When Web Pages Influence Choice: Effects of Visual Primes on Experts and Novices

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This article extends the idea that priming can influence preferences by making selected attributes focal. Our on-line experiments manipulate the background pictures and colors of a Web page, affecting consumer product choice. We demonstrate that these effects occur for both experts and novices, albeit by different mechanisms. For novices, priming drives differences in external search that, in turn, drive differences in choice. For experts, we observe differences in choice that are not mediated by changes in external search. These findings confirmed that on-line atmospherics in electronic environments could have a significant influence on consumer choice.

Imagine visiting a commercial Web site that has a rich and colorful graphical background. Is it possible that this background could influence the products you buy? Would these effects occur even if you were knowledgeable about the products offered? Most of our respondents, both experts and novices, tell us that they would be unaffected, but our results suggest otherwise—that even subtle changes in a Web environment can produce changes in the products selected for both expert and novice decision makers.

In this article, we use on-line experiments to examine how priming affects the construction of preferences (Fischhoff 1991; Payne, Bettman, and Johnson 1993; Slovic 1995) and explore the possibility that priming effects operate through external search as well as internal retrieval. Prior research in priming has demonstrated the resulting increase in accessibility of certain product-related information, suggesting that priming effects are primarily limited to memory-based choice. However, we examine the possibility that priming can change external search, thereby influencing stimulus-based choice. We argue that these effects operate in a manner similar to what Bruner (1957) termed "perceptual readiness" and what Higgins (1996, p. 136) suggests are "goals . . . that produce a readiness to respond to certain goal relevant stimuli."

We also examine how priming might work in the applied setting of on-line commerce. Because the internet environment reduces consumer search costs and puts consumers in control of the information they receive, many have argued that the internet empowers consumers. Indeed, the popular press (e.g., Cortese and Stepanek 1998) describes the Web as an environment that will improve consumers' decisions. Similarly, some have speculated that the Web induces a state of flow (Hoffman and Novak 1996) that could diminish or eliminate the effects of unrelated external stimuli. However, this research demonstrates the powerful influence of on-line atmospherics, in sharp contrast to the media's view that the Web empowers consumers.

A final goal of the current research is the extension of process analysis to Web data in a way that is reminiscent of information search techniques used to test different process theories, such as MouseLab (Johnson, Payne, and Bettman 1993) or Search Monitor (Brucks 1988). We argue that the use of such techniques increases sample size, variability in the independent variables, and external validity.

In the remainder of this article, we first develop theory that explores the linkages between priming, expertise, searching, and choice. We then present a pretest and two experiments that test our hypotheses. We close by discussing the implication of this work for our understanding of consumer preferences.

THEORETICAL BACKGROUND

The psychology literature has used the term "priming" to refer to several distinct phenomena that share the same underlying mechanism. Exposure to some prior event, the

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prime, increases the accessibility of information already existing in memory. This increase in accessibility is usually verified by one of three tests. In semantic priming studies (Collins and Loftus 1975; McKoon and Ratcliff 1995; McNamara 1992), subjects decide whether an item such as "dog" is a word or nonword and respond more quickly and accurately when the item is preceded by an associated word, such as "cat." In categorical priming, a person's judgment about a person, product, or object is influenced by the constructs that are activated in an earlier task (Herr 1989). In feature priming, which we use in our studies, a subject is exposed to a prime that is associated with a particular feature, and this feature is then weighted more heavily in evaluation (Yi 1990).

Yet, increased accessibility does not always cause the information to be incorporated into subsequent judgment and actions. When certain kinds of information are made accessible, such as stereotypes, they may produce no change in subsequent judgments (Devine 1989), or they may produce contrast effects (Herr 1986; Herr, Sherman, and Fazio 1983; Martin 1986), where the resulting judgment is in a direction opposite to that suggested by the prime.

Given the apparent subtlety of the visual primes we use here, which are embedded in the background wallpaper of a Web page, it is unlikely that we will find such a contrast effect in terms of subject reactance. Therefore, we expect this increased accessibility to affect product choice, which we capture in the following hypothesis:

H1: Subjects will have increased preferences for products that have higher values on the primed attribute.

Alba and Hutchinson (1987) define familiarity as the consumer's number of purchases or experiences with the product class and expertise as the ability to perform product-related tasks successfully. In this study, we examine the moderating roles of both subjective expertise (an individual's perception of his or her own knowledge) and objective expertise (as measured by a quiz; Brucks 1985).

How are priming's effects moderated by the consumer's level of expertise in the product category? The literature offers two opposing possibilities. First, expertise might limit the effect of priming. Alba and Hutchinson (1987) have suggested that experts process product information more deeply, while novices are more influenced by external factors. Several studies have confirmed that consumers who are inexperienced in the product class are more susceptible to context and response mode manipulations. For example, Coupey, Irwin, and Payne (1998) found that preference reversals between choice and matching tasks are greater when the products are unfamiliar to subjects. Novices have also been found to weigh attributes more heavily when they are made salient through promotion (Wright and Rip 1980). Finally, Bettman and Sujan (1987) found that in a choice of comparable alternatives (either cameras or computers) priming an attribute such as reliability affected novices' product choices but not those of experts. Therefore, we might expect novices to be more susceptible to the influences of priming than experts.

An alternative hypothesis is that priming indeed affects knowledgeable consumers but through a different route. The key distinction here is how memory-based and external search are used by experts and novices (Alba and Hutchinson 1987; Hastie and Park 1986; Johnson and Russo 1984). Because experts tend to have a surfeit of product knowledge (Brucks 1985), their preferences may actually be more susceptible to priming than those of novices. Experts are more likely than novices to operate on memory-based evaluations, so they may have more information consistent with the prime available for choice. Consistent with this notion, Chapman and Johnson (1999) have shown that making more information available in memory can increase the effect of anchors, which, they argue, operate through a priming mechanism. Given the two opposing theoretical arguments, we posit two opposing hypotheses:

H2a: The effect of priming on preferences will be stronger for novices than for experts in the product class; and

H2b: The effect of priming on preferences will not be moderated by levels of expertise.

The above hypotheses do not address the mechanisms that may be involved in any changes in preferences. Even if expertise does not moderate the effect of priming, there may be other mechanisms mediating the effect for both experts and novices. While Bettman and Sujan (1987) demonstrated that priming could influence the choices of both experts and novices, the authors offered the following as one limitation to their study: "the lack of detailed process measures to determine the microprocessing strategies underlying the observed effects." (p. 146) One purpose of the current article is to elucidate such underlying mechanisms.

Many priming researchers have used the increased availability of prime-consistent information in memory to explain their results. However, there is a second possible effect, relevant to external search environments such as these: that primes make certain goals more salient and therefore influence subsequent information search. Biehal and Chakravarti (1986) have shown that brand accessibility can influence the amount of information sought about the brand as well as brand choice. Ratneshwar et al. (1997) showed that subjects demonstrate higher recall and recognition of a product benefit that is made salient. But will individuals more thoroughly search for information about a particular product feature when that feature has been made accessible? To address this question, we examine whether priming influences the consumer's search for information. If priming increases the accessibility of prime-consistent goals, we expect decision makers to pay more attention to prime-consistent information. This leads to the following related hypotheses:

H3: Priming will influence the amount of prime-consistent attribute information searched.

This demonstration is important because it would establish that priming influences external as well as internal search.

Because novices depend more on external search, these effects will be stronger for novices than experts. Consequently, we expect these differences in external search to cause observed differences in choice. Therefore, for novices (but not necessarily experts), changes in search should mediate changes in preference. In other words, if the effect of priming operates by making prime-consistent goals more accessible, we expect the resulting differences in search to mediate any observed changes in novices' preferences:

H4: For novices, the prime should produce a change in search behavior that mediates the changes in preference.

Experts, in contrast to novices, depend more on memory-based search. Although changes in external search may well occur, we argue that these changes in search, if they occur, will be largely unrelated to changes in choice. Experts will be influenced instead by changes in the accessibility of prime consistent information in internal memory. Thus, we predict weaker or no mediation for the experts:

H5: For experts, the prime may not produce a change in search, and any changes in search will either not mediate or weakly mediate any change in preferences.

We tested these hypotheses with a pretest and two experiments. Experiment 1 assessed the predictions made in hypotheses 1 and 2, regarding priming's influence on choice and the moderating role of expertise. Experiment 2 replicated the findings of experiment 1 and tested the predictions of hypotheses 3–5, regarding the interactions between priming, expertise, and search.

PRETEST

In the pretest, we developed Web page backgrounds that primed product attributes in two product categories: cars and sofas. We administered a questionnaire via the World Wide Web in a computer laboratory with 47 subjects. Subjects first read advertisements that differed only in the background wallpaper and then, on a separate page, listed the most important attributes to consider when buying the product.

The two product categories, cars and sofas, were selected because they appealed to both students and nonstudents. Each participant completed the task for both product categories and was randomly assigned to one of two primes for each category. This resulted in a 2 (product, within) × 2 (prime, between) mixed design.

The car Web site contained either a red and orange flame-like background, designed to prime safety, or a green background with small dollar signs, designed to prime price. The sofa Web site contained either a blue background with fluffy clouds, designed to prime comfort, or a green background with embedded pennies, designed to prime price. After examining each ad, the subject proceeded to the next page (containing a neutral gray background and no prime), which asked them to list, in descending order, the four most important attributes to consider when buying a car or sofa. Two independent judges read and categorized the lists of salient attributes.

A categorical ANOVA revealed that subjects indeed mentioned primed attributes more frequently than unprimed attributes. In the car task, subjects exposed to the safety prime were more likely than those exposed to price prime to cite safety as important (76% vs. 64%), while those exposed to the price prime were more likely than those exposed to the safety prime to cite price as important (82% vs. 52%; $\chi^2(1) = 6.19$, $p < .01$). Two other features that were frequently mentioned were appearance and fuel efficiency, but these features were equally likely to be mentioned by both treatment groups.

A similar pattern was found for the sofa task. Subjects who saw the comfort prime were more likely than those who saw the price prime to cite comfort as an important feature when buying a sofa (90% vs. 78%), and those who saw price prime were more likely than those who saw comfort prime to cite price (94% vs. 66%; $\chi^2(1) = 7.37$, $p < .01$). Other features that were frequently mentioned were appearance and durability, but these attributes were equally likely to be mentioned by both treatment groups.

EXPERIMENT 1

Design

The pretest established that visual primes can increase the accessibility of certain attributes. But does priming an attribute increase preference for products that excel on that attribute, for both experts and novices? The first experiment tested the effect of priming on preference and choice, and it examined whether expertise would moderate this effect. We employed the same two product classes, cars and sofas, and the same background primes developed in the pretest. Since each subject performed the task for both cars and sofas, product category was a two-level within-subject factor and background prime was a between-subject factor. Each subject saw only one of two possible primes in a category. On the car Web site, the background on the welcome page was either red and orange with flames (to prime safety) or green with dollars (to prime price). On the sofa Web site, this initial screen was either blue with clouds (to prime comfort) or green with pennies (to prime price). Appendix A shows examples of these Web pages for the sofa task. Participants also answered multiple-choice questions about cars and furniture, designed by the experimenters to gain an objective measure of expertise. Using responses to the questions, we divided subjects in two groups, experts and novices.

Method

Seventy-six undergraduate students at a major university completed the 20-minute task in a computer lab in exchange for a $5.00 payment. Before making a choice, subjects first visited a Web page describing a hypothetical shopping site. The page background served as a prime, and subjects' reading was self-paced.

All subjects then went to identical shopping environments with neutral backgrounds that offered two different products within the product category. Each product description contained a picture and links to separate pages that described the product's features. The car features described were the engine, safety, price, and transmission. Both products were on the efficient frontier; the Calabria was a cheaper but less safe sedan, and the Siena was a minivan that was safer but more expensive.[1] The sofa product page contained the Palisades, an economical but less comfortable sofa, and the Knightsbridge, which was comfortable but expensive. An example of this page is shown in appendix B.

On the next page, subjects were required to make a choice between the two products. In addition, they provided a constant sum measure, which required allocating 100 points between the two products according to preference. Subjects who were primed on price were expected to prefer the cheaper product, while subjects who were primed on a quality feature (comfort or safety) were expected to prefer the product that rated higher on that feature. The order of these questions was counterbalanced to prevent a subject's answer on an early question from influencing responses to later questions. Finally, subjects answered questions about their gender, age, and expertise in the product class.

Results

Manipulation Checks. Subjects rated the two cars on safety and price and rated the two sofas on comfort and price, in order to confirm that our product descriptions produced the desired perceptions. Indeed, the Calabria was perceived as a cheaper ($t(138) = 1.78$, $p < .05$) and less safe ($t(138) = 5.31$, $p < .001$) vehicle than the Siena, and the Palisades was perceived as a somewhat cheaper ($t(150) = 1.35$, $p < .10$) and less comfortable sofa ($t(150) = 7.91$, $p < .001$) than the Knightsbridge.[2]

Dependent Measures. In the choice question, subjects were asked to choose the product they would prefer to purchase. A categorical ANOVA, aggregated across both product categories, indicated that subjects who were primed on money were significantly more likely to choose the cheaper, lower-quality product than were those primed on the quality feature (safety or comfort; $\chi^2(1) = 4.84$, $p < .05$). The cheaper car had an average market share of 65.8% among those who had been primed on money and an average market share of 50.0% among those who had been primed on safety. The cheaper sofa had an average market share of 55.8% among those who had been primed on money and an average market share of 38.7% among those who had been primed on comfort. The priming affected choice similarly in the two product categories, since the prime × product interaction was not significant (NS, $p > .50$). Also, the prime × expertise interaction was not significant (NS, $p > .50$), indicating that the manipulation similarly affected the choices of both novices and experts.

In the constant sum question, subjects were instructed to allocate 100 points between the two products to indicate their preferences. For the car category, subjects who were primed on price gave more points on average ($M = 61.5$) to the cheaper, less safe car than did subjects who were primed on safety ($M = 50.8$, $F(1, 66) = 2.98$, $p < .10$). In the sofa category, subjects who were primed on price gave more points on average ($M = 55.8$) to the cheaper, less comfortable sofa than did those who were primed on comfort ($M = 45.9$; $F(1, 66) = 3.48$, $p < .10$). Therefore, subjects had a stronger preference for the cheaper product when they had viewed a price prime than when they had seen a comfort or safety prime. The order in which products were shown on the page and the order in which questions were presented did not have a significant effect on these findings. Again, the prime × expertise interaction was not significant, indicating that experts were just as susceptible as novices to the manipulation.

Hypothesis 1, which suggested that subjects who were primed on a particular attribute would be more likely to prefer the product that excelled on that attribute, was supported. Somewhat surprisingly, this effect was the same for both experts and novices, inconsistent with hypothesis 2a but consistent with hypothesis 2b. Clearly, this result deserves more attention and will be addressed in experiment 2.

EXPERIMENT 2

Experiment 1 provided supportive evidence that the visual priming of attributes can affect product choice. Intriguing, however, are questions about how this priming occurs, particularly in the face of the somewhat surprising result that experts, like novices, were affected by priming. In the next experiment, we examine the effect of primes on information search, exploring the possibility that primes influence not just the retrieval in memory-based search but external search as well. We demonstrate that these search processes differ for experts and novices, nonetheless producing the same end result.

The results of experiment 1 suggest an interesting set of possibilities that depend on levels of expertise and the differential effects of priming. Simply put, we posit that both experts' and novices' choices are affected by primes but that these effects have different mechanisms for the experts and novices. Specifically, novices lack much internal product knowledge and rely on the externally provided product in-

[1] Coincidentally, Toyota introduced a minivan called the Sienna several months after this study took place, and thus the fictional minivan's name was changed to Sarina for the second experiment.

[2] Because of a minor programming error, we did not receive price ratings from six of the subjects, and so these data were excluded from the above analysis.

formation. Here, the effect of priming is primarily in making the feature of price or quality more salient, and it should operate through external search. Thus, for novices, the effect of priming is not necessarily to activate attribute-relevant information in memory but to increase the accessibility of the attribute as a goal. For experts, who have significant product knowledge in memory, the story has the same ending but reaches it by a different path. Here, internal attribute-relevant structures are made accessible by the prime, and it is the internal search of these attributes that produces the change in preferences.

As in experiment 1, individuals made choices of both cars and sofas after viewing an introductory page containing the prime. Experiment 2 contained several key changes. First, the visual prime was present as a sidebar on every page in the survey, as well as in the wallpaper on the opening page. This gave the site a consistent look and feel and exposed subjects to the prime for longer time periods. Also, subjects were randomly assigned to one of three primes for each category: money, quality, or a plain background. Finally, we measured the number of attributes searched and the amount of time spent looking at attribute information by recording the time when the subject clicked on a hyperlink to retrieve information. We measured entry and exit time for each hyperlink at the user's browser using a JavaScript program that measured the time at the client (as opposed to the server). We also only recruited subjects who had reported modem speeds of 33.6 kbps and higher and who were from the United States.

Method

Design. The experiment used a 2 (product category: cars vs. sofas; within subject) × 3 (prime: money vs. quality vs. plain; between subject) × 2 (order: car task first vs. sofa task first; between subject) design. Subjects were 385 internet users from a panel, who agreed to be contacted for future surveys after filling out an initial sign-up survey. The U.S. panelists represented the current internet population rather well, with a median age of 29 (just under the population median of between 30 and 34) and a median income of between $35,000 and $49,999 (which included the population median of $35,225; Bellman, Lohse, and Johnson 1999). They agreed to participate in the study in exchange for a 1/10 chance to win a $10 phone card and a 1/500 chance to win a $500 prize.

Procedure. On entering the site, subjects viewed some brief instructions and then completed both a car task and a sofa task. Participants viewed an introductory screen containing the background prime and information about the hypothetical commercial site. For the car task, this background was either green with pennies (money prime), red with flames (quality prime), or white (no prime). In addition, this prime was present as a sidebar on all of the other pages in the task. On the next page, subjects viewed the two products in the car category and had the option to link to separate pages to learn information about each car's engine, safety, price, and standard and optional features. The time stamp was recorded each time the participant accessed an attribute page. These time stamps were used to determine whether participants had viewed the attribute information and how long they spent looking at it. Participants then made a choice between the two products and indicated the strength of their preference by distributing a constant sum of 100 points between the two products. On the next page, subjects indicated the importance of safety and price (on a seven-point scale) and rated the two products on safety and price. Participants also completed a car quiz, which gave an objective measure of expertise.

The sofa task was almost exactly the same as the car task, and the subject was again randomly assigned to one of three background primes: blue with clouds (quality), green with pennies (money), or white (plain). Participants had the option to link to attribute pages to learn about the sofa's styling, comfort, price, and dimensions. They then completed choice and constant sum measures and answered a furniture quiz. Finally, after tasks for both categories were completed, subjects answered a funneled series of demand questions and several demographic questions.

Results and Discussion

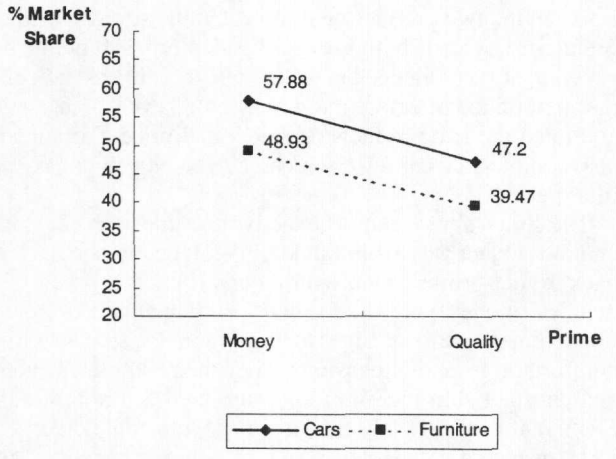
Manipulation Checks. As expected, participants rated the expensive product choices higher in quality and more expensive than the cheaper product choices. In the car category, subjects rated the Sarina higher than the Calabria on both safety (M = 5.40 vs. 4.66; $t(385) = 9.18$, $p < .0001$) and price (M = 4.89 vs. 4.47; $t(385) = 6.63$, $p < .0001$). In the sofa category, subjects rated the Knightsbridge higher than the Palisades on both comfort (M = 5.11 vs. 4.61; $t(385) = 6.14$, $p < .0001$) and price (M = 5.15 vs. 4.28; $t(385) = 10.46$, $p < .0001$).

The individual items on the car quiz were highly intercorrelated (Cronbach α = .89), as were the items on the furniture quiz (α = .87). These quiz scores were also highly correlated to subjects' own self-ratings of category expertise (α = .71 for cars and .75 for sofas). Subjects were divided into three equal groups according to their quiz scores. Furniture experts had higher quiz scores (M = 9.4, SD = .64) than did moderate subjects (M = 7.6, SD = .49), who scored higher than novices (M = 4.7, SD = 1.45). Car experts also had higher quiz scores (M = 10.9, SD = .83) than did moderate subjects (M = 8.1, SD = 1.16), who scored higher than novices (M = 4.3, SD = 1.25). Therefore, we can confidently conclude that three different levels of subject expertise exist in each category.

Analysis of Outliers. Of the 385 subjects, 45 did not browse any product attributes, and these subjects were removed from the analysis. In addition, several subjects were removed for spending an excessive amount of time browsing a single product feature. The mean for all looking times was 13.58 seconds, and the standard deviation was 26.53 seconds. Therefore, we Winsorized the data (Keselman, Lix, and Kowalchuk 1998; Luce 1986; Pachella 1974), defining

FIGURE 1

EXPERIMENT 2: PREFERENCE FOR THE CHEAPER PRODUCT AS A FUNCTION OF PRIME



the outlier cutoff as the mean plus three times the standard deviation, or 93.17 seconds. Twelve subjects had looking times greater than 93.17 seconds, and these were deleted, leaving 328 observations.

Effects of Prime on Choice and Constant Sum. Replicating the results of experiment 1, choice and constant sum assignments were affected by the background prime. As shown in figure 1, the prime significantly affected market shares of the two products in the choice set. A categorical ANOVA confirmed the main effect of prime on choice ($\chi^2(2) = 26.49$, $p < .001$) and an ANOVA confirmed the overall effect of prime on constant sum assignment ($F(8, 310) = 2.19$, $p < .05$). Planned contrasts revealed that the market share of the cheaper product was significantly higher for those who saw the money prime than for those who saw the quality prime (cars: $F(1, 310) = 11.16$, $p < .001$; sofas: $F(1, 310) = 6.80$, $p < .01$). The results in the control condition were quite similar to those in the money prime condition. Therefore, the effects appear to be primarily because of the quality primes and not the money primes.

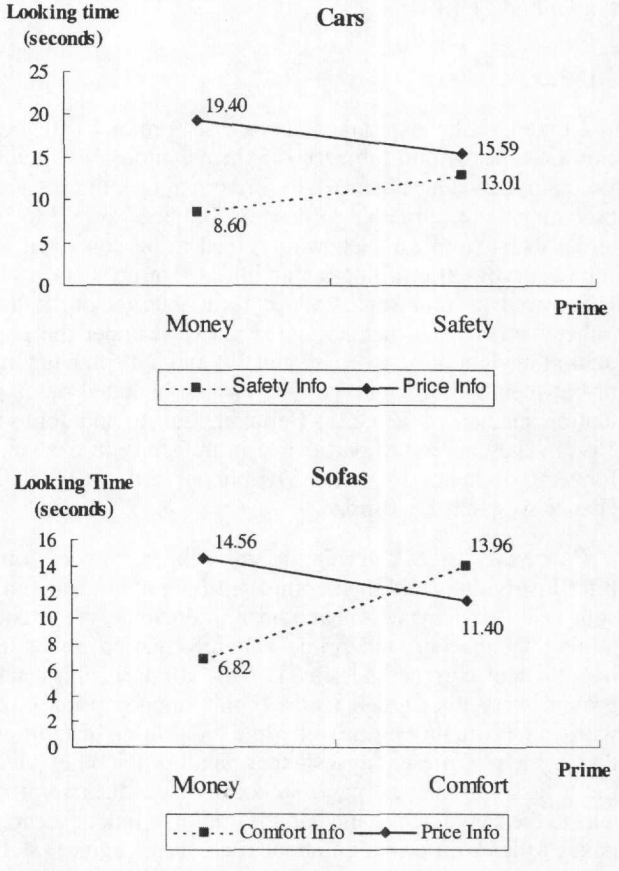
Consistent with hypothesis 2b, the effect of priming on choice was not moderated by expertise, as measured by the subject's quiz score ($F(8, 310) = 0.89$, $p > .20$). As in our prior studies, involvement, gender, and task order did not moderate the effect of priming on choice or constant sum assignment.

Effects of Prime on Search and Looking Time. Here, we expected primes to influence the amount of attention paid to the primed attributes, as measured by the number of attributes searched and the amount of time spent looking at attribute information. Our results confirmed hypothesis 3, that the prime significantly influenced the attention given to prime-consistent attributes. In the car task, subjects primed on safety looked at more safety features ($M = 1.22$ out of 2 possible features) than did those primed on price ($M = 1.03$, $F(8, 285) = 3.92$, $p < .0001$). Subjects primed on price looked at an average of 1.39 price features, while those primed on safety looked at 1.28 price features, a difference that was directional but not significant. In the sofa task, subjects primed on comfort looked at an average of 1.24 comfort features, compared to those primed on price, who looked at an average of 0.95 comfort features ($F(8, 285) = 4.83$, $p < .0001$). Meanwhile, those primed on price browsed an average of 1.53 price features, compared to those primed on comfort, who browsed an average of 1.21 price features ($F(285) = 7.39$, $p < .0001$).

We observed a similar pattern for the time spent looking at the attributes, as shown in figure 2. For cars, subjects primed on money looked at price information longer than did those primed on safety ($F(1, 310) = 3.74$, $p < .05$), while subjects primed on safety looked at safety information longer than did those primed on money ($F(1, 310) = 5.14$, $p < .05$). For sofas, subjects primed on money looked at

FIGURE 2

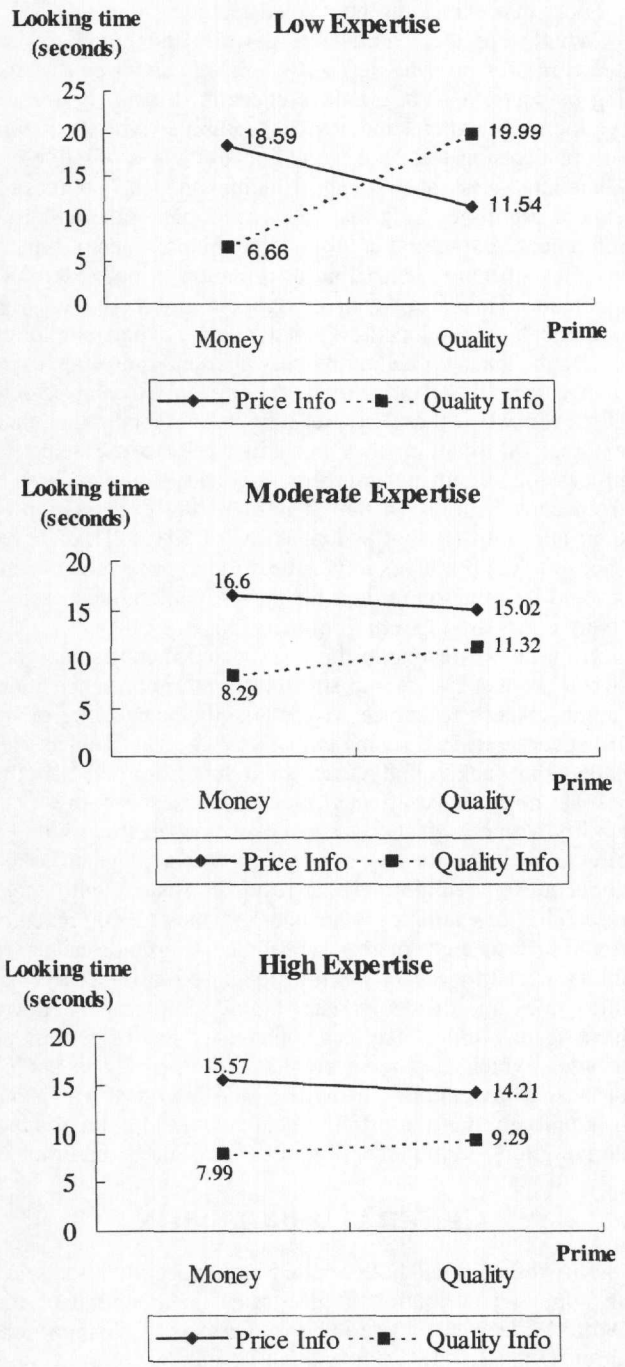
EXPERIMENT 2: LOOKING TIME AS A FUNCTION OF PRIME



price information longer than did those primed on comfort ($F(1,310) = 10.38$, $p < .001$), while subjects primed on comfort looked at comfort information longer than did those primed on money ($F(1,310) = 10.15$, $p < .001$).[3]

FIGURE 3

EXPERIMENT 2: LOOKING TIME AS A FUNCTION OF PRIME FOR VARYING LEVELS OF EXPERTISE



The Moderating Role of Expertise. The size of priming's effects on both the number of prime-consistent attributes searched and the amount of time spent looking at them depended on the level of expertise, consistent with hypotheses 4 and 5. In other words, the priming affected the search behavior of novices, but it did not affect the search behavior of experts. Novices were more likely to look at prime-consistent attribute information than prime-inconsistent attribute information. In contrast, experts and moderates were equally likely to look at both primed and nonprimed attributes. This was confirmed by a significant prime × expertise interaction ($F(16,285) = 2.73$, $p < .0005$). Novices were more likely to look at price information when primed on price in either the car task ($F(1,274) = 15.97$, $p < .0001$) or the sofa task ($F(1,274) = 15.84$, $p < .0001$) and more likely to look at quality information when primed on quality in either the car task ($F(1,274) = 3.85$, $p < .10$) or the sofa task ($F(1,274) = 16.09$, $p < .0001$). Meanwhile, experts and moderates were equally likely to look at primed and nonprimed attributes ($p > .50$ for all planned contrasts).

Priming also influenced the attribute looking times of novices and experts differently, as demonstrated by a significant prime × expertise interaction ($F(8,310) = 3.42$, $p < .001$). These results, aggregated across product categories, are shown in figure 3. Consistent with hypothesis 4, novices who received the money prime spent more time looking at price information and less time looking at quality (safety or comfort) information than did novices who received the quality prime ($F(8,310) = 5.58$, $p > .0001$). Consistent with hypothesis 5, there was no significant effect of priming on attribute looking time for individuals of moderate expertise ($F(8,310) = 0.92$, $p > .50$) or high expertise ($F(8,310) = 0.87$, $p > .50$).

The Mediating Role of Search. We hypothesized that browsing behavior would mediate the effect of priming on preference for novices (hypothesis 4) but not for experts (hypothesis 5). In other words, the relationship between priming and preference would be mediated by external search behavior only for novices, whereas experts would rely more on internal memory search and inference in forming preference. Baron and Kenny (1986) refer to this type of model as "moderated mediation" because the level of expertise moderates the mediational effects of search behavior. In order to test this model, we used looking time as the mediating variable (as defined by the difference between time spent looking at price information and time spent looking at quality information) and expertise as the moderator.

[3]In a prior study, not reported here, we examined information acquisition via user logs that record time at the server (rather than the client, as in this study). The results largely replicated the information acquisition analysis that we report here when we analyzed the order of acquisition. However, analysis of time, although directionally correct, suffered from excessive noise due to caching and network delays, suggesting that client-side measurement of latencies may be more desirable than server-side measurement in future research. That study also replicated the choice, constant sum, and mediational analysis reported here.

The two measures of search, looking time and number of attributes searched, are highly correlated because an individual must necessarily select an item before spending time looking at it. Not surprisingly, our pattern of results was similar for both measures, and therefore, we present only the looking time results.

The following relationships were examined following the steps outlined by Baron and Kenny (1986) as necessary to establish mediated moderation: (1) priming influenced preference, as already established ($F(8, 310) = 2.19$, $p < .05$); (2*a*) priming influenced looking time ($F(8, 301) = 4.24$, $p < .0001$) and looking time influenced preference ($F(1, 300) = 5.55$, $p < .05$); (2*b*) when looking time was added to model 1, the effect of priming on preference was reduced ($F(8, 310) = 1.16$, $p > .20$); and, (3) finally, the expertise × looking time interaction affected preference ($F(1, 299) = 3.54$, $p < .10$). The presence of this interaction, along with the mediational effects of looking time on the priming-to-preference relation, indicates the existence of moderated mediation.

In other words, mediation only occurred in the low-expertise condition. For low-expertise subjects, priming had a strong effect on looking time ($F(8, 310) = 3.47$, $p < .001$), and when looking time was added to the preference model, it had a significant effect on preference for the cheaper product ($F(1, 283) = 5.66$, $p < .05$) and reduced the effect of priming on preference for the cheaper product ($F(8, 325) = 1.80$, $p < .10$).

In contrast, mediation did not occur for the medium- and high-expertise subjects. Priming had no effect on looking time for medium-expertise ($F(8, 310) = 0.92$, $p > .50$) and high-expertise subjects ($F(8, 310) = 0.87$, $p > .50$). When added to the preference model, looking time did not exhibit a significant effect on preference nor did it reduce the effect of priming for either group of subjects.

Effects of Prime on Attribute Weights and Product Ratings. Despite the observed differences in preference, subjects' ratings of attribute importance were not affected by the primes. The background prime did not affect subjects' stated importance of quality ($F(8, 310) = 1.11$, $p > .50$) or price ($F(8, 310) = 0.32$, $p > .50$) or the difference between the importances of these two attributes ($F(8, 310) = 0.33$, $p > .50$). The product ratings on particular features, such as the safety of the Calabria, also did not differ as a function of the prime, expertise, or their interaction.

Demand Characteristics. As in other experiments, when subjects were asked the purpose of the experiment, not a single individual mentioned the graphics, visuals, pictures, or wallpaper in their responses. On the next page, when they were asked whether they believed that background visuals might have affected their choices, 13.77% of subjects said "yes." However, 9.35% of subjects also agreed that download time might have influenced their choices, and this was not the purpose of our experiment. These effects do not appear to be subliminal; when subjects were asked to recall background wallpaper in an open-ended question, 30 subjects recalled pennies, 25 recalled clouds, and 10 recalled flames.

Discussion. Experiment 2 confirmed that, although visual priming influences choice for both experts and novices, it is accomplished through different mechanisms for these two groups. After viewing the prime, novices are induced to spend more time looking at information related to the primed product feature, which then affects their preferences. However, experts show no differences in looking time as a function of the priming, but they still tend to prefer the product that excels on the primed feature.

What were the experts doing while the novices were searching for information? Although we cannot be sure using our current data, the differences in decision processes we found for experts and novices, combined with the nature of our decision task, put some constraints on possible explanations. First, as Alba and Hutchinson (1987) point out, experts are more likely than novices to make schema-based inferences, allowing them to assume the presence of typical product attributes when this information is not externally available. Therefore, even though our products were hypothetical, the product class is not, and car experts are likely to assume that a typical minivan is safer and more expensive than a typical sedan, without relying on external search. However, when these experts rely on memory rather than external information, they are still likely to use selective processing of attribute information and eliminate brands from consideration on the basis of partial examination of their attributes (Biehal and Chakravarti 1986). Thus, in response to the prime, experts appear to have selectively considered information in their memories, while novices selectively considered external information.

How do we reconcile the unexpected inconsistency between product choice and stated attribute importance? One might suspect reactance to the manipulated background. However, reactance seems unlikely since many subjects recalled the background visuals, but few admitted that the visuals might have affected their responses. Another possibility is that subjects were not conscious of the priming's effect, and thus, they were unable to report it when asked about attribute importance, a result consistent with other research. For example, Bizer and Krosnick (2001) recently found that, whereas increased attitude importance can cause increased attitude accessibility, increased attitude accessibility does not always increase attitude importance. As we have seen, priming may cause increased use of certain attributes, which are then weighted more heavily in choice because of availability, heuristics, and inference. However, it is unlikely that the priming changes the individual's underlying long-term perception of the attribute's importance.

GENERAL DISCUSSION

This research has both applied and conceptual goals. As an applied contribution, it illustrates the potential of the World Wide Web for use in consumer behavior experimentation (Johnson 2001). In particular, our last study brings

together at a fairly economical level a large relevant subject population, producing increased external validity while gathering process data traditionally collected in laboratory settings.

As a conceptual contribution, we demonstrate that visual primes can produce changes in choice, even for experts. We have also suggested that priming affects novices and experts via different routes. For novices, priming effects operate via external search and these effects mediate the observed changes in preference. For experts, external search remains unchanged and yet their choices are still affected. This finding, while consistent with the idea that experts have richer internal representations of the product class, is inconsistent with the idea that they are less easily swayed by contextual effects.

Although the link between priming, increased accessibility, and judgment has been well documented in both consumer and social psychology, the current work suggests other effects. The first, following from our analysis of novices, is that priming can influence search, which, in turn, influences choice. This result extends the range of the potential influences of priming. Our results with experts are less definitive because we do not directly observe the process that creates changes in choice. However, since we used new brands, unknown to the experts, it is not simply increased accessibility of information about the brands but, perhaps, the use of inferences about the products that are consistent with the prime.

The relationship between priming and expertise is complex and deserves further research. The choices in our studies were hypothetical, and it will be important for future research to demonstrate effects on choices that have greater consequences for subjects. A broader range of primed attributes and products would also lend credibility to these results. Finally, the internal, memory-based process by which priming influences the choices of experts needs to be explored further in future research.

It is important to note that our priming manipulation was not subliminal. All of our subjects could plainly see the background on the first page, and many recalled the wallpaper when asked in study 2. However, an important question is whether or not they were aware of the prime's effect. In fact, most subjects did not think that the wallpaper influenced their choice. Perhaps even more surprisingly, the wallpaper did not change subjects' attribute importance ratings. This lack of awareness suggests that the combination of labile preferences and the fluidity of design in electronic environments may present significant challenges to consumers.

APPENDIX A

FIGURE A1

SCREEN FOR SOFA TASK WITH COMFORT PRIME

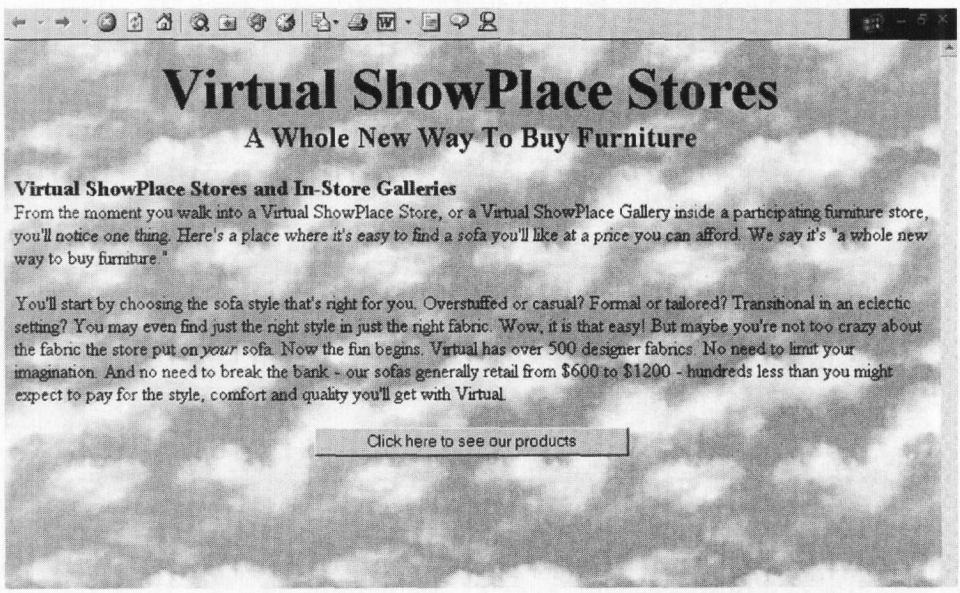


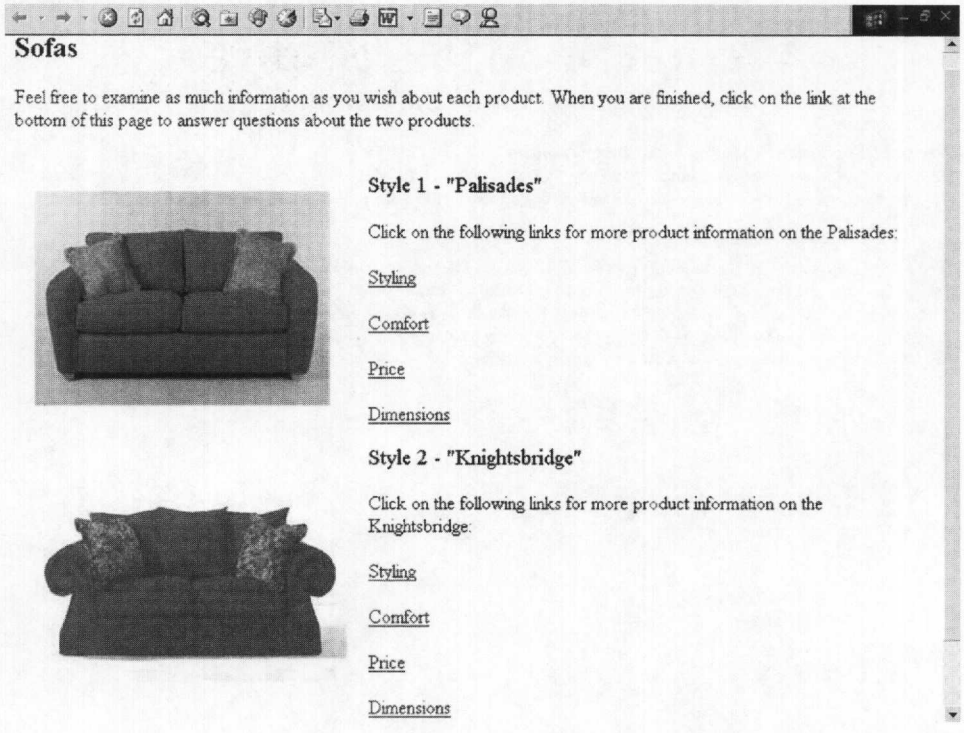
FIGURE A2

SCREEN FOR SOFA TASK WITH PRICE PRIME

APPENDIX B

FIGURE B1

PRODUCT INFORMATION SCREEN FOR SOFA TASK



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