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BUYER BEHAVIOR IN PERSONALIZED SHOPPING ENVIRONMENTS

Insights from the Institute for Online Consumer Studies

1. INTRODUCTION

One of the most exciting aspects of electronic shopping environments (such as online stores) is that they allow firms to create *personalized customer interfaces*. That is, user interfaces of commercial web sites can be designed to be adaptive to the specific interests, needs, and preferences of individual shoppers at particular points in time. In principle, such personalization can yield a unique user interface for each customer, based on what the site knows, or is able to infer, about that particular shopper.

As a research group, the authors have been working on advancing our understanding of buyer behavior in such personalized electronic shopping environments. This is important from both a scientific and an applied standpoint. In terms of basic research, there is a need to develop and test theories of human decision making in personalized information environments. From a more applied perspective, it is important to understand how shoppers respond to various aspects of interface personalization.

In what follows, we discuss the key insights to date from an ongoing program of research on buyer behavior in personalized electronic shopping environments. We present selected findings from a number of experiments that we have conducted, and the collective results are based on primary data obtained from a total of more than 2,000 study participants. This research program has been carried out with the support of the Institute for Online Consumer Studies (IOCS) – a laboratory for computer-based experimental research in the area of consumer decision making.¹

The findings we present are organized around three major themes:

1. The effects of *personalized product recommendations* on various aspects of buyer behavior in electronic shopping environments.

¹ The Institute for Online Consumer Studies (www.iocs.org) is also a platform for internet-based scientific experiments in the areas of consumer behavior and human decision making.

2. The impact of the availability of *personalized product-comparison tools* on shoppers' decision processes and choice among competing online stores.
3. The roles of experience-based interface-specific user skills and interface personalization in the development of *customer loyalty*.

For each of these themes, we present insights from multiple empirical studies. We focus on the key insights from the relevant streams of work and, in the interest of brevity, refrain from discussing individual studies in great depth. However, we always cite the original papers on which particular findings are based, and encourage interested readers to refer to these sources for a much more detailed discussion. One manifestation of this approach is that we do not report specifics with respect to data analysis and hypothesis tests. Note however that, unless explicitly stated otherwise, all effects or differences reported here are statistically significant at levels well beyond conventional standards (e.g., $p < .05$ or $p < .01$).

2. PERSONALIZED PRODUCT RECOMMENDATIONS

A key feature of electronic shopping interfaces is that they can easily be personalized based on information about individual visitors' preferences. One of the most promising potential benefits of such personalization is that it allows prospective buyers to screen large sets of products very efficiently and effectively (e.g., Alba et al. 1997). A common example of personalization in the context of customer interfaces is the presentation of a set of available products in the form of a list in which products are sorted in descending order of their predicted attractiveness to the shopper. We refer to the arrangement of products in this fashion as *personalized product recommendations* (PPRs). Some real-world examples of PPRs include consumer product recommendations based on other buyers' behavior (e.g., amazon.com) and on consumers' explicit input regarding their own preferences (e.g., activebuyersguide.com). The research findings reported here pertain to the latter type of PPRs.

In our research, we have experimentally examined the effects of such personalized recommendations on buyer decision making. In this section we report on some of the advantages and disadvantages of PPRs to buyers. The main results cover three related areas. First, at the decision outcome level, we find that shopping with PPRs tends to yield important benefits to buyers, in particular in terms of search cost reduction and improved decision quality (Häubl and Trifts 2000). Second, at the decision process level, our results show that PPRs significantly affected several aspects of the buyer search process (Dellaert and Häubl 2003; Häubl and Dellaert 2003). We have found that, at any given stage of buyers' searches through a lists of products, their decisions whether or not to continue the search and their choice of their most preferred product are affected by the presence of PPRs. Third, our research shows that the preference elicitation algorithms used to generate PPRs affect buyer product preferences, and that this influence can persist into future purchase decisions that buyers make, even when they are shopping without the assistance of PPRs at that point (Häubl and Murray 2003).

2.1 Assisting Consumers Through Personalized Product Recommendations

In research designed to examine the benefits to buyers of receiving PPRs, Häubl and Trifts (2000) conducted a large-scale experiment in which consumers were asked to shop for a backpacking tent and a mini stereo system in an (experimental) online store. A total of 54 products were available in each product category. Participants were assigned randomly to one of two experimental conditions – to shop either with or without PPRs. The recommendations in the experiment were based on subjective preference information provided by the participants in terms of six attributes for each product category. This information was elicited from all participants, but only in the PPR condition was it used as a basis for providing recommendations to buyers. In the PPR condition, products were sorted in descending order of attractiveness to the buyer. To make the task more consequential, all participants entered in a lottery in which they could win one of the two products they selected in the experiment plus a cash prize equal to \$500 minus the price of the product they selected. The analysis involved a comparison of buyers' decision-making effort and decision quality across the PPR and No-PPR conditions.

The results of the experiment demonstrated that, with the assistance of PPRs, buyers were able to make decisions with significantly less effort than they did without such assistance. In particular, participants who shopped without PPRs looked at the descriptions of an average of 11.65 products, while those who did receive PPRs inspected only 6.58 alternatives on average (see Figure 1). That is, this type of personalization of the customer interface reduced the extent of product search that consumers engaged in by almost 50 percent.

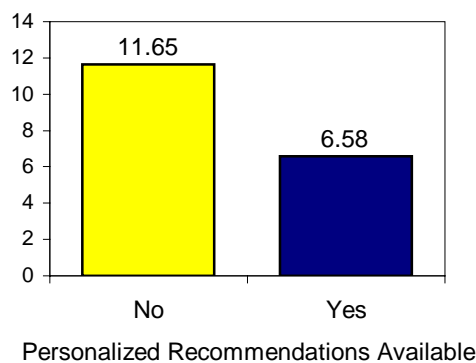


Figure 1.

Search Effort: Number of Products for Which Detailed Information was Inspected

Source: Häubl and Murray (2003), based on Häubl and Trifts (2000)

In addition to drastically reducing consumer search effort, the PPRs also led shoppers to make substantially better purchase decisions. For example, about 65 percent of the study participants who shopped without the assistance of PPRs chose

one of six target products that had been designed to be objectively superior to all other available products (see Häubl and Trifts 2000 for details). In comparison, 93 percent of those consumers who had received PPRs ended up choosing one of these six alternatives, thus making an objectively good purchase decision (see Figure 2). In sum, these results demonstrate not only that PPRs can benefit consumers, but that they may do so by both reducing the amount of effort it takes a consumer to make a purchase decision *and* improving the quality of these purchase decisions.

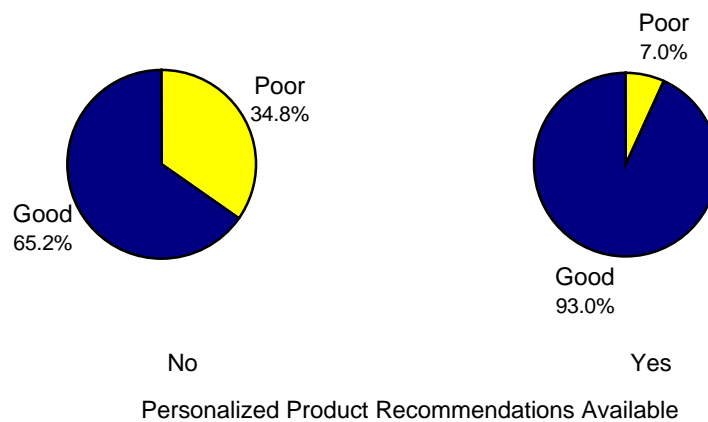


Figure 2.
Decision Quality: Choice of Product
Source: Häubl and Murray (2003), based on Häubl and Trifts (2000)

2.2 Personalized Product Recommendations and Consumer Search Processes

We further investigated these decision-outcome effects of PPRs in research that explored the more detailed process of buyers' step-by-step decisions when shopping with the assistance of PPRs (Dellaert and Häubl 2003). In general, PPRs present buyers with a decision environment that is considerably different from more traditional settings such as retail stores or retail catalogues. Understanding the detailed decisions that buyers make when going through a list of PPRs can help explain buyers' product choices and decision effort, as well as how these outcomes may change depending on the particular technology used for generating PPRs.

In our research, we conducted a controlled computer-based experiment in which participants were randomly assigned to either a condition with PPRs or one without PPRs. Participants shopped for a product in one of two categories – mini stereo systems or weekend holiday home rentals – depending on which of these product categories they had greater interest in. In this study, all participants provided subjective preference input in terms of six product attributes and price.

Subsequently, they were presented with a list of 500 hypothetical products. In the PPR condition, the products were listed in descending order of the shopper's anticipated preference. In the No-PPR condition, the list represented a randomized ordering of the products. Participants were asked to search for as long as they liked, and to eventually select their most preferred product from the list. The participants in this study were members of a large ongoing consumer panel in the Netherlands.

We examined various aspects of consumers' product-search and choice behavior in connection with PPRs. First, at the level of overall decision outcomes, we observed benefits of the presence of PPRs similar to the ones discussed above. In addition, we obtained interesting results about buyers' responses to PPRs in terms of their decision-making process. In line with the normative economic theory of search (e.g., Weitzman 1979), we observed that shoppers tended to search less if the decline in product utility in the list of recommendations was steeper, i.e., we found that buyers ended their search sooner if there was less to be gained from continuing their search through the list of recommended products. We also found that, as the level of random noise in the product recommendations given to them decreased (i.e., as the quality of the PPRs improved), buyers were more inclined to stop searching.

Another finding from the Dellaert and Häubl (2003) study is that PPRs increased the degree to which consumers relied on heuristics when making their step-by-step decisions in searching through the list of recommended products. A key explanation for this finding appears to be that the cognitive complexity, or difficulty, of making product comparisons between recommended products is, on average, higher than the complexity of comparing a random product from a list with the most attractive product a person has encountered in their earlier search of the list so far. The intuition behind this finding is that it is difficult for a consumer to determine which of two products that are approximately equally attractive, but at the same time differ on several of their attributes, is the preferred one (c.f. Shugan 1980).

2.3 Influencing Consumers Through Personalized Product Recommendations

Yet another area of our research (Häubl and Murray 2003) has addressed the question of whether the particular nature of the process by which PPRs are generated might influence consumers' product choices, and perhaps even their long-term preferences, in a category. The key manipulation in this study was that the process by which PPRs were generated was selective in that it was based on only a subset of the relevant product features. We examined this in the context of consumers' preferences for backpacking tents. Pre-tests had indicated that most consumers consider two product features, a tent's durability and its weight, to be of greatest importance in this product category. During the preference-elicitation phase of the PPR process, study participants were asked to express their subjective importance of only one of these two primary product attributes along with that of several other attributes, and the subsequent PPRs were based on consumers' preference in terms of that set of attributes. To counterbalance this manipulation

with the specific attributes used, the PPR process included durability (but not weight) for half the subjects and weight (but not durability) for the other half.

Participants were provided with PPRs based on their subjective preference, as revealed during the preference-elicitation phase. They then completed a simulated shopping trip for a backpacking tent. Their task was to select their most preferred product from a carefully designed set of 16 backpacking tents that was “efficient” in the sense that better levels of one attribute tended to be offset by worse levels of another (i.e., negative inter-attribute correlation). In particular, the product assortment was constructed such that none of the products had the most desirable level of both primary attributes. Two of the tents had the best level of durability (but not of weight), two other products had the most attractive level of weight (but not of durability). As a result, shoppers were forced to choose which of the two primary attributes they would obtain the most desirable level on.

The results of this study illustrate a powerful effect of PPRs on consumers’ choices. If the selective inclusion of attributes in the PPR process had no influence on purchase decisions, the extent to which an attribute drives product choice would be independent of whether or not it was used in generating the PPRs. However, 71 percent of the participants in this study selected a product that was superior on the primary attribute that had been included in the process of generating the PPRs, while only 29 percent selected an alternative that was superior on the other primary attribute – i.e., the one that had not been included in the PPR process. Thus, simply including a particular product feature in the process of generating PPRs caused that feature to become more important in consumers’ purchase decisions.

After performing several unrelated tasks, the same participants were asked to complete a series of preferential-choice tasks. No PPRs were provided at this point, and subjects were asked to choose their preferred product from each of twelve sequentially presented pairs of backpacking tents.² Interestingly, we found that consumers’ choices were still mostly driven by that primary attribute that had been included in the PPR process during the earlier shopping task, irrespective of whether that attribute was durability or weight. This demonstrates that the influence of PPRs on consumer preferences can persist into future shopping episodes, even ones taking place in environments that do not involve any form of personalization.

2.4 Section Summary

In conclusion, our research to date has shown that PPRs can significantly improve buyers’ decision-making both in terms of quality and effort required. We also conclude that PPRs provide some new risks for error in buyer decisions. In particular, we have found that buyers may rely more on decision heuristics when faced with PPRs and that a buyer’s preference structure may be affected

² The first six of these pairs included the tent that the subject had selected in the earlier shopping task along with different, previously unavailable alternatives. The final six choice sets consisted entirely of backpacking tents that had not been available in the initial shopping task.

significantly by the way in which his or her preferences are elicited in the PPR-process.

3. PERSONALIZED PRODUCT-COMPARISON TOOLS

The facilitation of side-by-side product comparisons is another aspect of personalization that our research has addressed. In this section, we examine the effects of two types of personalized comparative product displays on consumer decision making in electronic shopping environments. First, we discuss relevant findings by Häubl and Trifts (2000) on the effects of using a *comparison matrix*, an interactive tool that organizes information about considered products in an alternative-by-attribute matrix, on various aspects of consumer decision making. Basic forms of this type of tool are implemented on many online shopping sites, where they are often referred to as (electronic) shopping carts. Second, we present insights from a study by Trifts and Häubl (2003), which focused on the effects of the provision of direct access to *uncensored competitor price information* by an online retailer on consumer preference for that firm relative to competing vendors. While there are many third-party tools for systematic cross-vendor comparisons (e.g., shopbots), the number of such tools that are located *within* a retail site and provide personalized comparisons with competitors' offerings is limited (but see, e.g., www.progressive.com). Our empirical evidence suggests that both of these types of personalized product-comparison tools tend to be highly beneficial to shoppers and can, therefore, be used effectively by vendors in managing their customer relationships.

3.1 Comparison Matrices

A *comparison matrix* (CM) is a tool designed to assist consumers in making side-by-side comparisons among a set of considered products in an electronic shopping environment. The study by Häubl and Trifts (2000) provides insights into the effects of using a CM on various aspects of consumer decision making, particularly the quality and the efficiency of purchase decisions. The central thesis of this research is that such a personalized decision aid will benefit consumers by allowing for a shift in emphasis from memory-based to stimulus-based purchase decisions in the sense that it becomes less important for consumers to remember specific pieces of attribute information about products (see Alba et al. 1997). Overall, the empirical evidence reported by Häubl and Trifts (2000) supports this prediction.

The CM was implemented as an interactive display format in which product information was presented in an alternative-by-attribute matrix. It was designed to facilitate side-by-side comparisons among selected products. While viewing detailed information about an alternative in the electronic shopping environment, shoppers could choose to have that product added to their personal CM. (It was also possible to delete products from the CM). The display format was interactive in that

consumers were able request at any time that all products in the CM be sorted by any attribute.

While Häubl and Trifts (2000) examined the impact of the availability of a CM on several aspects of consumer decision making, we focus here on (1) the set of products that a shopper considered seriously for purchase and (2) the quality of the consumer’s ultimate purchase decision. Participants were assigned randomly to one of two experimental conditions – to shop either with or without the assistance of a CM. They then shopped for both a backpacking tent and a mini stereo system in an electronic shopping environment, with 54 products available in each of the two categories. The product choices were tied to a lottery incentive that was designed to make the experimental shopping task more consequential and, as a result, increase the validity of the findings by (see Häubl and Trifts 2000). After completing their purchases, all participants were presented with a list of the products they had inspected in each of the two categories and asked to indicate which of these products they had considered seriously before making their purchase decisions (i.e., their “consideration sets”).

The results show that consumers who had access to a CM had smaller consideration sets than those who shopped without the assistance of such a product-comparison tool. The mean number of products considered seriously for purchase was 3.77 when participants did not have access to a CM, and only 2.19 when they did (see Figure 3).

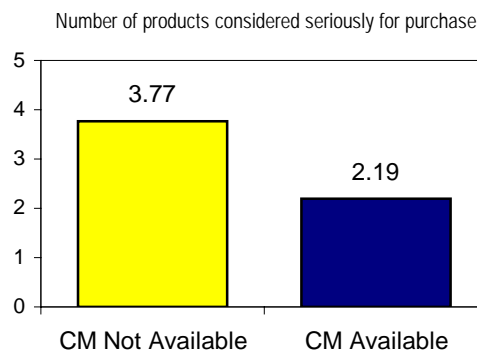


Figure 3.
Comparison Matrix and Consideration Set Size

Based on Häubl and Trifts (2000)

In addition, the availability of a CM led to a higher quality of consumers’ consideration sets, as measured by the proportion of seriously considered products that are “nondominated” – i.e., that are in the set of six target products designed to be objectively superior to all other available products (see also above). The mean share of nondominated products in shoppers’ consideration sets was 57.2 percent

without a CM, and 68.4 percent when a CM was available (see Figure 4). Thus, the availability of a CM caused the set of products that were considered seriously for purchase to be smaller, but of higher quality.

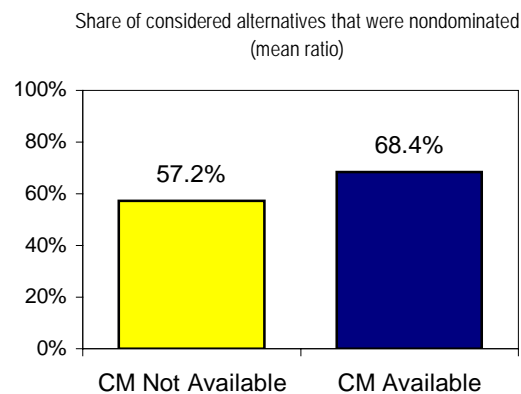


Figure 4.
Comparison Matrix and Consideration Set Quality

Based on Häubl and Trifts (2000)

The CM also had a positive effect on the quality of shopper's purchase decisions and on their confidence in their product choices. Consumers who were able to use a CM on their shopping trip were significantly less likely to abandon their initial choice during a subsequent switching task than were those who had no such assistance. (Switching to another product during this task was viewed as an indicator of poor decision quality.) The share of participants who switched to another, previously available, product was 44 percent for those who shopped without a CM and only 38 percent for those who had access to a CM during their shopping trip (see Figure 5). The availability of a comparison matrix also led to a small increase in the share of subjects who purchased a nondominated alternative, a second measure of decision quality, but this effect was not statistically significant.

In sum, the results of the study by Häubl and Trifts (2000) demonstrate that the availability of personalized product comparisons through a CM allows consumers to be more focused in their purchase decision processes (i.e., to have smaller consideration sets), to selectively consider more attractive products (i.e., to have consideration sets of higher quality), and to make better purchase decisions.

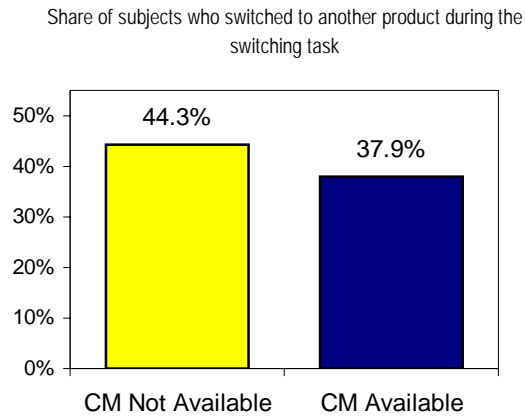


Figure 5.
Effect of Comparison Matrix on Decision Quality

Based on Häubl and Trifts (2000)

3.2 Facilitating Access to Competitor Information

Another stream of research on personalized product-comparison tools focuses on a retailer's provision of direct access to *uncensored competitor price information*. Due to the dynamic character of electronic shopping interfaces, online retailers are able to provide such comparative information about their competitors interactively (i.e., in response to a consumer's actions), directly (i.e., without filtering or censoring), and in a highly personalized manner (i.e., only for the specific products that a shopper is interested in). If the technology that enables cross-vendor price comparisons were incorporated into an online retailer's site, as opposed to shoppers having to use a third party intermediary (e.g., a shopbot), consumers should attribute the benefits of using this comparison tool to the retailer. In particular, consumers may infer that a vendor that provides access to uncensored competitor price information wishes to assist them in making a well-informed purchase decision.

Trifts and Häubl (2003) examined the effects of an online retailer's provision of such access on consumers' perceived trustworthiness of, and long-term preference for, that vendor. They propose that the act of providing such information can be conceptualized as a type of market signal (Spence 1974) that conveys information about unobservable qualities of the firm to potential customers (Boulding and Kirmani 1993; Kirmani and Rao 2000). By reducing the information asymmetry between the firm and its customers, such a signal is a type of communication openness that should have a positive effect on trust (Morgan and Hunt 1994; Anderson and Narus 1990; Anderson and Weitz 1989). Furthermore, since providing

direct access to uncensored competitor information would only be a profitable signal for sellers that occupy an objectively attractive market position³ (Boulding and Kirmani 1993), consumers may infer that a retailer that facilitates such access to uncensored information about its competitors' prices is attractive, and prefer it over one that does not.

In their paper, Trifts and Häubl (2003) also propose that consumers will make different causal attributions (Jones and Davis 1965; Kelley 1973) as to the motivations of the firm facilitating such comparisons depending on the firm's objective market position. That is, if no external factors can account for such actions, consumers will seek to explain the vendor's actions by examining its internal disposition (Prabhu and Stewart 2001). They propose that there will be a moderate range of objective market positions in which the positive effect of providing access to competitor price information on consumer preference is strongest, because consumers are likely to infer more altruistic motivations on the part of a moderately attractive firm, compared to one that occupies a clearly superior objective market position.

The study involved consumers' evaluations of an online bookstore. Participants were told that they had been assigned to one of several retailers, and that their task was to evaluate it based on a search for a sample of books. In fact, all subjects completed the task for the same store and considered an identical set of books. Participants were required to search for eight specific book titles (provided by the experimenter) in order to form an overall impression of the retailer. In addition to the focal vendor's online store, participants also used an independent source of comparative price information, which was provided by the experimenter and described as an unbiased and accurate tool for online price searches. Upon completion of each book search within the focal retailer's store, subjects were automatically transferred to a different web site, on which an alphabetical list of seven retailers carrying this book — the focal retailer plus six competitors — was generated dynamically. They were asked to check each vendor's price for the book, which required clicking on the name of each store on the list. For each of the eight books, participants were asked to record, on a paper form, the focal retailer's price and whether or not each competitor's price was lower than, equal to, or higher than the focal vendor's price.

Subjects were randomly assigned to one of six experimental conditions in a 2 (provision of access to competitor information) × 3 (objective market position) between-subjects design.

The *provision of access to uncensored competitor price information* by the focal online retailer (no or yes) was manipulated in the following manner. In the *no-access* condition, only information about the focal vendor's own offering was available. By contrast, in the *access* condition, that retailer also provided a list of all major online vendors that offered the target book at the lowest available price that day. Whether or not the focal retailer itself was included in this list for a particular book depended on its market position (see below). Participants were told that the

³ For example, vendors who offer (1) identical products at lower prices than their competitors or (2) objectively superior products at comparable prices.

information provided by the focal retailer was obtained in an automated, systematic search of the major competitors' online stores, and that this information was updated daily.

The *objective market position* of the focal retailer (unfavorable, moderate, or favorable) was manipulated by varying the latter's prices for the eight products, while holding the prices of the six competitors constant. The *favorable* market position was constructed such that the focal vendor had the lowest available price for each of the eight products. In each instance, the retailer was tied for the lowest price with three of its competitors. In the case of a *moderate* market position, the focal retailer was tied for the lowest price for four of the products, but was dominated on price by some competitors in connection with the other four products. The *unfavorable* market position was constructed such that the focal vendor was dominated on price by some competitors in connection with all eight products. In the three treatments of objective market position, the focal online retailer's average price across the eight product searches was either lower than that of any competitor (favorable), equal to the market average (moderate), or higher than that of any competitor (unfavorable).

After the eight price searches, participants were asked to rate their perceived trustworthiness of and preference for the focal online retailer (using 0-to-10 scales). They then completed two pairwise choice tasks in which they were asked to choose between the focal retailer and one of the two strongest competitors for their next book purchase. For each choice set, subjects also indicated the strength of their relative preference by stating how many percentage points of a price discount the less preferred retailer would have to offer them to make that vendor equally attractive to the one they chose. These decisions were tied to a probabilistic monetary incentive designed to increase the validity of the findings by making the shopping task more consequential (see Trifts and Häubl 2003 for details).

Facilitating access to competitor information increased the perceived trustworthiness of the focal online retailer – the mean ratings for the no-access and access conditions were 5.93 and 6.83, respectively. Moreover, while this effect on perceived trustworthiness was strong when the retailer's objective market position was either unfavorable or moderate, it was much smaller, and not statistically significant, for the objectively superior vendor (see Figure 6).

Consumers' choice of vendor was also affected by whether or not the focal online retailer provided access to uncensored information about its competitors' offerings. In particular, when the focal vendor was moderately attractive in terms of objective market position, it was chosen by a much greater number of shoppers for their next book purchase in the access condition (44 percent) than in the no-access condition (15 percent). The results of a mediation analysis indicate that the provision of access to competitor information affects store choice almost entirely through its effect on perceived vendor trustworthiness (see Trifts and Häubl 2003 for details). By contrast, facilitating access to competitor information did not have a significant effect on store choice at either the unfavorable or the favorable level of objective market position (see Figure 7).

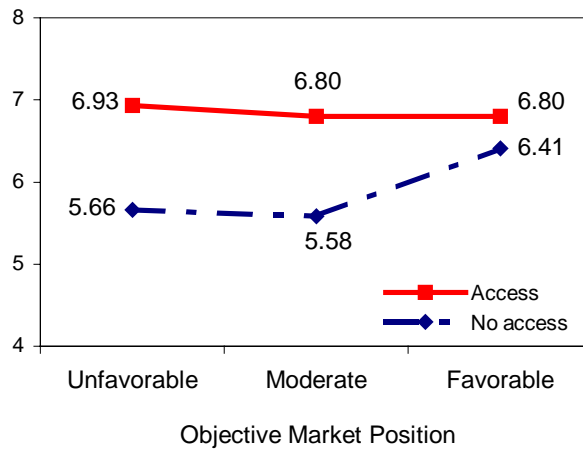


Figure 6.
Perceived Trustworthiness of Focal Retailer
 Source: Trifts and Häubl (2003)

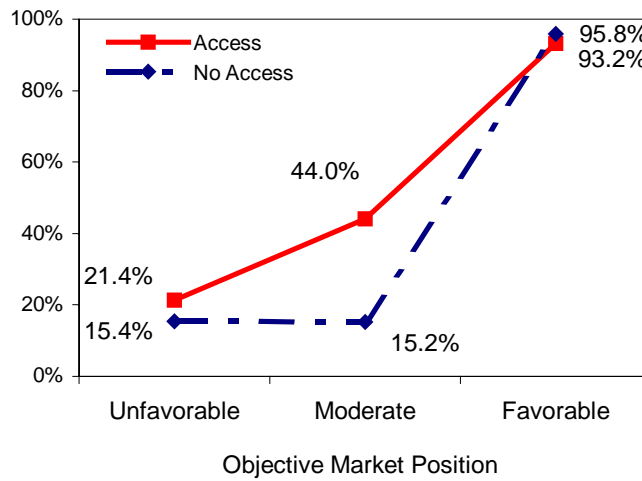


Figure 7.
Choice Share of Focal Retailer
 Source: Trifts and Häubl (2003)

In addition to selecting their preferred vendor, participants also indicated the strength of their preference by stating how many percentage points of price discount the less preferred retailer would have to offer them to make that vendor equally attractive to the one they did choose. These percentages were converted into a graded-paired-comparison score through multiplication by either +1, if the focal retailer was preferred, or -1, if the competitor was preferred. The resulting score represents the extent of relative preference for the focal online retailer.

The findings in terms of relative preferences corroborate those based on raw choices. Providing access to uncensored competitor information had a strong positive impact on consumer preference for the focal vendor when the latter's objective market position was moderate. In this case, relative preference for the focal retailer was stronger by an average of 8 percentage points (of price discount) when it facilitated access to competitor information than when it did not. A mediation analysis shows that providing such access influences store choice almost entirely via its effect on perceived retailer trustworthiness. Access provision had no effect on relative vendor preference at either of the extreme levels of the focal retailer's objective market position (see Figure 8).

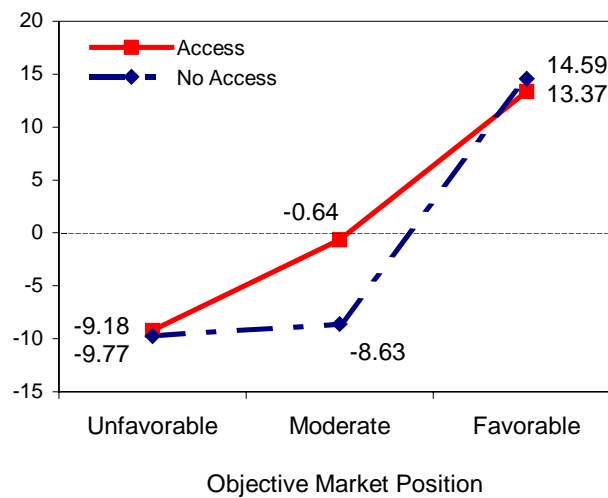


Figure 8.
Relative Preference for Focal Retailer

Source: Trifts and Häubl (2003)

3.3 Section Summary

The findings presented in this section indicate that the availability of personalized product-comparison tools can have a profound impact on consumer behavior in electronic shopping environments. In particular, our research on comparison matrices shows that the presentation of product information in interactive alternative-by-attribute displays facilitates in-depth product comparisons and benefits consumers by helping them focus in on a smaller set of more attractive products and, most importantly, make better purchase decisions. Moreover, we have demonstrated that online retailers can benefit significantly from providing shoppers with personalized access to uncensored information about competitors' offerings, in terms of both perceived trustworthiness and consumer choice.

4. PERSONALIZATION AND CUSTOMER LOYALTY

A key benefit to vendors of providing buyers with a personalized shopping environment is the latter's potential to increase customer loyalty. This is no small matter considering that in the online world the competition is "only a click-away." In fact, early internet pundits argued that the ease with which online shoppers can switch from one electronic store to the next would lead to a state of intense competition that would drive prices and profits to rock-bottom levels (Bakos 1997).

However, recent research has indicated that, over time, online consumers can grow to be very loyal shoppers (Brynjolfsson and Smith 2000; Johnson, Bellman, and Lohse 2003). This occurs because, even though it is easy to navigate from one internet vendor to the next, buyers prefer to shop using interfaces that they are experienced with. In particular, once a buyer has learned to use one electronic interface, the time and effort required to make a purchase using that interface is greatly reduced. As a result, buyers are hesitant to switch to another interface where they would have to learn new skills and invest more time and effort to complete the same task. This type of loyalty is often referred to as *cognitive lock-in*, and it differs significantly from traditional notions of loyalty because it does not require a positive attitude towards the product, high levels of satisfaction with the product, or the objectively superior product functionality. Instead, lock-in as a result of brand-specific training depends only upon the relative cost, in terms of time and effort, of learning to use a competitor.

The *principle of least effort* (Zipf 1949) has long recognized that people attempt to achieve the results they desire with a minimum amount effort. Having repeatedly practiced completing a task, such as buying a CD online, consumers acquire skills and knowledge that allow them to complete the task with a minimum amount of effort by merely repeating what they did in the past. Specific skills have been acquired that allow buyers to be more efficient when using the interface that they have previously used. As a result, the consumer is able to make similar purchases in the future with less effort, which creates a cost of switching. When the cost of switching is high enough, the buyer becomes *locked in* to the incumbent interface,

unable to switch to competitors without paying a substantial price in terms of new skill acquisition (Shapiro and Varian 1999; Wernerfelt 1985).

For example, an experienced typist is able to automatically recognize words and execute the appropriate keystrokes without having to consciously control the required individual cognitive and physical processes (Salthouse 1986). As the typist becomes more skilled, and more of the underlying processes become automatic, the time required to type a page decreases. In *The Psychology of Human-Computer Interaction*, Card, Moran, and Newell (1983) describe the learning process that a typist goes through. They detail the speed with which novice users gain a moderate level of skill, and then continue to improve at a decreasing rate. Interestingly, this type of learning can be linked to the development of a global preference for the QWERTY keyboard. In fact, the prevalence of typing skills that are specific to the QWERTY keyboard has been cited as the explanation for QWERTY's continued market dominance, even though evidence that it is an inferior keyboard layout has been around for almost 60 years (U.S. Navy Department Study 1944).

In the realm of online shopping, the ability to complete purchases quickly has been cited as one of the primary advantages of the internet. Bellman, Lohse, and Johnson (1999) surveyed 10,180 internet users on a number of issues related to web-based activity. With regards to internet shopping, they concluded that "consumers shop online or use online services to save time" and that "convenience, rather than cost savings, may be a key benefit offered by successful online stores (p. 38)." It is not surprising then that a large portion of internet users can be described as "simplifiers" – i.e. users whose primary goal is to simplify their lives and save themselves time. In fact, simplifiers account for 29 percent of internet consumers and over 50 percent of all online transactions (Forsyth, Lavoie, and McGuire 2000).

4.1 *The Importance of Skill Transferability*

From the customer's perspective, rather than searching the entire marketplace in an attempt to make the best possible (utility-maximizing) decision, it is often more efficient to repeat behaviors that previously led to satisfactory outcomes (Stigler and Becker 1977). This is true because for the vast majority of behaviors, repetition results in improved performance. In fact, psychologists studying the effects of repetition have found that it results in a type of learning that consistently adheres to the *power law of practice*: the time taken to complete a task decreases as a power function of practice (for a review, see Newell and Rosenbloom 1981). For a buyer who repeatedly uses one interface to make purchases, the power law of practice means that with each additional experience more skill is acquired, and with more experience the buyer continues to improve, although at a decreasing rate. As the buyer moves along this learning curve, the utility of the interface, which s/he is becoming increasingly skilled at using, increases.

As a result, developing skills specific to one interface results in a preference for that interface relative to other, competing interfaces. Wernerfelt (1985) argues that non-transferable user skills have much the same impact on consumer choice as

search costs such that “either user skills or search costs can support long-lived price differences in markets with rational consumers, and such price differences are bigger for bigger user skills and higher search costs” (p. 385). Moreover, he contends that the development of such user skills reduces the consumer’s incentive to switch between alternatives, or to search for alternatives, even in environments where the cost of search is zero. In essence, the user-skills theory of brand loyalty asserts that switching costs increase, and the probability of continued search decreases, as a function of the development of non-transferable skills.

A growing body of research examining human behavior in electronic environments supports the user-skills theory, and finds that the development of non-transferable skills can have a strong effect on buyer preferences (Johnson et al. 2003; Murray and Häubl 2002, 2003). In a recent laboratory experiment, Murray (2003) randomly assigned participants to one of two experience conditions. The conditions were defined by the amount of practice that each participant would have with an incumbent interface (Figure 9) before being exposed to a competitor interface (Figure 10). In one condition, respondents used the incumbent interface to complete 1 task before using the competitor, and in the other condition respondents used the incumbent interface 6 times before being exposed to the competitor. After using the competitor interface, all participants were required to choose which of the two interfaces they would like to use for an additional trial, and to rate the extent of their preference for the interface that they had chosen. A graded-paired-comparison (GPC) measure was constructed from the choice and preference data. For a choice set consisting of two interfaces (the incumbent and the competitor), the GPC variable (interface choice plus strength of preference for the chosen alternative rated on a 10-point scale) was coded as a zero-centered 21-point scale with end points -10 = “very strongly prefer the competitor” and +10 = “very strongly prefer the incumbent.”

The relative preferences between the two experimental groups are illustrated in Figure 11. Having completed one task with the incumbent interface resulted in no difference in preference between the two groups. However, after completing 6 tasks with the incumbent interface, a strong preference for the incumbent has developed, even though the only actual difference between the two interfaces is radio buttons or pull-down menus are used for navigation. The differences between competing interfaces in the real world are typically much greater.

In a study of consumer behavior on the World Wide Web, Johnson et al. (2003) found that online shopping sites that are easier to learn to use (i.e., have the steepest learning curves) exhibit the highest rates of purchasing. These authors used data from a panel of 19,466 online consumers. For each household in the panel, software was installed on their home PC that monitored all web-browsing activity. They found that the power law of practice can accurately account for the time consumers spend visiting a site, and that the easier a website is to learn to use the higher the probability of purchase. Based on this result, one of the most valuable assets that a web site can develop is a navigation design that allows for the rapid learning of non-transferable user skills – i.e., skills that are specific to its interface.



Figure 9.
Incumbent Interface from Murray (2003)

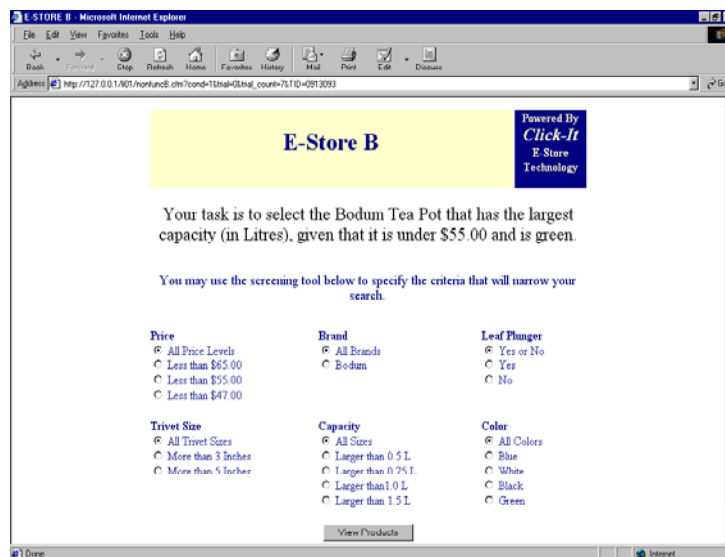


Figure 10.
Competitor Interface from Murray (2003)

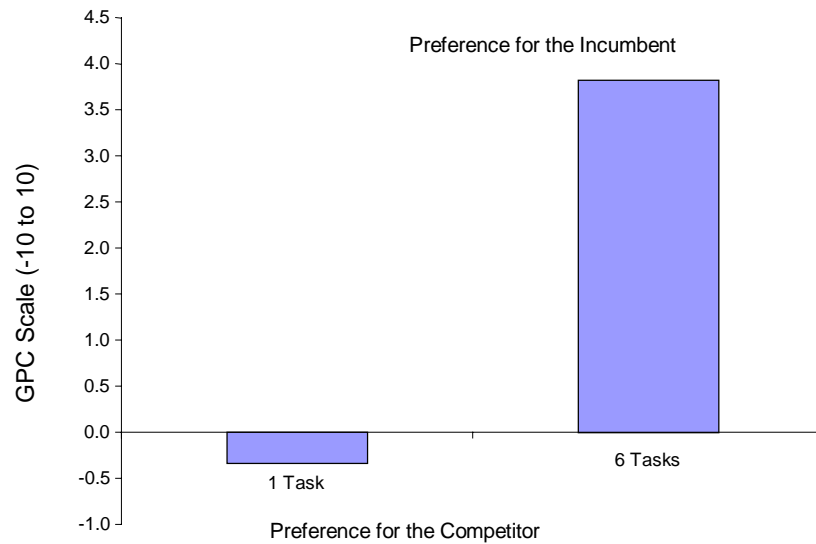


Figure 11.
Number of Tasks Completed with Incumbent and Interface Preference
 Source: Murray (2003)

4.2 *The Role of Personalization*

Given the emphasis that online buyers place on the ability of electronic interfaces to save them time and simplify their lives (Bellman et al. 1999; Forsyth et al. 2000), it should not be surprising that personalization has the potential to further enhance customer loyalty. One of the key strengths of personalization is its ability to reduce the time and effort required for the buyer to make a purchase decision (Häubl and Trifts 2000). This suggests that, by personalizing an electronic shopping environment, the vendor should be able to increase the switching cost for the customer, because personalization results in an even greater reduction in time and effort than experience with an interface alone could provide.

The battle between Barnes and Noble and Amazon.com over Amazon's "one-click" technology is a good example of how important personalization is in increasing ease of use and improving customer loyalty among commercial web sites (Cox 2002). The one-click feature personalizes the purchasing process for Amazon's customers by allowing them to store their credit card and shipping information. When customers find an item that they wish to purchase, they can simply use the one-click button to activate the automated checkout process. This, of course, substantially reduces the time and effort required to make a purchase at Amazon's site, and it has been successful enough that when Barnes and Noble attempted to

implement a similar technology in their online store, Amazon initiated a patent infringement lawsuit. As a result, the rather simple combination of web technologies that made “one-click” viable creates a personalized interface that adds substantial value to the customer’s shopping experience and underlies a business process that is a competitive advantage for Amazon.com.

4.3 Evidence from Consumer-Agent Interaction

Recent research examining the interaction between consumers and electronic agents that produce personalized product recommendations provides some additional insight into the value that a personalization tool can provide to a buyer over repeated shopping trips. The findings of a study by Häubl and Murray (2003) are relevant in this regard. The authors compared two groups of participants in a computer-based shopping experiment. One group was assisted by an electronic recommendation agent on each of eight shopping trips, while the other group completed all eight trips without any such assistance.

The data from this experiment that are most pertinent to this discussion are the measures of how effective the personalized environment (i.e., the condition in which participants were assisted by a recommendation agent) was in reducing consumers’ search effort over the 8 shopping trips as compared to the condition without personalization (i.e., without agent assistance). In addition, it is interesting to examine whether or not additional experience results in any additional reductions in effort. The key measure of expended search effort was the number of products for which a shopper inspected detailed product information before making a purchase decision. A total of 16 products were available on each of the 8 shopping trips. Figure 12 shows the mean number of products inspected on each shopping trip in the two conditions.

The personalized product presentation format provided by the recommendation agent resulted in a substantial reduction in the extent of consumer product search. In addition, shoppers’ search effort was further reduced with increasing experience. Given the preceding discussion of the powerful impact that ease of use has on buyer behavior, personalization technologies clearly have significant potential to enhance the ability of commercial web sites to cultivate customer loyalty in a systematic manner. As a result, the capability to create personalized shopping environments is of fundamental value to e-commerce firms.

4.4 Section Summary

The focus of this section has been on the development of customer loyalty as a function of shoppers’ repeated interaction with an electronic shopping environment, and on the significant potential of personalization to further increase the loyalty of shoppers to particular online store. We have highlighted the central role of interface-specific user skills as a basis for customer loyalty, and have discussed relevant empirical evidence to support our ideas.

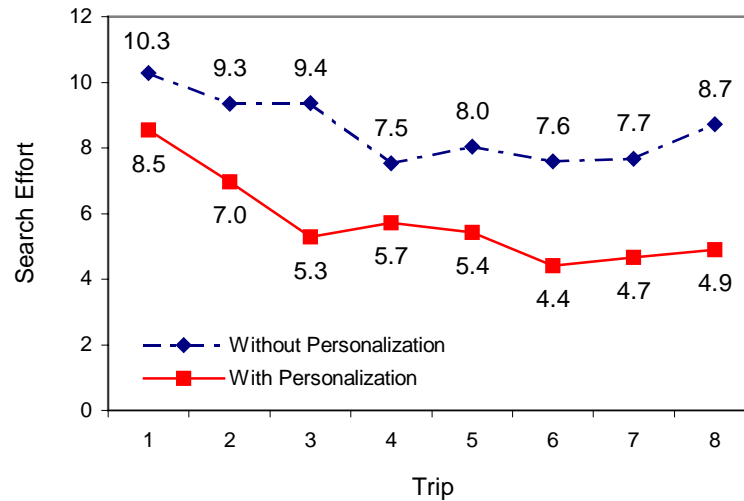


Figure 12.
Information Search Effort With and Without Personalization

Source: Häubl and Murray (2003)

5. CONCLUSION

We have provided an overview of the findings from a research program that is aimed at enhancing our understanding of buyer behavior in personalized electronic shopping environments. Based on empirical evidence from a several experiments, we have discussed insights relating to different forms of personalization, particularly tools that generate product recommendations based on customer preferences and tools that facilitate side-by-side comparisons of products. We have examined the effects of these different technologies on various aspects of consumer behavior, including (1) the overall extent of product search, (2) aspects of the step-by-step decision processes involved in product search (3) the focusing on a small number of attractive products, (4) the quality of consumers ultimate purchase decisions, (5) the susceptibility of consumer preferences to external influence, (6) the perceived trustworthiness of online vendors, (7) the acquisition of interface-specific user skills, and (8) the development of customer loyalty. The findings we have reported show that the personalization of shopping interfaces can have tremendous benefits for both buyers and sellers.

Our goal has been to provide a concise overview of the insights from our ongoing research program. We have focused on the key findings, and have deliberately provided only a degree of detail about individual studies that we deem necessary for readers to appreciate our results. For a much more detailed discussion

of the theoretical ideas, research methods, and results pertaining to specific studies, we refer interested readers to the original papers, which are cited here.

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