

Running Head: CONSTRUCTING PREFERENCES ONLINE

**CONSTRUCTING PREFERENCES ONLINE:
CAN WEB PAGES CHANGE WHAT YOU WANT?¹**

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Abstract

This paper examines the idea that web page design can change preferences by influencing attribute importance. An individual examining a web page can be primed by the background pictures or colors, which then affect attribute weights and ultimately product choice. A pilot study demonstrated that a web page background can manipulate salient features. Experiment 1 showed that these background stimuli actually influence product choice. A second experiment replicated the results with a large sample of Wharton Virtual Test Market panel participants, and also studied differences in the information search process as a result of priming. This research confirmed that peripheral cues in electronic environments can have a significant impact upon consumer choices.

CONSTRUCTING PREFERENCES ONLINE: CAN WEB PAGES CHANGE WHAT YOU WANT?

Electronic commerce presents to consumers a world which is mostly symbolic representations of products. These artificial marketplaces (Johnson, Lohse and Mandel, 1999) are have many aspects of the decision environment that are potentially manipulable, in part because they are totally removed from the physical presence of the product. As a result, the seller has great control over the design of these shopping environments, and at the extreme, can potentially design one for each customer.

In this paper we examine the idea that web page design can change preferences by influencing attribute importance. Specifically, the construction of preferences (Slovic, 1995, Fischhoff, 1991, Payne, Bettman and Johnson, 1993) may be influenced by web page backgrounds through associative priming. Priming occurs, for example, when a person retrieves an item from long-term memory and activation spreads automatically to other related items in memory (Higgins and King, 1981). This phenomenon has been shown to impact judgment in a number of ways. The construct that is currently activated in memory can impact, for example, one's judgment of one's own happiness (Strack, Schwarz and Gschneidinger, 1985), judgements of another person's hostility (Srull and Wyer, 1979), or the expensiveness of a car (Herr, 1989).

An individual examining a web page may be primed by the background pictures or colors, which may then affect attribute weights and ultimately product choice. For example, if the web page background is yellow (and has a texture similar to a lemon), the "lemon" node in one's brain may activate automatically, causing inferences about the quality of the car. Or a fiery orange background could cause an individual to draw inferences about the car's safety.

It is well established that priming can affect consumers' attitudes and perceptions (Herr, 1989; Yi, 1990; Schmitt, 1994). However, this research adds to the literature in several ways. First, we hope to extend priming research from print advertisements to a medium that is interactive (Ariely, 1998). Second, this research shows the effect of priming on a consumer's *choice* of products. Third, this paper explores the impact of priming on information search, which may in turn mediate choice. Finally, few studies to date have examined the effects of subtle visual stimuli on preferences.

On the web, search costs are radically reduced (Bakos, 1997), and the popular press (Anders, 1998; Cortese and Stepanek, 1998; Kuttner, 1998) suggests the dawn of more perfect marketplaces and more powerful consumers. In fact, fears of increased price competition, producing commodity-like conditions and Bertrand equilibria, are a major reason why existing businesses are resistant to electronic marketplaces. This paper suggests, on the contrary, that caveat emptor still has a place on the web.

What Do We Know About Priming?

The psychology literature has used the word priming to refer to several distinct types of phenomena that share the same underlying mechanism, spreading activation. Retrieving an item activates its internal representation, which then spreads through a network of related memory traces, facilitating later retrieval of these traces. In *semantic priming* studies (Collins and Loftus, 1975; McNamara, 1992; McKoon & Ratcliff, 1995), subjects decide whether an item, such as *dog*, is a word or nonword. Responses are faster and more accurate when preceded by an associated word, such as *cat*, than when preceded but an unassociated word.

In a second type of priming experiment, which we will call *categorical priming*, the dependent variable is the subject's judgment about a person, product or object, rather than a response latency. This judgment can be influenced by the constructs that are activated in an earlier task. For example, in a first task, subjects must construct sentences using words that activate thoughts about hostility, and then in a second task, rate an ambiguous individual's hostility (Srull and Wyer, 1979). The subsequent rating of the ambiguous target's hostility increases with the number of times hostility has been primed and decreases with the time interval between prime and stimulus (Srull and Wyer, 1979). In another application of categorical priming, Schwarz and colleagues showed that judgments about one's own happiness can be influenced by the information that has been made accessible in memory by earlier questions on a questionnaire (see for example, Strack, Schwarz and Gschneidinger, 1985).

There have been several applications of categorical priming to marketing. Herr (1989) showed that priming can influence later judgments of a car's price. Hypothetical cars were judged more expensive following priming by expensive cars than following priming by inexpensive cars. In a study by Schmitt (1994), subjects who were primed to think about personal values were more likely to evaluate a picture in terms of these values, while subjects who were primed on social values were more likely to refer to social values in their interpretations.

In a third type of priming, which we will call *feature priming*, a subject is exposed to a prime that is associated with a particular feature, and this feature is then weighted more heavily in evaluation. For example, Yi (1990) showed that priming certain product attributes prior to ad processing can affect the way the ad is processed, particularly when it contains ambiguous information. Subjects who were primed on versatility by looking at an advertisement gave a versatile computer a higher overall rating than a computer that was easy to use, while subjects

who were primed on ease of use rated the user-friendly computer higher. This showed that priming can cause a certain product feature to become more salient in the consumer's mind, which can result in higher or lower evaluations. Chapman and Johnson (1997) and Strack and Mussweiler (1997) argue that priming of features accounts for the anchoring effects in which an irrelevant numeric anchor influences a relevant judgment. The current study also utilizes feature priming, showing that a web page background can influence the importance of particular product features, and goes a step further by showing that feature priming can affect choice behavior.

Although most priming studies have used judgment as the dependent variable, there have been a few recent applications of priming to behavior. In one such application, Langley et al. (1992) showed that subjects who were told to use aggressive words in a story-writing exercise showed more interest later in viewing violent film clips than subjects who were told to use nonaggressive words. In addition, subjects for whom an elderly stereotype was activated walked more slowly when leaving the experiment (Bargh, Chen and Burrows, 1996). And a recent article in *Nature* (North, Hargreaves and McKendrick, 1997) demonstrated that French wine outsold German wine when French music was playing in the store, whereas German wine outsold French wine when German music was playing.

In applications, primes seldom occur in isolation, raising several interesting questions: How quickly do they decay, and do repeated primes (potentially across different modalities) reinforce each other? Higgins, Bargh and Lombardi (1985) provide evidence that activation decays slowly over time, and how slowly it decays depends on how frequently the construct had been primed. When subjects were exposed to multiple primes, the most recently primed item was more likely to be accessed after a short time delay (15 seconds), while the most frequently primed idea was more likely to be accessed after a long delay (120 seconds). The current research will

examine whether the activation of a product feature on one page can affect subsequent choices of products on other pages, which may contain other, conflicting (or consistent) primes.

While the current research is novel in that it examines computer mediated choice, it also contributes to the theory of priming. Several aspects of this research represent new knowledge:

- Many studies have examined priming's effect on attitude or judgment (Srull & Wyer, 1979; Higgins & King, 1980; Bargh & Pietromonaco, 1982; Herr, Sherman & Fazio, 1983; Herr 1989; Schmitt 1994). Attitude has not always been a reliable predictor of an individual's behavior, however (Fishbein and Ajzen, 1975), and applications of priming to choice behavior are scarce. In contrast, this study focuses on the effect of priming on a consumer's choice of products. Such a result would further strengthen the relevance of priming to the study of consumer behavior, and provide a link between these phenomena and the idea of constructive preferences in the behavioral decision research literature.
- Second, this paper explores the nature of priming effects and examines the possibility that priming changes external search as well as internal retrieval. If we believe that priming works by increasing the accessibility of product related information, we might suggest that its effects are primarily limited to memory-based choice. However, it is possible that priming leads to differences in search, which would suggest that priming might impact upon stimulus based search as well. Such a demonstration would help elucidate the mechanisms producing priming effects. Another benefit, if successful, 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, Schkade and Bettman, 1993) or Search Monitor (Brucks, 1985).

- Third, while several marketing studies have shown that *verbal* stimuli can influence consumers' judgments, few studies to date have examined the effects of subtle visual stimuli on these judgments. Many psychologists have studied the effects of visual primes (e.g., Posner, Snyder & Davidson, 1980). However, these primes have been shown to affect perceptual readiness, as measured by response time in feature identification, which is quite different from the effect of feature priming upon choice behavior which we examine.
- Fourth, the current study provides a high level of external validity. Participants are making choices in an atmosphere that closely mirrors an increasingly popular shopping environment, the World Wide Web. Other priming studies have used manipulations that a consumer is unlikely to encounter, such as word-search games proof reading tasks, etc.
- Finally, there are many reasons why one might not think that priming would work on the World Wide Web, which is thought of, in the popular press (e.g., Cortese and Stepanek, 1998), as an environment that will *improve* consumers' decisions. Many argue that since the medium is interactive, shoppers will control their own exposure to these stimuli, minimizing priming effects. Similarly, some have speculated that the web induces a state of 'flow' (Hoffman and Novak, 1996) which may diminish or eliminate the effect of priming. However, if successful, this research demonstrates the powerful potential of on-line atmospherics, in sharp contrast to the media's view that the web empowers consumers.

Pilot Study

Method

For our hypothesized effect to work, we need to establish that primes affect the differential salience of attributes. To demonstrate this, we ran a pilot study administered via the World Wide Web with forty-seven subjects. Subjects first read an advertisement that featured a product and then, on a separate page, listed the important attributes when buying the product. We varied the backgrounds of the first page to prime certain product features.

The two products, sofas and cars, were selected because they appealed to both students and non-students. Each participant completed the task for both products, and were randomly assigned to one of two primes for each product. This resulted in a 2 (product) x 2 (prime) mixed design.

For the sofa task, participants either saw the ad with a blue background with clouds, designed to prime comfort, or with a green background with pennies, designed to prime price. For the car task, subjects saw the product description on a page with either a red and orange flame-like background, designed to prime safety, or a green background with small dollar signs, designed to prime price. Upon initially accessing the task, the subject read some text describing the shopping site, with the prime in the background. The purpose of this design was to allow time for subjects to be primed by the background cues before seeing the actual ad. Then the individual scrolled down and looked at picture of the product and a few product claims. The picture of the car and product claims were taken from an actual web advertisement for the Chevy Lumina, selected because a pre-test showed that the car was not easily identifiable from the picture and description, and renamed "Calabria." The furniture site featured a sofa named the "Palisades." Examples of all experimental materials are available at: <http://fourps.wharton.upenn.edu/mandel/>.

After examining each ad, the subject proceeded to the next page (containing a gray background and no prime), and listed the four most important attributes (in order) to consider when buying a sofa or car. The dependent variable, importance rank, ranged from 1 (indicating that the attribute of interest was mentioned first) to 5 (indicating that the attribute of interest was not mentioned). Two independent judges read the lists of salient attributes and assigned importance ranks for the attributes of interest and any other attributes that subjects mentioned frequently.

Results

The results of the pilot study showed that subjects indeed mentioned primed attributes more frequently than unprimed attributes. A multivariate ANOVA with planned contrasts confirmed that subjects primed on comfort found comfort more salient than did those who were primed on price, while subjects primed on price found price more salient than did those who were primed on comfort ($F[1,135]=10.02$; $p=.001$). As shown in Table 1, for the sofa task, subjects who were primed with the cloud background assigned comfort an average importance rank of 1.83, while subjects who were primed with the penny background assigned comfort an average importance rank of 2.72. A Wilcoxon rank sum test revealed that this difference was highly significant ($W=7.74$; $p<.0001$). Meanwhile, subjects who saw the clouds assigned price an average rank of 3.69, which was significantly less important than the average rank given by subjects who had seen the pennies, 2.94 ($W=2.02$; $p=.0217$). Other features that were mentioned frequently were appearance and washability/durability. However, the importance ranks of these attributes did not differ significantly between treatment groups.

| Feature Importance - Sofa Task | | | | |
|---|----------------|--------------|-------------------|------------------------------------|
| | Comfort | Price | Appearance | Washability/ Durability |
| Clouds | 1.83 | 3.69 | 2.21 | 4.34 |
| Pennies | 2.72 | 2.94 | 2.00 | 4.33 |
| W* | 7.74 | -2.02 | n.s. | n.s. |
| p | 0.0001 | 0.0217 | | |
| Feature Importance - Automobile Task | | | | |
| | Safety | Price | Style | Fuel Efficiency |
| Flames | 3.04 | 3.4 | 3.48 | 4.16 |
| Dollars | 3.5 | 2.68 | 3.18 | 3.86 |
| W* | -0.75 | 1.24 | n.s. | n.s. |
| p | 0.2266 | 0.1075 | | |

Table 1: Importance Ranks

For the car task, a multivariate ANOVA with planned contrasts confirmed that subjects primed on price were more likely to mention price as important than those primed on safety, while subjects primed on safety were more likely to mention safety than those primed on price ($F[1,135]=3.21$; $p=.06$). Subjects who saw the flaming background in the car task assigned safety an average importance rank of 3.04, while subjects who saw the background with dollars an average importance rank of 3.5. This difference was in the hypothesized direction, but a Wilcoxon rank sum test showed that the difference was not significant ($W=-0.75$; $p=.23$). Subjects who saw the flaming background assigned price an average importance rank of 3.4, while subjects who saw the money background assigned price an average importance rank of 2.68, and this difference approached significance ($W=1.24$; $p=.11$).

Two other features that were mentioned frequently by subjects were style (or appearance) and fuel efficiency. However, there were no significant differences between the two treatment groups in the importance ranks assigned to these two features. Another attribute that might have

been primed by seeing flames is the car's power, but only one subject who saw the flaming background mentioned power at all, while two subjects who saw the money background mentioned it.

Did the priming differentially alter the subjects' moods, thereby influencing their responses? This possibility was tested on the last 15 subjects by having them fill out the PANAS affect scale (Watson, Clark & Tellegen, 1988), which measured emotions such as interest, excitement and fear on a scale from 1 to 5. Neither the overall scale nor its components showed differences between the treatment groups, $p > .20$, so the priming does not appear to have changed subjects' moods.

One possibility in priming studies is that subjects become aware of the experimenter's hypothesis. Did our subjects exhibit such demand effects? The last 15 subjects were given a set of open-ended debriefing questions, such as "What did you think this experiment was about?" and "How do you think the experimenter wanted you to answer the questions?" None of these subjects appeared to be aware of the experiment's purpose. Many subjects proposed that the goal of the experiment was to assess the role of attitudes, moods or values on product preferences. However, not a single subject referred to the background wallpaper or any other features of the web page design.

The pilot study establishes that our primes do increase the salience of certain attributes. However, the major focus of this research is on possible impacts of priming upon product choice, which we capture in the following hypothesis.

H1: Subjects will favor products that are stronger on the primed attribute.

We also examine the consumer's level of expertise in the product area as a possible moderator of the priming effect. 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 experimental 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. Therefore, the experiment will examine whether novices are more susceptible to the influences of priming than experts:

H2: The priming effect will be stronger for novices than for experts in the product class.

Experiment 1

Design

Does priming an attribute increase preference for products that excel on that attribute? The first experiment tested the effect of priming on product preference and choice. It also examined whether the effects of priming would be moderated by the subject's expertise in the product category. We employed the same two product classes, furniture and automobiles, and the same background primes as in the pilot study. The first manipulated factor was product category. Since each subject performed the task for both furniture and automobiles, this was a two-level within subject factor. The second factor, background prime, was between subject. For each category, the subject saw only one of two possible primes. On the sofa website, this initial screen was either blue with clouds (to prime comfort) or green with pennies (to prime price). On the car website, the background was either red and orange with flames (to prime safety) or green with dollars (to prime price).

Expertise was measured with three variables: ownership (whether or not the person had bought a car or sofa), subjective knowledge (self-ratings on product expertise) and objective

knowledge (multiple choice questions designed by the experimenter), as recommended by Brucks (1985). For the data collected in this study, a Cronbach test of reliability revealed that the three measures were not highly correlated ($\alpha=.62$) for cars and entirely uncorrelated ($\alpha=0.01$) for furniture. It seems that ownership, subjective knowledge and objective knowledge represent three independent constructs. Thus, the three measures were examined independently as covariates in the analysis.

Method

Participants were 76 undergraduate students at a major university, who completed the 20-minute task in a computer lab in exchange for a \$5.00 payment. For each product category, subjects visited a web page describing a hypothetical shopping site. On this page, the background served as a prime, and subjects read the text as long as they desired. **Figures 2 and 3** show examples of these pages for the furniture task, with either clouds or pennies in the background.

The subject then went to a shopping environment which offered two different products within the product category. Each showed a picture and links to separate pages that described the product's features. Each of the two cars had descriptions of its 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.² The sofa product page contained the Palisades, an economical but less comfortable couch, and the Knightsbridge, which was comfortable but expensive. An example of this page is shown in **Figure 4**.

²Coincidentally, Toyota introduced a minivan called the Sienna several months after this study took place, and thus the fictional minivan's name was changed to Savannah in the second experiment.

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. Subjects also rated the two available products on the two target features. The order of these questions was randomized 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 sofas on comfort and price, and rated the two cars on safety and price. One reason we took these measures was to affirm that our product descriptions produced the desired perceptions. Indeed, the Palisades was perceived as a cheaper ($t[150]=1.35$; $p=.09$, by a paired differences t-test) and less comfortable sofa ($t[150]=7.91$; $p<.001$) than the Knightsbridge, and the Calabria was perceived as a cheaper ($t[138]=1.78$; $p=.04$) and less safe ($t[138]=5.31$; $p<.001$) vehicle than the Siena. Due to a minor programming bug, we did not receive price ratings from six of the subjects, and so these data were excluded from the above analysis.

In this paper, we have hypothesized that priming influences choice by changing the differential *weights* assigned to product attributes. However, priming might instead influence choice by changing one's *beliefs* about the product's attributes. For example, would a subject

primed on safety perceive a larger difference in safety between the two automobiles than one primed on price? The difference in safety between the two vehicles was perceived similarly among subjects primed on safety (mean=1.25 out of 7 points) and those primed on price (mean=1.08). The difference in price was also perceived similarly among these two groups (.41 vs. .37, respectively). These beliefs did not differ significantly among treatment groups for either the car task or the furniture task. Thus, it appears that priming does not change an individual's beliefs about product attributes.

Dependent Measures

In the choice question, subjects were asked to choose the product they would prefer to purchase. A logit analysis of the data, aggregated across both product categories, indicated that subjects who were primed on money were significantly more likely to choose the cheaper product than those primed on the quality feature (safety or comfort) ($X^2[1]=4.84$; $p=.0278$). This effect was stronger for sofas than for automobiles. 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 ($X^2[1]=5.19$; $p=.02$). In the car task, the cheaper automobile 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 ($X^2[1]=1.72$; $p=.19$). Expertise and the priming*expertise interaction did not have a significant effect on choice.

In the constant sum question, subjects were instructed to allocate 100 points between the two products to indicate their preferences. When this constant sum measure was regressed against the independent variables, the main effect of priming approached significance. In the

furniture category, subjects who were primed on price gave more points on average (mean=55.8) to the cheaper, less comfortable sofa than did those who were primed on comfort (mean=45.9). This difference approached significance ($F[1,66]=3.48, p=.067$). For the automobile category, subjects who were primed on price gave more points on average (mean=61.5) to the cheaper, less safe car than did subjects who were primed on safety (mean=50.8). This difference also approached significance ($F[1,66]=2.98, p=.089$). Therefore, subjects had a stronger preference for the cheap product when they had seen a money prime than when they had seen a prime for the quality attribute (either safety or comfort).

Hypothesis 1, which suggests that subjects who are primed on a particular product feature will be more likely to prefer the product that excels on that feature, was supported. The priming effects were stronger for sofa choices than for car choices, perhaps because subjects were more familiar automobiles and had stronger preferences in this category. Experts were equally susceptible to this manipulation as non-experts, so Hypothesis 2 was not supported. In addition, 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.

Effects of Multiple Primes

Further evidence that priming affects choices can be found by exploring the effects of multiple primes. Since the primes for both tasks were randomly assigned, some subjects were primed twice on money (once in the car task and once in the furniture task), some were primed twice on a quality feature, and others were primed once on each construct. Subjects completed the two tasks within minutes of each other. Were their decisions in the second task influenced by the priming in the first task?

In order to test this possibility, we compared the constant sum responses on the second task from subjects who were primed on money twice to those who were primed on quality twice and to those primed on each feature once. As shown in Table 2, a paired differences t-test showed that subjects who received the money prime twice had marginally significant higher mean responses on the current product (mean=64.94, $p > .063$) than other subjects, indicating a stronger preference for the cheaper, lower quality product. Conversely, subjects who received the quality prime twice had significantly lower mean responses (mean=39.13, $p > .018$) than other subjects, indicating a stronger preference for the more expensive, higher quality product.

| 1st Prime/2nd Prime | Money/Money | Quality/Money | Money/Quality | Quality/Quality |
|---------------------|-------------|---------------|---------------|-----------------|
| Mean Constant Sum | 64.94 | 64.44 | 47.25 | 39.13 |
| Mean Market Share | 63.3% | 63.6% | 33.3% | 33.3% |

Table 2: Points assigned to the cheaper, lower quality product in the second of two tasks

These results appear to indicate that: (1) the previous prime exhibits a carryover effect on the current product evaluation; but (2) the recent prime has more influence on product

evaluation than the previous prime. Thus, when subjects were primed a second time, the first prime was still activated, but had decayed somewhat because of the time delay. While unexpected, these results emphasize the importance of primes by demonstrating how consistent repeated primes have a synergistic effect.

The choice data, in contrast, do not demonstrate the double priming effect. As shown in the second column of Table 2, subjects who received the money prime on the second task had approximately 63% probability of choosing the cheaper product, regardless of the previous prime they received. Subjects who received the quality prime had a 33.3% chance of choosing the cheaper product, again regardless of the previous prime. This result is not surprising; When subjects could express their preferences on a continuous scale the test may be more sensitive than when examining the binary choice probabilities.

Experiment 2

Experiment 1 provides supportive evidence that priming of attributes can affect choice. In the next experiment we attempt to replicate the effect using a large non-student sample. Further, we examine the effect of the primes by examining information search, exploring the possibility that primes influence not just the retrieval in memory based search, but in external search as well. Many demonstrations of priming explain their results using the increased salience and availability of prime consistent information in memory. 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. Alba, Hutchinson and Lynch (1991) assert that the question of whether product or attribute information is considered depends on how accessible this information is in memory. Biehal and Chakravarti (1986) have shown that brand

accessibility can influence the amount of information sought about the brand as well as brand choice. But will individuals more thoroughly search for information about a particular product feature when that feature has been made accessible?

The purpose of the second experiment is to replicate the choice data from Experiment 1, and further, to examine whether priming influences the consumer's search for information. This leads to the following hypotheses:

H3: Priming will influence the order in which subjects look at attribute information.

H4: Priming will influence the amount of time spent looking at attribute information.

One way to examine a subject's search patterns on the World Wide Web is by examining logfiles. For each web page that an individual accesses, a logfile is written to the server that contains the individual's IP Address (a unique identifier that is associated with the user's computer), the web site URL, and the date and time of the transaction. Since the information for each product attribute in the experiment was located on a different page, logfiles should track the order in which subjects retrieved this attribute information and the amount of time spent looking at each attribute description. This experiment tests hypotheses H3 and H4 by collecting a complete set of logfiles for each subject.

Experiment 2

Procedure

The second experiment was exactly the same as the second, with a few exceptions: (1) To provide access to the logfiles, the program included a statement which prevented the experimental web pages from being cached on a user's hard drive; (2) A larger, more

representative sample of subjects participated via the Wharton Virtual Test Market; and (3) Since there was no evidence that expertise mediated the priming effect in Experiment 1, expertise was not measured in this experiment.

The Wharton Virtual Test Market contains a panel of internet users from 82 countries who agreed to be contacted for future surveys after filling out an initial sign-up survey. The United States panelists represent 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 includes the population median of \$35,225) (Bellman, Lohse and Johnson, 1999). Of the panelists, 1,581 were contacted via email and asked to complete the current experiment on the World Wide Web in exchange for a chance to win one of the following prizes: one grand prize of \$200, one second prize of \$50, and four third prizes of \$25.

Due to our inexperience with running such large-scale web-based experiments, there were several problems with the data that we did not anticipate. In addition to expected non-response, programming errors lead the data contained some incomplete and duplicate observations. We deleted observations containing missing data (including those from participants who only completed one of the two product categories) and all duplicate observations (from participants who wanted to increase their chances of winning the cash prize), resulting in a final sample size of 364. Response rates and other data problems were unrelated to any of the experimental variables.

Results

Choice and Constant Sum

Replicating the results of Experiment 1, subjects who were primed with the money background weighted price more heavily in their decisions than subjects who were primed with the quality background. A logit analysis of the choice data, aggregated across the two product categories, confirmed that the web page background had a significant effect on product choice ($X^2[1]=8.87$; $p=.003$). As in the first experiment, the effect was stronger for furniture than for cars. The cheaper sofa had a market share of 43.6% among those primed on money, and a market share of 30.7% among those primed on comfort ($X^2[1]=6.67$, $p=.01$). The cheaper car had a market share of 51.2% among subjects primed on money, and a market share of 42.2% among those primed on safety ($X^2[1]=2.66$; $p=.10$).

Analysis of the constant sum data showed that, for furniture, subjects who saw the money background gave significantly more points to the cheaper sofa (mean=51.62) than did those who saw the background with clouds (mean=41.30) ($F[1,362]=11.29$, $p<.001$). For cars, subjects who saw the money background gave significantly more points to the cheaper car (mean=56.25) than did those who saw the flaming background (mean=48.31) ($F[1,362]=4.17$, $p=.04$). Therefore, Hypothesis 1, which states that subjects will tend to prefer products that excel on the features on which they were primed, was again supported.

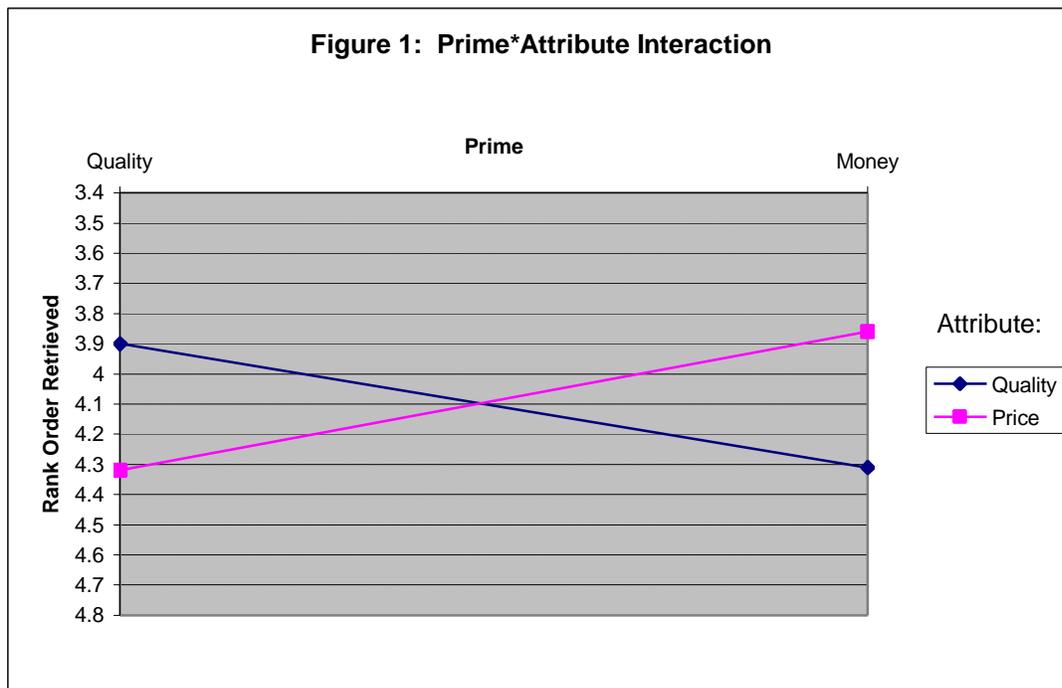
Information Search

How did priming affect the timing and order of information acquisition? One variable that was strongly influenced by priming was the order in which attribute information was retrieved. Hypothesis 3 suggested that an individual will retrieve more salient information sooner than less salient information. For example, subjects who have been primed by a background with pennies will retrieve information about a sofa's price earlier than those who have been primed by a background with clouds. Conversely, subjects who have seen a background with clouds should retrieve information about the sofa's comfort features sooner than those who have seen the money background.

The product page of the experiment showed pictures of two products and links to four attribute pages for each product. This resulted in a total of eight attributes which the subject could examine. The dependent variable discussed here is a measure of the order in which the subject chose to look at these attributes. For example, some subjects looked at all of the attribute pages in the order they were presented on the page. Others, for example, looked at the price information for both products first, followed by safety information for both products. The dependent variable, Order Retrieved, ranged from 1 to 9, where a value of 1 indicates that the subject examined the attribute of interest first, a value of 8 indicates that it was examined last, and a value of 9 indicates that it was not seen at all.

One way to analyze these results is to look at the difference in the order in which participants looked at the quality information and price information for each product in question. This difference was calculated for the car category and the furniture category. For example, if the subject looked at price information before quality information, this difference would be positive, and if the subject looked at quality information first, it would be negative. Priming significantly

affected this difference in search order for both furniture ($F[1,362]=4.56$, $p=.03$) and cars ($F[1,362]=67.18$, $p=.0001$). As shown in Figure 1, when subjects were primed on quality, the mean rank order in which they retrieved quality information was 3.9 out of 9, while the mean rank order in which they retrieved price information was 4.32. In other words, subjects primed on quality examined quality information earlier, on average, than price information. In contrast, subjects primed on price examined price information earlier, on average, than quality information. When subjects received the price prime, the mean rank order in which they retrieved price information was 3.86, whereas the mean rank order in which they retrieved quality information was 4.31. This prime*attribute interaction was significant ($F[1,362]=19.77$, $p=.0001$). Therefore, Hypothesis 3 was confirmed.



Hypothesis 4 suggested that subjects would spend more time looking at information about primed attributes. The looking time for an attribute page was calculated by sorting all of the

logfiles for a subject by time of acquisition, and then subtracting the acquisition time of the subsequent page retrieved from the acquisition time of the current page retrieved. Six observations were deleted for having looking times of over 200 seconds. Subjects who saw the money prime looked at price information for an average of 10.2 seconds and quality information for an average of 14.9 seconds, while subjects who saw the quality prime looked at price information for an average of 9.3 seconds and quality information for an average of 11.7 seconds. Thus, Hypothesis 4 was not supported. Individuals who were primed with the money background appeared to look at both price and quality information longer than those who were primed on quality, but the looking time was not significantly different between these two groups. A possible reason for this result is that the "looking time" was a relatively noisy measure which included variables such as the network response time, which vary widely depending on the type of modem used, delays due to traffic and congestion, etc. This suggests the possibility that order may remain a useful search measure under conditions in which latencies are not usable.

Mediation Analysis

We have established that priming affects both search order and choice. But does search order actually mediate the relationship between priming and choice? In other words, we know that priming can influence the order in which an individual searches for product information, but does the order in which they seek out information then influence their preferences?

Baron and Kenny (1986) describe three conditions that must hold in order to establish mediation: (1) the independent variable (*priming*, in our case) must affect the mediator (*search order*, in our case); (2) the independent variable (*priming*) must affect the dependent variable (*choice*); and (3) the mediator (*search order*) must affect the dependent variable (*choice*). In

addition, (3b) the effect of the independent variable on the dependent variable should be decreased when the mediator is added to the regression equation.

Our analysis has established that priming affects both search order and choice, so the first two requirements are met. To test the third condition, we regressed the constant sum measure (a measure of *choice*) on the difference in order in which subjects looked at quality vs. price information for each product category (a measure of *search order*). We found that search order did influence preference for furniture ($F[1,362]=4.60$, $p=.03$), but did not significantly influence preference for cars ($F[1,362]=1.25$, $p=.26$).

The final condition (3b) is that the effect of priming on choice should be significantly reduced by the addition of search order to the regression equation. For furniture, this effect was reduced from $F[1,362]=11.29$ ($p=.0009$) to $F[1,361]=10.53$ ($p=.0013$). For cars, it was reduced somewhat, from $F[1,362]=4.17$ ($p=.04$) to $F[1,361]=3.47$ ($p=.05$). In perfect mediation, the independent variable would have no effect when the mediator is controlled (Baron and Kenny, 1986), so this mediation effect is rather small. However, mediation occurred for the furniture category, so search order appears in some cases to mediate the effect of priming on product choice. Why didn't mediation occur for the automobile category? This is a topic for future research, but one possibility is that individuals employ more internal, memory-based search when selecting an automobile, a category with which most people are quite familiar, and more external search for sofas, a category with which many subjects were probably unfamiliar.

Discussion

This experiment not only replicated the results of Experiment 1 with a larger sample, but showed that the background of a web site can indeed impact a consumer's search process.

Priming influenced the order in which subjects searched for attribute information, but did not affect the amount of time spent looking at attribute information. Subjects tended, on average, to examine earlier information related to the attribute on which they were primed than unrelated information. This is an important result because consumers may terminate their search before looking at all of the attributes.

On some shopping sites such as Peapod, consumers have the option to sort products by a particular attribute (Degeratu et al. 1998), and priming might increase the likelihood of the consumer sorting on the primed attribute. Once the information is sorted, consumers place even greater weight on the sorted attribute (Lohse and Johnson 1998). This would even more profoundly exaggerate the effect of priming on product preferences.

Priming was not shown to influence the amount of time that consumers spent looking at attribute information. There are two possible explanations for this finding. First, the “looking time” measurement also included system response time, which varies widely depending on modem speed and time of day, and thus added a large amount of variability to the data. Second, there may have been a ceiling effect -- most attribute descriptions were only 2-3 sentences long, so most subjects read the entire description, regardless of background prime.

Conclusion

This research has both applied and conceptual goals. In application, it suggests that the combination of labile preferences when combined with the fluidity of design in electronic environments may present significant challenges to consumers. Many experts have predicted that the introduction of electronic commerce would provide consumers with increased power, since they may now search more easily for the lowest-price products, or the features that they desire.

This research suggests that peripheral cues in electronic environments can have a significant impact upon choices. While the study concentrated only on the effects of background color, these results can be extended to include other peripheral cues such as sound and video, and raises the possibility that such priming can occur across modalities. As a whole, this research illustrates the potential impact of on-line atmospherics to influence choice.

This raises the questions concerning the design, ownership and control of online shopping sites. A firm which decides to go to market electronically faces questions about whether or not to go through an intermediary, or to go direct, controlling their own online environment. Our research suggests an advantage of going direct: The firm can create sites that contain colors, backgrounds and other elements that are consistent with the company's message and which emphasize the product attributes for which the company is competitive. Firms should also encourage consumers to stay within the site, since once the individual exits the site, she may be primed by conflicting images at another location.

As a conceptual contribution, this research suggests several results, and raises some interesting potential research questions. First, it suggests that priming can be an important element of constructive preferences for choice as well as evaluations, attitudes and other judgments. Such effects occur even for relatively familiar products and non-student subjects, and appear unaffected by levels of expertise. Of course these choices are hypothetical, and it will be important for future research to demonstrate such effects on choices which have consequences that are experienced by subjects.

It is important to note that our priming manipulation is **not** subliminal. All of our subjects could plainly see the background on the first page. However, an important question is whether or not they were aware of the primes' effect. Certainly, our pretesting showed no signs of such

awareness, but this should be more closely examined in future research. If subjects are aware, we might, in fact, find contrast effects (Schwarz et al., 1985), where subjects decrease the weight given to the primed attribute. Similarly, questions of awareness would seem to be very important for understanding any potential role for public policy in understanding how online marketplaces influence consumers.

Finally, the current research illustrates the potential of the World Wide Web for use in consumer behavior experimentation. Our last study brings together at a fairly economical level a large relevant subject population. In addition, it allows the collection of information search data that previously required special purpose software and the use of a dedicated personal computer. Increasingly, it appears that the laboratory, both in method and concepts, is becoming increasingly relevant to the new world of on-line shopping.

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Figure 2: Screen for Furniture Task with Cloud Background



Figure 3: Screen for Furniture Task with Penny Background



Figure 4: Product Information Screen for Furniture Task

Sofas

Feel free to examine as much information as you wish about each product. When you are finished, click on the link at the bottom of this page to answer questions about the two products.

Style 1 - "Knightsbridge"

Click on the following links for more product information on the Knightsbridge:

- [Styling](#)
- [Comfort](#)
- [Price](#)
- [Dimensions](#)

Style 2 - "Palisades"

Click on the following links for more product information on the Palisades:

- [Styling](#)
- [Comfort](#)
- [Price](#)
- [Dimensions](#)

[Click Here](#) to answer questions about these sofas.