






Smart Shopping Carts to Increase Healthier Food Purchase: A Conjoint Experiment

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Abstract: Shopping carts, in general, should be suitable for carrying smart technology in the retail store environment. Also, a smart shopping cart can present verbal motivating stimuli to increase healthier food purchases. A conjoint experiment was used to test with a hypothetical purchasing task for young consumers (n=91) the potential of motivating stimulus on smart shopping carts to influence healthier purchases when buying frozen pizza. The results show a positive impact for all stimuli stemming from the smart shopping cart, three of which were health-based. This shows that stimuli revealing dynamic and personalized data through smart technology in a physical grocery retail setting have the potential to outperform traditional brand statements. Our conjoint experiment increased young consumers' likelihood of choosing a healthier frozen pizza. This result demonstrates that verbal stimuli on smart shopping carts can function as motivating augmentals on young adult consumers' healthier food purchases and are in line with the market positioning and customer-service focus of many retailers and brands today, emphasizing a social marketing standing.


1 INTRODUCTION


Increased sedentary lifestyles and consumption of unhealthy foods have caused an international epidemic of potential health issues related to being overweight or obese (Dobbs et al., 2014). Cardiovascular disease, diabetes, osteoarthritis, sleep apnea, and even some cancers are just a few of the potential side effects of living an unhealthy life (Wyatt et al., 2006). With the estimated annual cost of overweight and obesity at two trillion USD, steps must be taken to combat this downward spiral (Dobbs et al., 2014). Recently, we have seen increased prominence of studies promoting healthy foods, particularly in the retail setting. For example, research demonstrates that the majority of consumers' food


purchases are unplanned and contingent upon stimuli in the retail environment (Inman et al., 2009). The physical retail environment is, therefore, an important scene in which to study the effects of healthy food promotion and how to influence healthier food purchases most effectively. Retailers can and do play a large part in influencing their customers' purchasing decisions (Larsen et al., 2017). Some of the main factors that have been found to determine whether healthy or unhealthy food is purchased include the location of these foods within stores (Areni et al., 1999; Sigurdsson & Engilbertsson, 2015), the availability of healthy and unhealthy foods (Yeh et al., 2008), access to accurate nutrition information (Achabal et al., 1987; Dubbert et al., 1984), and price (Sigurdsson et al., 2011; 2014).

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Despite the prominent role of carrying equipment in retail, such as a basket and carts, there is, to the best of our knowledge, limited literature involving such equipment in grocery retailing and its potential to promote healthier food purchases (Larsen & Sigurdsson, 2019). Currently, there is also surprisingly limited knowledge of consumer behavior connected to the relationship between self-service digital assistants and consumer food purchases. New technology available in grocery stores may provide useful mechanisms for promoting healthier food purchases based on consumer activity at the point of purchase (Nikolova & Inman, 2015).

Self-service technologies combined with existing in-store equipment such as smart shopping carts (carts with digital screens connected to the Internet) are emerging as prominent options to influence buying behavior in general and also to promote healthier food purchases. Shopping carts have several strengths as an object for smart self-service technology. They tend to be in close vicinity to the shopper throughout the whole shopping trip and thus can increase the reach, frequency, and relevance of real-time personal consumer-oriented stimuli (Inman & Nikolova, 2017). While smartphones have several potentials, phones still have a small screen and can be left in the pocket or purse to a large extent. Screens mounted on carts can be larger than smartphone screens and should, therefore, be much more in front of the shopper. Furthermore, smart shelves and digital signage have a weakness in their static positioning within the store. Since a cart's primary function is to help consumers carry products, it provides opportunities to identify consumers' interests instantly. Despite that some of the first use of smart shopping cart at the beginning of the 1990s was not that successful (Inman & Nikolova, 2017), we see that new technology has been developed, and today, smart shopping cart has been significantly improved (e.g., Bello-Salau, et al., 2021; Shahroz, et al., 2020).

A few studies have investigated the relationship between technology-based solutions and healthier food purchases. Reitberger et al. (2014) concluded that the combination of Internet-of-Things (IoT) and mobile devices is a promising approach toward better (i.e., healthier) consumer food purchases inside stores. Many consumers lack service in stores, and consequently, self-service technologies can contribute to the shopping experience (Kallweit et al., 2014). Also, younger adult consumers expect smart technologies to enable them to make more informed purchases (Priporas et al., 2017). However, Kallweit et al. (2014; see also Fagerström et al., 2020) highlight that the technology itself only barely

mediates users' intention to use self-service technology in retail; rather, it is about what kind of service quality, such as information quality, the technology can provide to the user that matters. Self-service technologies such as mobile devices, smart shopping carts, and information kiosks can contribute to smart retail settings by creating additional value for customers and retailers. For example, connecting sensors such as location-based beacon technology to self-service devices enables retailers to interact directly with customers as they enter the store and to push content such as product information, price, and nutrition stimuli in real-time.

Based on the above discussion, understanding consumer interaction with smart self-service technologies in the retail grocery situation, especially regarding healthier purchases, would be of great interest to researchers and practitioners. The goal of this study is, therefore, to investigate the relative impact of three motivating stimuli on a smart shopping cart for healthier purchases in grocery retail: (1) nutritional stimulus based on a health index, (2) personalized health score based on products in the shopping cart, and (3) product popularity based on popular healthy purchases of the week.

2 THEORETICAL FRAMEWORK

Consumer behavior is, to a large extent, regulated by verbal stimuli in the form of speaking, writing, signing, and other forms of verbal behavior (Pierce & Cheney, 2013), such as advice, promises, laws, and instructions (Foxall, 2010). Rule-governed behavior is, according to Pierce and Cheney (2013), a term that is used when the behavior is regulated by the contingencies that the rule describes. For example, if a consumer's purchase is regulated by advice about buying and consuming more fatty fish because it is good for the heart and blood vessels, the behavior is rule-governed.

The current study contributes to the literature on rule-governed behavior by studying new stimuli stemming from technology designed to have motivating functions. The first is a verbal nutritional stimulus stemming from a smart shopping cart where we examine real-time stimuli stating a specific product's health ranking compared to other products in the category. For example, a verbal stimulus on a smart shopping cart screen can state that "A real-time health comparison index identifies this product as one of the most nutritious products related to calories and salt." A real-time health index stimulus ought to increase consumers' likelihood to purchase as it

increases the reinforcing value in line with functional consequences (Hayes et al., 2001).

The second augmental is a verbal personalized health score stimuli on a smart shopping cart. The verbal health score stimulus gives the consumer an indication of the total nutrition of the products purchased by the consumer. For example, when a new product is added to the smart shopping cart, an indication can be given that “Based on products in your shopping cart, this frozen pizza is indicated as a healthy purchase!” In this case, smart technology can increase the functional reinforcing value already attached to the product. Therefore, the personalized stimulus on the shopping cart screen can be categorized as a motivating augmental (Hayes et al., 2001), and thus, it ought to have a positive effect on the consumer’s likelihood to purchase.

The third augmental is a verbal stimulus informing the consumer about the most popular healthy product this week based on real-time customer purchases. Other consumers’ actions, such as popularity cues, can signal product quality (Cheung et al., 2014) and can similarly be used to signal healthier purchases. Research has found popularity to make the customer more likely to buy the product (Castro et al., 2013) and to increase consumers’ willingness to pay more for the product (Carare, 2012). For example, a verbal stimulus on a smart shopping cart screen can state: “Real-time product popularity: Based on real-time customer purchase, this is the most popular healthy product this week.” As for the previous two verbal stimuli, this can increase the functional reinforcing value already attached to the product. Therefore, a real-time product popularity score stimulus on the shopping cart screen can be categorized as a motivating augmental, and it most probably has a positive effect on the consumer’s likelihood to purchase.

3 METHOD

A survey based conjoint experiment was chosen for the purpose of this study. Conjoint analysis is a hybrid type of multivariate technique to understand consumer preferences toward products and services, and it is considered a realistic method to portray consumer decisions (Hair et al., 2010).

3.1 Participants

A university student population was chosen as young adults are interesting subjects to explore. They can be reasonably considered heavy users of new technology

and market movers, paving the way for new types of behaviors in retail. Also, overweight and obesity are growing most rapidly in young adults (Katzmarzyk et al., 2019), and they consume, to a great extent, ready meals such as frozen pizza. A student sample was also chosen due to limited resources to otherwise obtain a fair number of participants. Students are less demanding to recruit than external participants, especially in an experimental setting taking place physically at a university campus (as the present study did). By conducting the study in a controlled physical environment at the campus, we sought to instead decrease possible disturbing effects of the experimental setting. Further, students are quite homogenous in Norway in regard to demographics (age, socio-economic status etc.), which also ought to reduce disturbing background effects.

The sample comprised 91 (34 men and 57 women) Norwegian undergraduate students from Kristiania University College (Oslo) and the University of Oslo. The sample is slightly skewed toward females, and it profiles a relatively young adult consumer group. The participants’ ages were measured in three categories (18–22, 23–30, and 31–45), of which 56 were from the 18–22 category and 32 from the 23–30 category. Out of the 89 participants who answered the question about their previous use of smart carts, only eight had used smart carts previously. Participants’ limited use of smart shopping carts was expected as these technologies are still scant.

3.2 Design

The target product for the study was frozen pizza. The food industry sees the health trend and focuses more on healthier nutrition, such as fewer calories, less salt, and more natural ingredients, when developing new frozen pizzas. It is also reasonable to assume that a frozen pizza is perceived as unhealthy or ‘junk food’ (Combet et al., 2014), and thus, the effect of healthier options on the likelihood to purchase ought to be high. This makes it an interesting product to study.

A conjoint experiment where all participants received the same hypothetical shopping task and the same varied intervention stimuli to evaluate on a questionnaire was set up for the purpose of this study. Data were collected in two separate physical sessions, but the procedure was the same for all participants. This type of conjoint experiment with a within-subjects design and a survey helps to determine how participants evaluate different predetermined attributes related to the research object. Here, the attributes were hypothetical verbal stimuli on a

simulated smart self-service shopping cart, and the participants were asked to evaluate how likely they were to purchase the frozen pizza presented to them. Each attribute is specified by levels, representing realistic features of each attribute.

Six attributes of verbal stimuli (of which three were health-based) and their corresponding levels were identified for the study (see Table 1). “Nutritional stimulus,” “Healthy choice—shopping cart,” “Healthy choice—popularity,” “Price levels,” and “Taste” were operationalized at three levels. “Price types” was operationalized at four levels. The different levels of attributes are assumed to have a varying impact on purchase behavior. The attributes “Price types” and “Taste” were also pictured to represent technology-based stimuli, where “Price types” represented dynamic pricing, and “Taste” represented statements on product taste, including customer reviews of frozen pizza.

The “Nutritional stimulus” was pictured with a real-time product health comparison index of calories and salt as one level, a brand nutrition statement as a second level, and no information regarding nutrition as a third level. “Healthy choice—shopping cart” was pictured with a personalized health score based on products in the shopping cart as one level, a brand statement of healthy choice as a second level, and no information on healthy choice as a third level. “Healthy choice—popularity” was pictured with real-time popularity score as one level, a store statement regarding product popularity as a second level, and no information on popularity as a third level. The “Price levels” were based on price searches from a Norwegian online grocery retailer (www.kolonial.no). The average price for frozen pizza was NOK 56.50, with the highest at NOK 83.80 and the lowest at NOK 37.50. The four “Price types” with dynamic pricing levels and the three levels of “Taste” were based on studies conducted by Haws and Bearden (2006) and Mudambi and Schuff (2010), respectively, but adapted to fit the research context.

We used IBM SPSS™ for the design and analysis of the study. Six attributes and their corresponding levels would total 972 smart cart frozen pizza configurations ($3 \times 3 \times 3 \times 3 \times 4 \times 3$) based on the full factorial design. Using the fractional factorial design in SPSS, the number of configurations (i.e., cards) was reduced to 29 (including four holdout cards). The four holdout cards are used to validate the data and expose possible errors in the model. A main-effects model was chosen to design the study as it measures the direct impact of each attribute. The main-effects model assumes that the participant gets a total value of the combination of stimuli by adding up the value

of each stimulus (Hair et al., 2010). Under this method, the participants evaluated a set of experimentally varied stimuli, the 29 configurations (referred to here as stimulus cards). A full-profile method was chosen to collect the data, where each stimulus card was presented separately to the participants. While analyzing the data, a discrete measurement was used for all six stimuli.

Holbrook and Moore (1981) suggest using visual stimulus cards to present the stimulus. The visual stimulus cards were administered in a classroom using a Microsoft PowerPoint™ presentation and a pen-and-paper questionnaire for the participants. An illustration of stimulus cards and questions is presented in the Appendix.

3.3 Procedure

When the participants had voluntarily accepted to participate in the study, they were presented with a hypothetical shopping task. In the task, they were to assume that they were going to purchase a frozen pizza in the grocery store:

Assume that you are going to buy some groceries for dinner, and you are now standing in the store. The retail store you are regularly visiting has implemented smart carts, as you can see in the picture. The smart cart holds the shopping list that you made and uploaded last night. The smart cart also makes it possible to see the products you have already picked in your shopping cart. You are now in the selection process of frozen pizza, and the smart cart screen gives you product information. Based on previous experience, you know that the average price of frozen pizza is about NOK 56.50. You will now be presented 29 shopping situations. Evaluate the 29 shopping situations in relation to using the smart cart when purchasing the frozen pizza.

Before the data collection started, an example stimulus card was presented to the participants to familiarize them with the procedure. Once all 29 stimulus cards were evaluated, the participants were asked to provide some background information.

4 RESULTS

Based on the analysis, we evaluated the goodness-of-fit of the conjoint model. We found that the correlations between the actual and estimated preferences are significant (Pearson’s $R = 0.982$, $p < 0.001$ and Kendall’s tau = 0.873, $p < 0.001$). The Kendall’s tau for the holdout cards is fair (0.667) but

not significant ($p = 0.087$). Based on this, we can say that the conjoint model has acceptable accuracy.

The results are presented in Table 1. The constant is 5.087, and the impact estimate values of the levels vary both negatively and positively with this value. The importance values show notably that the stimuli “Price levels” is evaluated as the most important predictor of purchase for the frozen pizza. “Nutritional stimulus” is evaluated second, “Customer reviews taste” third, followed closely by “Price types,” “Healthy choice—shopping cart,” and “Healthy choice—popularity.” When taking a closer look at the primary stimuli under investigation here, “Nutritional stimulus,” “Healthy choice—shopping cart,” and “Healthy choice—popularity,” we can see that the impact estimates for Real-time nutrition stimulus, Personalized health score, and Real-time product popularity are positive and notably higher than the alternative levels for each stimulus. Hence, this type of stimulus increases the likelihood to purchase. The No information level scores relatively high negative impact estimates for all three stimuli. In other words, providing no information regarding “Nutritional stimulus,” “Healthy choice—shopping cart,” and “Healthy choice—popularity” decreases the likelihood to purchase. It is also worth noting that “Price types” regarding fixed and dynamic pricing is not clear-cut, as the impact estimates do not show a clear positive or negative pattern. Then again, customer reviews regarding taste score a relatively high positive impact estimate; likewise, a below-average market price positively impacts purchasing behavior.

In further analysis, we conducted a simulation of three scenarios regarding the “Nutritional stimulus,” “Healthy choice—shopping cart,” and “Healthy choice—popularity.” See Table 2. A conjoint simulation strives to understand how the participants would choose between different scenarios, including a specific set of stimuli (Hair et al., 2010). Here we wanted to better understand technology-based stimuli in comparison to only traditional brand or store-based stimuli and no information regarding healthy purchases. Hence, in the first scenario (A), we set all three health stimuli to simulate technology-related stimuli; in the second scenario (B), we set all three stimuli to simulate traditional brand or store statements regarding the healthy purchase, and finally, in the third scenario (C), we set all three variables to simulate no information regarding healthy purchase. We set “Price levels,” “Price types,” and “Taste” to simulate a typical shopping situation in which the price is fixed at an average market level, and the brand provides a statement

regarding product taste. By conducting this simulation, we gain insights into the predicted preference proportions of the three scenarios. The outcomes for each scenario case are shown according to preference scores along with a preference probability score, Logit (0-100%). Logit is an optimal measurement for repetitive purchase situations (Hair et al., 2010), which is typical for grocery shopping. The outcome results for scenario A, 56.3% (Logit), show that a very large proportion of the respondents would base their purchase on real-time or personalized health scores if they were provided with such stimuli on a smart device like a smart shopping cart. The Logit score drops to 25.6% for scenario B and 18.1% for scenario C. In practice this means that scenario A is clearly more preferred than scenario B and C, while scenario B is slightly more preferred than scenario C.

5 DISCUSSION

The conjoint analysis shows that, relative to the other stimuli except for a below-average price, the three technology-based health dimensions are important stimuli when purchasing a frozen pizza; they notably increase the likelihood of buying the product. No information stimulus scored strong negative results, indicating that leaving out healthy purchase stimuli decreases the likelihood of buying. However, this is not surprising, given that the product under investigation is frozen pizza. As discussed, it is reasonable to assume that a frozen pizza is likely to be perceived as unhealthy, and thus motivating stimuli indicating it is a healthy purchase have a positive impact on the likelihood of buying. Nevertheless, the simulation scores from the conjoint analysis indicate a high preference for the three technology-based health dimensions relative to conventional brand statements and no healthy purchase stimuli. This result is interesting as it indicates that smart technology-based motivating stimuli have the possibility to outperform conventional brand or store statements regarding healthier food purchases.

Overall, price level scored the highest importance, showing that price is an important attribute to increasing healthier food purchases. This result is in line with previous findings (Sigurdsson et al., 2011; 2014). However, it is reasonable to assume that the participants in this study are quite price-sensitive in general, as we studied undergraduate students. Nutritional stimulus scored the second-highest importance after price level, which also

Table 1: Conjoint utilities and importance values.

Attributes	Levels	Impact estimate	Standard error	Importance values
Nutritional stimulus	1. Real-time nutrition: A real-time health comparison index identifies this product as one of the most nutritious frozen pizzas related to calories and salt—Find out more.	0.471	0.098	16.646
	2. Brand statement: Fewer calories and less salt!	-0.146	0.098	
	3. No health information	-0.325	0.117	
Healthy choice—shopping cart	1. Personalized health score: Based on the nutrition content of the products in your shopping cart, this frozen pizza is indicated as a healthy choice—Find out more.	0.311	0.098	11.825
	2. Brand statement: This is a healthier choice!	-0.089	0.098	
	3. No health information	-0.221	0.117	
Healthy choice—popularity	1. Real-time product popularity: Based on real-time customer choice, this is the most popular healthy product this week—Find out more.	0.223	0.098	11.754
	2. Store statement: The store states that this is a popular healthy product! —Find out more	0.056	0.098	
	3. No health information	-0.280	0.117	
Price levels	1. Below-average market price: Price NOK 37.50	1.294	0.098	33.376
	2. Average market price: Price NOK 56.50	0.291	0.098	
	3. Above-average market price: Price NOK 83.80	-1.585	0.117	
Price types	1. Fixed price: Price NOK xx ¹	-0.168	0.107	12.200
	2. Dynamic price: Price NOK xx, ¹ based on a national index updated every month	0.058	0.133	
	3. Dynamic price: Price NOK xx, ¹ based on a national index updated every week	-0.036	0.133	
	4. Dynamic price: Price NOK xx, ¹ based on a national index updated every hour EUR 100 per night	0.146	0.133	
Taste	1. Customer review: Customer reviews on taste: 4.9 out of 5 stars	0.503	0.098	14.199
	2. Brand statement: Supreme taste!	-0.060	0.098	
	3. No information	-0.443	0.117	
	(Constant)	5.087	0.090	

¹ Price was indicated by price levels in the conjoint plan.

Table 2: Scenario simulation.

Scenarios	Cases	Stimuli and levels						Outcomes	
		Price level	Price types	Taste	Nutrition stimulus	Healthy choice—shopping cart	Healthy choice—popularity	Pref. scores	Logit ^a
Health scores	A	Average	Fixed	Brand Statement	Real-time	Personalized	Real-time	6.156	56.3
Health brand statements	B	Average	Fixed	Brand Statement	Brand Statement	Brand Statement	Brand Statement	4.972	25.6
No health info	C	Average	Fixed	Brand Statement	Blank – no info	Blank – no info	Blank – no info	4.324	18.1

a. 84 out of 88 subjects are used in the Logit method because these subjects have all non-negative scores.

indicates that this type of health stimulus is perceived as important. Accurate nutrition information has been found to affect healthier food purchases positively (Combet et al., 2014).

Grocery retailers are important shapers of stimuli that influence consumers purchasing behavior (Martinez et al., 2018). Based on the results from this study, retailers ought to be able to impact healthier

food purchases positively by providing young adult customers with self-service technological solutions that include technology-based health motivating stimuli like those used in this study. These types of digital solutions may particularly benefit retailers and brands who want to stand out as responsible actors in healthy purchases. Policymakers and initiators of healthy food consumption should notice these results

as well. For example, subsidizing or providing incentives to retailers regarding technological solutions for healthier food purchases may push or provide retailers with the capabilities to innovate and adopt new digital solutions. Even small interventions regarding consumer behavior could add up to significant long-term health effects in society (Wansink, 2016). Nevertheless, it should be noted that the price level was the main influencer on the likelihood to purchase; thus, retailers and brands need also to consider price reductions if they want to increase the purchase of healthier foods, at least among younger and price-sensitive customers.

Self-service technological solutions such as a smart shopping cart can be a vehicle for promoting healthier food instead of being used to increase buying behavior in general or worse, to promote unhealthy options. Furthermore, Larsen et al. (2020) have shown that most consumers go into a grocery store today without a shopping cart, especially young consumers often buying unhealthy food such as pizza. Digital solutions can be one of the retailer's solutions to this problem by making the shopping cart more attractive (see Arbore et al., 2014), especially for the young consumer segment. Larsen et al. (2020) show that younger consumers are underrepresented among those using the traditional "non-technology" shopping cart. Carts with attractive digital solutions might help retailers increase the share of younger consumers using a cart, which may increase store experiences as well as store sales. Therefore, there is a need for further research on how technology solutions, for example, personal health advice, can increase the likelihood of using a cart in grocery shopping.

5.1 Limitations and Further Research

There are some limitations related to data collection and interpreting the results in this study. Firstly, the study's reliance on a somewhat narrow undergraduate student sample may influence the impact of verbal health and price stimuli on purchases. Further studies could, therefore, replicate this study with a wider sample profile. A second limitation might be the order effect, as the order of stimuli was presented sequentially (Chrazan, 1994). Therefore, stimulus cards could be randomized in similar future studies. Finally, the studied hypothetical task was designed for frozen pizza and six pre-defined stimuli variables. The experimental design, in conjoint, calls for execution assumptions and delimitations made by the researcher (Hair et al., 2010). Hence, future studies could be conducted in an in-store setting with a real

smart cart solution and use other types of products and additional or different types of stimuli relevant in a grocery shopping situation. Conjoint analysis should be viewed as primarily explorative, although it is regarded as a realistic way to capture consumers' preferences (Hair et al., 2010).

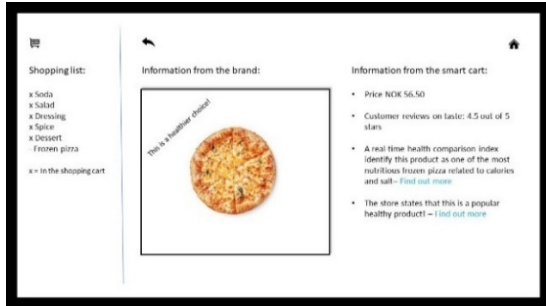
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APPENDIX

Stimulus card 8.



Based on the information from the smart cart, how likely is it that you would purchase the frozen pizza?

Not at all likely

Certainly likely

0 1 2 3 4 5 6 7 8 9 10

