

Influencing Sustainable Consumption Through Persuasive Agent Design

Completed Research Paper

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Abstract

Although a favorable disposition towards sustainable consumption has been gaining momentum, it fails to materialize into action. This study illustrates how IS design can influence sustainable consumption through the inclusion of persuasive agents. Building on Fogg's behavioral model for persuasive technology design, we designed a persuasive shopping agent that differentially 'nudges' users to purchase sustainable products according to their motivational level towards sustainable consumption. Specifically, we designed a 'spark' shopping agent that motivates cynical consumers by highlighting the benefits and corresponding risks of sustainable consumption, and a 'signal' shopping agent that simply reminds the caring and sustainable consumers of the availability of sustainable product options. Through a between-subject experiment, we confirm the effectiveness of both agents, although our study finds that users already active in sustainable consumption are not affected by persuasive agent design. Our findings have significant contributions and implications for both research and practice around Green IS design.

Keywords: Persuasive agent design, Green IS, sustainable consumption

Introduction

At the current rate of growth, the human population is expected to exceed 9.5 billion by 2050. Providing the natural resources – food, water, energy – to service such a population would currently require almost three planet earths¹. To address the needs of the current population without endangering the future population, individuals and institutions (governments, organizations) need to learn to consume responsibly. Recognizing the urgency of this need, the United Nations has made sustainable consumption one of 17 sustainable development goals². Sustainable consumption is the consumption of resources – material products, energy, and immaterial services – in such a way as to minimize the impact on the environment such that the needs of the present can be met without compromising the needs of the future (WCED 1987).

¹ <https://www.un.org/sustainabledevelopment/sustainable-consumption-production/>

² <https://www.un.org/sustainabledevelopment/sustainable-consumption-production/>

To have a significant impact, sustainable consumption must be undertaken by both individuals and institutions. This research will focus on the former. For individuals to engage in sustainable consumption, they need adequate information, traditionally in the form of standards and labels, to inform their consumption decisions. Sustainable consumers, also referred to as ethical consumers, are consumers who prefer products that do the least amount of damage to the environment and products that support forms of social justice (Carrigan and Attalla 2001). This broad definition applies to the economic, environmental, and social impact of consumption, which in turn reflects the triple bottom line of environmental sustainability, also termed as the 3Ps (Profit, Planet, People) (Elkington 2004).

A favorable disposition toward sustainable consumption has been gaining momentum: for instance, a survey of British consumers showed that roughly a quarter of shoppers would consider buying ethical products, even if this would cost them a significant premium³. Similarly, a survey of consumers in Hong Kong revealed that nearly 40% of consumers expressed a concern about the environment and awareness of the impact of their consumption on the environment⁴. In spite of these good intentions, previous studies have consistently found that consumers are less likely to choose sustainable products if they have to make a price trade-off (Carrigan and Attalla 2001; Iwanow et al. 2005; Vermeir and Verbeke 2008). In food choice, as in many other product categories, most consumers claim to consider sustainability issues generally important and desirable, but the attributes that consumers claim to be interested in are not always the attributes that actually determine their choices (Mueller et al. 2010). In short, the discrepancy between attitudes and actual behaviors is a persistent problem in the area of sustainable consumption (Ritchie et al. 1981; Stewart and Craig 2000). We argue that this attitude-behavior gap in sustainable consumption presents an important opportunity to design an information system that makes sustainability a more immediately salient issue for consumers and nudges them towards desired behaviors.

Toward this end, the major objective of this paper is to design and test an IS artifact capable of making the sustainability issue immediately salient for consumers, thus nudging them to look beyond the typical pricing information that often informs consumption decisions. We designed an IS artifact – an environmental sustainability shopping agent – to make the sustainability issue immediately salient for consumers. We then conducted a stated choice experiment with two product options, i.e., the more expensive sustainable products and the less expensive products with no sustainability information, to simulate real-life shopping. We differentiated between consumers who are indifferent to sustainable consumption and lack the motivation to purchase sustainable products from consumers who are favorable towards sustainable consumption and consequently have a high motivation to purchase sustainable products. An underlying assumption in our study is that the different types of nudges included in artifact design will have different influences on users depending on the users' pre-existing beliefs about sustainable consumption. Our study therefore contributes towards a better understanding of how an IS artifact can be designed in order to persuade consumers to opt for sustainable products. In doing so, we contribute to closing the gap between consumers' attitudes towards sustainable consumption and their actual behavior with a view towards developing insights on how to move the world closer to achieving the UN's sustainable development goal on sustainable consumption.

The rest of this paper is organized as follows: the next section summarizes the related works on Green IS sustainable consumption. We then outline the theoretical background of our study and list our hypotheses. This is followed by the description of the design of our study, and the presentation of our empirical results. The final section discusses the implications of our findings and concludes.

Green IS and Sustainable Consumption

Broadly speaking, Green IS refers to the management of information to support environmentally favorable practices and decisions (Boudreau et al. 2008). At the individual level, Green IS play several roles: an informing role such as IS that provide information to support green decision making (Corbett 2010), IS that direct individuals to eco-friendly stores and products (Pitt et al. 2011), product traceability systems that enable consumers to know more about the origins, history, and the production methods of a product (Coff 2010; Giddens et al. 2016) or IS that improve the efficiency of processes and services in order to reduce energy consumption (Corbett 2010). Recent work is suggesting a persuasive role for IS that extends beyond

³ <https://www.theguardian.com/business/2013/aug/19/ethical-shopping-growing-popularity-fairtrade>

⁴ https://www.consumer.org.hk/ws_en/news/press/2016/sustainable-consumption.html

informating to intentionally trying to motivate individuals to voluntarily engage in more sustainable behaviors (Loock et al. 2013). IS as a persuasive system should be designed to form, alter or reinforce attitudes and behaviors without using deception or coercion (Oinas-Kukkonen 2010). An example of such a persuasive Green IS is a carbon management system (CMS) that seeks to motivate individuals to reduce their carbon footprints by changing people's attitudes and goals through goal-setting and rewards (Corbett 2013). Research has shown that even seemingly mundane design choices can have important implications for environmental conservation (Ableitner et al. 2017). For example, in the area of energy use, researchers found that the use of digital devices to display water consumption, temperature, and energy efficiency while people were showering resulted in longer showers at higher temperatures when the image of a melting polar bear was also included on the display. Although the image of the polar bear was intended to motivate shorter, more energy efficient showers, the opposite occurred (Ableitner et al. 2017). Thus, while Green IS artifact design holds promise in motivating sustainable behaviors, we have much to learn about how to properly design the artifact so as to achieve the desired outcome. In terms of sustainable consumption, designing an IS artifact to be persuasive is particularly challenging given that sustainable products are almost always more expensive than their alternatives (Banaji and Buckingham 2009; Valor 2008) and hence, being a 'green consumer' involves compromises and trade-offs – and often contradictions (Young et al. 2010).

In this study, we design a pro-sustainable consumption shopping agent that engages with consumers to encourage the desired sustainable consumption behavior. The Persuasive Systems Design model explains four persuasive system principles, i.e., primary task, dialogue, system credibility, and social support (Oinas-Kukkonen and Harjuma 2009). Here we focus on the dialogue design principle, which is related to the IS artifact engaging with users to move them towards a target behavior by praising them, sending reminders, making suggestions, etc. (Oinas-Kukkonen and Harjuma 2009). Toward this end, we draw upon the Fogg behavioral model (FBM) that conceptualizes behavior triggers – or “something that tells people to perform a behavior now” – into facilitators, sparks and signals (Fogg 2009 p. 6). We will explain FBM in details below.

Theoretical Framework and Hypotheses

Fogg's Behavioral Model

FBM asserts that for a target behavior to happen, a person must have sufficient motivation and ability, and must be triggered to perform the behavior (Fogg 2009). There are three types of triggers: *facilitators*, *sparks* and *signals*. Facilitators are appropriate for people who have high motivation but lack the ability to perform the behavior (Fogg 2009). The goal is to trigger the behavior while making the behavior easy to do, such as for example, an online store's one-click buying, a software's one-click update, etc. (Fogg 2009). When people have the ability to perform the target behavior (in this case, to purchase sustainable products), *sparks* and *signals* are the appropriate triggers (Fogg 2009).

Sparks and signals are different types of nudges that are part of the persuasive system design ecosystem. It is a well-known fact that nudges are not equally effective under different circumstances, and as Schneider et al (2018) argue, a unique feature of digital artifacts is that they can lead to a more effective targeting by linking the different nudges with individual traits on a real-time basis. When a person lacks motivation to perform a target behavior yet has the ability to do so, a trigger should be designed in tandem with a motivational element. This is called a spark, such as for example, texts that highlight fear, hope, etc. (Fogg 2009). On the other hand, signals do not seek to motivate people; signals just serve as a reminder to perform the target behavior such as a traffic light that simply indicates when a behavior is appropriate or texts that remind people to turn off the light when leaving the room, etc. As reminders, signals work best when people have both the ability and the motivation to perform the target behavior (Fogg 2009).

The consumers in our research setting, which we will explain in the Research Methodology section, have the ability to purchase sustainable products. As a result, a facilitator is not an appropriate trigger to be incorporated into our IT artifact for sustainable consumption. When the consumers have the ability to purchase sustainable products, sparks and signals may make the sustainability issue immediately salient for consumers while moving the consumers to look beyond the pricing information. Accordingly, we incorporate sparks and signals into our IT artifact for sustainable consumption.

Consumers who are in different stages in their ‘sustainability journey’ are likely to behave differently when using the same artifact. The term sustainable consumption has the same broad meaning as ‘environmental’, ‘ethical’ and ‘green’ consumers, e.g. consumers who prefer products or services that do the least damage to the environment as well as those that support forms of social justice. Carrigan and Attalla (2001) segment consumers based on their ethical awareness and their behavioral intentions or motivations. The *oblivious* consumers’ lack of ethical awareness means that this topic has not yet entered into their purchase equation (Carrigan and Attalla 2001). As we are focusing on designing IS that motivates consumers to choose sustainable products, we limit our study participants to people who are already aware of the issue of sustainable consumption. Although the Internet fosters information transparency, until now sustainable consumption is only a fraction of the entire consumption space. Hence, the main issue may not be lack of awareness but lack of motivation. We refer to consumers who are aware about sustainable consumption but lack the motivation to purchase sustainable products as *cynical consumers*. When consumers lack the motivation to perform a target behavior yet have the ability to do so, they need a trigger in the form of sparks (Fogg 2009). A spark is a trigger that is designed in tandem with a motivational element (Fogg 2009). Without a motivational element, we argue that a trigger in the form of signals is not sufficient to move the cynical consumers towards sustainable consumptions. Accordingly, we hypothesize:

H1: Cynical consumers will be more likely to choose a sustainable product over a product with no sustainability information when there are sparks to guide their choices.

By contrast, consumers who are opposed to anything unethically produced have a high motivation to purchase sustainable products. Many studies report the ‘attitude/behavior gap’ or ‘values/action gap’ where consumers report that they are very concerned about sustainability issues, but they are struggling to translate this into actual purchases (e.g. Defra 2006; Hughner et al. 2007; Moisander 2007; Young et al. 2010). The everyday decisions on sustainable product choices often result in trade-offs between conflicting issues and result in a motivational complexity of sustainable consumptions (Moisander 2007; Young et al. 2010). Hughner et al (2007) show that while 46-67% of the population have generally favorable attitudes toward organic food, the actual purchase behavior forms only 4-10% of the different product ranges. The recent evidence shows that in 2018, the market share for ethical food and drink in England is just around 12% of the total market share⁵. In our study, we differentiate consumers who are not only motivated to purchase sustainable products but also have chosen sustainable product options before from consumers who have not previously purchased sustainable products but claim to be motivated to do so. We refer to the former consumers as *sustainable consumers* and the latter, as *caring consumers*. Caring consumers have higher motivation to purchase sustainable products compared to cynical consumers. Following FBM, such consumers need signals to remind them to perform the target behavior, i.e., to choose sustainable products but should not need sparks. Hence, we hypothesize:

H2: Caring consumers will be more likely to choose a sustainable product over a product with no sustainability information when there are signals/reminders to guide their choices.

Consumers may be selectively ethical in their sustainable consumptions (Carrigan and Attalla 2001). Although sustainable consumers have chosen sustainable product options before, they may for example be more likely to purchase products that protect the farmers’ welfare than products that protect the environment. In other words, they may be selective in their sustainability choice. Such consumers should also respond well to a signal, reminding them to consider the sustainable option. However, a spark might be ill-received – having purchased sustainably in the past, the consumer might be offended at the more forceful persuasion of a spark. A spark that is designed with a motivational element that highlights fear or inspires hope (Fogg, 2009) might annoy them or be viewed as a condescending trigger. Accordingly, we hypothesize:

H3: Sustainable consumers will be more likely to choose a sustainable product over a product with no sustainability information when there are signals/reminders to guide their choices.

⁵<https://www.ethicalconsumer.org/sites/default/files/inlinefiles/EC%20Markets%20Report%202018%20FINAL.pdf>

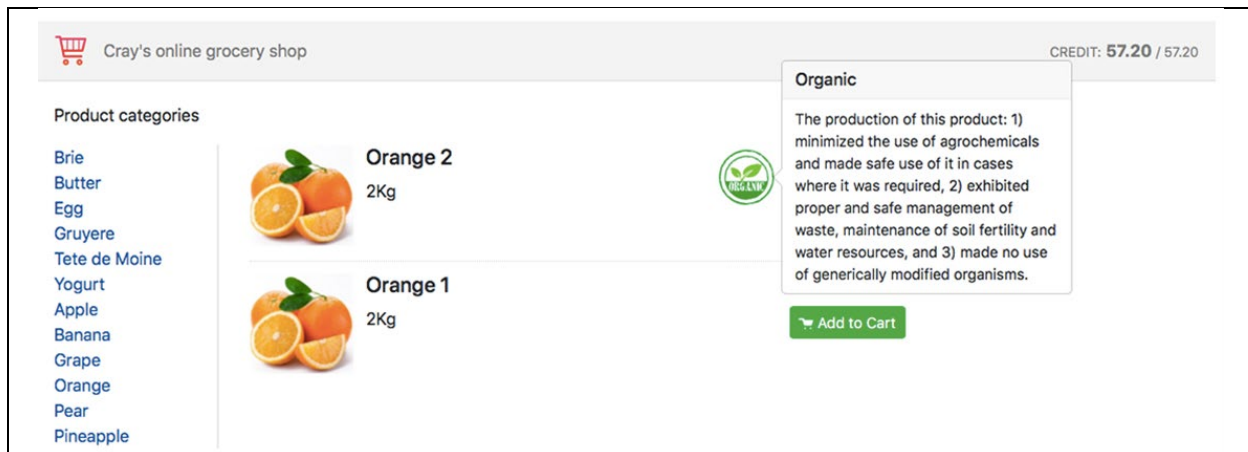
Research Methodology

To test our hypotheses, we conducted a between-subject stated choice experiment in the context of online grocery shopping. Stated choice experiments involve the presentation of a hypothetical choice situation to the experiment participants who must state their choice preferences among different alternatives (Louviere et al. 2000; McFadden 1986). We self-developed an online grocery store that presented three alternatives for each of the twelve grocery products that were available in the store (six fruits and vegetables, and six dairy products). We presented two alternatives for each of the twelve grocery products: 1) a sustainable product and 2) a product with no sustainability attribute information.

We varied the sustainability information attribute according to the 3Ps of environmental sustainability (People, Profit, and Planet); also known as the Triple Bottom Line. Each of the 3Ps reflects social, economic and environmental concerns respectively (Dao et al. 2011; Melville 2010). Four of the twelve products have the People information (child-labor-free) – “No forced labor or child labor were used for the production of this product.” Four other products have the Profit information (fair-trade) – “Workers received salaries equal to or higher than the minimum wage for the production of this product. Also, producers received prices that covered their costs of sustainable production and had control over the trading process”. And four products have the Planet information (organic) – “The production of this product: 1) minimized the use of agrochemicals and made safe use of it in cases where it was required, 2) exhibited proper and safe management of waste, maintenance of soil fertility and water resources, and 3) made no use of genetically modified organisms”. Hence, for example, one experiment participant might see a fair-trade banana, whereas another participant might see an organic banana. When a participant moved the cursor over the sustainable labels, the sustainable information automatically appeared (see Figure 1). Although the 3Ps are inter-related in some ways – for example, fair pay may result in a more just world for people and child labor may result in a higher profit – for purposes of our experiment we select the sustainability information that ties directly to the 3P choice rather than the information that results from the 3P choice made.

The pricing of the products with sustainability information was our main manipulation, where for half of the experiment participants, the price of the sustainable product was 20% more than the products with no information. This is aligned with our observation that prices in the supermarkets for sustainable products were on average 20% more expensive than products with no information. For the other half of the experiment participants, the sustainable product was priced equal to the product with no information. To avoid a sequential effect, we randomized the sequence in which the twelve grocery products and the two product alternatives were presented to the participants. If the participants closed the web browser and re-entered the online grocery store, they would see the same manipulated price as before. The participants in the study were not able to checkout from the store unless they had purchased all twelve products.

The participants had enough money in their virtual wallet to select all sustainable product options. To make the shopping activity as realistic as possible, participants could either spend all the money on sustainable products, or they could choose the alternative products with no sustainability attribute information, and with the leftover money enter into a lucky draw for a case prize, whereby the more leftover money they had, the greater the number of tickets were entered into the draw for them.



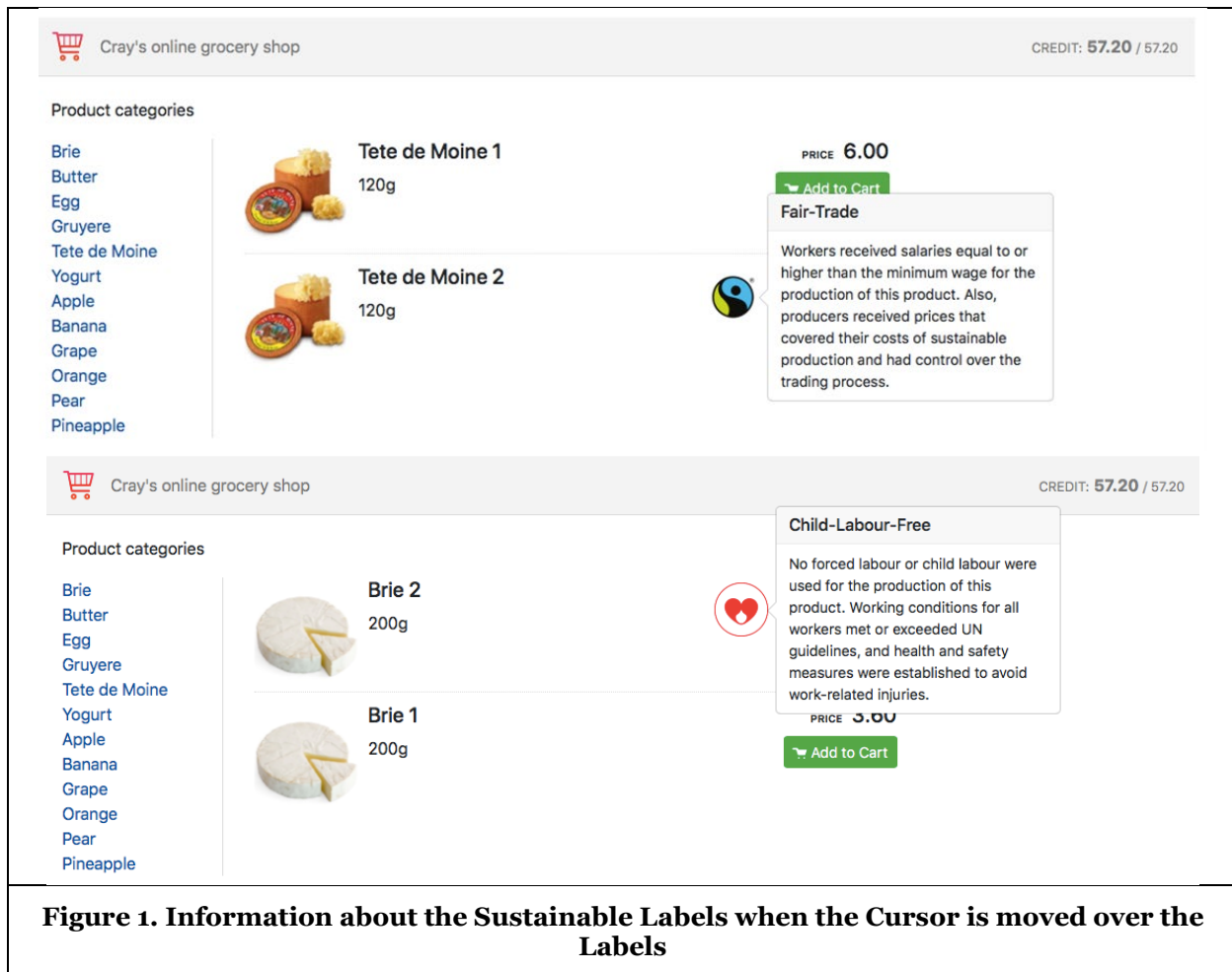
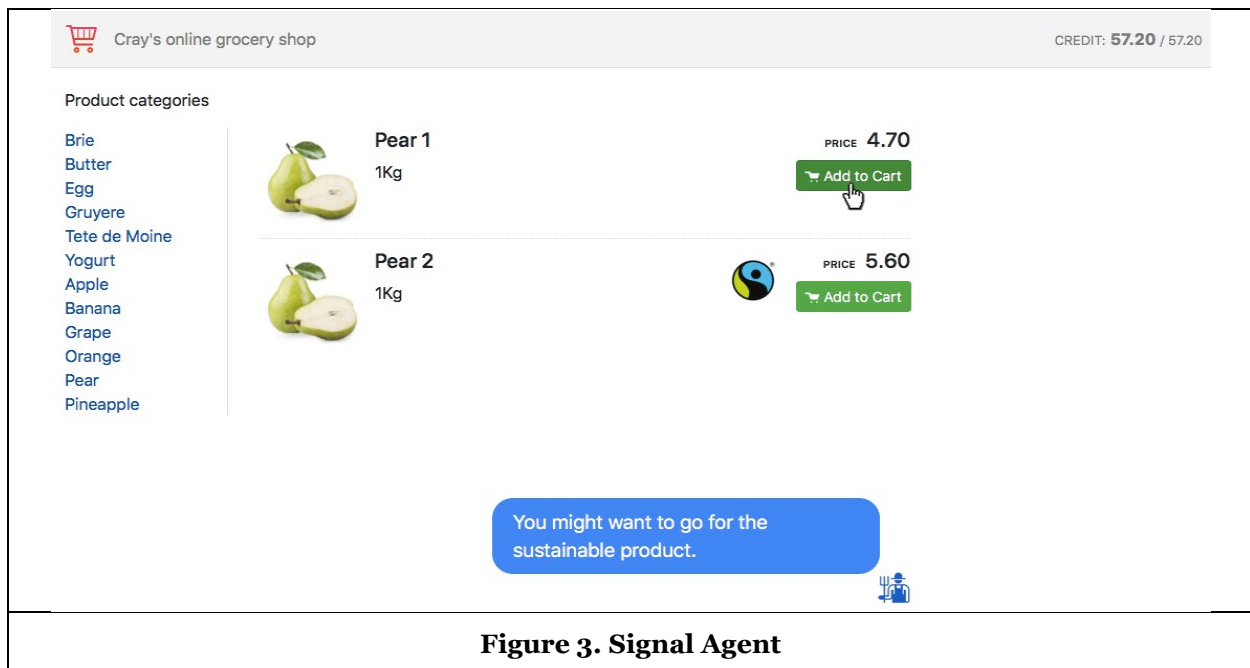
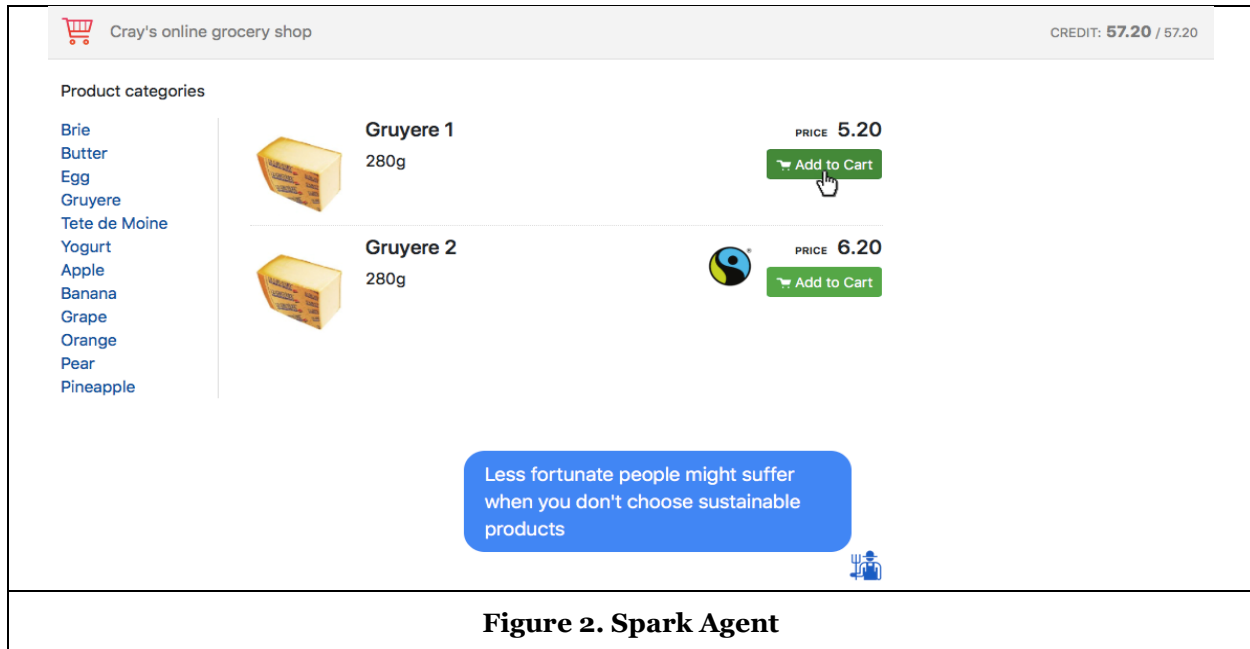


Figure 1. Information about the Sustainable Labels when the Cursor is moved over the Labels

To persuade the consumer towards sustainable product choices, a pro-environment shopping agent was created. There were three online grocery store designs. The experiment participants were randomly assigned to one of the online grocery store designs. The first design had no shopping agent (control group – see Figure 1). The second design had the ‘spark agent’ (experiment group 1), whereas the third design had the ‘signal agent’ (experiment group 2). The spark agent highlighted the benefits of sustainable consumption or the corresponding risks of not selecting sustainable products (see example in Figure 2) when the agent detected that the cursor was moved to a specific product option. The signal agent simply reminded the participants about the availability of sustainable product options when the agent detected that the cursor was moved to a product with no sustainability attribute information (see example in Figure 3). The agent randomly selected the motivational or reminder messages from the pool of messages shown in the Appendix. We conducted a labelled sorting of the messages with three coders to make sure that they were correctly classified as motivational or reminder messages. The coders classified the messages accordingly. Prior to our main study, we conducted a pilot study to test the reliability and validity of our pre-experiment survey and experiment design. We recruited 31 postgraduate students to participate in our pilot study. The participants of our pilot study did not raise any concern regarding the pre-experiment survey items, the experiment design, and the motivational and reminder messages. Hence, together with the labelled sorting of the messages, we fully established the correctness of the classification of the motivational and reminder messages.



Control Variables

We asked for the experiment participants' demographic information (gender, age, income) in a pre-experiment survey before they began the experiment to serve as control variables (see Table 1). In addition to the demographic information, we also captured the consumer type (the extent to which individual was, or was not, concerned about the environment) and measured the perceived sustainable shopping inconvenience (Freestone and McGoldrick 2008) and the level of personal agency (Vallacher and Wegner 1989), which we included as control variables in our main model.

The Cronbach's Alpha of perceived sustainable shopping inconvenience is above 0.6 (i.e., 0.759), and the corrected item-total correlations are above 0.3 (i.e., ranged from 0.397 to 0.602). These indicate that the

items were measuring the same concept. The Cronbach's Alpha of the level of personal agency is above 0.6 (i.e., 0.678), and the corrected item-total correlations are at least 0.30 (i.e., ranged from 0.30 to 0.475) indicating that the items are measuring the same concept. The descriptive statistics of the two variables are shown in Table 1. The correlation of these two continuous variables is -0.072; hence, they have no multicollinearity issue.

Variables	Min.	Max.	Mean	Std. deviation	Skewness	Kurtosis
Perceived sustainable shopping inconvenience	1.20	7.00	4.747	1.075	0.442	0.419
Level of personal agency	1.00	2.00	1.471	0.266	0.066	0.755

Table 1. Descriptive Statistics of the Main Model

In the pre-experiment survey, we had 403 responses. 16 respondents who were not aware of sustainable consumption were not sent the experiment link. The remaining 387 respondents received the experiment link five days after they completed the survey. They were randomly assigned to one of the three groups. A total of 269 respondents completed the experiment (89 in control group, 87 in spark group, 93 in signal group). The demographic characteristics of the 269 participants are shown in Table 2.

Gender	
Female	154 (57.2%)
Male	115 (42.8%)
Age	
18-25 years old	82 (30.5%)
26-35 years old	106 (39.4%)
>= 36 years old	81 (30.1%)
Monthly income	
<1000	96 (35.7%)
1000-1499	50 (18.6%)
1500-1999	46 (17.1%)
2000-2499	28 (10.4%)
2500-2999	13 (4.8%)
>=3000	36 (13.4%)
Consumer type	
Cynical consumer (not greatly concerned or not intend to take action)	148 (55%)
Caring consumer (intend to take action)	65 (24.2%)
Sustainable consumer (have taken action)	56 (20.8%)

Table 2. Demographic Characteristic of the Experiment Participants (N = 269)

Research Findings

To test our hypotheses, we examined the interaction effect of the grocery shop design with the different consumer types (see Table 3). Our randomization codes ensure a balanced number of participants across the three groups (control group, spark group, and signal group). As can be seen from Table 3, given the ability to purchase sustainable products, when there are sparks to choose sustainable products, cynical consumers are more likely to choose the sustainable products (H1 is supported); when there are signals/reminders to choose sustainable products, caring consumers are more likely to choose the sustainable products (H2 is supported); however, signals/reminders to choose sustainable products has no significant effect on sustainable consumers' likelihood to choose the sustainable products (H3 is not supported). People who have already taken action, i.e., have purchased sustainable products (sustainable

consumers), do not seem to require any persuasive agent design in order to make sustainable product choices.

Variables	Coefficient	Std. Error	P > z
Level of personal agency	0.430	0.144	0.003
Consumer type * Group (baseline: cynical consumer * control group)			
Cynical consumer*Spark group	1.379	0.477	0.004
Cynical consumer*Signal group	-0.143	0.457	0.754
Caring consumer*control group	0.050	0.160	0.754
Sustainable consumer*control group	0.594	0.178	0.001
Caring consumer*Spark group	0.401	0.231	0.083
Sustainable consumer*Spark group	0.234	0.254	0.357
Caring consumer*Signal group	0.581	0.232	0.012
Sustainable consumer*Signal group	0.395	0.260	0.129
Sustainable label (baseline: organic)			
Fair-trade	0.406	0.091	0.000
Child-labour-free	0.574	0.092	0.000
Perceived sustainable shopping inconvenience	-0.143	0.058	0.013
Perceived sustainable shopping inconvenience*control group (baseline)			
Perceived sustainable shopping inconvenience*spark group	-0.270	0.091	0.003
Perceived sustainable shopping inconvenience*signal group	0.031	0.087	0.718
Gender (baseline: female)	-0.033	0.081	0.688
Age	0.045	0.031	0.141
Education	0.041	0.060	0.489
Income	-0.131	0.025	0.000
LR chi ²	266.67		
Prob. > chi ²	0.000		
Table 3. Full Model			

Although we ran the analysis with fixed effect to account for the possible individual-specific effects, there could still be an argument that the first product choice might affect the participants' subsequent choices. We thus ran another analysis with a dummy variable that differentiated between the first product (first product = 1) and the subsequent products chosen (first product = 0). The results are shown in Table 4. There is no significant effect attributable to product choice order. Moreover, the effects of the other variables are consistent – the same as in Table 3. The odds ratio is shown in Table 5.

Variables	Coefficient	Std. Error	P > z
Level of personal agency	0.430	0.144	0.003
Consumer type * Group (baseline: cynical consumer * control group)			
Cynical consumer*Spark group	1.379	0.477	0.004
Cynical consumer*Signal group	-0.143	0.458	0.755
Caring consumer*control group	0.050	0.160	0.753
Sustainable consumer*control group	0.594	0.178	0.001
Caring consumer*Spark group	0.401	0.231	0.084

Sustainable consumer*Spark group	0.234	0.254	0.357
Caring consumer*Signal group	0.581	0.232	0.012
Sustainable consumer*Signal group	0.395	0.260	0.129
Sustainable label (baseline: organic)			
Fair-trade	0.408	0.091	0.000
Child-labour-free	0.576	0.092	0.000
Perceived sustainable shopping inconvenience	-0.151	0.058	0.009
Perceived sustainable shopping inconvenience*control group (baseline)			
Perceived sustainable shopping inconvenience*spark group	-0.251	0.092	0.007
Perceived sustainable shopping inconvenience*signal group	0.067	0.088	0.447
Gender (baseline: female)	-0.037	0.081	0.650
Age	0.052	0.031	0.092
Education	0.015	0.061	0.801
Income	-0.129	0.025	0.000
First product chosen (baseline: not first product chosen)	0.117	0.137	0.393
LR chi ²	278.89		
Prob > chi ²	0.000		
Table 4. Full Model Robustness Test			

Variables	Odds Ratio	Std. Error	P > z
Level of personal agency	1.537	0.222	0.003
Consumer type * Group (baseline: cynical consumer * control group)			
Cynical consumer*Spark group	3.971	1.893	0.004
Cynical consumer*Signal group	0.867	0.397	0.755
Caring consumer*control group	1.052	0.169	0.753
Sustainable consumer*control group	1.811	0.322	0.001
Caring consumer*Spark group	1.492	0.346	0.084
Sustainable consumer*Spark group	1.264	0.321	0.357
Caring consumer*Signal group	1.788	0.416	0.012
Sustainable consumer*Signal group	1.483	0.385	0.129
Sustainable label (baseline: organic)			
Fair-trade	1.503	0.137	0.000
Child-labour-free	1.778	0.137	0.000
Perceived sustainable shopping inconvenience	0.859	0.050	0.009
Perceived sustainable shopping inconvenience*control group (baseline)			
Perceived sustainable shopping inconvenience*spark group	0.778	0.072	0.007
Perceived sustainable shopping inconvenience*signal group	1.070	0.095	0.447
Gender (baseline: female)	0.964	0.078	0.650
Age	1.054	0.033	0.092
Education	1.015	0.061	0.801

Income	0.879	0.022	0.000
First product chosen (baseline: not first product chosen)	1.124	0.154	0.393
LR chi ²	278.89		
Prob > chi ²	0.000		

Table 5. Full Model Robustness Test (Odds Ratio)

Discussion

Drawing from Fogg's (2009) behavioral model for persuasive agent, we designed a shopping agent that motivates consumers by highlighting the benefits of sustainable consumption and the corresponding risks (spark agent), and another shopping agent that simply reminds the consumers of the availability of sustainable product options (signal agent). Our results demonstrate that sparks and signals can be effective persuasive agents in bridging the awareness-behavior gap: individuals abetted by a spark or signal were more likely to make environmentally sustainable product choices than those who had neither agent. Future research can examine different signal and spark designs to shed light on the most effective design options for either motivating, or reminding, individuals to make environmentally sustainable choices. Our persuasive agent designs work well in persuading people who lack the motivation to purchase sustainable products (cynical consumers) and people who are motivated but have not done so (caring consumers) to choose sustainable product option. The spark agent increased the odds of cynical consumers choosing the sustainable product by 297.1% whereas the signal agent increased the odds of caring consumers choosing the sustainable product by 78.8%. Interestingly, people who are motivated to purchase sustainable products and have taken action (sustainable consumers) do not need to be persuaded to choose sustainable products. Unfortunately, there are not many sustainable consumers: sustainable consumers constituted only 20.8% of the participants. This is consistent with previous studies that show a substantially reduced number of highly motivated consumers who choose the sustainable products without any intervention (Hussain 2000).

Our results suggest that in designing a persuasive agent, one must be careful not to make the sustainable shopping experience inconvenient. Previous studies consistently highlight that sustainable consumption needs time and space in peoples' lives (Gleim et al. 2013; Young et al. 2010). We found that the effectiveness of our spark agent, i.e., a shopping agent that communicates motivational messages to persuade consumers to purchase sustainable products, is significantly reduced when the shoppers' perceived level of shopping inconvenience increases. Perceived shopping inconvenience was highest for the grocery website with the spark agent whereas there was no significant difference in shopping inconvenience between the grocery website with no shopping agent and the grocery website with a signal agent. It might be that sparks arouse emotion, which increases the effort of shopping, whereas signals act as gentle reminders that do not disrupt the emotional state of the shopper nor require extensive reflection. The good news is that, controlling for this negative effect, our spark agent is still able to successfully persuade the cynical consumers to choose sustainable products. The odds are almost 3 times higher that cynical consumers will choose sustainable products when there is a persuasive agent that communicates motivational messages of sustainable consumption (with all the other variables in the model remaining constant).

Compared to the organic label, fair-trade and child-labor-free labels increase the likelihood of people selecting the sustainable product option. This finding might seem counter-intuitive: choosing the organic label would seem to offer direct benefits to the individual (health) whereas the free trade and child-labor-free labels have collective benefits (to society). One explanation is that individuals might not perceive organic options as being healthier, in which case there is no benefit to their purchase. The other might be that individuals who purchase environmentally sustainable products are more interested in helping others than in helping themselves. The latter explanation is consistent with the viewpoint that the importance of sustainable consumption is influenced by moral views rather than by personal factors (Valor 2008). Adopting this viewpoint, our findings would suggest then that individuals attach different levels of importance to each moral imperative. Specifically, the moral imperative associated with labor rights is stronger than that associated with environmental effects.

Regarding the effect of the demographic characteristics, in contrast to previous studies (Banaji and Buckingham 2009; Tallontire et al. 2001), we found that people with higher income are less likely to choose sustainable products. It might be that individuals with higher incomes are less able to relate to issues such as fair-trade and child labour, that they are more skeptical of the labels, or that they feel they contribute to a better world in other ways (e.g., higher taxes perhaps or charitable donations). More research is needed to understand why those with higher incomes would be less likely to purchase sustainability than those with lower incomes. Research that is not specifically interested in income as a predictor, or moderator, of environmentally sustainable behavior are advised to control for income when investigating sustainable consumption.

Contributions and Implications

This study contributes to the related literature in two important ways. First, our study contributes towards a better understanding of how to design an IS artifact that can persuade consumers to choose sustainable products. There used to be a concern that lack of information transparency is the reason why consumers do not choose sustainable products. However, the Internet and advancements in IS have provided a wealth of information for consumers to learn about sustainability product attributes. Nevertheless, although the Internet and IS foster information transparency, until now sustainable consumption is still only a fraction of the entire consumption space. Our study demonstrates the design of an IS artifact that can persuade consumers to choose sustainable products. A series of related works (Al-Natour et al. 2011; Köhler et al. 2011; Mimoun et al. 2017) shows how online shopping assistants and interactive decision aids can influence online consumer behavior. We add to such works by building on Fogg's behavioral model of persuasive technology design (Fogg 2009), and testing two persuasive shopping agents, i.e., a persuasive agent that communicates motivational messages of sustainable consumption (spark agent) and an agent that simply reminds the consumers about the availability of sustainable product options (signal agent). We found that while the spark agent effectively persuades cynical consumers to choose sustainable products, the signal agent effectively persuades caring consumers to choose sustainable products. This finding underscores that it is not enough to provide shopping agents that give information, the agents must be equipped with spark messaging to reach the most difficult to persuade consumer, e.g., the cynical consumer, or signals to remind the caring consumer. In fact, already sustainable consumers do not need either a spark or a signal, but their relative low presence suggests that for the foreseeable future, society will benefit by agents that can persuade the cynical and caring consumers.

Second, our study specifically contributes to the literature on Green IS for consumption-side transformation that is currently dominated by studies on energy consumption (Kranz and Picot 2012; Looch et al. 2013; Young et al. 2010). Sustainable food consumption involves compromises and trade-offs (Young et al. 2010). This is partly because environmentally sustainable food products are typically more expensive than their alternatives (Banaji and Buckingham 2009; Valor 2008; Valor et al. 2014), and omission of information is understood as lack of support rather than as a violation or opposition to a social/environmental issue (Sen and Bhattacharya 2001). Even when the sustainable products are more expensive than their alternatives that have no sustainability information attributes, our persuasive agent effectively persuaded consumers to choose sustainable products. Future studies can test the boundary of our persuasive agent designs by manipulating the price differences between the sustainable products and their alternative products.

Finally, our study provides guidance to e-commerce designers on how to go about designing a pro-sustainable consumption shopping agent. Although it could be difficult for grocery-shopping website designers to decide whether to show spark or signal agents to consumers, they could begin with a spark agent design since most people are ambivalent about sustainable consumption. Overtime, the grocery-shopping website will learn about the historical purchases of a consumer and then intelligently decide whether to still show a spark agent or change to a signal agent (see Schneider et al. 2018 for a related discussion). Some people may question the feasibility of a grocery-shopping website to be pro-sustainable consumption. Similar to the movement of the supermarkets to charge a fee for plastic bags, we believe that a grocery-shopping website should and could promote sustainable consumption while still giving consumers the option to purchase products with no sustainability attribute information if they so desire. Our shopping agent design is particularly beneficial for online grocery stores that compete based on premium-priced sustainable products such as www.waitrose.com. Besides grocery-shopping website design, our study is also relevant to the design of shopping agents on retail websites that promote

sustainable consumption (e.g., www.goodguide.com). Overall, our study contributes to closing the gap between consumers' attitudes towards sustainable consumption and their actual behavior to move the world closer in achieving UN's SDG on sustainable consumption and production (SDG #12).

Limitations and Conclusion

The main limitation of this study, as with any lab experiment, is that although we tried to simulate a real shopping experience where consumers can either spend money choosing more expensive sustainable products or choose less expensive products and keep the rest of the money for something else (in this case, for more lucky draw tickets), our experiment does not have the same degree of external validity that a field experiment would have. The strength of a lab experiment lies in its internal validity since the cause and effect can be more strongly established.

Despite the limitation of our lab experiment vis-à-vis a field experiment, our contributions to both research and practice are novel and important. Sustainable consumption represents a dilemma in terms of sacrificing immediate pricing gains for long-term collective benefits. Previous studies have consistently found that consumers are less likely to choose sustainable products if they have to make a price trade-off, which is almost always the case since sustainable products are generally more expensive than their alternatives. While we don't dispute this finding, we demonstrated that a pro-environment shopping agent was generally effective in persuading indifferent and caring consumers to purchase sustainable products. Websites that incorporate such shopping agents show promise in encouraging more sustainable product selection and in helping reduce the intention-behavior gap in the area of sustainable consumption.

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Appendix

Sample Motivational Messages (Experiment Group 1)

You are contributing to the planet's destruction by not choosing sustainable products
You are jeopardizing the future of our planet by not choosing sustainable products
You are putting future generations at risk by not choosing sustainable products
People associated with the production this product might suffer when you don't choose the sustainable version
Less fortunate people might suffer when you don't choose sustainable products
There is a high likelihood you are contributing to the planet's destruction with your choices!
Future generations might be at serious risk when you don't purchase sustainable products!
Our planet is going to be in serious trouble in the future if we don't shop with a sustainable mindset
You are helping to create a more sustainable world!
Thank you for being a conscientious shopper! People all over the world will benefit from this!
Kudos for thinking of a better world! There is a high likelihood you are contributing to a sustainable future with your choices!
You are an unselfish person! Less fortunate people are really benefiting from this!
I admire the product choices you make! You are contributing to a sustainable future with your choices!
I like how you think about sustainability! Your choices are really helping others!
That's a great choice! People all over the world are really benefiting from this!
I admire your commitment to make sustainable product choices! Less fortunate people are really benefiting from this!

Sample Reminder Messages (Experiment Group 2)

Remember to purchase the sustainable product
Keep in mind that you can purchase the sustainable product
Don't forget to purchase the sustainable product
You might want to go for the sustainable product
I suggest you think about going for the sustainable product
You have the option of choosing the sustainable product here
I hope you haven't forgotten that you can choose the sustainable product
You might consider the sustainable product option
I just wanted to remind you to consider the sustainable product option
Remember, you can choose the sustainable product here
Do you want to reconsider your choice and go for the sustainable product?
Don't you want to consider the sustainable product option?
Don't you think you should consider choosing the sustainable product option?
You might want to consider the sustainable product
You can also consider choosing the sustainable product
You can choose the sustainable product instead