive search costs are encountered (Alba et al., 1997). A potential new search cost in a web-based store environment is the cognitive cost of using the available electronic decision aid. This cost can be viewed as being akin to the cost of controlling the information flow (Ariely, 2000) or the cost of planning (Benbasat and Todd, 1996). The cost of using an electronic decision aid may increase due to over-screening (Menczer et al., 2002) or browsing (Smith, 2002).

1.5. Task environment

Consumers can use the available electronic decision aid to screen alternatives and identify a consideration set of the most attractive options. But, they may also "over-screen" alternatives if they use too many selection criteria and create a null consideration set (i.e., the "no matches found" message). The number of alternatives in the relational database linked to the electronic decision aid may influence the extent to which consumers are able to find alternatives that match needs. Likewise, the amount of time available may determine how often consumers re-set selection criteria and re-screen alternatives to match needs. When confronted with too few alternatives and/or too much time, consumers may adopt less efficient calibration strategies by setting wider or lower attribute cut-off levels, thereby diminishing the usefulness of an online environment. The two task environment influences (i.e., number of alternatives and time available) are known to influence information search and consideration set formation in off-line settings (Payne, 1982). An important question, then, is whether they have an effect in online settings too?

2. Hypotheses

Next, we generate empirically testable hypotheses that attempt to predict how information search and consideration set formation are likely to be influenced by the task environment factors discussed earlier (i.e., number of available alternatives and the amount of time available) while controlling for all other influences by keeping them constant. In so doing we provide a *partial* empirical test of the conceptual model (see Fig. 1). Attempting to test the model in its entirety would require varying all the constructs in a single study and therefore is beyond the scope of this research.

Two cognitive frameworks are available to understand how consumers may search for and evaluate products in online settings. The frameworks can be used to guide the formulation of hypotheses about how information search and alternative evaluation may be affected by the two task environment factors. The Bounded Rationality (BR) framework proposes that consumers are bounded in their quest for making accurate decisions by their cognitive ability. Consumers would focus on decision quality if they were not constrained by information processing limitations (Gigerenzer and Selten, 2001; March, 1978).

The Cognitive Cost (CC) framework acknowledges that consumers have information processing limitations (as in the BR framework) but proposes that the focus on accuracy is attenuated by a consideration of the cognitive costs associated with the attainment of that goal. In other words, consumers make a trade-off between decision quality improvement and effort reduction (Bellman et al., 2006; Benbasat and Todd, 1996; Payne et al., 1988). Most of the research on the CC framework suggests that the effort/decision quality trade-off is uneven with consumers focusing more on effort reduction than on decision quality improvement.

While there is some support of the BR framework, research findings seem to significantly support the CC framework in physical store (i.e., brick-and-mortar) environments. Consumers are more concerned with saving time and effort, because the benefits of such a focus are immediate and tangible. In contrast, the benefits of making a better and more accurate decision are delayed and ambiguous (Chu and Spires, 2000). Do these conclusions also extend to web-based store environments? Or does the availability of a recommendation agent shift the balance in favor of the BR framework? It is conceivable that there is a shift in emphasis from effort reduction to decision quality improvement in online settings, because an important assumption in the CC framework, namely, that feedback on decision quality is subject to ambiguity and delay (Chu and Spires, 2000), is less true in online settings. Empirical research on consumer decisions in online settings where a recommendation agent was used provides limited evidence of decision quality improvement (Haubl and Trifts, 2000). But, it is also possible that the available electronic decision aid will be used to maintain the focus on effort reduction as predicted by the CC framework.

The two task environment influences being studied may shed light on whether consumer search and evaluation in an online setting is more consistent with a BR focus or a CC focus. As mentioned earlier, the merchant has control over the number of alternatives made available, while the consumer controls the amount of time spent evaluating them. Thus, if many alternatives are made available by the manufacturer, consumers may pursue a BR focus by making more time available for their evaluation. Or, they may adopt a CC focus by deciding that making additional time available is not worth it. Likewise, when many alternatives are available, consumers may pursue a CC focus by making less time available for their evaluation. As mentioned earlier, both goals relate to the attractiveness of online shopping, namely, being able to consider a large number of alternatives, while also being able to save time (Lohse et al., 2000).

2.1. Information search

Information search in an online setting consists of two phases that combine planning with action (Payne et al., 2001). The initial phase involves screening (and re-screening) choice alternatives by performing *search iterations* to identify alternatives that match preferences. Once identified, alternatives may subsequently be *examined* (i.e., scrutinized) for more detailed information.

2.1.1. Number of search iterations

In the web environment, consumers can be expected to conduct multiple search iterations as they seek to identify alternatives for inclusion in the consideration set. Lynch and Ariely (2000) found evidence of more "drill-down" search, which is similar to iterative search. Chu and Spires (2000) found evidence of broader (i.e., less selective) information search when a DSS was used. As the number of alternatives increases, the number of search iterations is likely to decrease in the web environment due to the reduced likelihood of criteria over-specification (Widing and Talarzyk, 1993) and less "information foraging" (Pirolli and Card, 1999). The number of search iterations is also likely to decrease because the feedback mechanism in a recommendation agent will become less beneficial as the number of alternatives increases (Payne et al., 2001). However, as time available increases more search iterations can be expected due to novelty seeking (Menon and Kahn, 2002) and browsing behavior (Marchionini, 1995).

H1. There will be fewer search iterations in a web-based environment as the number of alternatives increases.

H2. There will be more search iterations in a web-based environment as time available increases.

2.1.2. Number of alternatives examined

A consequence of more search iterations in the web environment is that fewer alternatives may actually be examined (i.e., scrutinized) for information. The web environment offers a lower search cost, but this feature offers little benefit in terms of the cost of inspecting every

screened alternative. Haubl and Trifts (2000) found evidence of fewer alternatives being examined for information. Also, consumers are likely to trust the electronic decision aid when it is only filters (i.e., sorts) information (Haubl and Murray, 2003), and may feel little need for examining every screened alternative for further information. As the number of alternatives increases, fewer alternatives are likely to be examined for information because of the greater likelihood of screened alternatives matching needs (Widing and Talarzyk, 1993) and the reduced need to restructure information (Bettman et al., 1998). But, as time available increases, more alternatives are likely to be examined for information due to exploratory behavior (Alba et al., 1997) and inspection of screened alternatives (Rowley, 2000).

H3. There will be fewer alternatives examined for information in a web-based environment as the number of alternatives increases.

H4. There will be more alternatives examined for information in a web-based environment as time available increases.

2.2. Consideration sets

2.2.1. Consideration set size

In the web environment, consumers are likely to use more attributes to screen available alternatives while forming a consideration set. The electronic decision aid makes it easy to include even unimportant attributes during the screening process (Todd and Benbasat, 1994). Haubl and Trifts (2000) found evidence that consumers develop smaller consideration sets in online settings. However, as the number of alternatives increases, consideration set size will increase because of the increased likelihood of more alternatives matching needs and the diminished need to re-calibrate the electronic decision aid and re-screen alternatives (Payne et al., 2001). But, as time available increases, consideration set size will decrease due to greater use of elimination-type screening strategies (where selection criteria are applied to exclude alternatives).

H5. The size of the consideration set in a web-based environment will increase as the number of alternatives increases.

H6. The size of the consideration set in a web-based environment will decrease as time available increases.

2.2.2. Consideration set heterogeneity

In the web environment, the tendency toward more iterative search will result in more heterogeneous consideration sets. Also, changing selection criteria as consumers re-calibrate the electronic decision aid will also result in more heterogeneous consideration sets (Alba et al., 1997). As the number of alternatives increases, consideration set heterogeneity will increase because of more dissimilar alternatives being included in the consideration set (Roberts and Lattin, 1991). But, as the time available increases, consideration set heterogeneity will decrease due to the use of additional selection criteria resulting in more similar alternatives being included in the consideration set (Bettman et al., 1998).

H7. The heterogeneity of the consideration set in a web-based environment will increase as the number of alternatives increases.

H8. The heterogeneity of the consideration set in a web-based environment will decrease as time available increases.

3. Method

3.1. Study design

A study that simulated consumer decision-making in a web-based environment was conducted to test the hypotheses. The scenario consisted of undergraduate students choosing an apartment to rent near a hypothetical university. The web environment was characterized by the availability of an electronic decision aid that could be used to search a relational database of available apartments. Apartments were profiled using photographs and written descriptions.

The study employed a 2 number of alternatives (many, few)×2 time available (more, less)×2 web environment (web, web-auto) design. The first two factors are the two task environment influences of interest in the study. The two web environment conditions were collapsed because the distinction between them related to particular features of the electronic decision aid used, which were not pertinent to the study purpose. Prior to pooling the data on the third factor, homogeneity tests revealed no significant difference between the two web environment conditions on the dependent variables of interest.

3.2. Stimulus development

3.2.1. Selection of product category

The selection of (hypothetical) rental apartments as the product category was based on a number of considerations. First, the product category is familiar to student subjects. Second, alternatives in the product category can be objectively evaluated. Third, attribute importance normally differs across individuals leading to preference heterogeneity. Several experimental studies of decision behavior have used rental apartments as a product category (Payne, 1982; Todd and Benbasat, 1992).

3.2.2. Task

Subjects were instructed to role-play a student transferring to another university who needed to find an apartment. They were asked to develop a list of apartments that they would like to visit for further consideration on arrival at the new campus. The purpose of the task was to search for apartments and form a consideration set. Profiles for apartments were constructed using a fractional factorial design based on attributes such as rent, location, number of bedrooms, and the number and type of amenities. Each profile described the apartment on twenty attributes. Unrealistic and dominated alternatives were eliminated.

3.2.3. Web environment

The web environment was simulated by converting the apartment profiles into web displays. An electronic decision aid and relational database of apartment profiles similar to those at apartment search sites (e.g., http://www.apartments.com) was developed. A "search page" provided the interface between the electronic decision aid and the relational database. Subjects used this page to query the database about apartments that met their selection criteria. A screen indicated whether matching apartments had been found (or not). If matches were found, a screen displayed a list of matching apartments, with each listing being hyper-linked to the corresponding apartment profile. Hyper-links gave the subject the ability to: 1) return to the list of matching apartments, 2) return to the search page, or 3) add the apartment to their list of selected apartments.

3.2.4. Experimental conditions

The number of alternatives available was set at 30 in the "few" alternatives condition and at 99 for the "many" alternatives condition based on guidelines provided in previous research (Widing and Talarzyk, 1993). A pre-test indicated that subjects were able to complete the task in both conditions. In a second pre-test, subjects completed the experimental task with a certain number of alternatives (many or few) with no time constraint. The time pressure conditions were then created by multiplying the median time for task completion in each manipulation by 0.90 for the "low" and by 0.70 for the "high" time pressure condition based on guidelines provided in earlier studies (Ben-Zur and Breznitz, 1981; Payne et al., 1988).

Table 1
Correlations among variables.

	Number of search Iterations	Number of alternatives examined	Consideration set size	Consideration set homogeneity
Number of search iterations	–			
Number of alternatives examined	−.44**			
Consideration set size	−.33**	.59**	–	
Consideration set homogeneity	−.04	.17*	−.02	–

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

3.3. Experimental procedure

One hundred and twenty undergraduate students participated in the study. Subjects were randomly assigned to the experimental conditions with approximately 15 subjects per cell. Each experimental session involved a single participant. The incentives for participation included extra course credit and a chance to win a $100 lottery. Subjects first undertook a training task to familiarize themselves with the navigational features of the web environment. Then, for the main task, subjects used the electronic decision aid to create a "shopping cart" consisting of "apartments that they would seriously consider." Subjects were told that they could modify the "shopping cart" during the session, but were not told how many apartments were available or how many apartments they should select.

3.4. Dependent variables

3.4.1. Number of search iterations

The web server tracked the number of queries elicited from the relational database. The number of search iterations was calculated by counting the number of queries in the log file of the web server.

3.4.2. Number of alternatives examined

The number of alternatives examined (i.e., scrutinized) was determined by an inspection of the log file of the web server.

3.4.3. Consideration set size

Consideration set size was determined by tallying the number of different alternatives placed in the "shopping cart."

3.4.4. Heterogeneity of the consideration set

The heterogeneity of the consideration set (HCS) was measured by calculating the average weighted Euclidean distance between all pairs of alternatives included in the consideration set. The weights were based on self-reported attribute importance ratings collected before the experiment. Prior to estimation, the attribute importance weights were standardized to avoid over-weighting.

4. Results

4.1. Manipulation checks and reliability assessments

A GLM-ANOVA model, with the perceived number of alternatives as the dependent variable and the number of alternatives present (many vs. few), time pressure (low vs. high), and environment (web vs. web-auto), as the independent variables was used to assess the manipulation. As expected, a significant main effect for the number of alternatives manipulation (many vs. few) was found [F (1,112)=4.72, p<.05]. More alternatives were perceived to be present by subjects in the many alternatives condition ($\bar{x}$=6.6) than in the few alternatives condition ($\bar{x}$=5.9). Further, there was a marginally significant main effect for the time pressure (low vs. high) manipulation [F (1,112)= 3.42, p<.10]. More alternatives were perceived to be present in the more time available condition ($\bar{x}$=6.0) than in the less time available condition ($\bar{x}$=6.6). Therefore, the manipulations were assessed to be successful. Table 1 provides the pair-wise correlations among the dependent variables. Table 2 provides descriptive statistics for the dependent variables.

4.2. Individual hypotheses results

4.2.1. Number of search iterations

H1 posits that there will be fewer search iterations environment as the number of alternatives increases. The main effect for number of alternatives was marginally significant [F (1, 112)=2.76, p<.10]. Inspection of the marginal means shows that the number of search iterations was lower in the many alternatives condition ($\bar{x}$=7.3) than in the few alternatives condition ($\bar{x}$=8.5). Thus, H1 is weakly supported. H2 posits that there will be more iterations as time available increases. The main effect for time available was significant [F (1, 112)=4.93, p<.05]. Inspection of the marginal means shows that the number of search iterations was significantly higher (t=−2.22, p<.05) in the more time available condition ($\bar{x}$=8.9) than in the less time available condition ($\bar{x}$=7.3). Thus, H2 is supported. The number of alternatives× time available interaction was not significant.

4.2.2. Number of alternatives examined

H3 posits that fewer alternatives will be examined for information as the number of alternatives increases. The main effect for number of alternatives was not significant [F (1,105)=2.70, ns]. Inspection of the marginal means shows that more alternatives were examined for information in the many alternatives condition ($\bar{x}$=9.3) than in few alternatives condition ($\bar{x}$=8.0). Thus, H3 is not supported. H4 posits that as time available increases, the number of alternatives examined for information will increase. The main effect for time available was significant [F (1,105)=4.67, p<.05]. In the contrast comparisons, the number of alternatives examined increased in the expected direction as time available increased (t=−2.16, p<.05). Thus, H4 is supported. The time available× number of alternatives interaction was not significant.

4.2.3. Consideration set size

H5 posits that the consideration set size will increase as the number of alternatives increases. The main effect for number of alternatives was significant [F (1,112)=3.63, p<.05]. Inspection of the marginal means shows that the size of the consideration set was larger in the many alternatives condition ($\bar{x}$=4.8) than in the few alternatives condition ($\bar{x}$=4.2). Thus, H5 is supported. H6 posits that as time available increases, consideration set size will decrease. The main

Table 2
Descriptive statistics: means and SD.

	Web-based decision environment			
	Few alternatives available		Many alternatives available	
	Less time available	More time available	Less time available	More time available
Number of search iterations	7.81 (2.87)	9.25 (3.89)	6.87 (2.32)	8.27 (2.87)
Number of alternatives examined	7.60 (3.52)	8.50 (3.60)	8.20 (2.88)	10.56 (5.75)
Consideration set size	4.63 (1.65)	3.79 (1.23)	4.80 (1.40)	4.73 (1.71)
Consideration set homogeneity	21.84 (9.25)	21.75 (10.71)	21.48 (11.06)	21.38 (11.41)

Note: Entries are cell means with standard deviations shown in parentheses.

effect for time available was marginally significant [F (1,112)=2.75, p<.10]. In the contrast comparisons, the size of the consideration set decreased in the expected direction as time available increased (t=−2.16, p<.05). Thus, H6 is weakly supported. The time available×number of alternatives interaction was not significant.

4.2.4. Heterogeneity of the consideration set

H7 posits that the alternatives in the consideration set will be more heterogeneous as the number of alternatives increases. The main effect for number of alternatives was not significant [F (1,112)=0.04, ns]. Inspection of the marginal means shows that there was little change in consideration set heterogeneity between the few alternatives available ($\bar{x}$=21.8) and the more alternatives available ($\bar{x}$=21.4) conditions, with higher values indicating more heterogeneous consideration sets. Thus, H7 is not supported. H8 posits that as time available increases, heterogeneity of the consideration set will decrease. The main effect for time available was not significant [F(1,112)=0.01, ns]. Inspection of the marginal means shows that there was no change in consideration set heterogeneity between the less time available ($\bar{x}$=21.6) and the more time available ($\bar{x}$=21.6) conditions. Thus, H8 is not supported.

5. Discussion

Overall, the results provide mixed support for the hypothesized relationships, with five of the eight hypotheses receiving partial or full support. The findings relating to search when many alternatives are available show that while consumers conduct fewer search iterations (weak support for H1), they do not actually examine fewer alternatives for information (lack of support for H3). In contrast, the findings relating to search when more time is available show that the number of search iterations conducted increases (support for H2) but so does the number of alternatives examined (support for H4). Thus, an increase in the time available has the predicted effect on search, while an increase in the number of alternatives does not. The empirical results relating to consideration set formation show that consumers form larger consideration sets when many alternatives are available (support for H5), but form smaller considerations sets when more time is available (support for H6) as predicted. The heterogeneity of the consideration set remains unaffected when either more alternatives or more time is available (lack of support for H7 and H8).

6. General discussion

Overall, the findings offer support for the portion of the conceptual model subjected to the empirical test. While not all hypothesized relationships were significant, the two task environment influences examined affected information search and consideration set formation in the predicted manner. When more alternatives are available, consumers conduct fewer search iterations but yet develop larger consideration sets. When more time is available, they conduct more search iterations, examine more alternatives, but form smaller consideration sets. The two task environment factors seem to have independent effects on search and alternative evaluation in a web-based environment. In contrast, the two task environment factors are known to have an interactive effect in off-line settings, because more alternatives and less time are associated with task complexity. Further, when more alternatives are available consumers seem to engage in risk-averse behavior, because such is implied by larger consideration sets (Roberts and Lattin, 1991). But when more time is available, consumers engage in risk-taking behavior, because they form smaller consideration sets.

An interesting pattern of inter-relationships can be observed among measures normally associated with decision quality and the two task environment variables. Decision quality seems to *improve* in a web-based environment as more alternatives are available and there is less time. A possible reason for such an effect is information *underload* in a web-based environment. In other words, when there are few alternatives available and there plenty of time, the task becomes "difficult." An important implication that emerges from the study results is that electronic decision aids in web environments may impose new search costs on consumers that offset the overall lower search cost offered by these environments. These costs could have a detrimental effect for relatively straightforward choice tasks.

Overall, the study findings offer support for the CC framework in a web-based choice environment where a recommendation agent is available. Consumers conduct less search and retain more alternatives for later consideration. The result may be attributed to the feedback mechanism that is usually built into a recommendation agent. Consumers have the option of using the feedback provided by interacting with a recommendation agent to either make a more accurate decision or to save effort. Within the confines of this study it appears that consumers generally tend to use the feedback to accomplish the latter goal.

However, the findings also indicate that there may be partial shift in focus to decision quality improvement consistent with the BR framework, when more time is available, but not when there are more available alternatives. Thus, the good news is that consumers can shift focus from effort reduction to decision quality improvement, because the amount of time spent in an online store is under their control. But, the bad news is that merchants can "neutralize" the change in focus by making more alternatives available.

7. Summary and conclusion

Web-based choice environments are characterized by large product assortments through which consumers seek to navigate quickly. The vast amount of product information available can overwhelm consumers particularly in the limited time they have at their disposal to process it. An electronic decision is almost essential for information processing in these environments. Our findings indicate that recommendation agents may be more effective in helping consumers make less effortful decisions. But, the findings also show that if consumers are willing to spend the extra time, they can make less effortful *and* more accurate decisions while using a recommendation agent. The desire to accomplish both goals has been referred to as the "paradox of choice" in a web-based store (Tamaki, 2005). The more alternatives consumers consider the more likely are they to make a better quality decision. But, considering a variety of alternatives takes time and effort.

Recommendation agents are often closely tied to the environments in which they are used because they are frequently "designed" for those environments (Olson and Widing, 2002). Thus, marketers may need to build in more "flexibility" into their recommendation agents so that they perform well under different task environment conditions (Montgomery et al., 2004). Consumers who want to make quick purchase decisions should be able to do so, as should consumers who want to me more thorough in their product selections. Anecdotal reports in the business press suggest that there is a movement toward the development of "flexible" recommendation agents, despite the increasing cost of designing such shopbots (Perez, 2002; Reda, 2002).

In conclusion, the study seeks to contribute to the expanding literature on how consumers search for and evaluate products while shopping online. Specifically, it proposes a conceptual model of information search and consideration set formation in a web-based store environment based on constructs that are known to affect consumer behavior in online settings. An empirical test that relates to two important task environment influences in online settings is used to validate a portion of the model.

References

Alba J, Lynch J, Weitz B, Janiszewski C, Lutz R, Sawyer A, et al. Interactive home shopping: consumer, retailer, and manufacturer incentives to participate in electronic marketplaces. J Mark 1997;61(3):38–53.

Aksoy B. US online automotive forecast 2005 to 2010. Research Report. Jupiter Research; 2006.

Ariely D. Controlling the information flow: effects on consumers' decision making and preferences. J Consum Res 2000;27(2):233–48.
Bellman S, Johnson E, Lohse G, Mandel N. Designing marketplaces of the artificial with consumers in mind: four approaches to understanding consumer behavior in electronic environments. J Interact Market 2006;20(1):21–33.
Ben-Zur H, Breznitz S. The effects of time pressure on risky choice behavior. Acta Psychol 1981;47:89–104.
Benbasat I, Todd P. The effects of decision support and task contingencies on model formulation. Cogn Perspect Decis Support Syst 1996;17:241–52.
Bettman J, Luce MF, Payne JW. Constructive consumer choice processes. J Consum Res 1998;25(3):187–217.
Chu PC, Spires EE. The joint effects of effort and quality on decision strategy choice with computerized decision aids. Decis Sci 2000;31(2):259–92.
Diehl K, Kornish LJ, Lynch JG. Smart agents: when lower search costs for quality information increase price sensitivity. J Consum Res 2003;30:56–71.
Gigerenzer G, Selten R. Bounded rationality: the adaptive toolbox. Cambridge, MA: The MIT Press; 2001.
Haubl G, Murray KB. Preference construction and persistence in digital marketplaces: the role of electronic recommendation agents. J Consum Psychol 2003;13(1–2):75–91.
Haubl G, Trifts V. Consumer decision making in online environments. Mark Sci 2000;19:4–21 (Winter).
Iacobucci D, Phipps A, Bodapati A. Recommendation agents on the Internet. J Interact Market 2000;14:2–11 (Summer).
Johnson EJ, Moe WW, Fader PS, Bellman S, Lohse GL. On the depth and dynamics of online search behavior. Manage Sci 2004;50(3):299–308.
Lal R, Sarvary M. When and how is the internet likely to decrease price competition? Mark Sci 1999;18(4):485–503.
Lipsman A. The role of search in consumer buying. Research Report. comScore; 2006.
Lohse GL, Bellman S, Johnson EJ. consumer buying behavior on the internet: findings from panel data. J Interact Market 2000;14(1):15–29.
Lynch JG, Ariely D. Wine online: search costs affect competition on price, quality, distribution. Mark Sci 2000;19(Winter):83–103.
March JG. Bounded rationality, ambiguity and the engineering of choice. Bell J Econ 1978;19:587–608.
Marchionini G. Information seeking in electronic environments. New York, NY: Cambridge University Press; 1995.
Menon S, Kahn B. Cross-category effects of induced arousal and pleasure on the internet shopping experience. J Retail 2002;78:31–40.
Menczer F, Monge A, Street WN. Adaptive assistants for customized E-shopping. Working Paper. Iowa City, IA: Department of Management Sciences. University of Iowa; 2002.
Montgomery AL, Hosanagar K, Krishnan R, Clay KB. Designing a better shopbot. Manage Sci 2004;50(2):189–206.
Olson EL, Widing RE. Are interactive decision aids better than passive decision aids? A comparison with implications for information providers on the Internet. J Interact Market 2002;16(2):22–33.
Payne JW. Contingent decision making. Psychol Bull 1982;92:382–402.
Payne JW, Bettman JR, Johnson EJ. Adaptive strategy selection in decision making. J Exper Psychol, Lear Mem Cogn 1988;14:534–52.
Payne SJ, Howes A, Reader WR. Adaptively distributing cognition: a decision-making perspective on human-computer interaction. Behav Inf Technol 2001;20(5):339–46.
Perez E. Intelligent agents: it's nice to get stuff done for you. Online; 2002. p. 51–6. (May/June).
Pirolli P, Card S. Information foraging. Psychol Rev 1999;106:643–75 (October).
Reda S. Improving search engines emerges as key E-commerce initiative. Stores 2002:70–2.
Redmond WH. The potential impact of artificial agents in E-commerce markets. J Interact Market 2002;16(Winter):56–66.
Roberts JH, Lattin JM. Development and testing of a model of consideration set composition. J Mark Res 1991;28(4):429–40.
Rowley J. Product search in E-shopping. J Consum Mark 2000;17:20–35.
Saranow J. It's a match! as buyers head to the web for research, car makers are trying to make sure they find what they want. Wall Street J 2005;25:R4 July.
Smith MD. The impact of shopbots on electronic markets. J Acad Mark Sci 2002;30 (4):446–54.
Tamaki J. You be the judge; more consumers are going online to hunt for products and find good deals. Los Angeles Times 2005;3:E6 December.
Tedeschi B. Turning the online store into a multiplex. N Y Times 2005;2:4 November.
Todd P, Benbasat I. The use of information in decision making: an experimental investigation of the impact of computer-based decision aids. MIS Quarterly 1992;16:373–93 (September).
Todd P, Benbasat I. The influence of decision aids on choice strategies: an experimental analysis of the role of cognitive effort. Org Behav Human Decis Process 1994;60:36–74.
West P, Ariely D, Bellman S, Bradlow E, Huber J, Johnson E, et al. Agents to the rescue? Mark Lett 1999;10(3):285–300.
Widing R, Talarzyk WW. Electronic information systems for consumers: an evaluation of computer-assisted formats in multiple decision environments. J Mark Res 1993;30(May):125–41.