Open Science Online Grocery: A Tool for Studying Choice Context and Food Choice

ABSTRACT

The purpose of this paper is tointroduce a new tool—The Open Science Online Grocery—for studying the effects of the choice context on purchasing decisions. We first review the features of the tool: a mock online grocery store containing over 11,000 products wherein researchers can modify the choice context (e.g., positioning, labeling, suggestions) and observe resulting choice. Then, we present three studies illustrating how the tool can help assess how changes to labeling, ordering, and positioning affect choice. We find that both ordering and positioning have significant effects on choice while labeling does not. These findings largely align with existing research in field and laboratory settings. We hope this tool proves useful to researchers wanting to test choice context modifications in a relatively affordable and efficient manner.

***Keywords***: health behavior, online shopping, choice architecture, eating

**INTRODUCTION**

A healthy diet rich in fruits and vegetables is critical for the prevention of many chronic diseases (Hee Lee-Kwan et al. 2017). However, less than ten percent of Americans consume the recommended amount of fruits and vegetables each day (Hee Lee-Kwan et al. 2017). Policymakers have shown increasing interest in nudging consumers towards healthier food choices, including posting nutrition information in restaurants (Shah et al. 2014), mandated front-of-package labels (Hawley et al. 2013), and limiting soda portion sizes (John, Donnelly, and Roberto 2017).

Given the importance of and interest in nudging consumers towards healthier choices, it falls upon researchers to determine which nudges are most effective at changing behavior. However, conducting this research has proven difficult. A randomized control field experiment requires the cooperation of a major retailer. Retailers understandably may be concerned that randomized control trials (RCTs) will affect profit margins, confuse consumers, or require too much of their employees. Often, retailer hesitance prevents large scale randomized field testing; rather researchers end up testing ideas on single product categories, not having an appropriate control condition, or not running the trial at all. Absent retailer cooperation, researchers run choice architecture studies in artificial lab settings or using hypothetical scenarios with a limited range of products. Because of these limitations, it can be difficult to make well-controlled ecologically valid assessments of how the choice context affects consumer food choice.

The possibilities for choice context modifications are also expanding as an increasing number of consumers shop for groceries online (Inmar Intelligence 2020). As consumers move from brick-and-mortar to online retailers, certain interventions become possible or much easier to implement (e.g., product recommendations, following consumers over time, store reorganization). However, it is cost prohibitive for individual researchers to build their own mock online stores, and the issues inherent in retailer collaboration are largely similar in online versus brick-and-mortar retailers.

We developed the Open Science Online Grocery (OSOG) platform to provide a cost-effective and relatively ecologically valid option to researchers studying choice context’s effect on food choice. The OSOG platform mimics a large online grocery store, like Instacart or Amazon Fresh. OSOG allows researchers to easily change the choice context of the store and observe effects on consumers’ behavior. Because all purchases in OSOG are hypothetical, participants are neither charged for nor sent their groceries. However, researchers could fulfill participants’ orders using a local grocer if they so desired. OSOG integrates easily with existing survey software like Qualtrics and can be easily run with online panel participants.

In this paper, we first provide a descriptive overview of the store and its functionality. The rest of the paper is divided into three illustrations: labeling, sorting, and categories. Within each illustration, we briefly review the existing literature on the nudge before presenting empirical evidence from OSOG. Across three studies, we show that findings from the Open Science Online Grocery largely mirror those from the existing literature suggesting that novel innovations tested in OSOG would be likely to predict real world response to such interventions.

*The Open Science Online Grocery*

The Open Science Online Grocery (OSOG) platform is a free research tool designed to study the effect of choice context changes in a grocery setting. It is located at <https://openscience-onlinegrocery.com/>. OSOG is designed to be accessible to researchers with no web coding experience. However, researchers who are interested in making their own modifications to the store can access the source code at: https://github.com/Open-Science-Online-Grocery/online-grocery/ or contact the lead author to discuss options. Academic and government researchers are free to use, change, and distribute the software including components like photographs, item descriptions, and nutrition information. Industry researchers should reach out to the first author to discuss options.

OSOG consists of a researcher interface—where the researcher can easily make changes to the choice context—and a participant interface—where participants complete a mock grocery shopping trip that integrates the researchers’ choice context changes. We will discuss each of these interfaces separately.

**The Participant Interface**. The participant interface of OSOG looks similar to any other online grocery store that participants may be familiar with (e.g., Instacart, Amazon Fresh; see Fig. 1). Currently, the grocery store is populated with 11,096 products sourced from the website of a large grocery retailer in the Southeastern United States in 2018. The store includes unbranded products (e.g., produce, meat, fish), extant branded products (e.g., Cheerios, Skippy), and a fictional store brand called Howe’s. Product offerings will likely expand as more researchers use the store.

Researchers are also welcomed to expand and update the product offerings in OSOG. For example, researchers with some coding experience could use the original OSOG code to create a version of OSOG using product information sourced from a variety of different sources. For example, OpenFoodFacts (<https://world.openfoodfacts.org>) contains information (i.e., photograph, nutritional information, ingredients) from 660,000 products from around the world. Similarly, researchers could pull products from FoodDB (a database of all products available in UK supermarkets; Harrington et al. 2019) or Ciqual (a database containing nutrition information for unprocessed and prepared foods; <https://ciqual.anses.fr/>).

For each product in the store, we sourced price, product size, serving size, nutrition information, ingredients, a photograph of the product, and manufacturer’s product description (where applicable). Please note that the FDA does not require manufacturers to list certain micro- and macro-nutrients on product labels (e.g., Vitamin C, monounsaturated fat, Calcium) and so the database does not contain complete information on these nutrients.

On the main page of the grocery store, participants see an overview of the available products: product photographs, names, sizes, prices, and any front-of-package labels the researcher specifies. If participants click on a product, they see more information including the nutrition facts label, the ingredients, and the manufacturer’s description. Unless the researcher specifies otherwise, participants can add products to their cart from either the product overview page or the detailed product information page.

Participants can browse products by using a navigational menu at the top of the screen. The navigational menu includes nine built-in categories (i.e., produce; meat, dairy and eggs; bakery, pasta and grains; dry goods, breakfast and spices; pantry; canned; snacks; beverages; frozen foods), each with related subcategories. Participants can also directly search for products by name.

Participants view their cart and check out by clicking a cart icon. On the cart summary screen, participants view all the products in their cart, the price of each item, the before-tax cart total, the tax amount (7.5%), the total price, and any other information the researcher chooses to include.

***Data Privacy.*** OSOG does not collect any identifiable information that is linked with participants’ responses. When participants enter the store, they are prompted to enter their session ID. Session IDs are provided by the researcher and may be unique to each participant (like a participant ID). All the participant’s actions in the store are recorded under their session ID. Researchers who need to link participants’ actions in the store to survey or demographic responses should encourage participants to use the same ID in the store as in a Qualtrics survey.

All participant actions are recorded and kept indefinitely. The researcher could choose to delete the data from the server by deleting the entire experiment.

As is the case on the vast majority of websites, the IP address of all web visitors to OSOG are automatically logged in the web servers that run the store. This information is not made available to researchers. IP addresses are not linked to participants’ actions in the store and are automatically deleted every 30 days. In other words, although it is necessary to collect IP addresses, this information is never made available to researchers. In the unlikely case of a data breach, hackers would have access to IP addresses from the past 30 days, but would not be able to link them to any given experimental procedure or any participant actions.

A screenshot of a video game

Description automatically generated with medium confidence

*Figure 1*. The participant interface of the Open Science Online Grocery

**The Researcher Interface**. The researcher interface is a point-and-click interface that allows researchers to easily modify the choice context of the store. Table 1 lists all the currently modifiable components of the store. These components can be modified separately or in conjunction with one another. It is our hope that the capabilities of OSOG expand over time as more researchers use the platform and develop code to meet their specific needs.

|  |  |
| --- | --- |
| **Table 1.** The modifiable choice context components of OSOG. | |
| Component | Available Modifications |
| Front-of-Package (FOP) Labeling | FOP “healthy stars” labels based on the Guiding Stars system (Guiding Stars Licensing Company 2012)  *Custom FOP Labels*. FOP labels that can be uploaded as images by the researcher. The labels are placed on products based on a researcher-specified equation. |
| Within-Page Sorting | Products can be sorted within a page based on the system default, a random order, an order based on any available product information (e.g., calories from fat, price, alphabetical, health labels), or any researcher-specified order.  Toggle on-and-off participants’ ability to sort pages based on the same features.  Toggle on-and-off participants’ ability to use the search function within the store. |
| Custom Categories | Include additional product categories and subcategories above the nine built-in navigational categories. Researchers specify which products fall in the new categories. Products appear both in their original category and the researcher-created category.  Researchers can also toggle any given category on or off entirely. For example, it would be possible to present a grocery store that did not contain meat products. |
| Cart-Level Feedback | Toggle whether participants see a price total or not.  Provide feedback based on health labels (e.g. “8 out of 10 products in your cart have a health label”)  Upload an image that appears at check-out conditional on a researcher-specified equation. |
| Modifications to the Nutrition Facts Label | Require participants to add items to their cart from the detailed product page (i.e., ensure participants see nutrition information before checking out).  Change the formatting of the nutrition facts label including the font (type, size, color, bold, italics) and background color. Changes can apply to all labels or be conditional on product features. |
| Product Suggestions | When participants add specific items to their cart, a pop-up will appear asking whether they would like to also add a complimentary item (e.g., “we see you’re buying ranch dressing, would you like to add carrot sticks?”). If participants agree, the complementary item is also added to their cart. The researcher specifies all the product pairings. |
| Budgeting | Toggle participants’ ability to add items to their cart by dollar amount (e.g., “add $2.00 worth of bananas)  Set maximum or minimum cart totals required to check-out of the store. |

Please examine <https://openscience-onlinegrocery.com/pages/tutorials> for more specific instructions about how to use each feature and details on how to integrate OSOG with existing survey software like Qualtrics.

***Downloadable Data***. Researchers can download two .csv files from OSOG, depending on their research questions. One data set shows all the products in each participants’ cart when they checked out. This output includes nutrition information and price for each product, and summary statistics for the entire basket (e.g., total cost, number of items, total calories). The “All Participant Actions” file shows the researcher everything the participant did in the store: which items participants viewed detailed information on, the order in which items were presented on the screen, the order in which items were added to the cart, and whether items were deleted from the cart.

***Comparing OSOG to Existing Tools.*** OSOG is not the first online grocery store to be used in academic research. Other tools (i.e., NUMSmart (Finkelstein 2020), Dutch SN Virtumart (Hoenink et al. 2020), and The Virtual Supermarket (Waterlander et al. 2011)) have been used to conduct similar research. Table 2 compares the capabilities of OSOG to the other online grocery stores available to researchers. Of note, OSOG has several advantages compared to the other tools currently on the market. First, OSOG contains more products than any other online grocery tool. Second, OSOG is the only grocery tool containing products from American supermarkets, which may be familiar to North American consumers. Third, OSOG easily allows for the collection of data from online samples. Fourth, OSOG has more flexibility in terms of researcher interventions in terms of both (a) having built-in capabilities that the other tools do not (e.g., suggested products, the ability to alter nutrition labels, cart-level feedback) and (b) being open-source such that researchers can modify the store to add additional capabilities.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Table 2**. Comparing OSOG to other grocery research tools | | | | |
|  | Grocery Store | | | |
|  | OSOG | NUMSmart | Dutch SN Virtumart | The Virtual Supermarket |
| Style | Online Grocery Store | Online Grocery Store | VR | VR |
|  |  |  |  |  |
| Cost to researchers | Free | Free | Free | Free |
|  |  |  |  |  |
| Number of products | 11,000 | 4,000 | 1,200 | 700 |
|  |  |  |  |  |
| Country where products are sold | USA | Singapore | Netherlands | Netherlands |
|  |  |  |  |  |
| Compatible with an online sample | Yes | Yes | No | No |
|  |  |  |  |  |
| Add custom labels to products | Yes | Yes | Yes | Yes |
|  |  |  |  |  |
| Change the way products are ordered within a page | Yes | N/A | Yes | No |
|  |  |  |  |  |
| Alter the categories that appear within a store and/or create custom categories | Yes | N/A | Yes | No |
|  |  |  |  |  |
| Recommend products based on participant actions | Yes | N/A | No | No |
|  |  |  |  |  |
| Change the way the Nutrition Facts Label is displayed | Yes | N/A | Nutrition Facts not displayed at all | No |
|  |  |  |  |  |
| Set a budget for participants | Yes | Yes | Yes | Yes |
|  |  |  |  |  |
| Provide participants with feedback on the contents of their carts | Yes | Yes | No | No |
|  |  |  |  |  |
| Change the prices of products in the store | No | Yes | Yes | Yes |
|  |  |  |  |  |
| Does the store include brand name products? | Yes | Yes | N/A | No |

In the following sections, we provide three illustrations of the store. We test three choice context interventions that are backed by empirical work: front-of-package labels, within-page sorting, and product categorical organization. By testing well-known interventions, we hoped to replicate the findings of prior field studies. Thus, demonstrating that novel innovations tested in OSOG would be likely to predict real world response to such interventions. Recall that our purpose in running these studies was not to make a robust theoretical contribution, rather to introduce some of the functionalities of the tool and examine whether consumer behavior in the store is concordant with the existing literature.

**ILLUSTRATION I: FRONT-OF-PACKAGE HEALTH LABELS**

Front-of-package (FOP) labels appear on the outward facing side of product packaging in brick-and-mortar stores. In online stores, FOP labels appear directly on or below the product photograph when consumers browse the product overview page. The purpose of these labels is to provide easily understandable information to the consumer. FOP labels can indicate a variety of characteristics (e.g., organic, allergen-free). Research has largely focused on the effects of FOP health labels (e.g., traffic lights, guiding stars, heart check).

The effects of front-of-package health labels on food choice is highly variable. A Cochrane review (Crockett et al. 2018), a review of field studies (Cadario and Chandon 2020), and a large-scale RCT (Dubois et al. 2021) suggest a small effect. To our knowledge, only three studies have examined the effect of FOP labeling in an online grocer (Finkelstein, Ang, and Doble 2020; Sacks et al. 2011; Shin, van Dam, and Finkelstein 2020). Two of these studies found null effects, and one found an effect when FOP labels were combined with cart feedback (Shin et al. 2020).

The effects of FOP labels also differ depending on the label format, with healthy stars (i.e., the intervention used in Study 1) not having a significant effect on nutrient content of foods purchased and consumed (Croker et al. 2020). In this study, we sought to replicate the findings of existing field studies on FOP health labels. We expected to find a small or null effect of health labels in the OSOG.

***Methods***

We recruited 394 participants from Prolific (187 men, 202 women, 5 non-binary; *Mage* = 32.56, *SD* = 11.00; 252 White, 41Black, 45 Asian, 7 Southeast Asian, 24 Hispanic or Latinx, 2 Indigenous, 2 Pacific Islander, 19 bi- or multiracial, 2 other; *MBMI* = 26.01, *SD* = 7.94).

Participants were asked to use the Open Science Online Grocery to shop for groceries for the upcoming week. They were asked to buy what they would usually purchase in a normal shopping trip and to shop for other members of their household if that was something they would normally do. To improve ecological validity, all participants were informed that two participants would win the contents of their grocery cart. We could not logistically send the actual contents of grocery carts to the winning participants, but we did provide these participants with a monetary bonus in the amount of their cart total (a fact that all participants were informed of in an end-of-study debriefing).

Participants were randomly assigned to one of two versions of the Open Science Online Grocery. In the control condition, grocery items were unlabeled. In the experimental condition, some grocery items were labeled using the “Healthy Stars” algorithm which rates a food’s nutritional value from 0 to 3 stars. The star point algorithm mimics the Guiding Stars algorithm that is used to label nutritious foods in Canadian grocery stores (Guiding Stars Licensing Company 2012). The details of the algorithm can be found in the web appendix. Across both conditions, participants saw grocery items presented in the same order and were prompted to spend $35 before being able to check out.

After completing their hypothetical shopping, participants were asked how many people they imagined shopping for, how much money they spend on groceries in a typical week, and how similar the groceries they “purchased” in the experiment were to their typical purchases from 1 (*not at all similar*) to 7 (*very similar*). Then, all participants completed demographic questions and were debriefed regarding the true nature of the bonus.

***Results***

**Shopper Profile.** The majority of participants imagined shopping for themselves (27.2%) or themselves and another person (28.9%). On average, participants reported purchasing similar items to their typical grocery shopping trip (*M* = 5.92/7.00, *SD* = 1.10); purchase typicality did not differ across conditions, *t*(392) = .35, *p* = .73.

**Primary Results*.*** We did not observe any significant differences in any of the measured health variables across conditions. Full results can be found in Table 3.

***Discussion***

In this study, we demonstrated that there was no effect of a healthy stars FOP labeling system on the healthiness of purchased items in OSOG. This finding replicates Crocker et al., (2020)’s study of star FOP labels in an online grocery setting and accords with a large body of literature finding small or null effects of FOP labels on food choice. In the next study, we sought to replicate another choice context intervention that is backed by a large body of literature: page sorting.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 3.** The effect of three interventions on cart price, number of items in cart, and item healthiness | | | | | | | | | |
|  | Illustration I: The effect of FOP Labels | | | Illustration II: The Effect of Page Sorting | | | Illustration III: The Effect of Categorization | | |
| Outcome | Test  Group | Control Group | t(392) | Test Group | Control Group | t(362) | Test Group | Control Group | t(281) |
|  | M (SD) | M (SD) |  | M (SD) | M (SD) |  | M (SD) | M (SD) |  |
| Total Price (USD) | 96.05  (89.42) | 110.88 (113.58) | 1.44 | 109.25 (103.85) | 95.42 (85.25) | 1.39 | 94.26 (78.41) | 106.12  (106.21) | 1.06 |
| Number of items purchased | 24.72  (21.01) | 30.44  (31.94) | 2.10\* | 29.02 (28.24) | 26.08 (22.81) | 1.10 | 28.48 (23.59) | 33.22 (36.19) | 1.31 |
| Calories per serving | 123.55  (53.35) | 122.76  (44.01) | .16 | 115.36 (35.70) | 130.69 (55.95) | 3.10\*\* | 116.67 (44.96) | 120.35 (34.14) | .78 |
| Total fat (g) per serving | 3.17  (2.09) | 3.22  (2.18) | .23 | 2.95  (1.78) | 3.25 (1.94) | 1.52 | 3.48 (2.01) | 3.58 (1.80) | .41 |
| Saturated fat (g) per serving | 1.16  (.92) | 1.13  (.89) | .25 | 1.02  (.89) | 1.19 (.85) | 1.82† | 1.23 (.85) | 1.38 (.89) | 1.43 |
| Trans fat (g) per serving | .02  (.06) | .01  (.03) | 1.65 | .005  (.017) | .015 (.061) | 2.18\* | .01 (.02) | .02  (.05) | 2.24\* |
| Cholesterol (mg) per serving | 12.73  (11.83) | 12.70  (12.33) | .25 | 12.17 (11.33) | 15.36 (21.22) | 1.79† | 15.69 (14.74) | 13.42 (10.30) | 1.49 |
| Sodium (mg) per serving | 133.34  (104.90) | 139.75 (108.57) | .60 | 124.50 (93.15) | 144.35 (110.31) | 1.85† | 144.15 (94.10) | 164.50 (107.23) | 1.69† |
| Carbohydrates (g) per serving | 20.47  (12.67) | 20.07  (11.12) | .33 | 18.62  (7.77) | 21.88 (15.08) | 2.58\* | 17.45 (11.09) | 18.05 (6.48) | .54 |
| Fiber (g) per serving | 2.01  (1.29) | 2.04  (1.15) | .24 | 2.09  (1.04) | 2.13 (1.30) | .31 | 1.86 (1.15) | 1.91 (.99) | .38 |
| Sugar (g) per serving | 10.78  (10.91) | 10.18  (9.65) | .58 | 8.58  (6.37) | 11.43 (12.04) | 2.81\* | 7.75 (8.91) | 7.59 (4.78) | .19 |
| Protein (g) per serving | 4.14  (2.37) | 4.29  (2.46) | .61 | 4.26  (2.22) | 4.60 (2.28) | 1.46 | 4.77 (2.33) | 4.73  (1.95) | .14 |
| Star points per serving | .56  (5.19) | .77  (4.92) | .41 | 1.97  (4.53) | .71 (5.05) | 2.51\* | -.48 (4.97) | .90 (4.66) | 2.42\* |
| Note: \*\*p<.01, \*p<.05, †p<.10 | | | | | | | | | |

**ILLUSTRATION II: PAGE SORTING**

In the OSOG, it is possible to change the default way foods are displayed on the page. We specifically studied whether bringing healthy foods to the top of the page would affect behavior. Conceptually, this intervention is similar to visibility enhancements (e.g. placing healthy objects at eye level, placing healthy entrees early in a menu) or positioning nudges (e.g., putting healthier items closer to the participant) in brick-and-mortar stores, both of which have consistent effects on purchasing (Bucher et al. 2016; Cadario and Chandon 2020). Studies of online shopping behavior also point to an effect of ordering. An observational study of online grocery shoppers suggests that consumers are likely to select items appearing closer to the top of each category (Anesbury et al. 2016). For non-grocery online retailers, there also seems to be a consistent effect of position such that items positioned closer to the top of a list are more likely to enter the consideration set (Cai and Xu 2008; Xu and Kim 2008), more likely to be clicked (Murphy, Hofacker, and Mizerski 2006), and ultimately more likely to be chosen (Tam and Ho 2005). In this study, we sought to replicate the effects of sorting using the OSOG. We expected to observe an effect of product sorting on the healthfulness of the items in participants’ carts at checkout.

***Methods***

We recruited 364 participants from Prolific (171 men, 186 women, 7 non-binary; *Mage* = 31.30, *SD* = 10.62; 254 White, 22 Black, 39 Asian, 7 Southeast Asian, 17 Hispanic or Latinx, 1 Indigenous, 1 Pacific Islander, 20 bi- or multiracial, 3 other; *MBMI* = 25.35, *SD* = 6.79, excluding one participant who declined to answer).

Participants were asked to use the Open Science Online Grocery to shop for groceries for the upcoming week. Instructions were the same as in prior experiments, including two participants winning the contents of their cart.

Participants were randomly assigned to one of two versions of the Open Science Online Grocery. In the control condition, grocery items were organized randomly within each category. In the experimental condition, grocery items were organized by nutritional value with the most nutritious items being displayed at the top of each category. Specifically, items were ordered by the same star points algorithm used in Study 1. Across both conditions, participants were not shown front-of-package labels, were able to use the built-in search function, and were prompted to spend $35 before being able to check out. A glitch in the study allowed 13 participants to check out without meeting this minimum threshold.

After completing their hypothetical shopping, participants completed the same shopper profile, demographics, and debriefing as in Study 1.

*Results*

**Shopper Profile.** The majority of participants imagined shopping for themselves (30.8%) or themselves and another person (30.5%). On average, participants reported purchasing similar items to their typical grocery shopping trip (*M* = 5.88/7.00, *SD* = 1.13); purchase typicality did not differ across conditions, *t*(362) = .52, *p* = .60.

***Primary Results.*** Participants in the experimental re-ordering condition purchased items with fewer calories, less trans fat, fewer carbohydrates, less sugar, and more star points than participants in the control condition, all *p*s< .03. Several other micro- and macronutrients (saturated fat, cholesterol, sodium) trended in the expected direction, all *p*s < .08. Full results can be found in Table 3.

***Discussion***

In this study, we find that changing the default sorting to present healthier items first results in overall healthier purchases (compared to a randomly ordered store). This effect is particularly notable given that OSOG has a search function. If participants knew exactly what they were looking for, they would have searched the items and the within-page sorting would not have affected their purchases. The observed effect of within-page sorting on purchase behavior replicates visibility findings from brick-and-mortar retailers (Bucher et al. 2016; Cadario and Chandon 2020) and replicates page sorting findings from non-grocery retailers (Tam and Ho 2005).

In our final illustration, we investigate whether creating curated product categories of healthy foods (similar to having a “healthy” section of a brick-and-mortar store) would affect consumer behavior.

**ILLUSTRATION III: CATEGORICAL ORGANIZATION WITHIN THE STORE**

In the OSOG,researchers can curate a custom category. In this experiment, we created a category that contained only the healthiest products in the store.By definition, curating a category allows consumers to opt-in to a limited consideration set. For example, rather than choosing among all the available soups, consumers are limiting themselves to only the healthiest soups.

We expect that a curated category would improve consumer choice for a variety of reasons. First, consumers experience less choice overload, and are more motivated to actually purchase from small versus large assortments (Boatwright and Nunes 2001; Iyengar and Lepper 2000). For example, a consumer who is curious about veggie burgers might have been overwhelmed by the large selection in the standard store. However, she may find it easier to make a purchase decision if choosing from a limited set of only the healthiest veggie burgers. Second, creating a curated category reduces consumers’ search costs. When searching among large assortments, consumers often eliminate options that do not meet minimum criteria (Bettman, Luce, and Payne 1998). By curating a category of healthy foods, we are enabling elimination. By allowing consumers to easily act on their desire to choose healthier products, we should facilitate healthier choices.

There is limited empirical data on category curation and choice. A study examining consumers’ response to restaurant menu format found that, when calorie information is posted, consumers avoid a menu section containing only low calorie items, leading them to choose an food item with more calories overall (Parker and Lehmann 2014). However, this finding is within a hedonic context where consumption is immediate; in the context consumers’ taste goals may be more salient than their health goals (VanEpps, Downs, and Loewenstein 2016). Furthermore, data from non-food related consumption contexts suggests that products appearing in curated categories are consumed at much higher rates than products that do not appear in curated categories (Aguiar and Waldfogel 2021). Based on this research and the literature on consumer consideration sets, we suspect that consumers will purchase healthier foods when a “healthy section” is made available.

***Methods***

We recruited 283 participants from Prolific (123 men, 157 women, 3 non-binary or prefer to self-describe; *Mage* = 32.75, *SD* = 11.80; 198 White, 22 Black, 29 Asian, 1 Southeast Asian, 17 Hispanic or Latinx, 1 Pacific Islander, 13 bi- or multiracial, 2 other or prefer not to answer; *MBMI* = 25.68, *SD* = 6.19).

Participants were asked to use the Open Science Online Grocery to shop for groceries for the upcoming week. Instructions were the same as in prior experiments, including two participants winning the contents of their cart.

Participants were randomly assigned to one of two versions of the Open Science Online Grocery. In the control condition, participants saw nine product categories (i.e., produce; meat, dairy and eggs; bakery, pasta and grains; dry goods, breakfast and spices; pantry; canned; snacks; beverages, and; frozen foods) as headings to help navigate the store. In the experimental condition, participants could opt in to seeing an additional heading “Healthy Section.” The healthy section included subcategories representing each of the other store categories (e.g., produce, dry goods). Items appearing in the Healthy Section were in the 70th percentile or higher of health as rated by the star point algorithm outlined in Study 1. In both conditions, participants were not shown front-of-package labels and were prompted to spend $35 before being able to check out.

After completing their hypothetical shopping, participants completed the same shopper profile, demographics, and debriefing as in Study 1.

**Results**

***Opting In*.** Recall that we allowed participants to opt in to seeing the healthy items category. We did this to reduce reactance responses to the feature. 15 participants chose not to see the Healthy Section. Statistics are presented below using an intent-to-treat analysis. However, results are similar if the participants who opted out are assigned to the control condition.

***Shopper Profile*.** The majority of participants imagined shopping for themselves (31.8%) or themselves and another person (33.9%). On average, participants reported purchasing similar items to their typical grocery shopping trip (*M* = 6.05/7.00, *SD* = 1.10); purchase typicality did not differ across conditions, *t*(280) = .47, *p* = .64.

***Primary Results.*** Participants in the experimental re-ordering condition purchased items with less trans-fat and more star points than participants in the control condition, all *p*s< .03. Sodium trended in the expected direction, *p* = .09. Full results can be found in Table 3.

**DISCUSSION**

Across three studies, we demonstrate an effect of sorting and categorization on consumer choice in the OSOG store. We fail to demonstrate an effect of labeling. The effects for ordering and labeling increase our confidence in the relative ecological validity of the store because they mirror the effects generally found in large scale field studies.

The effects of curated categories is also important in that it implies areas where future research is needed. The observed effect of curated categories is encouraging, suggesting that categorical organization may be helpful in a grocery setting, when consumers may be more actively pursuing a health goal. However, many questions remain. For example, what is the optimal assortment size within these categories? Do curated categories outperform filters that may perform a similar exclusionary function?

Our goal in running these studies was to introduce researchers to a new tool to examine the effects of choice context on consumer food choice. In this paper, we present three illustrations of the store’s capabilities. However, we do not see these illustrations as the ultimate empirical demonstration of the store’s features. For example, although we found a null effect of star labels, we encourage researchers to make labeling changes within the store and observe how they affect purchase behavior. As we did not test the effect of traffic light labels, organic labels, or any other of the myriad of FOP labels currently being used in the market, more research could contribute valuable knowledge to understanding the effects of labeling.

It is important to note that we do not envision the store as a substitute for field studies. Although the store can be made incentive compatible by providing bonuses, it is not a substitute for an experimental or quasi-experimental field study. Rather, we envision the store as a first step in a research project: a way to determine if there is any support for a hypothesis before beginning a cost- and labor-intensive field study. Furthermore, researchers can use results from the store to address any concerns retailers may have about profits or consumer satisfaction, perhaps making retailer collaboration more likely.

**Beyond Food Choice: Using OSOG To Study Consumer Behavior More Broadly**

The studies included in this package do not represent the full capabilities of the store. There are many store features that we did not test as part of this package (see Table 1). Furthermore, there are many other ways of using the OSOG that do not necessarily rely on changes to the choice context. For example, researchers have used the store as a pre- post-intervention measure of behavioral flexibility in food choice in adolescents with anorexia nervosa and their parents (Timko et al. 2021).

Furthermore, consumer behavior researchers can use the store to study research questions unrelated to health behavior. For example, one group of researchers are using the store to mimic a consumer-brand interaction and assess downstream consequences for brand connection and brand community (Rifkin, Valsesia, & Cutright, personal communication). A second group of researchers is using the store to study a variety of recommendation algorithms (Xu, Deng & Mela, personal communication). Because researchers can be certain where items appeared on the screen, the store also lends itself to eye-tracking studies. When combined with an eye-tracker, OSOG may provide valuable insights into how consumers seek and engage with product information.

As the capabilities of the store improve over time, it may become possible to use the tool to study consumer reactions to price changes or promotions, packaging changes, or stock-outs. We encourage readers to be creative with the store and to contact the first author if they have questions about store capabilities.

References

Aguiar, Luis and Joel Waldfogel (2021), “Platforms, Power, and Promotion: Evidence from Spotify Playlists,” *Journal of Industrial Economics*.

Anesbury, Zachary, Magda Nenycz-Thiel, John Daews, and Rachel Kennedy (2016), “How Do Shoppers Behave Online? An Observational Study of Online Grocery Shopping,” *Journal of Consumer Behaviour*, 15(3), 261–70.

Bettman, James R, Mary Frances Luce, and John W Payne (1998), “Constructive Consumer Choice Processes,” *Journal of Consumer Research*, 25(3), 187–217, https://academic.oup.com/jcr/article-lookup/doi/10.1086/209535.

Boatwright, Peter and Joseph C. Nunes (2001), “Reducing Assortment: An Attribute-Based Approach,” *Journal of Marketing*, 65(3), 50–63.

Bucher, Tamara, Clare Collins, Megan E. Rollo, Tracy A. McCaffrey, Nienke De Vlieger, Daphne Van Der Bend, Helen Truby, and Federico J.A. Perez-Cueto (2016), “Nudging Consumers towards Healthier Choices: A Systematic Review of Positional Influences on Food Choice,” *British Journal of Nutrition*, 115(12), 2252–63.

Cadario, Romain and Pierre Chandon (2020), “Which Healthy Eating Nudges Work Best? A Meta-Analysis of Field Experiments,” *Marketing Science*, 39(3), 465–86.

Cai, Shun and Yunjie Xu (2008), “Designing Product Lists for E-Commerce: The Effects of Sorting on Consumer Decision Making,” *International Journal of Human-Computer Interaction*, 24(7), 700–721.

Crockett, Rachel A., Sarah E. King, Theresa M. Marteau, A. T. Prevost, Giacomo Bignardi, Nia W. Roberts, Brendon Stubbs, Gareth J. Hollands, and Susan A. Jebb (2018), “Nutritional Labelling for Healthier Food or Non-Alcoholic Drink Purchasing and Consumption,” *Cochrane Database of Systematic Reviews*, 2018(2).

Croker, H., J. Packer, Simon J. Russell, C. Stansfield, and R. M. Viner (2020), “Front of Pack Nutritional Labelling Schemes: A Systematic Review and Meta-Analysis of Recent Evidence Relating to Objectively Measured Consumption and Purchasing,” *Journal of Human Nutrition and Dietetics*, 33(4), 518–37.

Dubois, Pierre, Paulo Albuquerque, Olivier Allais, Céline Bonnet, Patrice Bertail, Pierre Combris, Saadi Lahlou, Natalie Rigal, Bernard Ruffieux, and Pierre Chandon (2021), “Effects of Front-of-Pack Labels on the Nutritional Quality of Supermarket Food Purchases: Evidence from a Large-Scale Randomized Controlled Trial,” *Journal of the Academy of Marketing Science*, 49(1), 119–38.

Finkelstein, Eric A (2020), “NUMSmart: An Experimental Online Grocery Store to Promote Healthier Shopping,” https://nusmartbulletin.wordpress.com/publications/.

Finkelstein, Eric Andrew, Felicia Jia Ler Ang, and Brett Doble (2020), “Randomized Trial Evaluating the Effectiveness of within versus Across-Category Front-of-Package Lower-Calorie Labelling on Food Demand,” *BMC Public Health*, 20(312), 1–10.

Guiding Stars Licensing Company (2012), *Understanding the Science behind the Guiding Stars® Algorithm for Canada*, 2652379, Canada, https://guidingstars.ca/about/how-it-works/our-algorithm/.

Harrington, Richard Andrew, Vyas Adhikari, Mike Rayner, and Peter Scarborough (2019), “Nutrient Composition Databases in the Age of Big Data: FoodDB, a Comprehensive, Real-Time Database Infrastructure,” *BMJ Open*, 9(6), 1–10.

Hawley, Kristy L., Christina A. Roberto, Marie A. Bragg, Peggy J Liu, Marlene B. Schwartz, and Kelly D. Brownell (2013), “The Science on Front-of-Package Food Labels,” *Public Health Nutrition*, 16(3), 430–39.

Hee Lee-Kwan, Seung, Latetia V Moore, Heidi M Blanck, Diane M Harris, and Deb Galuska (2017), “Disparities in State-Specific Adult Fruit and Vegetable Consumption — United States, 2015,” *CDC Morbidity and Mortality Weekly Report*, https://www.cdc.gov/mmwr/cme/conted\_info.html#weekly.

Hoenink, Jody C., Joreintje D. Mackenbach, Wilma Waterlander, Jeroen Lakerveld, Nynke Van Der Laan, and Joline W.J. Beulens (2020), “The Effects of Nudging and Pricing on Healthy Food Purchasing Behavior in a Virtual Supermarket Setting: A Randomized Experiment,” *International Journal of Behavioral Nutrition and Physical Activity*, 17(1), 1–12.

Inmar Intelligence (2020), “A Surge in Online Grocery Shopping,” *Thought Leadership Blog*, https://www.inmar.com/blog/thought-leadership/surge-online-grocery-shopping.

Iyengar, Sheena S. and Mark R. Lepper (2000), “When Choice Is Demotivating: Can One Desire Too Much of a Good Thing?,” *Journal of Personality and Social Psychology*, 79(6), 995–1006.

John, Leslie K, Grant E Donnelly, and Christina A Roberto (2017), “Psychologically Informed Implementations of Sugary-Drink Portion Limits.,” *Psychological Science*, 28(5), 620–29.

Murphy, Jamie, Charles Hofacker, and Richard Mizerski (2006), “Primacy and Recency Effects on Clicking Behavior,” *Journal of Computer-Mediated Communication*, 11(2), 522–35.

Parker, Jeffrey R. and Donald R. Lehmann (2014), “How and When Grouping Low-Calorie Options Reduces the Benefits of Providing Dish-Specific Calorie Information,” *Journal of Consumer Research*, 41(1), 213–35.

Sacks, Gary, Kim Tikellis, Lynne Millar, and Boyd Swinburn (2011), “Impact of ‘Traffic-Light’ Nutrition Information on Online Food Purchases in Australia,” *Australian and New Zealand Journal of Public Health*, 35(2), 122–26.

Shah, Avni M., James R Bettman, Peter A. Ubel, Punam Anand Keller, and Julie A. Edell (2014), “Surcharges plus Unhealthy Labels Reduce Demand for Unhealthy Menu Items,” *Journal of Marketing Research*, 51(6), 773–89.

Shin, Soye, Rob M. van Dam, and Eric A. Finkelstein (2020), “The Effect of Dynamic Food Labels with Real-Time Feedback on Diet Quality: Results from a Randomized Controlled Trial,” *Nutrients*, 12(7), 1–16.

Tam, Kar Yan and Shuk Ying Ho (2005), “Web Personalization as a Persuasion Strategy: An Elaboration Likelihood Model Perspective,” *Information Systems Research*, 16(3), 271–91.

Timko, C. Alix, Anushua Bhattacharya, Kathleen Kara Fitzpatrick, Holly Howe, Daniel Rodriguez, Connor Mears, Kerri Heckert, Peter A. Ubel, Jill Ehrenreich-May, and Rebecka Peebles (2021), “The Shifting Perspectives Study Protocol: Cognitive Remediation Therapy as an Adjunctive Treatment to Family Based Treatment for Adolescents with Anorexia Nervosa,” *Contemporary Clinical Trials*, 103(January), 106313.

VanEpps, Eric M., Julie S. Downs, and George Loewenstein (2016), “Advance Ordering for Healthier Eating? Field Experiments on the Relationship Between the Meal Order–Consumption Time Delay and Meal Content,” *Journal of Marketing Research*, 53(3), 369–80, http://journals.ama.org/doi/10.1509/jmr.14.0234.

Waterlander, Wilma E., Michael Scarpa, Daisy Lentz, and Ingrid H.M. Steenhuis (2011), “The Virtual Supermarket: An Innovative Research Tool to Study Consumer Food Purchasing Behaviour,” *BMC Public Health*, 11(1), 1–10.

Xu, Yunjie (Calvin) and Hee Woong Kim (2008), “Order Effect and Vendor Inspection in Online Comparison Shopping,” *Journal of Retailing*, 84(4), 477–86.