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Choice Architecture Effects on Indulgent Consumption: Evidence from Combinations of Nudges at an Ice-Cream Store

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ABSTRACT

In response to growing interest in healthy diets, various choice architecture interventions (e.g., assortment organization, traffic-light labeling) have been introduced to "nudge" consumers to eat healthier. In two long-running field experiments at an ice-cream store, we examined how combinations of choice architecture interventions might work together to influence purchase decisions of quantity and choice, and further intake of calories and saturated fat. Consistent with prior literature linking mental representations of food healthiness with lateral orientations, we find that displaying "virtue" flavors to customers' left reduces calories and saturated fat purchased, more so if virtue flavors are matched with green labels. These reductions are caused by a reduced purchase quantity and an increased choice likelihood of virtue options. The investigation of combinations of different choice architecture tools on purchase decisions and consumption consequences provides useful implications for researchers and practitioners.

Keywords: Choice Architecture; Behavioral Economics; Self-Control; Nudges; Traffic-Light Labeling

In response to growing public interest in healthy eating, marketers of indulgent foods have introduced seemingly healthy menu options (e.g., salad at McDonald's), offered relatively less unhealthy versions of indulgent items (e.g., oatmeal cookies at Starbucks; reduced fat variants of popular offerings; collectively termed as 'healthful indulgences' by Belei et al. 2012), and framed indulgent foods as less harmful (Mohr, Lichtenstein, and Janiszewski 2012). Consequently, assortments contain many options that vary greatly in relative healthiness.

In such complex choice contexts, researchers and practitioners have recognized the importance of choice architecture tools, or "nudges", that induce behaviors in predictable ways without removing options or changing incentives (Thaler and Sunstein 2008; Johnson et al. 2012). Examples of popular choice architecture tools for complex assortments are visual enhancements, such as placing healthy items at eye level (Thorndike et al. 2012), nutrition labeling (Thorndike et al. 2012; Koenigstorfer, Groeppel-Klein, and Kamm 2014; Nikolova and Inman 2015), and partitioning alternatives by healthfulness (Münscher, Vetter, and Scheuerle 2016). Although these nudges have received much attention in the literature (Cadario and Chandon 2020), these studies mostly tested the effects of single nudges, i.e., isolated from other interventions. Consequently, while the results of these studies are useful to understand the effects of different interventions, they are of limited use for practitioners who are interested in combining interventions to maximize behavioral change. In such situations, practitioners need to understand the relative effect sizes and whether combinations of interventions interact to increase effectiveness. The goal of this research is to take a first step into this direction by exploring the combined effects of three frequently used choice architecture tools: 1) partitioning, 2) organization of choice alternatives, and 3) traffic-light color labeling (Johnson et al. 2012).

To obtain substantive insights into the combined effects of choice architecture tools, we followed a non-deductive research approach that is exploratory, rather than confirmatory, in nature (Lynch et al. 2012; Janiszewski and van Osselaer 2021). In service of ecological validity, we conducted two field experiments at an ice-cream store in which consumers voluntarily entered with an intention to indulge (Bagchi and Block 2011), and in which alternatives varied in relative healthfulness. This setting allows us to test the combined effects of different choice architectures on consumers' purchase decisions (choice and quantity) and also important consumption outcomes (intake of calories and saturated fat). Moreover, this context allows us to examine whether previous findings are robust in situations where consumers have a desire to indulge.

Our results show that combining choice architecture interventions can have significant effects on consumers' purchase decisions as well as their consumption outcomes. Specifically, compared to a baseline assortment without interventions, placing relatively healthy items with green labels to the left of the consumer reduced purchased calories by up to ten percent, and saturated fats by up to eighteen percent. These results were driven by both reduced purchase quantities and increased shares of relatively healthy choices. In what follows, we provide a literature review of choice architecture tools and their effects on decision making and consumption, and describe two field experiments and their findings. We then discuss contributions, limitations of the current work, and conclude with a call for future investigations.

LITERATURE REVIEW

Effects of Choice Architectures on Purchase Decisions and Consumption Consequences

Before reviewing specific choice architecture tools, we summarize our two field experiments in which combinations of choice architecture tools affect 1) purchase decisions and 2) consumption consequences (see Web Appendix 1). First, choice architecture interventions influence purchase decisions, specifically a) choice, i.e., 'what to eat' and b) quantity, i.e., 'how much to eat' (Fedorikhin and Patrick 2010; Wansink and Chandon 2014), assuming no wastage. The decision of 'what to eat' involves the choice between healthy and unhealthy alternatives. At the same time, the consumer also needs to decide the purchase quantity. Second, as a result of these choice and quantity decisions, combinations of choice architecture tools can influence consumption outcomes such as the intake of calories and saturated fats. These two outcomes are key determinants of consumer welfare (Ma et al. 2013). Overconsumption of calories is the primary cause of the obesity problem (Livingston and Zylke 2012; McFerran and Mukhopadhyay 2013), while overconsumption of saturated fats raises cholesterol levels that increase risk of heart diseases (Hegsted 2000). If combining choice architecture tools can either increase the choice likelihood of healthier alternatives or lower purchased quantity, it may reduce intake of calories and saturated fats. Note that in addition to choice and quantity, choice architecture interventions could also affect purchase incidence (i.e., whether or not to purchase anything). However, only actual purchases, not non-purchases, were recorded in our data.

Choice Architecture Interventions

Choice architecture interventions encompass a range of retailing decisions, such as location of alternatives on a display, size of assortment, structure of assortment, and labeling (Broniarczyk 2008; Lamberton and Diehl 2013). These decisions influence how consumers attend to and process information about the presented alternatives. After reviewing popular choice architecture tools (Johnson et al., 2012; Cadario and Chandon 2020) and consulting the owner of the store where we conducted our field experiments[1], we selected three commonly used nudges in the domain of food: partitioning, assortment organization, and labeling.

Partitioning. Partitioning involves the decision to group alternatives into specific categories, thereby influencing the perceived importance of the attributes used to create those categories (Fox et al. 2005; Johnson et al. 2012). Hence, grouping virtues and vices[2] separately may increase the importance of healthfulness in decision making. A challenge of this intervention is that consumers are required to recognize the partitioning. Therefore, if relative healthfulness is correlated with another more visually salient feature (e.g., color or shape), such partitioning may be more effective. In our field experiments, relative healthfulness is associated with colors as most vices are dark (e.g., chocolate), and most virtues are light (e.g., fruit sorbets and yogurts). This color-based partitioning matches with the 'dark/light and vices/virtues' association, according to extant literature showing dark colors associated with immoral concepts (Sherman and Clore 2009) as well as indulgent consumption (Zhang, Wadhwa, and Chattopadhyay 2016). Thus, we examine whether color-based and healthfulness-based partitions affect choice and quantity decisions, and influence calories and saturated fats purchased.

Assortment Organization. When deciding how to partition options, retailers need to place

[1] It is, of course, essential to obtain agreement of a store owner in order to conduct a field experiment on site. Moreover, an intervention that is feasible to implement (and successful) at one store is also possibly feasible at a different store. Consequently, the three choice architecture tools we chose were selected for their popularity, feasibility, and potential for future applicability.
[2] Wertenbroch (1999) defines virtues and vices relative to each other in terms of asymmetries in their intertemporal delivery of utility, such that virtues deliver greater utility in the distant future than in the near future, and vices deliver more immediate gratification than long-term benefit. For example, Shiv and Fedorikhin (1999) used fruit salad and chocolate cake for a virtue and a vice, respectively.

alternatives on the shelf. Assortment organization can have powerful effects on consumer choice (Broniarczyk 2008) by affecting salience (i.e., eye-level; Drèze, Hoch, and Purk 1994; Valenzuela and Raghubir 2009; Thorndike et al. 2012) or fluency (Chae and Hoegg 2013; Deng et al., 2016; Romero and Biswas 2016). Obviously, the way alternatives can be partitioned depends on how the items are displayed in the assortment. For instance, fresh food in supermarkets, buffets in restaurants, as well as ice-cream in our field experiment, are usually presented on a table-like display in front of the customer (see Web Appendix 2 for pictures of the display in our field experiment). In such settings, it is common to partition items either horizontally or vertically from the customer's perspective.

A horizontal partition, in which virtues (or lighter colored flavors) are placed to the left (vs. right) may affect healthy consumption (see Figure 1a for left/right conditions and Web Appendix 2 for a sample picture) for two reasons. First, previous research shows that the left-hand side is associated with lighter concepts and weight (Deng and Kahn 2009; Chae and Hoegg 2013), which may affect processing fluency. As shown by Romero and Biswas, this enhanced processing fluency may increase self-control and subsequent healthy choices. Moreover, Casasanto (2009) found that right-handed people, a majority of the population, tend to associate desirable abstract concepts with the right spatial location, which coincides with the desirable features of unhealthy (i.e., tasty) alternatives. Second, given that most customers in our field experiments are used to reading from left to right, they are likely to process the assortment in this way, making items placed on the left more salient (Dallas, Liu, and Ubel 2019).

A vertical organization, in which virtues are placed to the front (vs. back) manipulates salience, as items placed in the front are closer to the customer and, therefore, more salient. Hence, virtues (or lighter colored flavors) presented at the front (vs. back) may increase the healthfulness of purchase decisions (Thorndike et al. 2012; see Figure 1b for front/back conditions and Web Appendix 2 for a sample picture).

[insert Figure 1 about here]

Traffic-Light Labeling. Traffic light nutrition labeling refers to the practice of marking labels for food items with the colors yellow, green, and red, based on healthfulness (Thorndike et al. 2012; Koenigstorfer et al. 2014). The intuition is that people automatically associate green and red with specific motivational implications — green connotes healthy, natural, and approach ("go"), whereas red is associated with danger and avoidance ("stop"). Because such visual information is easy to process (Nikolova and Inman 2015), traffic-light labeling can effectively induce healthy food purchases (Koenigstorfer et al. 2014; VanEpps, Downs, and Loewenstein 2016). Conceptually, this tool might strengthen the effects of partitioning and assortment organization by making virtues more salient. We test whether superimposing traffic-light labeling can contribute further to combining healthfulness-based partitioning and assortment organization tools.

Summary and Overview of Field Experiments

We explore how choice architecture interventions: 1) partitioning, 2) assortment organization, and 3) traffic-light labeling can promote healthy eating through either increasing choice likelihood of virtues or decreasing quantities purchased, or both. Due to the lack of previous literature on the effects of combining these interventions, we did not have a priori predictions. Rather, we aimed to explore how specific combinations of choice architecture tools may influence consumption consequences (calorie and saturated fat intake) by influencing either of these two purchase decisions.

Next, we report two field experiments, each conducted over several weeks at an ice-cream store. Field Experiment 1 tested the effects of combining partitioning (healthfulness-based vs. color-based) and assortment organization. Because our findings were consistent for placing virtues and light-colored flavors to the left, we built on these findings in Field Experiment 2, which tested the effects of adding traffic-light labeling to assortment organization while using healthfulness-based partitioning. Both field experiments were conducted at a small privately-owned ice-cream store in Hong Kong.

FIELD EXPERIMENT 1

The goal of Experiment 1 was to examine whether partitioning and assortment organization could affect quantity and choice decisions, and consequently calorie and saturated fat purchase. This experiment was conducted over a period of 30 days, every week from Tuesday to Friday from 5 pm to 10 pm. During this period, 1,157 customers visited the store and bought up to three scoops of ice cream. The display of twenty flavors of ice cream was placed alongside a public sidewalk (Figure 1). In total 20 flavors were arranged in two rows of ten columns. Each tin contained a different flavor, and the flavors varied significantly in color and healthiness as measured in calories and saturated fat.

Method

Partitioning Flavors. During the time of the experiment, the store sold 37 different flavors. To partition these flavors into "virtues" and "vices", we conducted a nutritional analysis of the seven most popular flavors[3], which accounted for 43.5% of total sales (see Web Appendix 3). As expected, virtue flavors were fruit-based sorbets or yogurts, whereas vice flavors contained ingredients such as chocolate and whole milk. Based on this analysis, we partitioned all fruit-based sorbets and yogurts (11 flavors) as virtues and the remaining flavors (26) as vices. In addition, we also categorized flavors based on their color properties: lighter (16 flavors) vs. darker (21 flavors). The two partitioning schemes (healthfulness-based and color-based) were highly related. A cross-tabulation test showed that the two categorizations were not significantly different ($\chi^2(1) = 2.65$, $p = .15$). Overall, 63.6% of virtues were light-colored, and 65.4% vices were dark. Web Appendix 4 contains a list of all flavors and how they were partitioned in terms of healthfulness and color.

Assortment Organization. Using the two partitioning criteria described above, we organized the flavors in five different ways, resulting in a 5 (assortment organization) x 2 (partitioning) between-subjects design. Given the two by ten display arrangement at the store (see Figure 1), we used the following five assortment organizations: all virtue or light-color flavors displayed: 1) in the five columns to the customer's left (tins 6 to 10 and 16 to 20 in Figure 1), 2) in the five columns to the customer's right (tins 1 to 5 and 11 to 15), 3) in the front row (tins 1 to 10), 4) in the back row (tins 11 to 20), or 5) alternating (even tins in the front row and odd tins in the back row, or vice versa). This last "alternating" condition served as the control.[4] See Web Appendix 2

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[3] Since the store was an independent small business making the ice cream in-house, and calorie labeling was not mandatory, it had not conducted nutritional analyses for any products.
[4] The alternating condition was implemented in two different ways: placing target flavors in odd (vs. even) numbered tins in the front row and even (vs. odd) numbered tins in the back row. Because these two alternating implementations are conceptually identical, they were collapsed into a single alternating control condition.

for sample pictures.

Data Recording. A research assistant sat inside the store and recorded the chosen flavor(s) and number of scoops for each purchase decision. The research assistant also collected individual- and store-level data as described below, to control for non-manipulated factors.

Measures

Purchase Decisions. We analyzed purchase quantity and choice proportion of virtue flavors. Purchase quantity was directly measured using the total number of scoops ordered, which varied between one to three scoops. To derive the choice proportion of virtue flavors, we divided the number of virtue scoops chosen by the purchase quantity.

Calorie and Saturated Fat Purchase. To assess consumption consequences, we estimated calories (M = 230, SD = 71) and saturated fat (M = 6.00, SD = 2.90) purchased by each customer using the nutritional analysis described above (Cornil and Chandon 2013). For the flavors for which we did not have calorie and saturated fat content, we imputed category-specific average values separately for virtues and vices.

Control Variables. We collected various individual-level and store-level variables and daily-weather information (see Web Appendix 5).

Results

Web Appendix 6 provides descriptive statistics of purchase decisions and consumption consequences across the different conditions (for a graphical depiction, see Web Appendix 7). To investigate the main and interaction effects of partitioning and assortment organization, we conducted regression analyses with assortment organization effect-coded using the alternating condition as baseline (i.e., coded -1), and the partitioning manipulation dummy-coded (0 = healthfulness vs. 1 = color). Table 1 presents the results[5].

[insert Table 1 about here]

Consistent with the descriptive statistics in Web Appendix 6, the different partitions did not have a main effect on purchase decisions or consumption consequences (all p-values > .05). However, assortment organization affected purchase decisions and subsequent consumption consequences. First, placing virtues at the customers' left of the display significantly reduced purchase quantity (b = –.15, p = .017), but also marginally reduced the choice proportion of virtues (b = –.09, p =.052). The quantity effect was slightly stronger, resulting in a significant reduction of calorie intake (b = –15.48, p = .043), while saturated fats did not decrease significantly (b = –.34, p = .282). Second, placing virtues at the right side significantly increased purchase quantity (b = .15, p = .009), while increasing the choice proportion of virtues (b = .12, p = .008). These opposing forces cancelled out any effects on consumption consequences (all p-values >.10). Finally, placing virtues at the front marginally reduced the quantity purchased (b = –.12, p = .051), which did not significantly affect consumption consequences. By contrast, organizing virtues at the back marginally increased the quantity purchased (b = .12, p = .058), which significantly increased calorie (b = 20.48, p = .013) and saturated fats purchased (b = .82, p = .015).

[5] We conducted the same analyses controlling for non-manipulated variables (Web Appendix 8). While most results were robust after controlling for covariates, we focus on the (marginally) significant effects that appeared in both regressions.

Overall, we found that the effects of left-right organization held for both healthy and colored partitioning. However, placing light-colored flavors to the back flipped the quantity results of placing healthy flavors. Compared to placing healthy flavors to the back, we found a significant reduction in purchase quantity ($b = -.27$, $p = .003$), resulting in a significantly lower calorie ($b = -41.92$, $p < .001$) and saturated fats purchased ($b = -1.67$, $p < .001$).

Discussion

Experiment 1 found a beneficial effect of arranging virtues at the left side on calories and saturated fats purchased (left-side effect). This left-side effect occurred for both partitioning schemes, consistent with the 'dark/light and vices/virtues' association presented in previous research. However, when light-colored flavors were positioned in the back with dark-colored items in the front, unexpectedly, calories and fats were reduced. This effect was opposite to the partitioning based on healthfulness and could be driven by salience as light flavors to the back (and closer to the salesperson) may have attracted more attention. However, this was not expected based on previous literature, and thus, we did not further investigate color-based partitioning in Experiment 2.

Importantly, the left-side effect is consistent with Romero and Biswas' (2016) mental representation hypothesis, which suggests that people organize healthy vs. unhealthy and light vs. dark from left to right. Hence, organizing virtues to customers' left seemed to create a congruence between their mental representations and the display. Furthermore, as many people tend to process information from left to right (e.g., Dallas et al. 2019), this too can contribute to the salience of virtues, thereby increasing their choice probability. Notably, although placing virtue flavors to the left of the customer reduced calorie intake, customers seemed to trade off quantity and virtue choice: they reduced total quantity, but increased proportion of vices. From the perspective of inducing healthy eating, this result is not the most desirable as the two forces cancel each other out. A possible explanation for this finding is that customers were not aware of the choice architecture in terms of the lateral division and therefore did not consciously implement a healthier decision (Valenzuela and Raghubir 2015). Presumably, even matching virtues and vices with the left and right sides of the display might not be sufficient for customers to notice contrasting categories. In Experiment 2, we build on this insight and aim to make the organization manipulation more salient by superimposing traffic-light labeling.

FIELD EXPERIMENT 2

Experiment 2 aimed to examine the effects of superimposing traffic-light labeling on assortment organization while implementing healthfulness-based partitioning for all conditions. While exploring various combinations of specific traffic-light labeling and assortment organization methods, we focused on the left-side effect identified in Experiment 1, and examined whether customers' calorie and saturated fat purchased could be further reduced by traffic-light labeling. We collaborated with the same ice-cream store for 79 days (1,430 customers).

Method

Experiment 2 followed a 5 (assortment organization) x 3 (traffic-light labeling) experimental design. While assortment organization was similar to Experiment 1, we made several changes.

In Experiment 1, we had partitioned flavors either by virtue-vice or by color. Since the results were consistent for the left-right manipulation and virtue-vice based partitioning clearly distinguishes healthier alternatives from less healthy alternatives, we chose to focus on this healthfulness-based partitioning alone. Thus, in Experiment 2, we partitioned items into "virtues" and “vices”: among all 43 different flavors available, 15 flavors were virtues, and 28 flavors were vices. To manipulate assortment organization, we co-located virtue flavors in one of five different ways, which were identical to those used in Experiment 1, i.e., all virtue flavors to the 1) left, 2) right, 3) front, 4) back, or 5) alternating. The alternating condition served as a control condition as in Experiment 1.

Most importantly, in Experiment 2, we introduced traffic-light labeling such that half the flavors were labeled with red labels while the other half received green labels. These labels were co-located in one of three ways. The first two involved left versus right co-locations: all green labels to the customer’s left, and all green labels to the customer’s right. The third condition featured alternating labeling, similar to the alternating organization condition (see Web Appendix 2 for sample pictures). Similar to Experiment 1, we implemented two alternating conditions that we combined for analysis (see Footnote 4). We again changed experimental conditions every day, following a pre-determined schedule. Note that although prior research usually adopted three-color traffic-light labeling (red, yellow, and green), we utilized only red and green to match vice and virtue classifications.

Measures

The research assistant collected the same information as in Experiment 1 (see Web Appendix 5 for the control variables), and calorie and saturated fat purchase were calculated in the same manner.

Results

Web Appendix 9 provides descriptive statistics of consumption consequences and purchase decisions across the organization and traffic-light labeling conditions (for a graphical depiction of this Table, see Web Appendix 10).

Similar to Experiment 1, we used regression analysis to investigate the effect of crossing assortment organization and traffic-light color labeling tools on purchase decisions (quantity and choice decisions) and consumption consequences (calories and saturated fats). Assortment organization was effect-coded as in Experiment 1, and we used two dummy variables for traffic-light labeling: a) green-left (1 = green (red) labels to the flavors at the customers' left (right); 0 otherwise), and b) green-right (1 = green (red) labels to the flavors at the customers' right (left); 0 otherwise). In addition, we included a match variable that equaled 1 for the control condition where virtue flavors in the alternating organizations matched the green labels, -1 if there was a mismatch, and 0 otherwise. As before, we ran regressions with and without controlling for non-manipulated variables (see Web Appendix 11 for the results with covariates). While some results changed after controlling for covariates (see Table 2), our main results were robust. Hence, we focus here on the results without covariates, presented in Table 2.

[insert Table 2 about here]

Unlike Experiment 1, the organization manipulations did not have significant influence on purchase decisions and consumption consequences, compared to the control (alternating) condition (*p*s > .28). Presumably, adding the traffic-light color labeling might distract consumers, nullifying the effect of assortment organizations of virtuous options. Moreover, the traffic-light labeling did not have a strong main effect on purchase decisions or consumption consequences. Even though placing green labels to the right significantly increased purchase quantity ($b = .10$, $p = .010$), leading to increased calorie ($b = 12.65$, $p = .016$) and saturated fat consumption ($b = .45$, $p = .024$), these effects became insignificant after controlling for covariates.

More importantly, matching green color labels with virtues in different assortment arrangements can help customers to make healthier purchase decisions. First, matching green color labels with virtues in an alternated arrangement (‘Alternating Match’) marginally reduced purchase quantity (b = –.11, p =.091), without affecting the choice proportion of virtues (b = .07, p =.123). This resulted in a marginally significant reduction of calorie intake (b = –14.21, p = .084). However, when controlling for covariates, these effects became insignificant.

Second, and in line with our left-side findings of Experiment 1, we found that placing virtues to the left with green labels significantly increased the choice proportion of virtues (b = .12, p = .050), but did not reduce the quantity (‘Left x Green-Left’ interaction, b = –.06, p = .533). Consequently, there were significant reductions in calorie (b = –23.07, p = .048) and saturated fat consumption (b = –1.28, p = .004). These results remained robust after controlling for covariates (see Web Appendix 11).

Finally, as expected, we did not find any robust effects on consumption consequences when red labels were matched with virtues in any location (e.g., ‘Left x Green-Right’ in which virtues are placed with red labels at the customers’ left; ‘Right x Green-Left’ in which virtues are placed with red labels at the customers’ right).

Discussion

Experiment 2 found that the effect of traffic-light color labeling was particularly pronounced when both virtue flavors and green labels were co-located to the *left* of the consumer. In contrast to Experiment 1 where placing virtuous flavors at the left reduced purchase quantity but also the share of virtue options, in Experiment 2 customers rather increased the share of virtue options in their choice. This suggests that when virtue flavors and green labels are placed to the customer’s left, people do not trade-off quantity and virtue choice. Thus, superimposing traffic-light labeling assists consumers in reducing calorie and saturated fat purchase by choosing healthier options, instead of reducing quantity purchase due to enhanced salience of virtues. However, when traffic-light color labels did not match with healthfulness of flavors, no desirable effects were reliably obtained on any outcome variables.

To compute the overall reduction of calories and saturated fat purchased due to co-locating green labeling for virtues at the left, we divided the total left-side effect (i.e., betas for Left, Green-Left, and Left x Green-Left) by the regression constant, which corresponds to the control condition. These analyses reveal that placing virtue flavors and green labels to the left side of consumers reduced calorie purchase by 10.1% and saturated fat purchase by 18.3%. These results are encouraging given that the effect sizes of nutrition labeling in field data tend to be smaller than those obtained from laboratory studies (Dubois et al., 2021) and interventions such as labeling and accessibility-enhancement tend to have relatively small effect sizes (Cadario and Chandon 2020).

GENERAL DISCUSSION

In this research, we explored the interactive effects of choice architecture tools on food purchase decisions (quantity and choice) and subsequent consumption consequences (calorie and saturated fat purchase). Across two long-running field experiments at an ice-cream store, we found that choice architecture tools interactively influence purchase decisions as well as calorific and saturated fat purchase. More specifically, we found that placing virtues to the customer’s left improves healthful decision-making (Experiment 1), and that this effect is accentuated by highlighting virtues with green traffic-light labels (Experiment 2). These effects are observed on purchase quantity and choice proportions for virtues, and carry through to influence the amounts of calories and saturated fats purchased. We explored these effects in an indulgent food context in which assortments contain many alternatives that vary in healthiness.

Contributions

Our research substantively contributes to the existing body of literature on choice architecture and healthy eating by: 1) examining the effects of combining choice architecture tools on food consumption and identifying effective combinations, 2) demonstrating that the same choice architecture tools can influence decision variables differently, depending on which other choice architecture tools are simultaneously in operation, and 3) documenting the effectiveness of combining nudges in promoting healthier food consumption in an actual retail setting where indulgence is expected.

First, our research contributes to the choice architecture literature by examining the effects of combinations of choice architecture tools. Particularly, we found that the left-side effect (i.e., arranging virtues to the left side of the customer) was pronounced when green labels were included, and red labels were displayed on vices to the right of the customer. Our left-side effect replicates the findings of Romero and Biswas (2016) and extends them in several ways in a naturalistic setting by investigating the effects on choice and quantity, as well as consumption consequences. These findings also add evidence for the desirable effects of traffic-light labeling that have been often shown in isolation (Thorndike et al. 2012; VanEpps et al. 2016). By combining it with other choice architecture tools, we further found that the beneficial effects of traffic-light color labeling could be accentuated. Overall, this exploratory approach allows us to discover which combinations of choice architecture tools can best achieve reductions in calorie and saturated fat intake.

Second, in exploring the effects of combining choice architecture tools on important consumption outcomes (calorie and saturated fat intake), we were able to integrate critical decision variables (choice and quantity) in both field experiments, consistent with Wansink and Chandon (2014). This approach enables us to document the novel findings that different combinations of nudges can impact choice and quantity decisions differently. While these nudges are intended to help consumers exert their self-control, it has remained unexplored whether they operate by reducing purchase quantity or by increasing choices of virtues instead of vices. Our results show that depending on which other choice architecture tool is in operation, placing virtues to the left of customers can either decrease purchase quantity or increase choices of virtues. Either way, combining choice architecture tools can induce decreased calorific and saturated fat intake. Our findings suggest that combining nudges can allow consumers to indulge themselves by consuming vices, but in moderation. Moreover, as we found in Experiment 2, adding traffic-light color labeling to virtues on the left side can trigger consumers to substitute vices with virtues without compromising the overall quantity. Together, these findings provide evidence that the same choice architecture tool can induce different behavioral responses, depending on how it is combined with other choice architecture tools. This highlights the importance of further context-specific explorations of such combinations.

Third, our findings demonstrate the effectiveness of choice architecture even in situations where consumers have an existing intention to indulge, and therefore may be most at risk. Till date, particularly in the study of assortment organizations that are concerned with healthy eating, a majority of field experiments have been situated either in neutral environments (e.g., grocery stores, Curhan 1974; workplaces, Baskin et al. 2016), or in locations where health is salient (e.g., hospital cafeterias; Thorndike et al. 2012). It was unclear whether subtle "nudges" would be effective in situations where the default is to indulge. Our research is the first to study this question in the context of a pre-existing intention to indulge (e.g., visiting an ice cream store) and show that in such settings adding traffic-light color labeling may enhance healthy consumption. The fact that we found an effect of assortment organization in this context, even though we did not explicitly instruct consumers to focus on health or highlight other related cues (e.g., nutrition information labeling), is heartening and important.

Practical Implications

The current investigation provides managerially important insights by focusing on a context where retailers decide on the assortment of indulgent foods that vary in healthiness. Many retailers in this area are aware of increasing health concerns of customers, and therefore offer healthier alternatives or even position themselves as food establishments for healthy items. However, such retailers may be concerned about implementing choice architectures that nudge people into healthier choices, as this may reduce purchase quantity and, therefore, sales and profits. As illustrated in Experiment 1, we found that this may indeed be the case if relatively healthy items are displayed to the customers left. Interestingly, superimposing traffic-light color labeling on such partitioning encourages healthier choices without reducing choice quantity. Hence, retailers of indulgent foods who are interested in facilitating healthy eating can consider placing healthy flavors to the left in combination with matching traffic-light color labeling. This intervention increases healthier consumption, improving consumer welfare, without hurting sales. In the long run, retailers may even benefit from this if consumers who seek healthier consumption consequences are retained.

Limitations and Future Research

Our current research has several limitations. First, we measured choice and quantity from buyers only, and had no way to track non-buyers. Hence, we cannot comment on whether the choice architecture tools had any impact on the decision to purchase or not. Second, due to budget constraints, we could only conduct nutrition analysis on the selected most popular flavors and relied on estimated values for calorie and saturated fat content. Third, we operationalized traffic-light labeling using green and red (but not yellow). Consequently, there are differences in the operationalization of traffic-light color labeling between our study and others. Moreover, since we used field experiments, we were not able to investigate the underlying mechanisms. This opens up several interesting questions for future research and theoretical advancement. Why did people make healthier decisions when virtues are placed to their left in an indulgent consumption context? Did this increase fluency and subsequent self-control (Romero and Boswas 2016), or were other processes at play (Casasanto 2009; Deng and Kahn 2009; Chae and Hoegg 2013; Dallas et al. 2019)? Next, by what mechanism did traffic-light labeling increase healthy choices rather than reducing purchase quantity? While most prior research has explicitly informed decision makers of the traffic-light labeling scheme (Thorndike et al. 2012), our implementation was implicit because no such information was given. Future research could address customers' awareness of choice architecture tools. Finally, our findings are limited to one product category in a quick-service retail setting, where nudges may have stronger effects due to low investment of time and effort in decision making (Peters et al. 2016). It is worth exploring whether such effects are observed across different categories and retail settings (e.g., full-service restaurants).

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TABLES

Table 1. Regression Coefficients for the Effects of Choice Architecture Tools on Purchase Decisions and Consumption Consequences (Field Experiment 1).

	Purchase Decisions		Consumption Consequences	
	Quantity	Choice	Calories	Saturated Fats
Partitioning				
Light-colored	–.03	.01	–2.28	–.07[b]
Organization				
Left	–.15*	–.09†	–15.48*	–.34
Right	.15**	.12**	7.24	–.16
Front	–.12†	.04	–10.62[b]	–.15
Back	.12†	–.06	20.48*	.82*
Partitioning x Organization				
Light-colored x Left	.03	.08	4.79	.16
Light-colored x Right	.07	–.12†	18.41†[a]	.84*
Light-colored x Front	.15†[a]	–.06	15.93	.58
Light-colored x Back	–.27**	.09	–41.92***	–1.67***

Note.†p<.10;*p<.05; **p<.01; ***p<.001
[a]The parameter drops from significance ($p \geq .10$) if covariates are controlled for.
[b]The parameter becomes either marginally significant ($p < .10$) or significant ($p < .05$) if covariates are controlled for.
In the regression models, the baseline condition is set to the 'Healthfulness-based' partitioning and 'Alternating' organization conditions. Assortment organization effect-coded using the alternating condition as baseline (i.e., coded -1), and the partitioning manipulation dummy-coded (0 = healthfulness vs. 1 = color).

Table 2. Regression Coefficients for the Effects of Choice Architecture on Purchase Decisions and Consumption Consequences (Field Experiment 2).

	Purchase Decisions		Consumption Consequences	
	Quantity	Choice	Calories	Saturated Fats
Organization				
Left	.01	.02	3.72[b]	.26[b]
Right	–.03	.01	–6.26	–.21
Front	–.03	–.01	–4.71	–.17
Back	–.03	.02	–5.71	–.22
Traffic-Light Labeling				
Green-Left	–.03[b]	–.01	–4.64[b]	–.20[b]
Green-Right	.10*[a]	–.03	12.65*[a]	.45*[a]
Organization x Traffic-Light Labeling				
a. Match between virtues and green labels				
Alternating Match	–.11†[a]	.07	–14.21†[a]	–.44
Left x Green-Left (Match at Left)	–.06	.12†	–23.07*	–1.28**
Right x Green-Right (Match at Right)	–.10	.05	–12.94	–.57
b. Unmatch between virtues and green labels				
Left x Green-Right	–.01	–.05	–4.02	–.10
Right x Green-Left	–.10	–.08	–4.03	–.05
Front x Green-Left	.01	.03	1.62	.08
Front x Green-Right	.16†	–.01	18.60†[a]	.38
Back x Green-Left	–.01	–.10†	7.03	.46
Back x Green-Right	–.00	–.01	4.12	.20

Note.†p<.10;*p<.05; **p<.01; ***p<.001

[a]The parameter becomes insignificant ($p \geq .10$) when covariates are controlled for.

[b]The parameter becomes either marginally significant ($p < .10$) or significant ($p < .05$) if covariates are controlled for.

In the regression models, the baseline condition is set to the 'Alternating' organization with 'Green-Alternating' labeling conditions. Assortment organization was effect-coded and traffic-light labeling dummy-coded: a) green-left (1 = green (red) labels to the flavors at the customers' left (right); 0 otherwise), and b) green-right (1 = green (red) labels to the flavors at the customers' right (left); 0 otherwise). Also, match variables were effect-coded (1 = the control condition where virtue flavors in the alternating organizations matched the green labels; -1 if there was a mismatch; 0 otherwise).

FIGURE CAPTION

Figure 1. In-store display layout featuring assortment organization manipulations as implemented. (A) “Customer’s left”/“Customer’s right” condition; (B) “Front”/“Back” condition; (C) “Alternating” condition.