The Influence of Smart Shopping Carts on the Healthier Food Choices of Young Consumers*

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Abstract

Shopping carts can be designed to accommodate and integrate smart devices seamlessly within a retail setting, allowing for enhanced connectivity and functionality. Moreover, smart devices on a smart shopping cart can provide verbal motivating stimuli to enhance consumers' purchasing of healthy food. A conjoint experiment was conducted to examine the potential influence of motivating stimuli on smart shopping carts to encourage healthier purchases among young consumers. The study involved 91 participants and presented them with a hypothetical purchasing task related to buying frozen pizza. The findings indicate a positive impact associated with all stimuli originating from the smart shopping cart, with three focused explicitly on health-related aspects. Our results suggest that the presentation of real-time, dynamic, and personalized data through smart technology within a physical grocery retail setting holds the potential to surpass the effectiveness of traditional firm-based and static brand statements. Our study made young customers more likely to select a healthier frozen pizza. This finding supports the market positioning and customer-service focus of many retailers and brands today. It shows how verbal stimuli on smart shopping carts can serve as motivating augmentals on young adult consumers' purchases of healthier foods. The managerial implications for grocery retailers contributing positively to their customers' overall well-being and life satisfaction are discussed, as well as limitations and future studies.

Keywords: grocery retailing, healthy food purchase, self-service technology, smart shopping carts, rule-governed behavior, conjoint experiment

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 [2]. Cardiovascular disease, diabetes, osteoarthritis, sleep apnea, and even some cancers are just a few of the potential side effects of leading an unhealthy life [3]. With the estimated annual cost of overweight and obesity at two trillion USD, the whole society must take steps to combat this downward spiral [2]. Recently, we have seen increased prominence in studies promoting healthy foods, particularly in retail. For example, research demonstrates that most consumers' food purchases are unplanned and contingent upon stimuli in the retail environment [4]. Therefore, the physical retail environment is essential to studying the effects of healthy food promotion and how to influence healthier food purchases most effectively. 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 retail stores [5, 6], the availability of healthy and unhealthy foods [7], access to accurate nutrition information [8-10], and price [11-13].

Retailers can and do play a large part in influencing customers' purchasing [14]. The retailing environment provides ample opportunities for studying consumers' behavior [see, e.g., 15]. For instance, despite the prominent role of carrying equipment in retail, such as baskets and carts, there is surprisingly limited literature involving such equipment in grocery retailing and its potential to promote healthier food purchases [16]. There is also minimal 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 valuable mechanisms for promoting healthier food purchases based on real-time consumer activity at the point of purchase [17, 18]. These advancements enable grocery retailers to respond dynamically to customer preferences and trends, creating opportunities to implement targeted strategies that encourage the selection of healthier food options.

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 [19, 20] and to promote healthier food purchases in particular. Shopping carts have several strengths as an object for smart self-service technology. They tend to be close to the shopper throughout the whole shopping trip and thus can increase the reach, frequency, and relevance of real-time personal consumer-oriented stimuli [21]. 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 are larger than smartphone screens and should 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 carts at the beginning of the 1990s was not that successful [21]; we see that new technology has been developed, and today's smart shopping cart has been significantly improved [e.g., 22, 23, 24]. Therefore, this study will focus on smart

shopping carts as a technological solution to promote healthier food purchases in the physical grocery retail setting.

Studies have investigated the relationship between technology-based solutions and healthier food purchases. In a study by Reitberger, Spreicer [25], they combined Internet-of-Things (IoT) technology and mobile devices to investigate issues regarding human-computer interaction in a smart in-store retail setting. The study concluded that combining IoT and mobile devices is a promising approach toward better (i.e., healthier) consumer food purchases inside retail stores. Many consumers lack service in retail stores, and consequently, self-service technologies can contribute to the shopping experience [26]. Also, younger adult consumers expect smart retail technologies to enable them to make more informed purchases [27]. However, Kallweit, Spreer [26] (see also [28, 29]) highlight that the technology itself only barely mediates users' intention to use self-service technology in retail; instead, it is about what kind of service quality, such as information quality, the technology can provide to the user that matters.

Moreover, in a study by Hyun-Joo [30], the service quality of the technology was highlighted as a main factor for using self-service technology in retail. 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 the retailer. For instance, integrating sensors like location-based beacon technology with self-service devices empowers retailers to engage directly with customers upon entering the store, delivering real-time content such as product information, pricing details, and nutritional stimuli.

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 both 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.

In the initial section of this paper, we examine the theoretical framework employed to assess the comparative influence of nutritional stimuli, personalized health scores, and product popularity within the context of a smart cart. The subsequent section provides an overview of the research methodology utilized. Following that, the third section combines the discussion of the findings with managerial implications and suggestions for future research. The conclusive part of the paper then presents the overall conclusions drawn from the study.

2 Theoretical Framework

Consumer behavior is regulated mainly by verbal stimuli in the form of speaking, writing, singing, and other forms of verbal behavior [31], such as advice, promises, laws, and instructions [32]. According to Pierce and Cheney [31], rule-governed behavior is a term 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 main property of rules is that they describe the contingencies of reinforcement or punishment and, therefore, can increase the speed of consumer learning. Wells (2014) claims that rules and rule-governed consumer behavior comprise an imperative and unexplored research direction in marketing and argues that it is necessary to understand better how rules influence consumer purchases.

Hayes, Zettle [33] distinguish rule-governed behavior further into pliance, tracking, and augmenting. Augmenting, the focus of the current study, is described by Hayes, Zettle [33 p. 109] as a rule-governed behavior "under the control of apparent changes in the capacity of events to function as reinforcers or punishers." Furthermore, an augmental is a verbal stimulus with motivating functions that alters the consequences (reinforcers and punishers). According to Hayes, Barnes-Holmes [34], there are two types of augmentals: motivating augmentals and formative augmentals. Motivating augmentals are rules that increase the reinforcing value in line with functional consequences. A motivating augmental is a verbal stimulus that has an evocative or abative effect on consumer purchase, such as the following advertisement: "In a situation with a very high cholesterol level, you should exercise more—try our gym today." Formative augmentals establish some new events as an essential consequence. An example of a formative augmental is the message: "With our gym's day-care service, you can now enjoy your workout while your child is playing in the kids' lounge."

The current study contributes to the literature on augmentals by studying new stimuli stemming from technology designed to have motivating functions. The first is a verbal nutritional stimulus from a smart shopping cart. 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, "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 should increase consumers' likelihood to purchase as it increases the reinforcing value in line with functional consequences [34].

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 that the consumer picks. For example, when a new product is placed in the smart shopping cart, an indication can be that "Based on products in your shopping cart, this frozen pizza is indicated as a healthy purchase!" In this case, the 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 [34], and thus, it ought to positively affect 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 [35] and can similarly be used to signal healthier purchases. Research has found that popularity makes customers more likely to buy the product [i.e., 36, 37] and increases consumers' willingness to pay more [38]. 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 ought to positively affect the consumer's likelihood to purchase.

3 Method

In this study, we employed conjoint analysis, a method recognized as a hybrid form of multivariate technique [39]. Conjoint analysis is commonly applied to examine consumer behaviors and choices concerning various products and services. Acknowledged for its realistic approach to depicting consumer preferences, conjoint analysis is a valuable tool for comprehending aspects of consumer choice within grocery shopping. Well-known for its ability to simulate real-world choice-making scenarios, conjoint analysis allows researchers to gain insights into the stimuli influencing consumers' selections and the trade-offs they are making [40]. The usefulness of this method positions it as a helpful asset for unraveling the complexities inherent in consumer choice processes [41], contributing to a comprehensive understanding of market dynamics and facilitating more informed business strategies.

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 among young adults [42], and they consume, to a great extent, ready meals such as frozen pizza. A student sample was also chosen due to limited resources to 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 on campus, we should decrease possible disturbing effects in the experimental setting. Further, students in Norway are heterogeneous regarding demographic characteristics (age, socio-economic status, etc.), which should also reduce disturbing background effects.

The study sample comprised 91 undergraduate students (34 men and 57 women) from Kristiania University College (Oslo, Norway) and the University of Oslo (Oslo, Norway) who accepted an invitation to participate in the study. The sample is slightly skewed toward females and 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. Of the 89 participants who answered the question about their previous use of smart carts, only eight had used them. Participants' limited use of smart shopping carts was expected as these technologies are still scant. Based on a scale ranging from 0 (very little) to 10

(very much), the participants were also asked to rate their concerns with health-related issues when shopping for groceries. The answers ranged from min. 3 to max. 10 with a mean score of 6.76, a median of 7, and a standard deviation of 1.5. Hence, the participants were, on average, quite concerned about making healthy food purchases.

3.2 Design

The target product for the study was frozen pizza since it can be considered a popular product for the participants in the study. Also, 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' [43], and thus, the effect of healthier options on the likelihood of 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 this study. Data were collected in two separate physical sessions, but the procedure was the same for all participants. This type of conjoint study with a within-subjects experimental 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" were 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 a 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 [44] and Mudambi and Schuff [45], respectively, but adapted to fit the research context.

IBM SPSS™ was used for both the design and analysis of our study. We employed a full profile approach where participants ranked a series of profiles based on their preferences. Each profile represented a complete product or service and encompassed various combinations of attribute levels for all six attributes of interest. In total, there were 972 configurations for smart cart frozen pizza (3 x 3 x 3 x 3 x 4 x 3). Recognizing the impracticality of having 91 participants rank all 972 configurations, we employed a fractional factorial design within the full-profile approach. The fractional factorial design presented a suitable fraction of all possible combinations of the factor levels. The resulting orthogonal array [40, 46] efficiently captured the main effects for each factor level, assuming negligible interactions between levels of different attributes (SPSS, 2019). This orthogonal array experimental design technique reduced the initial set of 972 configurations to 29, which included four holdout cases. These holdout cases were evaluated by participants but were excluded from building the preference model, serving instead as a validity check.

The study adopted a main-effects model to measure the direct impact of each stimulus (attribute). This model assumes that participants derive a total value for a combination of stimuli by summing up the value of each stimulus. The 29 configurations, referred to as stimulus cards, were experimentally varied, providing a realistic perception and minimizing the likelihood of biased comparisons through fractional factorial design [39].

During data analysis, a discrete measurement was applied to all six stimuli. This approach avoided making linear or quadratic assumptions about the relationship between the stimuli and the likelihood of purchase scores.

Table 1. The stimuli and their respective levels examined in this study.

Stimuli	Levels
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 2. Brand statement: Fewer calories and less salt! 3. Blank - no health information
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 2. Brand statement: This is a healthier choice! 3. Blank - no health information
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 2. Store statement: The store states that this is a popular healthy product! — Find out more 3. Blank - no health information
Price levels	1. Below-average market price: Price NOK 37.50 2. Average market price: Price NOK 56.50 3. Above-average market price: Price NOK 83.80

Price types	1. Fixed price: Price NOK xx[1] 2. Dynamic price: Price NOK xx,[1] based on a national index updated every month 3. Dynamic price: Price NOK xx,[1] based on a national index updated every week 4. Dynamic price: Price NOK xx,[1] based on a national index updated every hour
Taste	1. Real-time customer review: Customer reviews on taste: 4.9 out of 5 stars 2. Brand statement: Supreme taste! 3. Blank - no information

[1] Price was indicated by Price levels in the conjoint plan.

3.3 Materials

The stimulus cards were generated using Microsoft PowerPoint™. Visual stimulus cards are suggested to present the stimulus [47]. The visual stimulus cards were administered in a classroom using a PowerPoint presentation and a pen-and-paper questionnaire for the participants. The illustrations of the stimulus cards and questions are presented in the Appendix.

3.4 Procedure

When the participants voluntarily agreed to participate in the study, they were presented with a hypothetical shopping task (here translated from Norwegian to English). 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 with 29 shopping situations. Evaluate the 29 shopping situations concerning using the smart cart when purchasing the frozen pizza.*"

A Likert-type scale ranging from "not at all likely to purchase" (coded 0) to "certainly likely to purchase" (code 10) was used to measure the descriptive anchors. 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 presented and evaluated, the participants were asked to provide some background information.

3.5 Analysis

The model for the response r_k for the k th card from a subject is

$$r_k = \beta_0 + \sum_{p=1}^{t} u_{py_{kp}} \quad (1)$$

where $u_{py_{kp}}$ is the part-worth utility associated with the y_{kp} th level of the p^{th} attribute on the k^{th} card. Consumer preferences modeled using the part-worth utility function model [40] posits that

$$s_k = \sum_{p=1}^{t} f_p\left(y_{kp}\right) \quad (2)$$

where s_k denotes the consumer preference for k^{th} card, y_{kp} is the level of the p^{th} attribute in the k^{th} card, and f_p denotes the part-worth function of different levels of y_{kp} for the p^{th} attribute. The relative importance of a product attribute compared to others can be calculated using the equation below

$$O_p = \frac{(\max u_p - \min u_p)}{\sum_{p=1}^{} (\max u_p - \min u_p)} \quad (3)$$

where O_p is the relative importance of the product attribute, max u_p is the utility of the attribute's most preferred level and min u_p is the utility of the attribute's least preferred level.

4 Results

Based on the analysis, we evaluated the goodness-of-fit of the conjoint model, and 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). 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 and internal validity.

A summary of the total sample results is presented in Table 2. The constant is 5.087, and the impact estimate values of the levels vary both negatively and positively with this value. The importance values in Table 2 show notably that the stimuli "Price levels" are evaluated as the most important predictor of purchase for the frozen pizza. "Nutritional stimulus" is considered 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 of purchasing. The “No health 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 of purchasing. It is also worth noting that "Price types" regarding fixed and dynamic pricing are unclear, as the impact estimates do not show a clear positive or negative pattern. Then again, Real-time 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 3. 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 compared to traditional brand- or store-based stimuli without information regarding healthy purchases. Hence, in the first scenario (A), we set all three stimuli to simulate technology-related stimuli; in the second scenario (B), we set all three stimuli to simulate traditional brand or store statements regarding healthy purchases, 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 three preference probability scores (0-100%): Maximum utility, Bradley-Terry-Luce (BTL), and Logit. We focus on Logit here as it is an optimal measurement for repetitive purchase situations (Hair et al., 2010), which is typical for grocery shopping. The outcome results, 56.3% (Logit), show that a considerable proportion of the respondents would base their purchase on real-time or personalized health scores if 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, scenario A is more preferred than scenario B and C, while scenario B is slightly more preferred than scenario C. It should be noted that all the outcome scores follow the same pattern as for the Logit scores.

Table 2. A summary of the sample results shows impact estimate, standard error, and importance values [1].

Stimuli and 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. Real-time 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 conjoin plan.

Table 3. Scenario simulation of three scenarios: "Nutritional stimulus," "Healthy choice—shopping cart," and "Healthy choice—popularity."[1].

		Stimuli and levels						Outcomes			
Scenarios	Cases	Price level	Price types	Taste	Nutrition stimulus	Healthy choice—shopping cart	Healthy choice—popularity	Preference scores	Maximum Utility	Bradley-Terry-Luce[b]	Logit[b]
Health scores	A	Average	Fixed	Brand statement	Real-time	Personalized	Real-time	6.156	63.1	40.7	56.3
Health brand statement	B	Average	Fixed	Brand statement	Brand statement	Brand statement	Brand statement	4.972	23.3	32.0	25.6
No health info	C	Average	Fixed	Brand statement	Blank - no info	Blank - no info	Blank - no info	4.324	13.6	27.3	18.1

a. Including tied simulations
b. 84 out of 88 subjects are used in the Bradley-Terry-Luce and Logit methods because these subjects have all non-negative scores.

5 Discussion

5.1 Research Implications

Establishing an environment that actively encourages individuals to make healthier food purchases plays a crucial role in contributing to the long-term health outcomes of society [48]. Fostering a health-conscious atmosphere, promoting nutritional awareness, and offering accessible, healthy options address immediate dietary choices and contribute to the broader public health landscape. The goal of this study was to investigate the relative impact of three technology-based motivating stimuli on a 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. Enhancing knowledge of the impact of motivational stimuli from shopper-facing technology, like smart shopping carts, on consumers' food purchasing behavior is imperative. Conducting in-depth investigations into the complex dynamics of these stimuli can provide insights into the factors influencing consumer choices during the grocery shopping experience. This knowledge, in turn, facilitates the development of more effective strategies for leveraging digital assistants to positively influence healthy food purchases, contributing to understanding the interplay between technology and consumer behavior in grocery shopping.

The conjoint analysis shows that, relative to the other stimuli except for a below-average price, the three technology-based health dimensions are important 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, since the product under investigation is frozen pizza, this is unsurprising. 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 positively impact 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 interesting result demonstrates that smart technology-based motivating stimuli can 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 aligns with previous findings [11-13, 49]. 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, indicating that this type of health stimulus is perceived as important. Accurate nutrition information has been found to affect healthier food purchases positively [43]. Price types regarding fixed and dynamic pricing, although not a focus in this article, did not show a clear pattern.

In this study, motivating stimuli from a smart shopping cart have been demonstrated to function as motivating augmentals on young adult consumers' healthier food purchases. Thus, rule-governed behavior [33] is designed to facilitate intervention as it is formulated in terms of environmental verbal stimuli in the consumer's behavior setting that can be manipulated directly. Findings can immediately be applied to influence healthier food purchases, which should be important to the grocery retailing industry, retail researchers, and public health officials. In addition, this study addressed the call for research on how rules and rule-governed behavior influence consumer purchases in general [50]. By investigating the dynamics of consumer choice-making and the role of rules and rule-governed behavior in shaping those choices, our research gives valuable insights into understanding the complex interplay between cognitive responses, behavioral guidelines, and the choice process. This inquiry not only responds to the existing gap in the literature but also seeks to shed light on how consumers navigate and adhere to various rules when making choices.

5.2 Managerial Implications

Grocery retailers are important shapers of stimuli that influence consumers purchasing behavior [51]. Grocery retailers actively influence or mold the various stimuli that affect consumers' choice-making processes. In this context, stimuli could include visual displays, product placement, promotions, pricing strategies, and the store's layout and ambiance. Shopper-facing technologies are designed to enhance the overall shopping experience for customers [21]. These technologies leverage various tools, devices, and applications to provide convenience, personalization, and engagement. Integrating self-service technologies, along with in-store equipment like smart shopping carts equipped with digital screens connected to the Internet, is becoming increasingly prominent as an effective means to influence consumers to purchase healthier food options when shopping for groceries.

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 digital solutions may benefit retailers and brands who want to stand out as responsible actors in healthy purchases. Grocery retailers should focus on consumers' healthy choices for several compelling reasons. Firstly, there is an emergent tendency among consumers toward healthier lifestyles and dietary choices. In an online survey of about 8000 consumers in the US, UK, France, and Germany by Grimmelt, Moulton [52] in 2022 findings show that 70 % of the participants want to be healthier, and food is fundamental to achieving that goal. Many consumers are more conscious of their health and seek healthy food alternatives. However, the same survey found that consumers are frustrated because retailers do not meet their demand for healthy eating [52]. By catering to this demand, grocery retailers can attract and retain customers.

Secondly, embracing a commitment to promoting healthier choices demonstrates social responsibility. Grocery retailers can contribute to the communities' well-being by making it easier for consumers to access and choose nutritious options. The term shopping well-being has become a term of interest within retailing. It refers to the

positive impact of the shopping experience on various aspects of life satisfaction, encompassing consumer, social, leisure, and community domains [53]. When grocery retailers are aware of and work towards shopping well-being, they can strategically tailor their offerings and services to enhance customers' satisfaction across consumer, social, leisure, and community dimensions. This awareness allows grocery retailers to create a shopping environment that meets customers' functional needs and contributes positively to their overall well-being and life satisfaction. New shopper-facing technologies, such as smart shopping carts equipped with digital screens, as used in the present study, can assist in this [20]. Technological advances, such as smart shopping carts, facilitate the establishment of highly personalized, dynamic, and real-time goal-nudging activities. This emerging technology serves as a tool for localized setups within stores, monitoring the impacts of goal-nudging activities with exceptional precision [18].

Thirdly, offering diverse healthy food choices gives grocery retailers a competitive advantage. In a market where consumers prioritize health, retailers that provide various nutritious options are more likely to stand out and attract a health-conscious customer base. When businesses actively engage in socially responsible practices, such as well-being and life satisfaction for their customers, they contribute to a favorable perception among consumers [54]. This positive image improves brand loyalty and attracts a growing segment of socially conscious consumers who prefer supporting businesses associated with their values. Additionally, companies that demonstrate a commitment to well-being and life satisfaction for their customers may experience improved relationships with stakeholders, including the media, employees, and investors. In the long run, a solid social responsibility ethos can enhance brand trust, resilience, and sustained competitiveness in the marketplace [54].

Finally, policymakers and initiators of healthy food consumption should also notice these results. For example, subsidizing or providing incentives to retailers regarding technological solutions for healthier food purchases may push or give retailers the capability to innovate and adopt new digital solutions. Even small consumer behavior interventions could add to significant long-term health effects in society [48]. Nevertheless, it should be noted that the price level was the main influencer on the likelihood of purchase; thus, retailers and brands must also consider dropping prices to increase the purchase of healthier foods. Retailers can position themselves as responsible corporate "citizens" by proactively offering and promoting healthier food choices and complying with relevant regulations.

Smart 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, Sigurdsson [55] have shown that most consumers go into a grocery store today without a shopping cart, especially young consumers, who often buy 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 56], especially for the young consumer segment. Larsen, Sigurdsson [55] 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 and sales. Therefore, there is a need for further research on how technology solutions, in terms of, for example, personal health advice, can increase the likelihood of using a cart when shopping for groceries.

5.3 Limitations and Future 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 or non-heterogeneous undergraduate student sample may influence the impact of verbal health and price stimuli on purchasing purchases. Further studies could, therefore, replicate this study with a broader sample profile. A second limitation might be the order effect, as the order of stimuli was presented sequentially [57]. Therefore, stimulus cards could be randomized in similar future studies. A third potential limitation of this study is related to its main-effect design. A main-effect model overlooks the possible interaction effects between stimuli (attributes). On the other hand, we also ran a conjoint simulation, which portrayed the preference proportions of three scenarios. The simulation analysis transforms raw utility data into realistic and valuable comparisons between attribute combinations, which means that the simulation reflects interaction effects between the attributes included in the scenarios. Finally, the studied hypothetical task was designed for frozen pizza and six pre-defined stimuli variables. Using hypothetical tasks in research does not necessarily weaken internal and external validity. For example, studies by Bosselmann and Craik [58] reported substantial congruence between direct and simulation presentations. The experimental design in conjoint analysis calls for execution assumptions and limitations made by the researcher [39]. Conjoint as a technique should be viewed as primarily explorative, although it is regarded as a realistic way to capture consumers' preferences [39]. However, future studies could be conducted in a natural in-store setting and use other products and additional or different stimuli relevant to a grocery shopping situation.

6 Conclusion

This study aimed to expand the understanding of technology health-based motivating stimuli when young adults purchase groceries. Results from a conjoint experiment based on a hypothetical shopping situation indicate that the investigated health stimuli on a smart self-service shopping cart increase the likelihood of purchasing the product. Stimuli regarding nutrition especially showed a high impact on purchasing relative to other stimuli. However, the price level was the attribute with the highest impact overall. The use of rules and rule-governed behavior for investigating the impact of technology-based motivating stimuli on healthier food purchases resulted in essential knowledge for the grocery retailing industry, as well as for researchers and public health officials. Focusing on consumers' healthy choices is responsive to market trends, aligns with consumer demand, provides a competitive advantage, and contributes to positive brand perception. It is a strategic approach that benefits the retailer and its community. This approach does not completely change how we perform activities to influence

consumers' purchase of healthier food. Instead, it increases our precision when understanding, predicting, and influencing consumer behavior in this context. Future research could replicate the methods used in this study, consider the discussed limitations, and improve them.

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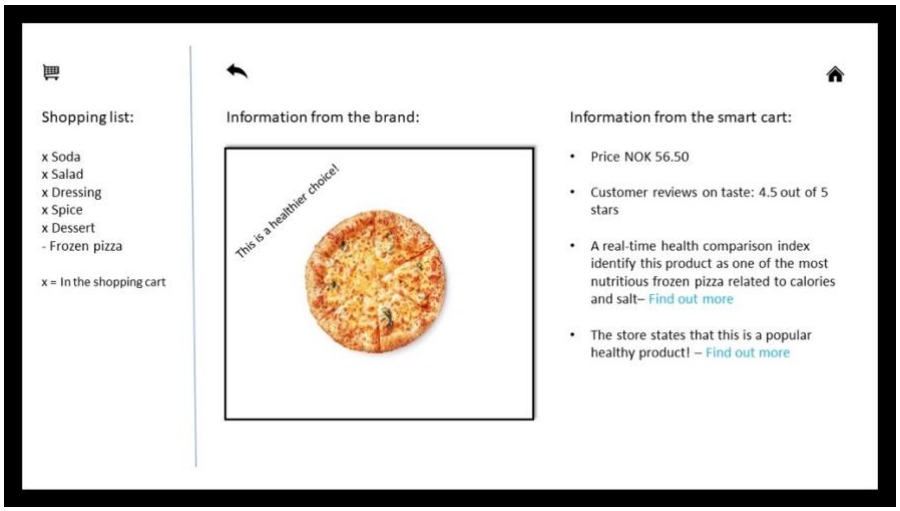
Appendix

Stimulus card 8 [1].



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

Not at all likely to purchase										Certainly likely to purchase
0	1	2	3	4	5	6	7	8	9	10