Does Eye Tracking Reveal More About the Effects of Buying Impulsiveness on the Green Industry Consumer Choice Behavior?

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Abstract

Although consumer behavior research has investigated impulsive buying behavior since the early 1950s, no studies explored the relationship between eye gaze metrics, buying impulsiveness scores and purchase decisions. The present study is a preliminary approach to setting consumer purchase decisions as a function of not only product attributes, but also individuals' buying impulsiveness and eye gaze measures, which were collected using an eye tracking device during choice experiments. Specifically, we investigated the moderation effects of eye gaze measures on the relationship between buying impulsiveness and plant purchase likelihood. The results showed that impulsive buying scores were negatively related to purchase decisions, and that eye gaze duration (when viewing plant displays) influenced that relationship, depending on the type of the display information viewed (e.g., price vs. production methods or plant type signs). Theoretical contributions to choice behavior literature and implications for developing effective plant sales marketing efforts are discussed.

1 Introduction

The U.S. green industry has experienced unprecedented growth, innovation, and change over the last two decades. Recently, slow growth in demand and tighter profit margins, indicative of a mature market. While the industry outlook may be somewhat uncertain in terms of sales growth and consumer demand, it is clear that innovativeness will continue to be a requisite skill in ensuring the survivability and profitability of green industry firms in the future. Much of this innovativeness must be focused on enhancing the value proposition offered by industry firms by emphasizing the economic, social (e.g., health and well-being), and environmental benefits (e.g., energy/water saving production methods, or use of recyclable/compostable containers) that green industry products and services offer end consumers (Hall and Dickson, 2011). Accordingly, understanding consumers' preferences for green industry products and certain characteristics will help support and enhance the value proposition offered by industry firms.

Most of the past research investigating the green industry consumers' choice behavior has focused on product-specific characteristics (e.g., price, plant longevity guarantees, recyclable

containers, etc.) and willingness to pay a premium price based on the utility derived from each of the product attributes. Only a small number of studies examined the link between consumers' demographic characteristics and product attributes. However, there are theoretically relevant, individual-specific characteristics (in addition to the standard set of socio-demographic variables) that influence the behavioral process underlying choice decisions (e.g.., preference for environmentally friendly attributes). The present study sets consumer preferences for green industry products (annual plants, vegetables, and herbs) as a function of not only product attributes, but also individual-specific buying impulsiveness scores (BIS) and label gaze duration (collected using portable eye tracking device during choice experiments).

Impulsive buying behavior, which is defined as "a sudden, often powerful and persistent urge to buy something immediately" (Rook and Fisher, 1995), contributes to the U.S. retail industry by an estimated $4 billion in annual sales (Mogelonsky, 1998). To the best of our knowledge, the extent to which impulse buying, triggered by emotional rather than rational decisions, contributes to the green industry products' sales has not been investigated. To address this shortcoming, the present study also investigates the relationship between individuals' buying impulsiveness scores and choice decisions.

Cue utilization is the cognitive processes that are involved in gathering information from the external environment and using this information to make a decision to act in a particular way (Olson, 1978). Olson (1978) classified cues as intrinsic (e.g. product ingredients) and extrinsic cues (e.g. signs, packaging, labels, etc.). Since horticultural products are minimally packaged, we wanted to investigate the visual activity on the product (intrinsic cue) and signs (extrinsic cues) to determine which were best related to BIS.

To incorporate gaze measures into the choice experiment, eye tracking technology (ETT) was used to track participants' eye gazes when viewing plant choice scenarios on a computer screen. Participants gaze duration data were collected for plant label areas [i.e., areas of interest (AOIs)]. Our first hypothesis is that buying impulsiveness will influence intentions to purchase plants. Next we hypothesized that the effects of individual buying impulsiveness will be influenced by eye gaze measures (i.e., interaction effects of BIS and eye gaze behavior on purchase intentions).

To test our hypotheses, we conducted a series of experiments at six North American locations (Florida, Indiana, Michigan, Minnesota, Texas, and Ontario, Canada) during spring

2012. Respondents were recruited within the surrounding area of the research institution hosting the experiment, and were offered $25 to participate in the experiment. The number of participants ranged from 48 to 67, totaling 331 for six locations.   After signing university approved informed consent documents, the participants proceeded to evaluate the 16 plant choice scenarios, by indicating their likelihood (1-10 Likert scale) of purchasing a plant in the display shown on a 21-inch computer screen. After indicating their likelihood of purchasing, the respondents completed the BIS scale, followed by a standard set of questions on socio-demographic characteristics.

Empirical results may lead to several theoretical and applied contributions. First, the present study incorporates ETT into conjoint analysis framework, which is traditionally used in consumer choice studies. Second, analysis of eye gaze measures may shed light on a critical assumption that is intrinsically made in computer-based choice experiments, that information on a critical part of stimuli (shown on a computer screen) is necessarily viewed by the subjects. Third, from the green industry perspective, the results will provide useful information about how plant signs are viewed, and how individual-specific characteristics such as CFC and BIS (combined with gaze pattern measures 1 to 4 discussed above) influence choice decisions.

1.1 Buying Impulsiveness

Investigations of impulsive behavior mechanisms date back to the 1950s (Applebaum, 1951; Katona and Mueller, 1955; West, 1951). Earlier studies characterized impulsive buying as a purchase behavior which was not planned by the customers before, but which was inspired through in-store sales promotional mechanisms such as attractive pricing, displays, demonstrations or sales talks (Applebaum, 1951; Clover 1950). Because 68% of buying decisions are unplanned, point-of-purchase communications can be integral to stimulating sales (Stahlberg and Maila, 2010). The underlying mechanisms of impulsive buying behaviors are biochemically and psychologically stimulated impulses, which drive most of human activity (Rook, 1987). Wolman (1973) described psychological impulse as something not consciously planned, which arises immediately upon confrontation with a specific stimulus, while Goldenson (1984) referred to a psychological impulse as "a strong, sometimes irresistible urge; a sudden inclination to act without deliberation." When triggered, psychological impulses create

irresistible urge to behave in a certain way spontaneously, as opposed to habitual behavior, which can be automatic but not necessarily impulsive (Rook, 1987).

Impulsive buying behavior has been linked to self-control, management of personal finance, post purchase satisfaction, social reactions and overall self-esteem (Rook and Fisher, 1995; Rook and Hoch, 1985), to name a few. One way to quantify buying impulsiveness is through scales initially developed by Eysenck et al. (1985) and further modified by Rook (1987). The modified version of the buying impulsiveness scale includes 9 items[1], which was utilized in this study.

1.2 Eye Tracking in Consumer Research

The visual appeal of flowers is unquestionable, however little is known is about the extent to which visual attention contributes to purchase decisions. We incorporated eye tracking technology (ETT) in the consumer choice experiment conducted for this study in order to gather explicit eye gaze data, which could potentially help to explain purchase intention behaviors. Eye movement is the fastest movement the human body can make, with nearly 200,000 stops and starts each day (Wedel and Pieters, 2008a). Each fixation (or stop) lasts only 200-500 milliseconds (Rayner, 1998). Wedel and Pieters (2008b) reported that people don't look at random and eye movement is largely subconscious, guided by the type of information sought and its value to the task at hand. Eye tracking technology (ETT) was developed in the medical field, but has found its way into the consumer research arena in light of lower cost and more portable equipment. Most peer-reviewed studies using ETT investigated reading (see Rayner (1998), for a 20 year review of this subject). In consumer research, the peer-reviewed studies are sparse (Wedel and Pieters 2008a for a comprehensive consumer research review). ETT has been used to study how consumers view print advertisements. Meissner and Decker (2010) demonstrated that consumers spent more time (fixations) viewing product attributes that were more important to them.

In the past, researchers have generally relied on stated preference surveys whereby some mechanism (e.g., conjoint analysis) is used to quantify the value of attributes that make up the purchase decision. The benefit of using a stated preference mechanism, especially conjoint

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[1] Detailed description of the buying impulsiveness scale along with exploratory and confirmatory factor analyses can be found in Rook and Fisher (1995).

analysis, is the internal validity (Yue et al. 2010), which can come from controlling stimuli via using hypothetical stimuli, such as having respondents evaluate digitally altered pictures (plants, labels, etc.). It also can be less costly and can be applied to almost any new product (Lusk, Feldkamp, and Schroeder 2004). However, the major disadvantage of these studies is they are not incentive compatible (List and Shogren 1998), implying the respondent has no incentive to accurately rate their willingness to purchase/pay (WTP), thereby potentially overstating their WTP (Yue, Alfnes, and Jensen 2009). To induce respondents to accurately assess their WTP, researchers have recently turned their attention to non-hypothetical mechanisms, notably silent auctions. These techniques have addressed the incentive compatibility issue (List and Shogren 1998), but are still limited by the artificial nature of the experiment and the need for real products to be sold (Lusk, Feldkamp, and Schroeder 2004). Hybrids of these techniques have been used (e.g., Silva et al. 2007), however, the need for real products to fulfill the non-hypothetical nature of the product cannot be eliminated. In other words, researchers still have to make a restrictive assumption that the products, labels, and any other visual information has been viewed in its entirety by the experiment participants, which may or may not be the case in real-world situations.

ETT offers an innovative means to combine the advantages of the above two techniques (internal validity and increased incentive compatibility compared to stated preference mechanisms) in order to capture a consumer's reaction to a display and its components as the reaction takes place. ETT moves away from commonly utilized economic experimental techniques to assess consumer intention to purchase and allows the researcher to assess the impact of key variables of interest in more detail with the ability to examine what captures and keeps the consumer's attention during the decision process.

1.3 Hypotheses

Based on the previous literature linking individual buying impulsiveness scale to choice behavior, we hypothesized that buying impulsiveness scores will influence intentions to purchase ornamental, edible and food-producing plants (Hypothesis 1). Next we hypothesized that the effects of individual buying impulsiveness will be influenced by gaze duration (i.e., interaction effects of BIS and gaze duration variables on purchase intentions will be significant) (Hypothesis 2).

2 Methods

2.1 Choice Experiment Design

In an independent garden center, we constructed one display containing each type of plants (petunias, mixed herbs, and assorted vegetable) with three blank signs equally spaced above the plant material. Using Photoshop, signs had text digitally added to include prices ($1.49, $1.99, or $2.49), environmentally-friendly production methods ("grown using energy-saving practices," "grown using water-saving practices," and "grown sustainably"), and plant types—petunias (ornamental), assorted vegetables (food-producing), and mixed herbs (edible). The production claims were presented without definition or elaboration (Behe et al., 2013b). Sign text was added in the same font size and style and included an identification of the plant type (always central sign) and price (randomly assigned to the left or right sign) and production information (assigned opposite price), Figure 1.

In order to develop a conjoint experimental design and elicit consumer preference for differing production environmental claims and price, we followed protocols and instruments introduced by Hall et al. (2010) and Behe et al. (2013b). Sixteen choice scenarios were generated using fractional factorial design—3 (plant types) x 4 (production practices) x 3 (prices). The price points were identified by the authors by visiting several retail garden centers during spring, 2012. The reason for selecting different types of plants was not to identify specific preferences for the plants shown, but to gain additional understanding about how preferences varied by plant types (ornamental, food-producing, and edible), consistent with Behe et al. (2013b).

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Insert Figure 1 about here

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2.2 Participants and Eye Tracking Procedures

During the spring-summer 2012, 331 subjects were recruited for our experiment by local newspaper advertisements and flyers posted proximate to the study locations in six North American university or research center venues, including Orlando, FL; College Station, TX; West Lafayette, IN; East Lansing, MI, St. Paul, MN, and Vineland Station, Ontario, Canada.

After being informed about the study purpose and signing an IRB approved informed consent form, subjects completed the demographic portion of the survey questionnaire. They were subsequently seated at the Tobii X1 Light eye tracking device and were oriented with and calibrated to the equipment (Behe et al., 2013a). They were encouraged to sit as still as possible while viewing the displays. The visual data collection began with the subject viewing a sample display to become familiar with the study protocol. Verbal ratings on a 1 (not at all likely to buy) to 10 (very likely to buy) Likert scale were solicited. The researcher recorded the verbal response as a colleague advanced the image shown to the next one. At each location, images were randomized for presentation to subjects.

After viewing the 16 images, subjects completed supplemental questions with regard to the past plant purchases and other attitudinal and behavioral questions. As part of the behavioral measures, subjects completed 9-item buying impulsiveness scale, which was adapted from Rook and Fisher (1995). The internal validity was acceptable (Cronbach's $\alpha = 0.89$).

Although eye tracking device generates a number of gaze behavior measures, such as time to first fixation (TFF), first fixation duration (FFD), fixation count (FC), and total visit duration (TVD), only the latter is used in the present study. The TVD, alternatively called gaze duration in this study, is the amount of time (in milliseconds) the subjects view a particular AOI. For example, the gaze duration variable of the "grown using sustainable practices" sign/AOI measures the amount of time that particular sign was viewed by each participant. Alternatively, gaze duration variable of the "grown using energy-saving practices" or "grown using water-saving practices" AOIs measures the time that the participants spent looking at these particular AOIs, i.e., signs with "energy-saving" and "water-saving" labels, respectively. Therefore, the interactions of BIS and gaze duration variables show the moderating effects of individuals' gaze duration on the relationship between BIS and purchase likelihood ratings.

2.4 Econometric Model

The econometric model is specified to define the relationship between the dependent variable, which is a Likert scale purchase likelihood rating, ranging from 1 (not at all likely to buy) to 10 (very likely to buy), and independent variables, which are plant attributes, eye gaze duration (converted to seconds), buying impulsiveness scale (Rook and Fisher, 1995), and a standard set of demographic variables. Ordered logit model was used to estimate the model

coefficients, and STATA software-based post-estimation commands by Long and Freese (2006) were used to model fit and test statistics. In order to estimate how the gaze duration influences the relationship between buying impulsiveness scale and purchase likelihood, we introduced eye gaze duration and buying impulsiveness scale interaction terms into the model. Post-estimation marginal effects and interaction magnitudes were computed following Ai and Norton (2003) recommendations for nonlinear models by considering the following structural model:

$$y_i^* = x_i \beta + \varepsilon_i, \tag{1}$$

where y^* is a latent variable (ranging from $-\infty$ to ∞), i is the observation and ε is a random error. By dropping the notation i for convenience, the probability of observing $y = j$ for given values of x can be presented as:

$$\Pr(y = j|x) = \Pr(\kappa_{j-1} \leq y^* < \kappa_j|x) \tag{2}$$

where $j = 1$ to J (product rating) and κs represent ordinal category cutpoints or threshold parameters. When the latent y^* crosses these κ cutpoints, the observed category changes. By substituting $x\beta + \varepsilon$ for y^* and after some algebraic manipulation, the probability of a given rating outcome will be:

$$\Pr(y = j|x) = F(\kappa_j - x\beta) - F(\kappa_{j-1} - x\beta), \tag{3}$$

where F is the cumulative distribution function for ε, which in case of ordinal logit is logistic with $Var(\varepsilon) = \pi^2/3$. In the regression equation $y^* = x\beta + \varepsilon$, y^* is the unobserved dependent variable, and what is observed is the respondents rating answer y that is related to y^* in the following way: $y = j$ if $\kappa_{j-1} < y^* \leq \kappa_j$ for $j = 1$ to J.

In order to explain how marginal and interaction effects were calculated from the ordered response model, without loss of generality we can assume that there are three independent variables (x_1, x_2 and x_3) in the x vector, where only x_2 and x_3 are interacted. Therefore the β'x part of the equation can be presented as $\beta'x = \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_{23}(x_2 * x_3)$. The thresholds ($\kappa$s) and covariate coefficients (βs) are jointly estimated by the Maximum Likelihood method. Assuming $\varepsilon \sim N(0,1)$, the probability for the jth outcome is:

$$\Pr(y = j|x) = F(\kappa_j - \beta'x) - F(\kappa_{j-1} - \beta'x), \tag{4}$$

where F is the cumulative (logistic) distribution, which is continuous and twice differentiable. The marginal effects of x_1 for the jth response are then calculated as:

$$\frac{\partial \Pr(y=j|x)}{\partial x_1} = [F(\kappa_{j-1} - \beta'x) - F(\kappa_j - \beta'x)]\beta_1 = [F_{j-1}(\cdot) - F_j(\cdot)]\beta_1, \tag{5}$$

which determines how a change in x_1 changes outcome probabilities. The marginal effects of variables which are also entered in the model as interaction terms, i.e., x_2 and x_3 cannot be calculated by standard post-estimation commands readily available in software such as STATA. The marginal effect of the interaction term as calculated by standard software (i.e., β_{23} for our example) is incorrect and leads to misinterpretation (Ai and Norton, 2003; p. 124). Following recommendations in Ai and Norton (2003), the marginal effects for x_2 were calculated as shown in the following manner:

$$\frac{\partial \Pr(y=j|\mathbf{x})}{\partial x_2} = F_{j-1}(\cdot)[\beta_2 + \beta_{23}x_3] - F_j(\cdot)[\beta_2 + \beta_{23}x_3]. \tag{6}$$

Similar procedure was used to calculate the marginal effects of x_3. Note that the difference in calculations for x_1 (which doesn't enter the model as interaction) and x_2 or x_3 which are also entered in the model as interactions ($x_2 * x_3$), is that the marginal effect of x_1 is zero, if the coefficient β_1 is zero. Whereas the marginal effect of x_2 (or x_3) may be nonzero even if the coefficient β_2 (or β_3) is zero.

The magnitude of the interaction terms in our model, i.e., $x_2 * x_3$, was calculated using partial derivative of equation 6 with respect to x_3:

$$\frac{\partial^2 \Pr(y=j|\mathbf{x})}{\partial x_2 \partial x_3} = [F_{j-1}(\cdot) - F_j(\cdot)]\beta_{23} - [\beta_2 + \beta_{23}x_3][\beta_3 + \beta_{23}x_2][F'_{j-1}(\cdot) - F'_j(\cdot)], \tag{7}$$

where $F'(\cdot)$ is the first derivative of the density function with respect to its argument. As shown by the equation above, even if the coefficient ton the interaction term β_{23} is zero, the magnitude of the interaction effect of $x_2 * x_3$ can be nonzero, simply because in addition to $x_2 * x_3$ interaction, it also depends on the individual coefficients β_2 and β_3.

The coefficients represented in the results section are fully standardized and the marginal effects are interpreted in the following way. For a standard deviation increase in the independent variable, the dependent variable is expected to increase by β standard deviations, holding other variables constant. The magnitude of the interaction terms in the model can be interpreted as magnifying or moderating relationships on the main effects.

3   Results

First three columns in Table 1 show results of the base model, relating 1) plant attributes (sustainable, energy-saving, water-saving, price) 2) buying impulsiveness scale, 3) a set of socio-

demographic variables, and 4) location indicator variables to individuals' plant purchase intentions. As indicated above, the marginal effects coefficients show that given a standard deviation increase in an explanatory variable, the dependent variable is expected to increase by β standard deviations, holding other variables constant.

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Insert Table 1 about here

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The results showed a positive and moderate relationship between likely to buy (LTB) and production methods related attributes, indicating that plants grown using sustainable, energy-saving, and water saving production practices were preferred similarly more than conventionally grown (base attribute) plants. Price and LTB were negatively related, meaning lower priced products were preferred. The results also showed that less impulsive participants (lower BIS score) were more likely to buy the plants shown. The marginal effect showed that a standard deviation increase in the BIS variable would lead to -0.088 standard deviation decrease in purchase likelihood.

Age and LTB were mildly positively related, so we observed a slight increase in purchase intention with an increase in age consistent with Dennis and Behe (2007). In our sample, women were much more LTB plants compared to men and participants from households with more family members were more LTB the plants shown. Non-Caucasians had a higher LTB rating compared to Caucasian participants, which was the opposite of the results found in Dennis and Behe (2007). Education and income were inversely related to LTB, meaning as income and education level rose, the attractiveness of the plants declined. Residents of metropolitan areas were less LTB the plants compared to participants from suburban or rural areas. Participants from Minnesota were the most LTB the plants shown but Texans were the least LTB. (The base alternative for location indicators was Ontario, Canada, the sixth location of choice experiments.) Further, we investigated the relationship between variables based on visual data and purchase likelihood, results from which are discussed below.

3.1 Visual Data Results

Columns under Model 2 in Table 1 include the effects of gaze duration on the relationship between buying impulsiveness scale and purchase likelihood, in addition to the variables in the first model. In order to account for interaction effects, we included gaze duration variables for each of the AOIs and gaze duration interactions with the BIS variable. As explained in the Methods section, gaze duration is the amount of time the participants viewed a particular AOI, and is derived by multiplying FC by fixation duration per visit. Lenzner et al. (2012) reported that higher fixation counts (FC) were observed on low frequency words, vague or imprecise relative terms, vague or ambiguous noun phrases, complex syntax, complex logical structures, and low syntactic redundancy phrases in a study of word comprehension for words used in a survey.

The results showed that the "energy-saving" sign had the highest coefficient (0.285), meaning that participants spent more time on this production method compared to the others ("sustainable" or "water-saving"). Coefficients on the water-saving sign was lower (0.272), followed by sustainable sign (0.262). The word "sustainable" may be more familiar than "water-saving" and would account for the slightly lower gaze time consistent with and Lenzner et al. (2011). Resource conservation is one dimension of sustainability (Brkalcich et al., 1991) and energy-saving and water-saving practices are key dimensions of resource conservation, which may be more challenging to comprehend. Water-saving production practices might be confused with water-saving plants in the landscape, and the clarity or ease of comprehension may be one reason for the longer gaze duration on the "water saving" term.

The BIS scores and LTB were negatively related, with a standard deviation increase in the BIS score translating into 0.087 standard deviation decrease in purchase likelihood. Similar to the first model, less impulsive participants (lower BIS score) were more likely to buy the plants shown. This may be an indication that consumers who are most like the study participants may be less influenced by point-of-purchase communications because they were less impulsive.

Time spent on price signs was found to increase with prices increasing from the lowest to the highest. For example, gaze duration on the lowest price was half of that of the highest price. Marginal effects showed that for a standard deviation increase in the gaze duration per price AOI, the purchase likelihood is expected to decrease by 0.053, 0.078 and 0.077 standard

deviations, holding other variables constant. This may be an indication that study participants needed to reflect longer about making a purchase at the higher price.

The BIS score and gaze duration interactions on all three production methods signs were not statistically significant. These results are interesting in that shoppers with higher impulsiveness scores may care less (or not care at all) about environmentally-friendly attributes. In other words, viewing time related to the production methods signs did not alter the relationship between BIS and LTB. BIS and gaze duration for price signs were positively related and statistically significant; more impulsive participants had higher gaze duration than less impulsive participants. The marginal effects ranged from 0.023 to 0.27, indicating that at higher levels of gaze duration, the relationship between BIS and LTB is stronger. In other words, the longer they looked at the sign, the more likely they were to buy a plant from the display.

Similar to the results in the base model, age and gender (female) variables were positively related to purchase likelihood. As the number of individuals in the household increased, the LTB also increased. Non-Caucasian study participants were more LTB than Caucasian participants. As education and income rose, LTB declined. One explanation for this finding may be that at higher income and education levels, participants may be more likely to not make the purchase but to have a landscaping service buy and install plants. Participants from suburban and rural areas were more LTB than participants from metropolitan areas, perhaps due in part to space constraints. Participants from Minnesota were most LTB wile residents of Michigan were least LTB.

4   Conclusions

4.1 Marketing Implications

As the Green Industry becomes more competitive firms need to better understand how to attract customers. One way firms can attract customers, and gain an increase in sales, is to understand the role of product attributes as well as consumer characteristics in the purchase decision. More than half of retail purchase decisions are unplanned (Stahlberg and Maila, 2010) so the role that BIS plays in purchase decisions, moderated by gaze data, makes important practical and theoretical contributions. Through this research several important findings have been identified. First, our results find a positive relationship between LTB and production method with plants labeled as produced via sustainable, energy-saving, or water saving means

being preferred to plants labeled as conventionally grown. This result is not surprising as this finding is consistent with Behe et al. (2013). However, our results do provide new insights into the role of impulsiveness on plant choice and the role of production practice. For instance, less impulsive participants (lower BIS score) were more likely to buy the plants shown; conversely, more thoughtful consumers may be more likely to buy the plants labeled with eco-friendly production practices. Gaze duration for each of the environmentally friendly production practices did not explain the relationship between impulsiveness and purchase likelihood, implying that impulsive consumers may disregard production practices and related information displayed at the point of purchase.

Utilizing the results above it is clear that firms need to understand their clientele before implementing a marketing strategy. For instance, a firm that caters to consumers that have a higher probability of being impulsive should focus on labeling strategies that capitalize on their impulsive nature (e.g. displaying plant production practices will not work as well), while firms with less impulsive consumers can benefit from production practice signs (or other labels in this vein). Point of purchase materials might include this type of information to appeal to the less impulsive consumer, to demonstrate the eco-friendliness of the production practices. Also, consumers gazed longer at higher priced products, meaning they thought about the price longer before reaching a purchase decision. Higher priced products may not benefit from impulse purchases when that price is prominently displayed in signs or other point-of-purchase communications.

4.2 Strengths, Limitations, and Future Directions

To the best of our knowledge, this study is the first to investigate the role of gaze movements on plant signs at the point-of-purchase with BIS. Few studies have examined the role of eye movement with products and signs at the point-of-purchase, but not combined with buying impulsiveness in one study. Buying impulsiveness and the use of signs at the point of purchase were demonstrated to be related, however much remains to be investigated. The key contribution of the paper is to relate gaze movement and extrinsic cues (e.g., signs) with BIS. The limitations of the study are various. One product category (live transplants) may not be indicative of other product categories, especially packaged products. Plants are typically marketed in little to no packaging, making the product itself a primary visual stimulus at the

point of purchase. Although six areas in North America were investigation sites, the representativeness of the study participants may not be reflective of all plant purchasers. ETT can only be used with individuals who can be calibrated on the ET equipment. Future research testing the validity of this framework further by involving other products and increased number of experiment participants could expand our understanding of visual behavior relates to purchase intentions.

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Figures and Tables

Figure 1. An example of a display showing vegetable plants, grown using energy-saving practices and $1.99 price per container.

Table 1. Ordered logit regression coefficients and marginal effects relating buying impulsiveness scale (BIS), gaze duration, interactions of BIS and gaze duration, demographic variables, and location indicators to plant purchase likelihood.

	Model 1			Model 2			
	Coef.		Std. Errors	Coef.		Std. Errors	Marginal Effect
Attributes							
Sustainable	0.262	***	0.028	0.272	***	0.032	0.061
Energy-saving	0.285	***	0.028	0.300	***	0.032	0.068
Water-saving	0.272	***	0.027	0.273	***	0.032	0.064
Price	-0.078	***	0.002	-0.083	***	0.002	-0.276
Buying Impulsiveness Score							
BIS	-0.088	***	0.008	-0.105	***	0.010	-0.087
Gaze Duration per AOIs							
Gaze-sustainable	-	-	-	-0.006		0.027	-0.003
Gaze-energy-saving	-	-	-	-0.003		0.029	-0.001
Gaze-water-saving	-	-	-	0.022		0.028	0.012
Gaze-price 1.99	-	-	-	-0.100	***	0.026	-0.053
Gaze-price 2.49	-	-	-	-0.186	***	0.035	-0.078
Gaze-price 2.99	-	-	-	-0.207	***	0.039	-0.077
BIS×Gaze Duration Interactions	-	-	-				
BIS×Gaze-sustainable	-	-	-	-0.001		0.008	-0.002
BIS×Gaze-energy-saving	-	-	-	-0.002		0.008	-0.003
BIS×Gaze-water-saving	-	-	-	-0.006		0.008	-0.006
BIS×Gaze-price 1.99	-	-	-	0.028	***	0.008	0.027
BIS×Gaze-price 2.49	-	-	-	0.035	***	0.010	0.027
BIS×Gaze-price 2.99	-	-	-	0.034	***	0.011	0.023
Socio-demographics							
Age	0.005	**	0.001	0.006	**	0.001	0.043
Gender: Female	0.360	***	0.021	0.363	**	0.021	0.084
Num. of HHD members	0.273	*	0.012	0.273	*	0.012	0.120
Ethnicity: Caucasian	-0.111	***	0.033	-0.116	***	0.033	-0.019
Higher education	-0.057	***	0.021	-0.060	***	0.021	-0.015
Area of residence: Metro	-0.101	***	0.025	-0.106	**	0.025	-0.021
Income level	-0.013	***	0.005	-0.013	***	0.005	-0.015
Location							
Florida	-0.035		0.036	-0.022		0.036	-0.004
Texas	-0.555	**	0.034	-0.556	**	0.034	-0.113
Indiana	-0.395	***	0.036	-0.403	***	0.036	-0.069

Michigan	-0.287	***	0.033	-0.290	***	0.033	-0.062
Minnesota	0.140	***	0.033	0.135	***	0.033	0.026
Threshold Parameters							
$\kappa 1$	-3.570		0.074	-3.699		0.078	
$\kappa 2$	-2.755		0.071	-2.884		0.075	
$\kappa 3$	-2.216		0.070	-2.344		0.074	
$\kappa 4$	-1.642		0.069	-1.770		0.073	
$\kappa 5$	-0.907		0.069	-1.033		0.073	
$\kappa 6$	-0.262		0.069	-0.387		0.073	
$\kappa 7$	0.513		0.069	0.389		0.073	
$\kappa 8$	1.424		0.070	1.303		0.074	
$\kappa 9$	2.318		0.071	2.199		0.075	
Log-likelihood	-73160			-73103			
LR Chi2 (17) (29)	4338.02			4453.16			
Prob > Chi2	0.001			0.001			
Number of Obs.	26160			26160			

Note: Dependent variable is likelihood to purchase a plant. The likelihood is measured by Likert Scale, 1=Definitely Would Not Purchase, …, 10 = Definitely Would Purchase. Statistically significant (p-value < .05) coefficients are shown in bold. Base category for location indicator variables is Ontario, Canada.