

The Fiction of No Friction: A User Skills Approach to Cognitive Lock-In

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In general, economic models of search predict that increased search leads to lower prices and reduced consumer loyalty. The ease with which an on-line shopper can travel from one internet retailer to the next has raised the spectre of internet retailing as a medium of *frictionless commerce* (Bakos 1997; Lewis 1997). Given the potential for such hyper-competition and the rapid growth of on-line shopping, it is of significant interest to marketers to better understand the character and the extent of consumer loyalty in electronic marketplaces.

Contrary to popular opinion, on-line shopping has not lived up to its billing as a frictionless marketplace. Although the potential to reduce costs related to information search and product comparison clearly exists in electronic markets (Häubl and Trifts, 2000), recent research suggests that online consumers are engaging in only limited search and comparison shopping. For example, Johnson, Moe, Fader, Bellman and Lohse (2000) find that the average number of on-line stores searched before a CD is purchased is 1.1, and that 70% of CD shoppers and 70% of book shoppers are loyal to a single site. Similarly, Brynjolfsson and Smith (1999) find that on-line consumers tend to make purchases from higher priced vendors even for homogeneous products such as CDs and books. The early evidence from on-line shopping seems to suggest that cyberspace is far from frictionless.

An emerging stream of research attributes this type of on-line loyalty to a phenomenon known as *cognitive lock-in* (Johnson, Bellman, and Lohse 2000; Zauberan 2001). Cognitive lock-in refers to the idea that, even in situations where search costs are low, and searching results in consumers paying a lower price, consumers will not shop around. Instead, they will

return to the site with which they are experienced. This type of loyalty has been explained as the result of the development of user skills (Stigler and Becker 1977; Wernerfelt 1985), which make an incumbent site more useful, even though, given the same experience with another site, the latter would be equally useful (Johnson, Bellman, and Lohse 2000).

This paper investigates the impact of the development of user skills on consumer choice among interfaces for electronic shopping. Our results indicate that the development of interface specific user skills can increase consumers' preference for that interface relative to competing interfaces. In addition, an exploratory analysis of the data suggests that the user skills construct consists of two dimensions – transferable and non-transferable skills – that work in opposing directions and determine the degree to which a consumer will become locked-in to a specific interface. The paper concludes with a general discussion of the role of skill acquisition in the development of consumer loyalty.

Brand Loyalty and User skills

In their 1977 paper Stigler and Becker argue that “the costs of searching for information and of applying the information to a new situation are such that habit is often a more efficient way to deal with moderate or temporary changes in the environment than would be a full, apparently utility-maximizing decision (p. 82).” In addition, they suggest that such habits develop because the consumer has invested time and effort in learning about the choice environment and developing skills specific to that environment. Wernerfelt (1985) built upon these ideas and formally modeled the notion that developing skills specific to one brand results in a preference for that brand relative to other competing brands, even when the consumer is aware that some of the other brands are equally useful and can be acquired at a

lower price. Wernerfelt 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 brands or to search for alternative brands 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.

The Relationship Between Learning and Lock-In

This form of brand loyalty has been described as a type of lock-in that results from brand-specific experience, because the skills acquired during such experience reduce a person’s probability of switching brands (Shapiro and Varian 1999). Interestingly, this type of lock-in differs from the traditional notion of lock-in based on switching costs (Klemperer 1995) because it is entirely cognitive and depends only on the development of skill through experience. As a result, the models that have been produced in the economic literature arguing for the importance of habit and skill acquisition in buyer behavior intersect with the long history in the psychological literature (for example Bryan and Harter 1899) on these same topics.

In particular, psychologists have been interested in studying the nature of the relationship between repeated experience with a task and the development of the skills required to effectively complete the task. It has been found that this type of learning 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). This phenomenon is often referred to as a learning curve and is so ubiquitous in studies of skill acquisition that “current theories of skill acquisition and automaticity treat the power law as a benchmark prediction that they must make in order to be taken seriously (Logan 1992, p. 883).” In addition, recent research has demonstrated that the standard deviation of the task completion times should also decrease as a power function of practice (Logan 1988). Therefore, if we are to believe that online shoppers are acquiring skills as a result of their experience with a particular website we require evidence that repeated exposure to a site results in a decrease in time spent on the site and a decrease in the standard deviations among those times across people. Moreover, that decrease in time should be closely approximated by a power function. In addition, if such skill acquisition is locking consumers in to specific sites we should observe an increase in preference for a site that corresponds to any increase in user skills that are specific to that site. In this paper we will refer to the first website at which user skills are developed as the incumbent website. The user skills theory of brand loyalty leads us to the following hypotheses:

H_{1a}: The amount of time required to complete a shopping task using an incumbent website decreases as a power function of practice.

H_{1b}: The standard deviations among the times across people required to complete a shopping task using an incumbent website decreases as a power function of practice.

H_{1c}: As more skill is acquired through experience with an incumbent website, user preference for the incumbent should increase relative to its competition.

Transferable versus Non-Transferable User Skills

The theory that cognitive lock-in results from the development of brand-specific user skills explicitly recognizes that those skills must be non-transferable (Wernerfelt 1985). However, it should be evident that not all skills acquired during experience with one brand are non-transferable. For instance, learning to use SAS's statistical software teaches the user about SAS's software, but it also teaches the user something about statistics programs in general. Therefore, learning about SAS results in the development of skills that are transferable to other statistics programs such as SPSS. Nevertheless, learning to use SAS should also result in the development of non-transferable user skills that increase the consumer's preference for SAS relative to SPSS. We believe it is important to recognize that both types of skills, transferable and non-transferable, can have a significant impact on consumer choice. In particular we argue that when competing interfaces are very similar, consumers will acquire skills that are easily transferable from one interface to the other. As a result they will be more likely to switch between interfaces than they would be in an environment where a greater proportion of non-transferable skills are developed – i.e., in an environment where the competing interfaces are substantially different from the incumbent interface. While experience results in the acquisition of transferable as well as non-transferable user skills, only non-transferable user skills result in greater relative preference for the incumbent that increases as experience with the incumbent interface increases. Therefore,

H₂: Consumers' preference for the incumbent interface increases, as more of the acquired skills are non-transferable. In other words, preference for the incumbent interface should be greater in an environment where the competing interfaces are different from the

incumbent relative to environments where the competing interfaces are similar to the incumbent.

The Experiment

The primary objective of this experiment was to examine the possibility of cognitive lock-in as a result of skill development through experience with an incumbent interface. The study was fully computer-based, and involved the completion of an online shopping search task. The entire experiment was conducted in an Internet-based electronic store designed specifically for the experiment. This study was completed by 71 participants in a research laboratory equipped with state-of-the-art networked personal computers. They participated via a secure internet site, and were randomly assigned to one of twelve experimental conditions (see below).

Our analysis of the data from this experiment is separated into two parts. First, we undertake a confirmatory analysis to test the formal hypotheses stated above. Second, we conduct an exploratory analysis of our data, using factor analysis, to help us better understand the role that transferable and non-transferable skills may play in consumer perceptions of the choice environment and the nature of their preferences among competing interfaces.

Method

Experimental Design. Two factors are manipulated in this experiment using a 2 by 6 between-subjects full-factorial design. First, we manipulate the similarity of the incumbent interface relative to a competing interface at two levels: the competing interface is either very similar to the incumbent or it is different from the incumbent. In the similar condition the

competing interface was different only in its color scheme. In the different condition the competing interface had a different color scheme, a different style of screening tool¹, and the location of the attributes used in the screening tool was changed (for an example condition see Appendix B). Second, we manipulate the number of exposures to the incumbent interface at six levels: participants are randomly assigned to experience from one to six trials with the incumbent before being exposed to the competitor.

Procedure. Those subjects who completed fewer than 6 shopping tasks (i.e. trials with the incumbent) were required to complete filler tasks so that all subjects completed 6 tasks in total. Each shopping task required subjects to find a product by searching within a product space that contained 16 products (see Appendix A for an example product category). To assist them, subjects had access to a screening tool that allowed them to specify particular product attributes and thereby reduce the number of products through which they would have to search to complete the task. The following is an example of one shopping task: Your task is to select the Apple iMac with the fastest processor, given that it is under \$2000.00² and is snow colored. Which interface served as the incumbent was counterbalanced between conditions (for example, the condition wherein the screening tool with the pull-down menus served as the incumbent is illustrated in Appendix B). Those participants who did not complete all 6 shopping tasks were instead exposed to a filler task based on the same product category as the shopping task that they did not complete. However, the filler task was not search-related and instead required subjects to simply list product attributes and to estimate the product's average price.

¹ If the incumbent interface used drop down menus for its screening tool the competitor would have radio buttons for its screening tool, and if the incumbent interface used radio buttons then the competitor would have drop down menus. Which style of screening tool served as the incumbent was counterbalanced with all other conditions.

² All prices are in Canadian Dollars

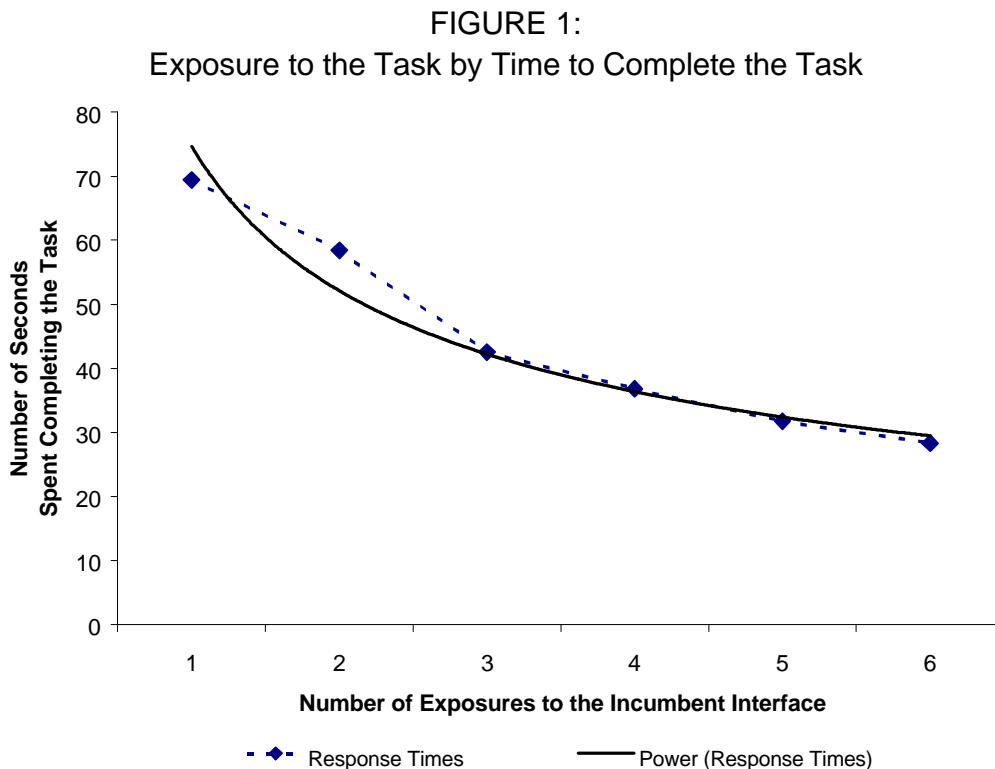
After completing the shopping task from 1 to 6 times with the incumbent interface subjects were forced to use a competitor interface to complete a seventh shopping task. The competitor interface was either very similar or somewhat different from the incumbent interface (see Appendix B). Having completed the seventh task using the competitor interface subjects were asked to choose which of the two interfaces they would like to use to complete additional shopping tasks. In addition to choosing between the two interfaces subjects were also asked to indicate how much they preferred the interface that they had chosen on a scale from 1 (just barely prefer) to 10 (very strongly prefer). Having made a choice and indicated their extent of preference, participants completed one more shopping task using the interface of their choice. After completing the last shopping task the participants completed an online questionnaire that required them to rate how similar they found the competitor and the incumbent to be, and to rate how easy it was for them to switch from the incumbent to the competitor.

Confirmatory Results

To support H_{1a} and H_{1b} we must examine the fit of the means and standard deviations of the completion time data to the power law (Logan, 1988). According to the power law,

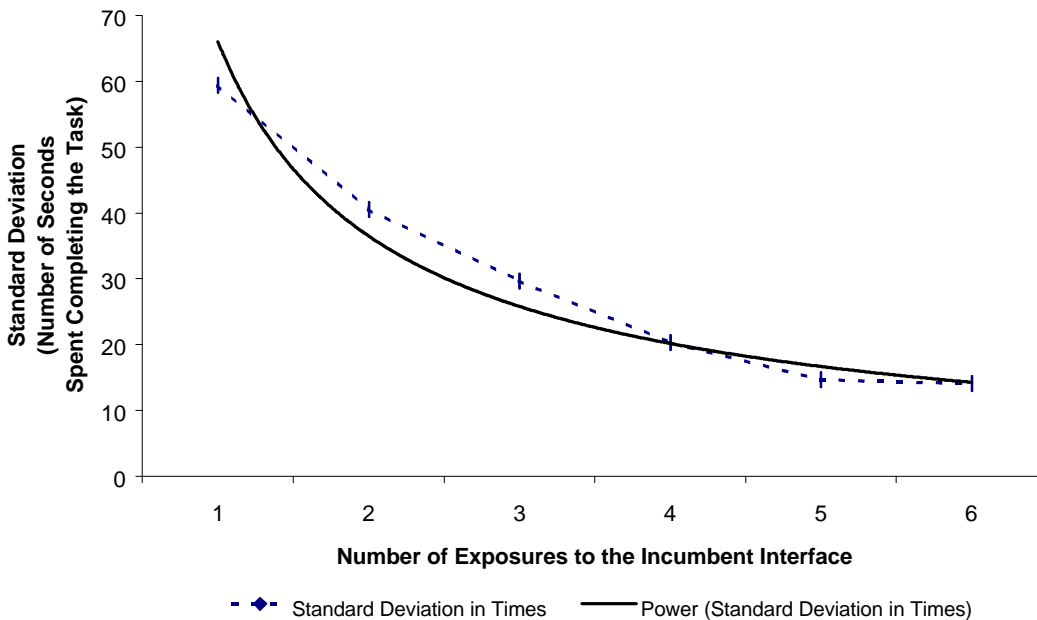
$$T = a + bN^c,$$

where T is the time required to complete the task, a is the asymptote (the limit on performance), b is the difference between the initial and the asymptotic performance, N is the number of exposures to the task (the amount of practice), and the exponent c is the learning rate. The fit of the mean completion times to the power function, Figure 1, is very tight, which supports H_{1a} ($R^2 = 0.970$, d.f. = 4, $F = 127.31$, $c = -0.5098$). The fit of the mean completion times standard deviations, across people, to the power function, is also very tight (Figure 2), which supports H_{1b} ($R^2 = 0.965$, d.f. = 4, $F = 110.67$, $c = -0.8667$). The magnitude



of this effect can be assessed by examining the fit of a linear trend line to these data. While the fit of the linear trend line is not as good as the fit of the power function ($R^2 = 0.928$), it does provide us with an interpretable beta (-8.1626). This coefficient indicates that for each additional exposure the mean completion time falls by approximately 8.2 seconds. These

FIGURE 2:
Standard Deviation of Task Completion Times by Trial

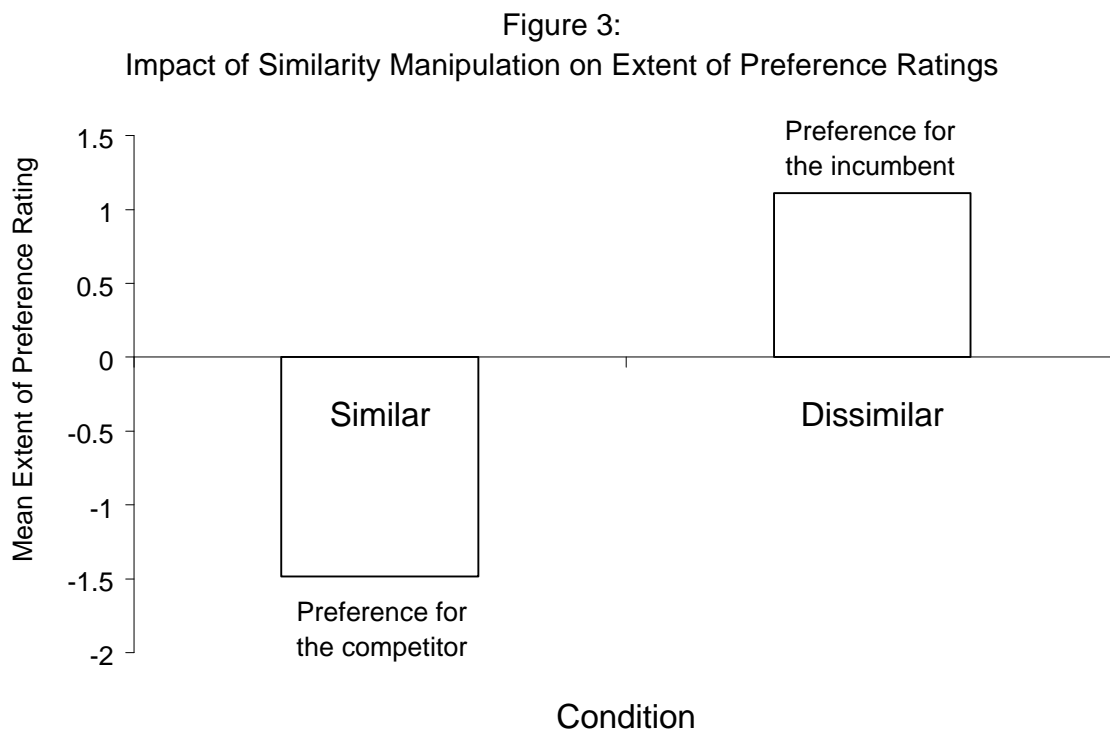


results provide strong evidence that participants are acquiring greater skill in using the interface as experience with the interface increases.

Based on both the observed choices and the extent-of-preference measures, we constructed a 20-point graded-paired-comparison (GPC) response variable (with end points $-9.5 =$ “very strongly prefer the competitor” and $+9.5 =$ “very strongly prefer the incumbent”) that allows a quantitative representation of a person’s relative preference for the two interface alternatives in a choice set. A participant’s GPC score was used as the dependent variable in the OLS regression estimation of three coefficients: the first representing the effect of the number of trials with the incumbent on a participant’s preference for the incumbent; the second representing the effect of our manipulation of interface similarity; and, the third representing the interaction between the number of trials and the manipulation of similarity. With regard to the effect of the number of trials on participants’ preference for the incumbent,

we find a positive trend (t -value = 2.26; p -value = 0.0267), which supports for H_{1c} : greater exposure to the incumbent interface results in greater preference for the incumbent relative to the competitor.

Next we examine hypothesis H_2 , which argues that a greater preference for the incumbent should exist in the condition where the competitor interface was different from the incumbent as compared to the condition in which the competitor interface was very similar to the incumbent. We find that this is in fact the case (see Figure 3), as the difference between these two conditions is marginally significant (t -value = 1.95; p -value < 0.0549). However, given that we have a directional prediction for this effect, it is appropriate to conduct a one-tail independent samples t -test between these two conditions. Based on this test, the difference between the two conditions is significant (t -value = 1.944; p -value < 0.02797). Therefore, H_2 is supported and it appears that this type of lock-in is dependent upon the extent



to which user skills are transferable. The interaction between the number of trials and the manipulation of similarity is not significant (t -value = 0.03; p -value < 0.9742).

Discussion

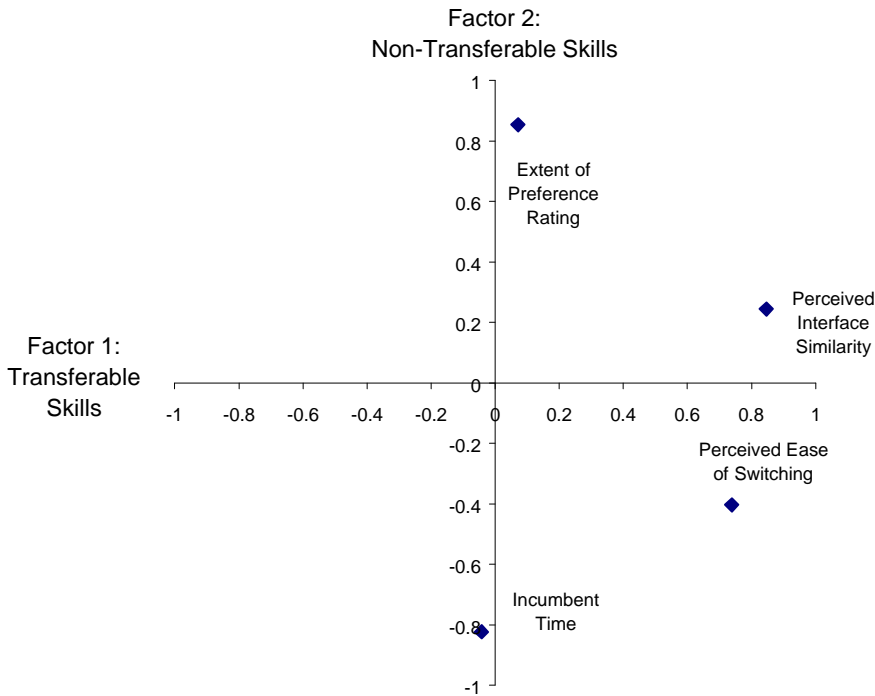
The evidence from our confirmatory analysis provides support for the formal hypotheses. We find that greater exposure to the incumbent interface does result in the acquisition of skill that allows the shopping task to be completed increasingly rapidly with each successive trial. In addition, we find that greater exposure to the incumbent interface results in greater preference for the incumbent interface, and that the preference for the incumbent interface only develops when the competitor interface is different from the incumbent (i.e. when some non-transferable skills are acquired). These findings support the user skills explanation for this type of cognitive lock-in.

Two alternative explanations may be postulated for these findings. One is that the effects are simply the result of mere exposure (Zajonc 1968) to the interface. A second is that familiarity (Coupey, Irwin and Payne 1998) with the incumbent interface has led to an increase in preference for the incumbent. While we agree that exposure and familiarity are essential to the type of learning we are discussing in this paper, we are arguing in favour of a deeper and more specific explanation that directly ties the acquisition of skill to consumers' preference for the incumbent. The important difference between our explanation and the competing explanations is that the user skills explanation *requires* that, in addition to being exposed to the interface and becoming familiar with it, shoppers acquire skill at using the interface.

Exploratory Results

To further investigate the impact that these two types of skills have we performed a factor analysis, with a varimax rotation, on four variables: the extent of preference ratings, the average time spent with the incumbent per trial, participants’ ratings of similarity and participants’ ratings of the ease of switching. This analysis is performed on the data from the condition with an incumbent interface that is different from the competitor because, it is in this condition that non-transferable skills are acquired. The rotated factor loadings plot illustrating the results of the analysis is depicted in Figure 4. Our analysis finds two underlying factors, with eigenvalues greater than 1, which we have labelled transferable and non-transferable user skills.

Figure 4: Plot of Varimax Rotated Factor Loadings



Discussion

It is evident from the above analyses that ratings of similarity and ease of switching load strongly, in the positive direction, on the first factor (transferable user skills). This suggests that as transferable user skills increase ratings of perceived similarity and ratings of the perceived ease of switching also increase. Preference ratings load strongly, in the positive direction, on the second factor (non-transferable user skills). This suggests that as non-transferable user skills increase consumer preference moves towards the incumbent (a strong positive impact on the GPC scale). In addition, as non-transferable user skills increase, we find that the average amount of time spent with the incumbent interface per trial decreases. This finding corresponds with our earlier finding that preference for the incumbent increases, while the amount of time spent with the incumbent decreases over trials. Interestingly, the amount of time spent with the incumbent interface does not load very strongly on the transferable user skills factor. This may occur because transferable user skills are acquired quickly and easily, while non-transferable user skills are gained only with a greater number of incumbent interface trials. These findings, although exploratory in nature, are highly consistent with the notion that the two types of skills can be acquired simultaneously and have separate effects on consumer behavior. In particular it appears that while transferable skills may affect the consumer perceptions about the competition and the ease of switching, it is the non-transferable skills that drive consumer preference. While these findings are in agreement with the more general user skills theory of brand loyalty, they also add to the literature by demonstrating the distinct roles played by the two types of user skills.

The experiment reported in this paper provides evidence that consumers can become locked-in to an incumbent interface as the result of skill acquisition. Although such findings

have been predicted (Wernerfelt 1985), and empirical evidence of user skills based brand loyalty has been documented (Johnson, Bellman and Lohse 2000), previous work has focused on the role of non-transferable user skills. In contrast, this paper has demonstrated that transferable user skills can also play an important role in determining the degree of lock-in. However, the results reported here are clearly preliminary and further work is required to replicate these findings.

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Appendix A

The following marketplace³ was used for task number 6:

Apple iMac				
<i>Attribute 1</i>	<i>Attribute 2</i>	<i>Attribute 3</i>	<i>Attribute 4</i>	<i>Attribute 5</i>
Color	Processor Speed	RAM	Internet Browser	Price
Sage	500 MHz G3	32 MB	Netscape Communicator	\$2,347.00
Ruby	500 MHz G3	64 MB	Microsoft Internet Explorer	\$2,448.00
Snow	500 MHz G3	64 MB	Netscape Communicator	\$2,498.00
Indigo	500 MHz G3	64 MB	Microsoft Internet Explorer	\$2,647.00
Indigo	450 MHz G3	32 MB	Microsoft Internet Explorer	\$1,999.00
Sage	450 MHz G3	64 MB	Netscape Communicator	\$2,148.00
Ruby	450 MHz G3	64 MB	Microsoft Internet Explorer	\$2,198.00
Snow	450 MHz G3	64 MB	Netscape Communicator	\$2,299.00
Snow	400 MHz G3	32 MB	Microsoft Internet Explorer	\$1,547.00
Indigo	400 MHz G3	32 MB	Netscape Communicator	\$1,648.00
Sage	400 MHz G3	32 MB	Microsoft Internet Explorer	\$1,698.00
Ruby	400 MHz G3	64 MB	Netscape Communicator	\$1,847.00
Indigo	350 MHz G3	32 MB	Netscape Communicator	\$1,199.00
Sage	350 MHz G3	32 MB	Microsoft Internet Explorer	\$1,348.00
Ruby	350 MHz G3	32 MB	Netscape Communicator	\$1,398.00
Snow	350 MHz G3	64 MB	Microsoft Internet Explorer	\$1,499.00

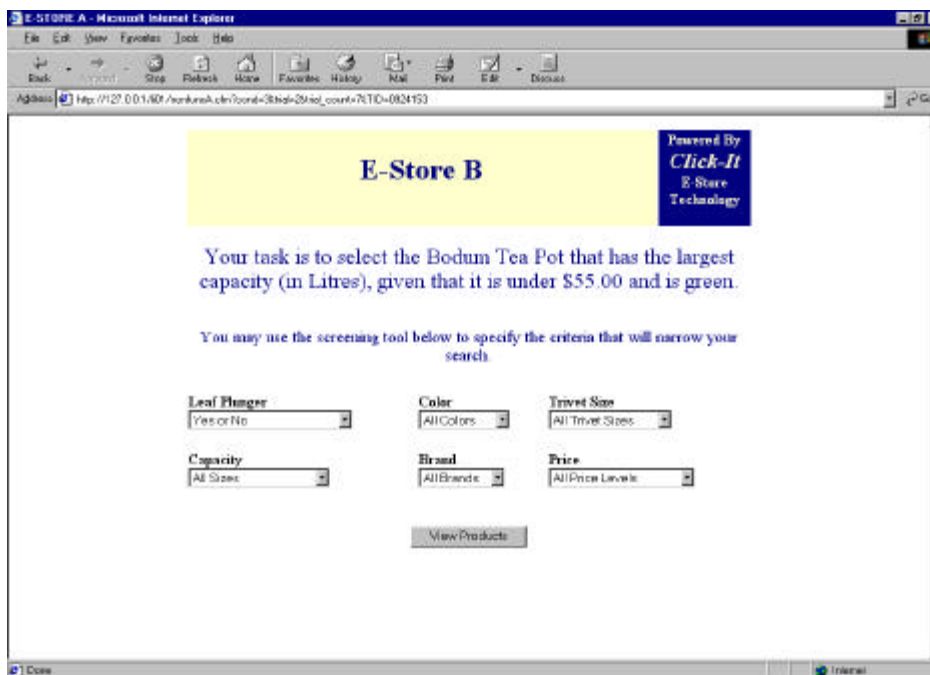
³ The marketplaces used for all 6 tasks are available from the first author upon request.

Appendix B

The Incumbent Store (for one condition):



The *Similar* Competitor (for one condition):





The *Different* Competitor (for one condition):