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TRIGGER FEATURES ON PROTOTYPES INCREASE PREFERENCE FOR SUSTAINABILITY

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ABSTRACT

The gap between customers preferring sustainable products in surveys and actually buying sustainable products in the market can be addressed through design. Our previous research proposed a method for creating design features that trigger thoughts of sustainability, termed ST (sustainability triggering) features. In the research presented here, a selection of ST features generated from the previous experiment was designed into realistic toaster prototypes. Subjects participated in a test vs. control purchase experiment, in which some "customers" saw a subset of toasters with ST features during purchasing tasks and some did not. First, subjects selected a subset of toasters for purchase. Then, they chose one from that set for a final purchase. Next, they wrote an email with instructions on how to select a toaster to a hypothetical purchasing agent. Finally, they answered interview questions and rated/ranked toasters. The coded email and interview results demonstrate that exposure to ST features significantly triggered the possible use of sustainability as a purchase criterion.

1 INTRODUCTION

The gap between customers wanting and buying sustainable products poses challenges to engineering designers: addressing preferences for sustainability identified during customer needs analysis does not always lead to market success of a product. Academic work identifies demographic, socio-economic, and psychological characteristics of customers as factors that explain this attitude-behavior gap (e.g., [1-3]). Sustainable products force customers to make perceived or real trade-offs on important product features, such as quality, performance and price (e.g., [4-7]).

The work investigates an alternative approach using an innovative design method to address this gap. The idea that people construct preferences case-by-case when prompted to make a decision [8] implies that sustainable preferences are context-specific, and can be activated by contextual cues. This idea is demonstrated to have market-changing potential by MacDonald et al. [9]. They found that activating customer preference for sustainable design, in this case recycled content in paper towels, lead to substantially increased profitability and decreased GHG emissions.

Judgment of product sustainability is a relatively new and complex customer consideration, and thus the construction of preferences [8] is susceptible to biases and heuristics that are not always helpful [10]. If explicit product features can serve as a guidepost for judging sustainability, or prime a customer to think about sustainability, this can eliminate need to communicate sustainability with marketing messages (e.g., labels and logos), which are susceptible to customer mistrust [11]. We define product feature as a product attribute or characteristic that is visible to the customer when evaluating the product.

The work is an application of Tybout and Hauser's customer behavior model [12] to sustainable products. Customers perceive the products and aggregate perceptions to form product consideration rules and subsequently trade-off preferences under constraints.

In our previous work, we proposed that carefully designed features could trigger customers to think about sustainability. A priming-designers method was proposed: prime designers with a sensory-heightening activity, in the form of a collage exercise

or a questionnaire, before idea generation for features designed to trigger thoughts of sustainability in the customer, termed ST features. Compared to no prime or benchmark primes, the new method helped designers generate more product features that were ST features [13, 14].

This study tests the propositions presented in [13, 14] in a realistic purchase scenario. Subjects performed a set of simulated-purchasing tasks in a test vs. control experimental design and both qualitative and quantitative results were analyzed. The paper proceeds as follows: In the next section, approaches to elicit customer preferences are discussed. Section 3 depicts the detailed experimental processes. Results and discussion are contained in Section 4 and 5 respectively, and Section 6 provides conclusions.

2 EXISTING EXPERIMENTAL APPROACHES TO ELICIT CUSTOMER STATED PREFERENCES

Economists and behavioral decision-making researchers often equate preference with decision-making, or willingness to pay [8, 15]. Customers are modeled as making decisions with different strategies, typically compensatory, non-compensatory, or a mix.

A compensatory decision-making strategy requires explicit trade-offs among attributes. For example, how much more one is willing to pay for a longer rather than standard warranty in a car involves making an explicit trade-off between warranty and price. In non-compensatory strategies, a good value on one product attribute cannot make up for a poor value on another [15, 16]. For instance, one may have a rule that they will only consider purchasing a sedan. When deciding between many products or complex products, it is effective to model customers as using a consider-then-choose decision-making strategy, where they first identify a small consideration set of products, then choose one product from that set [16-19]. This approach is based on the premise that, due to limited cognitive ability, a typical customer can only consider 3 to7 alternatives at a time [20].

Researchers have explored a variety of approaches to model customer preferences. In this review, approaches are classified as compositional or decompositional. Further approaches combine the two, but are not discussed here. In a compositional approach, preferences are investigated by recording explicitly how subjects evaluate product attributes; in a decompositional approach, a product profile is evaluated as a whole [21]. In other words, the former approach uses attribute-based evaluation, and the latter uses alternative-based evaluation.

Compositional Approaches. In Multi-Attribute Utility theory (MATU), customers evaluate the importance and value of each attribute using assumed combining strategies to arrive an overall evaluation. In [22], subjects were asked to rate their preference on each attribute level from 1 to 10, and then allocate a constant sum (e.g., 100) to all attributes to indicate their importance.

CASEMAP (computer-assisted self-explication of multi-attributed preferences) is similar to MAUT, but it results in more descriptive data with narrative questions. In CASEMAP, subjects are questioned to indicate totally unacceptable attribute levels, their most- and least-preferred levels for each attribute; determine the most critical attribute; rate the importance of other attributes relative to the critical attribute, and report preferences of different acceptable levels within each attribute [23]. Partworths for acceptable attribute levels are obtained by multiplying the importance rating and preference rating.

Ding et al. [24] explore an unstructured direct-elicitation (UDE) approach, in which subjects write an email to an agent to explain what type of products they would like to own and ask the agent to buy one for them. This approach is used by our study below. Except for a requirement to begin the email with "Dear friend," subjects can use any format to describe their decision criteria. In Ding's work, the "email" approach is incentive-aligned, and subjects are entered into a lottery with a chance to receive a product that closely matches the one they described (this is not done in our study) [24]. This improves accuracy and specificity. Note that before prompting subject to write an email, UDE requires some initial tasks that involve subjects thinking deeply about their decision process (e.g., CASEMAP, answer discrete choice questions, select some products from a larger set).

Another compositional approach is Web-based upgrading method, which mimics the experience of purchasing a computer from build-your-own-goods Web sites (e.g., Dell). At the beginning, each subject is endowed with a particular version of the product. The subject is allowed to upgrade it to a more desirable product configuration, one attribute at a time, and asked to state his or her willingness to pay (WTP) for each level to which he or she is interested in upgrading for that attribute [22]. A cutoff price generated randomly by the computer for each level of that attribute will determine which level is upgradable. The process is iterated until the subject decides not to upgrade any more. In this way, subjects only evaluate attributes and levels they are interested in and the tasks are more natural.

Decompositional Approaches. In decompositional approaches product profiles are evaluated, typically in comparisons. In a conjoint survey, products profiles are created from combinations of different attribute levels and subjects are asked to indicate their preferences among profiles by ranking, rating, or choosing [25]. Customer preferences are estimated as a combination of the "partworths" of the attribute levels [25]. Choice-based conjoint (CBC) analysis is the most commonly-used conjoint method. To obtain accurate estimates of preferences, conjoint analysis requires a minimum number of profiles to be evaluated; this number increases exponentially as the number of attributes/levels increases and results in tremendous cognitive burden on conjoint subjects [22, 26].

The "Consider-then-choose" approach first asks subjects to state their consideration sets. A consideration set is a subset of presented profiles. Hauser et al. [27] use a web page interface. Product profiles are displayed on the left side of the webpage, represented as icons. When the mouse selects a profile icon, the attributes are displayed in the middle of the screen, and subjects are asked whether or not they would consider purchasing the profile. If the "Consider" button is clicked, the product is displayed in a consideration set on the right side of the webpage. Subjects then choose a product from this set as their final choice and/or rank every product in the set. This is another approach adapted for use in our study, but uses real prototypes instead of a computer screen.

3 METHODOLOGY

3.1. Design of the Experiment

Subjects were exposed to a set of products, with ST features (features designed to trigger thoughts of sustainability) present in test condition A and no ST features, but instead Extra features, in control condition B. A consider-then-choose task, adapted from [27] and an unstructured direct elicitation (UDE) approach (write an email to an agent) [24], as discussed in Section 2, were employed to elicit customer decisions. In the consider-then-choose task, subjects were explicitly asked to form a consideration set first, then make a purchase from that set. In the email task, subjects typed an email to an agent explaining the toaster to buy. They began with "Dear Friend" and then could use any format to describe their preferences. Then subjects answered two interview questions: (Q-Info) what additional information would you like to know about the toasters shown; and (Q-Rationale) what is your rationale for the decisions in the first decision task? The qualitative answers to email and interview were coded by two judges on three dimensions (the data on D3 will not be reported in this paper):

D1: What toaster feature does the instruction talk about? (List of features, check all that apply)

D2: Does that information reveal that the subject is considering sustainability? (Yes/ Could be interpreted as yes/ No)

D3: What is the preference of a criterion expressed in that information? (Essential/ Preferred but not essential/ Acceptable but not preferred or essential/ Trivial/ Must not have)

We propose that sustainability-triggering features of a product lead subjects to seek more information on sustainability and increase their considerations of sustainability during purchasing decisions. This proposition is broken down into hypotheses that are tested using this experiment, in the order of data collected:

H1a: Subjects in condition A consider products from the ST Set more frequently than subjects in condition B consider products from the Extra Set. – tested with consideration data

H1b: Subjects in condition A purchase products from the ST Set more frequently than subjects in condition B purchase products from the Extra Set. – tested with choice data

H2: Sustainability is more frequently mentioned as a purchasing instruction by subjects in condition A than subjects in condition B –tested with email data on D2

H3: Subjects in condition A more frequently seek information of the products on sustainability than subjects in condition B – tested with Q-Info data on D2

3.2. Stimulus Preparation

Selection of product features and levels. Consistent with the previous priming designer study [13, 14], bread toasters were selected as the case product. Customer interviews and web research identified brand, price, capacity, color, and slot size as key attributes. Brand, price, and color were not considered in this study, as they are product attributes that easily dominate choice decisions, and with few subjects and limited prototypes, the experiment could not be complex enough to counteract this effect.

Common features: All of the toasters were in black color, of non-specific brand, and were described as costing the same. Their dimensions were 9.4 by 5.5 by 6.3 inches and they had 2 slots, 4.9 inches in length. Three Base features were included in various configurations across all profiles: slot size (regular/bagel), dial shape, and dial metrics (with numbers or darkness).

Varied features across conditions: Features, and levels of features that varied across experimental conditions are listed in Table 1, which includes a description of all toasters shown to subjects in various combinations, termed profiles. Five ST features or feature levels were included in the study. These were selected from the 171 "good" ST features generated during the design exercise in [13, 14]. The criteria for selecting the features were as follows: (1) have a top rating on triggering thoughts of sustainability across expert and customer judges; (2) have a top rating of feasibility across expert and customer judges; (3) be easily incorporated as a design feature in a prototype; and (4) be applicable in daily use for US customers.

The five features are labeled in Fig 1.: (A) a flip-cover that keeps in heat; (B) two activation levers—one for each piece of bread; (C) a power save mode; (D) an embossed leaf pattern, and (E) a dial with power levels. The power levels around a dial ("600 Watts," "800 Watts," and "1100 Watts") represent the rate of energy consumed at each darkness level. The flipping covers sit on the top of each slot, which are opened by pressing an "Open Cover" button on the front of a toaster, and are automatically closed by the activation level (non-functional in prototype). Two activation levers enable users to heat each slot independently or as a combination, saving energy. A power save button theoretically helps to save energy usage when the toaster is connected to an electric outlet but not toasting, but it is unlikely it would have any real effect on energy usage for a manual toaster. The embossed leaf pattern raises up some areas

on housing surface to make them look like or feel like leaves. Again, it is not necessary that the ST features *be* sustainable themselves, but rather that they trigger thoughts of sustainability.

To balance the experiment, two Extra features were added to the toasters presented in the control condition. These were extra lift and defrost, both represented as buttons on the toaster, and selected by the authors randomly. They were not classified in the experiment of previous priming-designers study [13, 14] as "good" ST features, nor mentioned at all.

Profile design. Subjects each saw a set of eight prototypes with design profiles from Table 1. These included four toasters shared between the test and control conditions, and four toasters for each condition (Fig. 2). Toasters 1-8 are a fractional factorial selection of Base and Extra features. Toasters 1-4 were shared by both conditions and only include Base features, they are called the Base Set. Toasters 5-8 only appeared in the control condition B and include Extra features, called the Extra Set. Toasters 9-16 have ST features and are shown in the test condition, called the ST Set

Prototype fabrication. Thermal forming was used to make toaster prototypes out of ABS (acrylonitrile butadiene styrene) plastic over a foam model with removable components (to create narrower bread slots and leaf patterns). 3D printing was used to create realistic dials, levers, and buttons. Words were printed onto black stickers and affixed to the toasters where labeling was required. Fig. 1 shows some examples of the finished prototypes, including two close-ups, which highlight all of the ST features. Great care was taken to maintain consistency amongst prototypes; it took over ninety hours to create the 16 prototypes used in the study.

(i) Toasters as shown in purchase task

(ii) Close-up 1 (iii) Close-up 2

FIGURE 1. (i) shows a purchase task. (ii) and (iii) show ST features (A) flip-cover that keeps in heat; (B) two activation levers; (C) power save button; (D) embossed leaf pattern, and (E) dial metric writing in watts (power level).

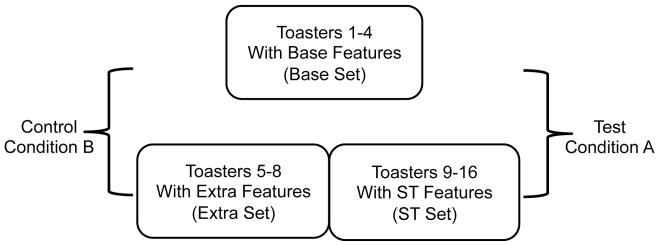

FIGURE 2. Toasters seen in the test and control conditions..

TABLE 1. Feature level combinations for each profile (grey color indicates a feature or feature level appears in that profile).

Toaster #	Appeared in Condition ...	Basic Features/Levels						ST Features/Levels					Extra Features	
		Slot size		Dial shape		Dial metric								
		Standard	Extra wide (Bagel)	Round dial 1	Round dial 2	Numbers	Darkness	Power level	Flipping covers	Two activation levers	Power save	Embossed leaf pattern	Extra lift	Defrost
1	A&B	■			■		■							
2	A&B		■			■								
3	A&B		■	■			■							
4	A&B	■		■		■								
5	B		■		■		■							
6	B	■			■	■							■	
7	B	■		■			■							
8	B		■	■		■								■
9	A		■		■		■					■		
10	A	■			■	■			■					
11	A	■		■			■			■				
12	A		■	■		■					■			
13	A		■		■			■						
14	A	■			■			■			■			
15	A	■		■			■		■			■		
16	A		■	■		■			■	■				

TABLE 2. Summary of demographic information of subjects in each condition (N=11 per condition).

Age	Condition		Income	Condition		Education	Condition		Occupation	Condition		Purchased sustainable products	Condition	
	A	B		A	B		A	B		A	B		A	B
18-25	4	3	<25k	3	2	Some college	1	0	Student	4	4	Yes	10	9
26-35	2	4	25k- 50k	3	3	College degree	3	6	College staff	7	7	No	1	2
36-45	0	3	50k-100k	3	4	Masters degree	6	3						
46-55	3	1	>100k	1	2	Doctoral degree	1	2						
56+	2	0	No answer	1	0									

3.3. Subjects

Twenty-two subjects were recruited from Iowa State University campus and the surrounding area by email, Craigslist advertisement and fliers, with $5 cash compensation. 55% are female and 86% have purchased sustainable products in the past. Table 2 summarizes subject demographic information by condition. Note that the majority of participants were college staff.

3.4. Procedure

Fig. 3 provides an overview of the procedure. Eleven subjects were randomly assigned to each condition. To mimic a real shopping experience, eight toasters were placed on the shelf, in combinations noted in Section 3.2, Fig. 2 and Table 1. All the toasters shown were placed in random order. Subjects were told, "The purpose of this study is to learn about customer decision-making regarding consumer products. Toasters are the example products. You will perform a set of simulated purchasing tasks and answer some survey questions. Your participation will last for about 30 minutes." and were free to examine the toasters at their own pace. They were all asked to purposefully place products they would consider purchasing on a table, and then choose a final one from that set. Next, for the email and interview task, subjects responded to a Qualtrics survey, as described in Section 3.1.

Next subjects rated eight or nine toasters on how likely each of the toasters was to trigger them to think about sustainability and ranked their sustainability in order. Subjects in the control condition evaluated half of the toasters that they saw previously (Toasters 1-4), and five new toasters, each with one ST feature (Toasters 9-13). This captured evaluations for individual ST features without previous exposure in the choice task. Subjects in the test condition evaluated the toasters from their choice task.

The experiment concluded with a post-experiment survey to collect demographics, purchasing habits, sustainability awareness, and so on.

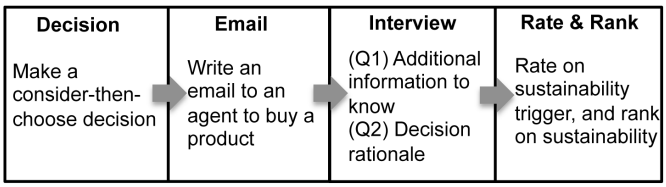

FIGURE 3. Experimental flow for the main procedures.

3.5. Data Processing

Consideration sets and final purchases: Toasters were clustered into three sets, as depicted in Fig. 2. The set with Extra features, and the set with ST features were presented as unique set for control and test conditions, respectively. First, number of toasters considered from either of these two sets was counted per subject. Similar counting process was then conducted for the choice data.

Email, Q-Info, and Q-Rationale: Two judges, who were blind to the hypotheses and the test conditions of the subjects, coded Email, Q-Info, and Q-Rationale as described below. In the first stage, written answers by each subject were parsed into individual items, each of which must only contain one product feature or other requirement, while keeping raw description as much as possible. For example, "Dear Friend" emails were parsed into individual instructions. The number of items that each answer was separated into was counted and compared between judges to check for consistency. The overall Person correlation between the two judges was 0.74 initially. Then the two judges met to discuss and reconciled differences to complete agreement.

In the second stage, these individual items were judged on the three dimensions D1, D2, and D3 (see Section 3.1) by marking in a spreadsheet. Detailed definitions, rules, and examples of the three dimensions were provided both in written and orally, and the judges were trained on a coding example with discussion prior to working individually. For D2 the two judges made an agreement on their understanding: "yes" (definitely) indicates one's motivation is to be sustainable (e.g., I am also interested in a "green" product beyond energy conservation, such as being made free of lead); and "could" (possibly) means one's behavior or choice has a positive effect on sustainability, but the motivation may or may not be about sustainability (e.g., I like to have a power save function since my utility bills are high). The judgments were conservative, as evidenced in Tables A1 through A3 in the Appendix, which list all elements judged to definitely or possibly mention sustainability. For D1, D2, and D3 combined, initial agreement between judges on the 274 individual items was 74%. The other 26% were re-judged and discussed to 100% agreement.

4 RESULTS

The 22 respondents provided 120 individual instructions (Email), 67 questions asking for additional information (Q-

TABLE 3. Summary of hypothesis testing.

Hypotheses	Quantified relationship	Data used	Sig. level	Evidence presented in
H1a: Subjects in condition A consider products from the ST Set more frequently than subjects in condition B consider products from the Extra Set.	$ST_A > Extra_B$	Consideration (counts)	p>0.1	Fig. 4
H1b: Subjects in condition A purchase products from the ST Set more frequently than subjects in condition B purchase products from the Extra Set.	$ST_A > Extra_B$	Choice (counts)	p>0.1	Fig. 4
H2: Sustainability is more frequently mentioned as a purchasing instruction by subjects in condition A than subjects in condition B	% (Def/pos=1) $_A$ > % (Def/pos)=1) $_B$	Email (binary)	p<0.05 *	Table 4, Fig. 5
	Def/pos $_A$ > Def/pos $_B$	Email (counts)	p<0.05 *	Table 4, Fig. 6
H3: Subjects in condition A more frequently seek information of the products on sustainability than subjects in condition B	% (Def/pos=1) $_A$ > % (Def/pos=1) $_B$	Q-Info (binary)	p>0.1	Table 4, Fig. 5
	Def/pos $_A$ > Def/pos $_B$	Q-Info (counts)	p>0.1	Table 4, Fig. 6

info), and 88 individual components of their rationales for the decisions they made (Q-Rationale). For the control condition, Toasters 8 and 3 were selected for purchase most frequently, and Toaster 12 for the test condition. On average, there were 3 toasters in a subject's consideration set in the test condition and 3 toasters in a control condition consideration set.

Table 3 summarizes the results for each hypothesis. Overall, only 7 items were classified by the judges as definitely related to sustainability while 46 were classified as possibly related to sustainability (see Tables A1 to A3 in the appendix for details). In this section, the two categories are combined and abbreviated as "*def/pos*" in writing and in tables and analysis. The email data had 17 def/pos sustainability-related-instructions in the test condition and 1 in the control. In Q-Info, 20 individual questions were identified as def/pos related to sustainability, with the large majority (14) coming from subjects in the test condition. In Q-Rationale, 14 out of 15 def/pos sustainability-related-reasons were from the test condition.

4.1. H1a and H1b testing

Analysis of variance (ANOVA) approach was used to compare the quantity of toasters considered or purchased from the Extra Set to the ST Set. ANOVAs were conducted with total number of the targeted toasters "considered" or "purchased" by each subject as responses and "condition" as independent variable. No significant differences were found in considerations (test vs. control: 1.9 vs. 1.7; F=0.3, p>0.1) or choices (test vs. control: 0.7 vs. 0.5; F=0.7, p>0.1). Thus Hypotheses 1a and 1b are not supported, see Fig. 4 for a comparison on the mean counts.

4.2. H2 and H3 testing

To test Hypotheses 2 and 3, the coding data were processed in two ways: first, individuals were coded as binary data: 1= definitely "Yes" or possibly "Could", or 0= "Not" mentioning sustainability; next, individuals were coded by count of the number of times they def/pos mentioned sustainability. A logistic regression analysis was applied on the binary data, while ANOVA was conducted for the counts. A summary of number of subjects that def/pos mentioned sustainability, mean counts of mentions per subject per condition, and statistical significance are shown in Table 4. It indicates that the responses classified as possibly mentioning ("Could") sustainability dictate whether or not the differences between the test and control condition are found to be significant. Definite and possible mentions of sustainability are combined, termed "def/pos" in the tables. This is noted as limiting the strength of the differences. Fig. 5 and Fig. 6 depict percentage of subjects' def/pos mentioning sustainability, and mean counts of mentioning for each condition in Q-Info and email task, respectively.

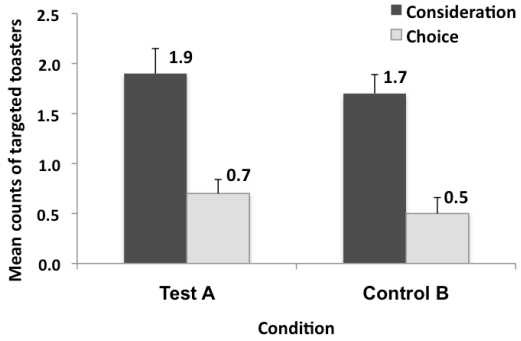

FIGURE 4. No significant differences in considerations or choices between ST Set and Extra Set toasters.

On email data, the logistic analysis revealed that more subjects in the test condition definitely or possibly mentioned sustainability than in the control condition (73% vs. 9%, p<0.05). More sustainability-related criteria, definitely or possibly, were mentioned to instruct an agent to buy a toaster in the test condition as supported by ANOVA (1.5 vs. 0.1, F=6.5, p<0.05). Therefore, H2 is supported.

No dramatic difference was found in Q-Info between the test and control conditions, either by logistic analysis on binary data (73% vs. 45%, p>0.1) or ANOVA on counts (1.3 vs. 0.5, F=2.5, p>0.1). H3 is not supported.

TABLE 4. Logistic regression and ANOVA reveals that subjects in condition A are more likely to def/pos mention sustainability. ('*' p<0.05, compared to control condition B)

		Number of subjects that mention suitability			Mean count of mentions per subject		
		Logistic regression			ANOVA		
		Yes	Could	Def/pos	Yes	Could	Def/pos
Email	A	2	6*	8*	0.5	1.1*	1.5*
	B	0	1	1	0	0.1	0.1
Q-Info	A	1	7	8	0.1	1.2	1.3
	B	0	5	5	0	0.5	0.5

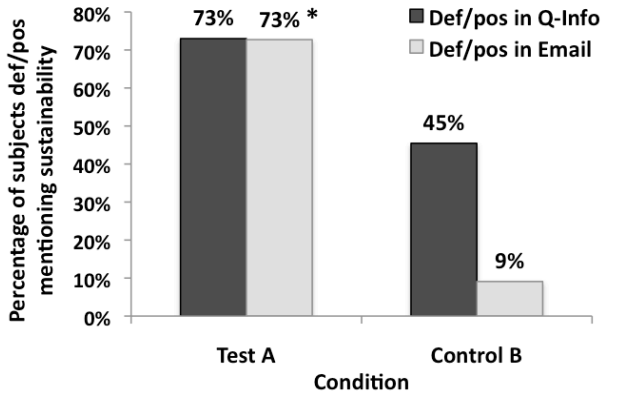

FIGURE 5. More subjects def/pos mention sustainability in the test condition.

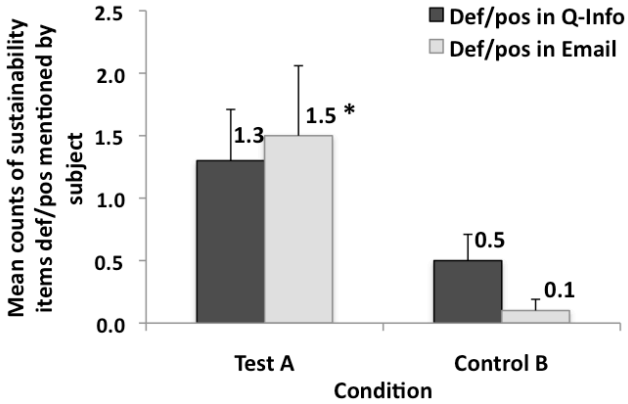

FIGURE 6. Subjects def/pos mention sustainability more frequently in the test condition.

TABLE 5. ANOVA shows that def/pos sustainability instructions, even those that do not mention ST features, are more prevalent in the test condition. ('*' p<0.05, "." p<0.1)

Sustainability	Condition	Mention ST Feature	Not Mention ST Feature
Def/pos=1 (mentioned)	Test A	0.6*	1.0 .
	Control B	0.0	0.1
Def/pos=0 (Not)	Test A	0.4	4.9
	Control B	0.1	4.5

4.3. Additional Results- D1 and D2

Email instructions and Q-Info items were categorized as mentioning ST features (ST) and not (No-ST), based on judges' classifications (D1). Mentioning an ST feature is different than being judged as def/pos mentioning sustainability. ST features are designed to trigger thoughts of sustainability, and are *not the same* as actual sustainability. For example, an embossed leaf pattern does not make a toaster more sustainable. The classification in these separate dimensions is detailed in Table 5. ANOAVA on email data shows that def/pos sustainability-related instructions mentioned ST features significantly more in the test than control (0.6 vs. 0.0, F=6.8, p<0.05). Additionally and importantly, instructions not mentioning ST features also reached significance at p<0.1 level (1.0 vs. 0.1, F=4.3, p=0.0501<0.1).

5 DISCUSSION

The experiment supports Hypothesis 2: sustainability-triggering features of a product increase thoughts of sustainability during purchasing decision-making. There is one caveat to this: the hypothesis is tested on a combination of data that definitely and possibly mentioned sustainability vs. did not mention sustainability. There was not enough data judged as definitely mentioning sustainability to analyze this category on its own. Review Tables A1-A3 in the appendix to see how judges conservatively distinguished between definitely and possibly mentioning sustainability—the items in the "Could" category do demonstrate a change in perspective for the subjects. The difficulty of judging an instruction as definitely mentioning sustainability is due, in part, to the nebulous nature of the term, and customer misunderstanding of what is sustainable. With this caveat in mind, subjects that were exposed to ST features did def/pos mention more sustainability-related instructions in their emails to a toaster-buying agent. Significance in both the number of subjects that def/pos mention sustainability and frequency of mention in the email task suggest that subjects in the test condition had heightened sustainability awareness.

One possible explanation of the difference in the mention of sustainability is simply that the subjects in the test condition were mentioning ST features in their instructions, features that the control condition did not see. The results in Section 4.3 suggest that this is not the case. Email instructions that were judged as def/pos related to sustainability, but did not mention ST features, are significantly more frequent in the test condition at p=0.0501. This suggests that evaluating products with ST features activates customer thoughts of sustainability or associated feelings such as social responsibility. For example, emails from the test condition mentioned good insulation, longer life-span, durable knobs and buttons, energy efficiency, and donations to a non-profit with purchase. The theory of construction of preference explains this observation: the presence of ST features changes decision context. It may be that well-designed ST features heightens sustainability

awareness and activates sustainable behavior. It may be that ST features align with customer interests in cutting bills or having more options, and this activates other latent preferences. It is also possible that the presence of ST features in the choice context lessen frustrations with lack-of-options for addressing sustainability, and thus causes the subject to request even more options.

While decision context and decision approach changes towards a more sustainable mindset in the test condition, the resulting purchases present a less-clear conclusion. The presence of Extra features in the control condition, extra lift and defrost functions influence final purchase and consideration set formation about as much as the ST features do in the test condition. Therefore it is not possible to say that these particular ST features cause a change in purchase behavior that is larger than randomly added features. This implies that while choice context changed, it did not change final purchase in a manner that was noticeably different from a control condition. Note, again, that the ST features presented do not necessarily decrease the environmental, economic, or societal impacts of a toaster. An embossed leaf pattern is not a sustainable feature. Thus, it is reasonable that final purchase pattern would not change in the presence of these ST features. Purchase pattern may have changed if had the subjects been given the additional information on the true sustainability of the products as they requested in the course of the study (Q-Info). Further, price was not included in the study – had it been, we may have discovered that subjects were willing to pay more for toasters with ST features than Extra features.

6 CONCLUSION

This research examined how carefully-designed product features can influence product decision context. It determined that the presence of features specifically designed to trigger thoughts of sustainability caused subjects to think about sustainability and increased their requests for sustainable products in a purchase task. The results are significant only when both possible and definite mentions of sustainability are pooled in the tests.

A toaster is a low-price, low-risk product with few features and options, therefore, the results should be applied with care to high-price products with many features. Also, the subject pool was educated, with slightly more than half of the subjects having received masters or doctoral degree. Most of the subjects indicated having purchased a sustainable product in the past, but the overall commitment to sustainability was not tested. While education and purchasing habits may limit the generalization of the findings, they did not confound the triggering effect of ST features, as education and sustainable purchases were distributed almost equally between the test and control conditions.

Future work will investigate if the presence of ST features positively influences preference for and importance of actual sustainable product attributes in choice decision, such as energy usage and easily replaceable/repairable parts. This will be measured using search, choice, and willingness-to-pay tests. The work will also attempt to identify and test the underlying reasons for change in sustainable preference. For example, trust for a product's sustainability in the presence and absence of ST features can be explicitly measured.

The promising results from this research will encourage engineering designers to design products not just for the customer final choice, but also to shape decision context and the construction of preferences. It is likely that a well-designed feature can activate and/or influence preference for a variety of complex evaluations, such as safety, trust, and sense of responsibility. Such a feature may not be functional, or even meaningful, but its psychological effects are not negligible, as it proactively shapes customer preferences.

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APPENDIX

TABLE A1. Individual instructions judged as related to sustainability in emails: definitely or possibly mentioned sustainability.

#	Individual instructions judged as related to sustainability in emails	Considering sustainability?	
		Yes	Could be
1	I would like to save power, so a toaster that minimizes power consumption during or not during use is an added bonus.	1	
2	Any sorts of energy saving features are important to me. With that in mind, if there is an option to engage an energy saving mode on the toaster, I would most certainly prefer that toaster. [Importance order: 1a]	1	
3	Any sorts of energy saving features are important to me. With that in mind, if there is an option to engage an option to only use one of the toaster "slots" during the operation, I would most certainly prefer that toaster. [Importance order: 1b]	1	
4	I am not interested in a product, which has digital read-outs or a clock or any "indicator" lights that will require energy usage when the toaster is not in operation or extra energy use when the toaster is in operation. [Importance order: 2]	1	
5	I am also very interested in a "green" product beyond energy conservation. With that in mind, if the product has been made with recycled content materials, been made free of lead and other toxins in the production process, has a return option for recycling at the end of its useful life for me, and/or a donation to a non-profit is made as a result of purchasing the product, these are things I would like to support and would be interested in that product. [Importance order: 6]	1	
6	Power saving ([I] tend to use a lot of electricity and my bills are high and [I] am very forgetful with things. Therefore this option best suits a lazy person) [required, importance order: 1]		1
7	Heating options (this is standard with toasters but if there are toasters with more than three options it would be better) [required, importance order: 2]		1
8	Extra features (like heating slices individually) [required, importance order: 3]		1
9	[E]rgonomics features (it shouldn't allow too much heat to transfer to the outer walls of the toaster) [required, importance order: 4c]		1
10	[A] cover is not needed as I consider it just another part that can break down		1
11	[O]ther considerations are: quality of craftsmanship ([I] prefer sturdy metal body, [k]nobs/buttons/slider should not be flimsy)		1
12	[O]ther considerations are: energy efficiency		1
13	The most important aspect to consider is build quality - I'd rather have a toaster with fewer features that will last longer than one that with all the features but breaks in the first year.		1
14	Please choose a toaster that has individual controls for toasting either one slice of bread or two, I'm the only one who will be eating and sometimes I would like to just have one slice instead of two.		1
15	Price is not a concern for me. I am expecting the price to be fairly expensive, but I would rather purchase a reliable toaster (last longer) now and spend a little extra, rather than have to purchase another one 3 or 4 years down the road.		1
16	I would prefer the longest warranty, just in case something does happen.		1
17	Even though I definitely want two slots, I would like a toaster that has two separate levers for each slot. Sometimes I am not toasting two pieces and I hate when one side is on and burning the crumbs inside.		1
18	I am also very interested in the integrity of the product and durability. One of the best ways I have found to gauge this is by the warranty offered by the manufacturers. With this in mind, a product having a warranty of two years or more would be a preferred product. [Importance order: 3]		1

TABLE A2. Individual questions judged as related to sustainability in Q-Info: definitely or possibly mentioned sustainability.

#	Individual questions judged as related to sustainability in Q-Info	Considering sustainability?	
		Yes	Could be
1	Are there other environmental features, besides energy savings (if applicable) of the product, if so what are they?	1	
2	Which one is more durable?		1
3	Which one is faster in achieving the needed heating?		1
4	[H]ow long can I use for this toaster? Is it easy to broken?		1
5	Is the power level adjusted by the knob [dial] or just the toasting time [is adjusted by the dial]?		1
6	How sturdy is the construction of these?		1
7	What material is the body made of (Metal? Plastic?)		1

TABLE A2 (CONTINUED). Individual instructions judged as related to sustainability in Q-Info: definitely or possibly mentioned sustainability.

#	Individual instructions judged as related to sustainability in Q-Info	Considering sustainability?	
		Yes	Could be
8	How much power would it need at maximum brown[ness]?		1
9	How hot are the three temperature settings?		1
10	What is the power save?		1
11	The power. Are all models have same heating time?		1
12	Are all models turn off by themselves after the toasting is done?		1
13	What is the build quality like between the toasters? Are they all equal?		1
14	[R]eliability - how long will they last?		1
15	Is there a warranty available for the toasters?		1
16	How long is the average "lifespan" of the toasters - will I need to buy another in a few years?		1
17	What is the energy usage?		1
18	Are there energy saving features, if so what are they?		1
19	What is the product's warranty?		1
20	Do they have any warranty?		1

TABLE A3. Individual reasons judged as related to sustainability in Q-Rationale: definitely or possibly mentioned sustainability.

#	Individual reasons judged as related to sustainability in Q-Rationale	Considering sustainability?	
		Yes	Could be
1	[F]unctions available- power save.	1	
2	Power saving was the best as it had a bagel option as well.		1
3	Next [I] chose the one with a single slice toasting option incase [I']m not too hungry.		1
4	[E]ndurance.		1
5	Don't really know the effect of the closing doors on the top but I doubt the added effect (shorter time to brown?) would be worth the potential hassle and change to break down. I would use it as a major criterion if it would save a lot of power, though.		1
6	I chose the toaster that had two levers for each slot- although I'm not sure if this would make a difference, but it could be helpful if you needed to adjust one slice differently than the other.		1
7	I then looked at the features that seemed more relevant or useful to my needs. The energy saver mode on the toaster I chose was not a feature that I commonly would have pursued, but it seemed like a nice useful feature especially since I do not use my toaster frequently and so that toaster seemed to have the greatest number of features that I found useful.		1
8	I liked the one that allowed for toasting one slice instead of two.		1
9	[E]ase of use- proper function all of the time.		1
10	[E]ssential functions (toaster function has to work every time).		1
11	I also then took into account if the toasters had one or two levers for each slot.		1
12	Also, I noticed one of the toasters had a "Power Save" button, which ultimately ended up being my number one choice.		1
13	Energy savings features - preference was given to the toaster with a specific power save feature.		1
14	Energy savings features - preference was given to the toaster with the ability to engage one "slot" of the toaster rather than only both slots during operation.		1
15	Simplicity of design - preference was given to toasters that did not have a lot of extra features or gadgets as part of the operation such as digital printouts.		1