Menu positions influence soft drink selection at touchscreen kiosks

Contribution Statement

The present research provides insight into a very important consumer-relevant question: how to influence consumers to buy healthier food products, especially at fast food outlets. This question is addressed in the context of consumers buying soft drinks at electronic kiosks, which are becoming the industry-standard in fast food retailing. This article demonstrates the successful application of a nudge intervention. The nudge intervention decreases how often a sugary soft drink is sold from McDonald's touch screen kiosks across stores in England and Wales. We conducted a large-scale field experiment with McDonald's, so our results are ecologically valid and generalizable across the fast food industry. This research is situated within the existing knowledge on how menu positions influence choice. The research adds to what is already known about the consumer-relevant problem by showing how switching the order of soft drink options on electronic kiosks influences which soft drink consumers select.

Abstract

The current study investigates whether companies can influence which soft drink consumers select on touchscreen kiosks. Soft drink options presented on touchscreen kiosks are multi-dimensional stimuli represented by icons and locations. Overtime the pairing of icon and location forms an expectation that certain icons will be in certain locations. As a result of these location expectations, changing the order of the soft drinks may help consumers consider more healthful items. In the current study, the Coca-Cola icon was moved from the first to last location and the Coke Zero icon from the third to first. The intervention decreased the number of times Coca-Cola was sold and increased the number of times Coke Zero was sold. The discussion explores the rationale for the intervention and the importance of fitting interventions into existing choice environments to modify real-world behavior.

Keywords: Nudge; Decision making; Attention; Menu position; Soft drinks.

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Public health interventions aim to change people's unhealthy behaviors (Quigley, 2013). Behavior change can be achieved through harder or softer mechanisms, e.g., through mandates or nudges (Thaler & Sunstein, 2003). As an example of a mandate, in 2016 the United Kingdom announced The Soft Drinks Industry Levy, which placed an additional tax on soft drinks that contained five or more grams of sugar per 100 ml (HM Treasury, HM Revenue & Customs, & Department of Health & Social Care, 2016). In response, The Coca-Cola Company reduced the sugar content in many of their soft drinks, such as Fanta, but not in their best seller, Coca-Cola. In contrast to mandates, softer mechanisms like nudges might involve something as simple as changing the order in which items appear on a menu. The present study investigates whether this kind of light-touch, low-cost nudge intervention can reduce the sale of sugary soft drinks.

Healthful eating has been the focus of myriad light-touch, low-cost nudge interventions. A 2016 meta-analysis identified 42 studies describing nudge interventions related to healthful eating (Arno & Thomas, 2016). Over half of the studies involve changing an aspect of the food options' reachability (N=24 studies, e.g. Rozen, et al., 2011) and over a quarter involve increasing people's awareness of nutritional information (N = 13, e.g. Kiessel & Villas-Boas, 2013). The remaining interventions involve primes (N= 2, e.g. Shimizu, et al., 2010), distractions (N = 2, e.g. Hetherington et al., 2006), and, finally, within-meal food variety (N = 1, Norton, et al., 2006). The present study demonstrates a novel and effective light-touch, low-cost nudge intervention for changing consumers' food choices in a real-world setting: Consumers' pre-existing, product-specific location expectations.

While the practice of using light-touch, low-cost psychological mechanisms to influence public behavior is nothing new (Marchiori et al., 2017), its popularity was enhanced by Thaler and Sunstein (2008). According to Thaler and Sunstein (2008), nudge theory posits

that altering the choice architecture (the environment within which people make choices) without explicitly forbidding any options or significantly changing their economic incentives can influence people's behavior in predictable ways not anticipated by rational economic theory. This is possible because the human brain uses a number of automatic (and often subconscious) heuristics to simplify decision-making, and these heuristics can lead people to behave in predictably biased ways (DellaVigna, 2009).

The idea of a "nudge" intervention expressed in Thaler and Sunstein (2008) helped to found the Behavioural Insights Team in the United Kingdom. The Behavioural Insights team developed a framework called MINDSPACE to categorize the largely automatic and contextual effects of the environment on behavior (Dolan et al., 2012). MINDSPACE then served as the team's initial operating framework (Vlaev et al., 2016). Recently, more focused types of behavioral units operating within government ministries and departments have emerged. To date, the number of such dedicated institutional units has exceeded 50 in governments around the world (OECD, 2018). In addition, there are many other government teams involved in applying behavioral insights to policy, and similar initiatives have been started by universities and non-government organizations, as well as by the private sector.

Laboratory and field studies find that the order of simultaneously presented items can influence which item(s) people select. This order effect is realized by at least two mechanisms (Bar-Hillel, 2011; Rodway, Schepman, & Thoma, 2016). The first mechanism is physical reachability (Bar-Hillel, Peer, & Acquisti, 2014). The idea is that, ceteris paribus, items located in the most reachable location are the most likely to be selected. When consumers are facing the center of a horizontal array of items, the middle item is typically the easiest to reach (Bar-Hillel, 2015). Shaw et al. (2000) appeal to reachability to explain their finding that participants were most likely to select a highlighter pen from the middle of three highlighters and to select a paper survey from the middle of three piles of surveys.

The second mechanism involves people's beliefs, general or specific, about where the most preferred item(s) is placed. The usefulness of this mechanism to helpfully impact people's behavior is largely unexplored in real-world settings. However, in a laboratory study, where some participants were told that pretzel packs were ordered randomly while others were told that they were ordered naturally, it was found that those in the random condition were less likely to select the middle pack than those in the market condition (Valenzuela & Raghubir, 2009). This finding suggests that consumers have general beliefs about where the most preferred item(s) are placed on market shelves.

McDonald's consumers' choices are likely affected by reachability and by general and specific beliefs. Before the current intervention, soft drinks were presented on McDonald's touchscreen kiosks in the following order: Coca-Cola, Diet Coke, Coke Zero, Sprite Zero, Oasis, and Fanta (Figure 1A). As the middle options were already no sugar options, neither their reachability (Bar-Hillel, 2015) nor people's general preference for the middle (Valenzuela & Raghubir, 2009) could be used to change consumers' choices. However, using consumers' specific beliefs was a viable option. General location preferences may be altered by experience with particular products, whereby consumers develop specific location expectations (Dreze, Hoch, & Purk, 1994: Valenzuela, Raghubir, & Mitakakis, 2013).

Consumers who had experienced using McDonald's touchscreen kiosks likely expected to see each soft drink represented by a particular icon in a particular location. The current intervention relies on such product-specific location expectations at McDonald's touchscreen kiosks to change consumers' choices, thus this paper examines a novel nudge intervention for changing consumers' food choices in a real-world setting. Specifically, the intervention swapped the location on Coca-Cola, which was in the first location on

McDonald's touchscreen kiosks, with Coke Zero, which was in the third location (Figure 1B). The following two hypotheses were developed to assess the intervention's effects:

H1: Coca-Cola sales will decrease from pre- to post- intervention.

H2: Coke Zero sales will increase from pre- to post- intervention.

Given the overall changes to menu order, the present intervention might also influence how often other soft drinks are sold. However, these are of less interest and we do not make specific hypotheses as to the direction of any such changes. Furthermore, we anticipate that the effect sizes of such incidental changes with be considerably smaller than the effect sizes of the changes related to the two target drinks: Coca-Cola and Coke Zero.

Method

United Kingdom's McDonald's Restaurants Limited provided the research team with data from English and Welsh stores. At the time of this study, most stores in England and Wales used electronic kiosks to allow consumers to place their own orders, but soft drinks were dispensed by staff behind the front counter. Free refills were not offered. The data set includes the number of soft drink sales that occurred between July 24th 2016 and January 7th 2017. The intervention was implemented on October 16th 2016, so the data set includes information for 12 weeks pre- and 12 weeks post-intervention. Temporally adjacent time-periods were selected to ensure that the intervention was the only change made to the way soft drinks were presented on the touchscreen kiosks. The data set contains information from 622 stores with touchscreen kiosks. To be included in the analyses, a store had to have a record of sales for every week of the study and, for every week, had to have sold at least one of each type of soft drink. This second criterion was added to ensure that the stores used in the study had all six types of soft drink available for purchase every week.

We considered the shorter- and longer-term effects of the intervention in terms of both descriptive statistics (medians and standard deviations) and non-parametric inferential

statistics. To assess the shorter-term effects, soft drinks sold in stores during the week pre-intervention and during the week post-intervention were compared using seven Wilcoxon-Signed Rank tests. One test compared the total number sold pre- and post-intervention and the other six compared the numbers sold pre- and post-intervention for each soft drink. The conventional significance level was used to evaluate statistical results 0.05 (2-tailed), and precise p-values over 0.001 are stated. To assess the longer-term effects of the intervention, soft drinks sold during the 12 weeks pre-intervention and during the 12 weeks post-intervention were also compared in the same way.

In addition to the number of sales, the data set also includes each store's postcode. Each postcode was linked to its decile Index of Multiple Deprivation, an index measuring a geographic area's level of deprivation or poverty by combining seven different aspects, where 1 = the most deprived and 10 = the least deprived (Swirrl IT Ltd, 2015). The relationship between the communities' levels of deprivation and the intervention's effects were examined using four Spearman's Rank-Order correlations. The first and second correlations examined the relationship between the communities' levels of deprivation and the intervention's shorter-term effects on the sale of Coca-Cola and Coke Zero, respectively. The third and fourth correlations examined the relationship between the communities' levels of deprivation and the intervention's longer-term effects on the sale of Coca-Cola and Coke Zero, respectively. For the correlational analyses, the effect of the intervention was assessed by the difference in the number of sales, post-intervention minus pre-intervention. The significance level was set at 0.05 (2-tailed).

Results

Three aspects of the data are considered: i) the shorter-term effects of the intervention, ii) the longer-term effects of the intervention, and iii) the relationship between the communities' levels of deprivation and the intervention's effects.

Shorter-term Effects

Of the 622 stores, 511 had sufficient sales to be included in the analyses. The descriptive statistics (medians and standard deviations) are presented in the left half of Table 1. The total number of soft drinks sold within each store remained largely stable from the week pre-intervention to the week post-intervention. While the popularity of each soft drink also remained largely stable, notably sales of Coca-Cola decreased (Mdn_{pre} = 364 to Mdn_{post} = 330) and sales of Coke Zero increased (Mdn_{pre} = 88 to Mdn_{post} = 107).

Figure 2 shows the median store's sale differences between the week post-intervention and the week pre-intervention for each type of soft drink sold. Coca-Cola has the most negative bar indicating the largest decrease in sales, and Coke Zero has the most positive bar indicating the largest increase in sales.

Sales for the week pre- and post-intervention were compared using seven Wilcoxon-Signed Ranked tests. The total number of soft drinks sold decreased, $Z = 2.89$, $p = 0.004$, $r = 0.09$, with 218 negative ranks, 209 positive ranks, and 2 ties. As predicted, there was a significant decrease in the number of times Coca-Cola was sold, $Z = 14.98$, $p < 0.001$, $r = 0.47$,[1] with 410 negative ranks, 98 positive ranks, and 3 ties. Also, as predicted there was a significant increase in the number of times Coke Zero was sold, $Z = 15.68$, $p < 0.001$, $r = 0.49$, with 80 negative ranks, 427 positive ranks, and 4 ties. There was also a significant increase in the sales of Diet Coke, $Z = 4.67$, $p < 0.001$, $r = 0.15$, with 209 negative ranks, 292 positive ranks, and 10 ties and Sprite Zero, $Z = 3.45$, $p = 0.001$, $r = 0.11$, with 218 negative ranks, 276 positive ranks, and 17 ties. . Significant changes were not found for the remaining soft drinks: Oasis ($Z = 0.16$, $p = 0.88$ $r = 0.005$) and Fanta ($Z = 0.23$, $p = 0.82$ $r = 0.007$).

[1] Effect sizes were calculated using AICBT Ltd.'s Comparing two sets of data sets online tool on 21-09-2018. Experimental design was set to 'Same Subject' and data to 'Non-parametric.' To access this tool go to: https://www.ai-therapy.com/psychology-statistics/hypothesis-testing/two-samples?groups=0&parametric=1

177 **Longer-term Effects**

178 Of the 622 stores, 367 had sufficient sales to be included in the analyses. The
179 descriptive statistics (medians and standard deviations) are presented in the right half of
180 Table 1. Similar to the shorter-term effects, the total number of soft drinks sold and the
181 popularity of each soft drink remained largely stable. As expected, sales of Coca-Cola
182 decreased (Mdn_{pre} = 4558 to Mdn_{post} = 4213) and sales of Coke Zero increased (Mdn_{pre} =
183 1043 to Mdn_{post} = 1360).

184 Figure 3 shows the median store's sale differences from the 12 weeks post-
185 intervention to the 12 weeks pre-intervention. The total number of soft drinks sold in stores
186 did not change significantly, $Z = 1.67$, $p = 0.10$, $r = 0.06$. As predicted, there was a significant
187 decrease in the number of times Coca-Cola was sold, $Z = 8.96$, $p < 0.001$, $r = 0.33$, with 265
188 negative ranks, 102 positive ranks, and 0 ties. Also, as predicted, there was a significant
189 increase in the number of times Coke Zero was sold, $Z = 15.75$, $p < 0.001$, $r = 0.58$, with 22
190 negative ranks, 245 positive ranks, and 0 ties. There was also a significant increase in the
191 sales of Diet Coke, $Z = 3.28$, $p = 0.001$, $r = 0.12$, with 157 negative ranks, 208 positive ranks,
192 and 2 ties, and Fanta, $Z = 2.72$, $p = 0.01$, $r = 0.10$, with 161 negative ranks, 204 positive
193 ranks, and 2 ties. Significant changes were not found for the remaining soft drinks: Sprite
194 Zero ($Z = 1.40$, $p = 0.16$, $r = 0.05$) and Oasis ($Z = 1.56$, $p = 0.12$, $r = 0.06$).

195 **Relationship between level of deprivation and the intervention's effects**

196 Indices of deprivation were located for 476 of the 511 stores' postcodes included in
197 the analyses of shorter-term effects. The relationship between these communities' levels of
198 deprivation and the intervention's shorter-term effects on Coca-Cola was not significant,
199 $r(511) = 0.08$, $p = 0.09$. This was also true for Coke Zero, $r(511) = 0.02$, $p = 0.74$.

200 Indices of deprivation were located for 344 of the 367 stores' postcodes included in
201 the analyses of longer-term effects. The relationship between these communities' levels of

deprivation and the intervention's longer-term effects was not significant, for Coca-Cola, $r(344) = -0.09$, $p = 0.08$, and for Coke Zero, $r(344) = -0.09$, $p = 0.11$.

Discussion

The present study demonstrates that a light-touch, low-cost nudge can decrease how often a sugary soft drink is purchased and increase how often a no sugar soft drink is purchased. The intervention changed the positions of two soft drinks on McDonald's touchscreen kiosks: Coca-Cola was moved from the first to the last position and Coke Zero from third to first. Both the shorter-term and longer-term analyses showed decreases in Coca-Cola sales and increases in Coke Zero sales. Our intervention did influence the sales of other soft drinks as well, but as predicted, the effect sizes of these changes were considerably smaller (*r's* ranging from 0.005 to 0.15 compared to *r's* ranging from 0.33 to 0.58).

Two mechanisms relevant to order effects were described in the introduction. The first involved reachability. As previously noted, the current intervention did not draw from this explanation. The most reachable items on the touchscreen kiosks were already no sugar options. In other choice environments, however, reachability would be an attractive feature on which to intervene. For example, at a salad bar Rozin et al. (2011) found that items such as cheese and broccoli were more likely to be selected when they were placed in easier to reach locations (the edges) than when they were placed in harder to reach locations (the middle). Also, when eating pre-packaged meals, Rolls, Roe, and Meengs (2007) found that people tended to consume more food when items were packaged in larger portions. Plausibly, this is due to the fact that having to open a new package makes the food less reachable.

The second mechanism had to do with people's beliefs about the way items are ordered. These beliefs can be general, i.e., regarding general product placement, or specific, i.e., regarding product-specific placement. Valenzuela and Raghubir's (2009) study describes consumers' general location preferences for the middle item on market shelf displays. Atalay,

Bodur, and Rasolofoarison's (2012) eye-tracking study is consistent with Valenzuela and Raghubir's finding, as the middle item in horizontal arrays tends to receive the most visual attention. While the item consumers attend to most is not necessarily predictive of their ultimate choice (Chandon, et al. 2007), awareness of an item is necessary to choose it. As the middle items on McDonald's kiosks were already no sugar options, we could not make use of consumers' location preferences for the middle item to help them make healthful choices.

The current intervention drew not from general beliefs but from specific beliefs regarding product-specific location expectations on McDonald's touchscreen kiosks. Pre-intervention, Coca-Cola was McDonald's best seller and was placed in the first location. Our theory has two components: (1) As the first location would be expected to hold the most popular drink item, Coca-Cola, a significant portion of consumers would initially look at the first item (Fitousi 2016; Simon, 1969), and (2) many who found the first item they looked at satisficing would choose it without considering additional items (Simon, 1956; Schwartz, 2002). Put another way, our theory is that if consumers' act as satisficers (rather than as maximizers) when choosing soft drinks and find Coke Zero to be a satisfactory option, then presenting Coke Zero in the first place they are likely to look will cause many to choose this more healthful option (or at least consider options other than Coca-Cola). It is possible that some consumers mistakenly selected Coke Zero thinking it was Coca-Cola, but these initial mistakes alone cannot reasonably explain the results of our longer-term analyses.

While the practical potential of nudge interventions is exciting, the academic expansion of nudge theory has been limited. This limitation is partly due to the term "nudge" not being clearly defined by Thaler and Sunstein (2008 p. 6; Marteau, et al, 2011; Bonell, et al. 2011). The explosion of new interventions without a clear definition has led to many interventions mistakenly being called "nudges" merely because they are informed by

psychology and behaviorial economics (Selinger & Whyte, 2011). To streamline the inquiry, Hollands et al. (2013, p. 3) put forth the following operational definition:

> "[Nudge interventions] involve altering the properties or placement of objects or stimuli within micro-environments with the intention of changing health-related behaviour. Such interventions are implemented within the same micro-environment as that in which the target behaviour is performed, typically require minimal conscious engagement, can in principle influence the behaviour of many people simultaneously, and are not targeted or tailored to specific individuals."

The current intervention clearly meets this definition and so forwards a more focused debate around the effectiveness of nudge interventions regarding health-related behavior.

The present project can also be seen as contributing to habit theory. Habits are behaviors formed through associative mechanisms that are automatically activated by environmental cues (Vlaev & Dolan, 2015). People report that nearly half of their food-related behaviors are habitual (Wood et al., 2002). Consumers' food-related habits are likely cued by physical stimuli, e.g. the sight or smell of McDonalds, and patterned events, e.g. stopping at McDonalds on the way home from work (Gardner et al., 2012). According to Verplanken and Wood (2006, p. 100) "when old cues to everyday activities change, habits are disrupted, and people potentially are spurred to think about their actions and perhaps to use their intentions as a guide to new choices." Altering the order in which simultaneously presented items appear on a menu can be seen as disrupting the old cues, in this case, the perceptual stimulus of a Coca-Cola icon on the kiosk screens in the location that many consumers first look. This disruption may have given these consumers a chance to "think about" their otherwise habituated menu choice. In other words, the present intervention can be understood in terms of habit theory, whereby what we did was to disrupt the cues for purchasing Coca-Cola.

Now we would like to acknowledge several limitations. One limitation is that qualitative information was not collected to say how consumers felt about the intervention. It would be interesting to know if consumers were even aware of the change. Previous qualitative studies suggest that consumers find nudges that promote healthy food choices acceptable (Nørnberg, et al 2016), with their attitudes being more positive when the intervention is perceived as being "effective" and "fair" (Bos, et al 2013). Although we do not know how consumers felt about our intervention, we do know that McDonald's did not receive sufficient complaints for them to revert to the old ordering: As of March 2019, McDonald's electronic kiosks in the UK still place Coke Zero first and Coca-Cola last. Another limitation is that the study is a repeated measures design without a control condition. It is possible that a rapid cultural change occurred across England and Wales where people switched to Coke Zero independent of our intervention, but this possibility seems to require an incredible and unexplained coincidence, given the results of our shorter-term analyses.

It is not obvious whether a laboratory setting is suitable for addressing these limitations. While some features of the current real-world study are easy to transfer to the laboratory setting, others are not. For example, one could readily vary the order in which six soft drinks are placed on a computer screen and measure which soft drink participants select. However, one cannot easily shape participants' expectations for where soft drinks are located. Perhaps, one could ask participants to complete a series of consecutive trials making an artificial choice after each. However, as the overall proportion of participants who switch to Coke Zero will be low, many participants would be needed. Further, the face-validity of this method seems unacceptably low, because participants would be making artificial choices. Indeed, if consumers' ordering expectations are part of a longer string of their actual ordering habits, then the laboratory setting itself may be wholly inappropriate.

The present intervention relied on product-specific location expectations to change consumers' choices, thus demonstrating a novel and effective nudge intervention option for changing consumers' food choices in a real-world setting. Having many intervention options is important, because choice environments restrict what intervention options are feasible. As mentioned previously, the pre-intervention ordering on McDonald's kiosks made reachability and consumers' general preference for the middle unsuitable intervention options. Moreover, the present intervention's effects might not generalize to McDonald's in the United States. In the States, at present, the soft drink consumers order may not be the same as what they consume: consumers can discard, fill, and refill their drinks freely at a self-serve dispenser.

In closing, we encourage managers and public policy makers to consider how the physical layout of their environment influences people's expectations and to think about how those expectations can be leveraged to improve public health. Where habits have some command over human behavior, there is likely room for a nudge. This said, it is implausible that nudge interventions alone can solve overconsumption problems. Rather, nudges should be considered as just one part of a multifaceted approach to helping consumers make more healthful choices.

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436 Figure Legends

437

438 Figure 1. Diagram of the touchscreen kiosks display pre- and post- intervention

439

440 Figure 2. The median change between the number of soft drinks sold the week pre-

441 intervention and the week post-intervention

442

443 Figure 3. The median change between the number of soft drinks sold the 12 weeks pre-

444 intervention and the 12 weeks post-intervention

445

Table 1. Medians and standard deviations for items sold pre- and post-intervention

Soft Drink Type		1-Week Pre-Intervention	1-Week Post-Intervention	12-Weeks Pre-Intervention	12-Weeks Post-Intervention
Coca-Cola	Median	364.00	330.00	4558.00	4213.00
	(Std. Deviation)	(339.72)	(296.93)	(3895.27)	(4046.59)
Coke Zero	Median	88.00	107.00	1043.00	1360.00
	(Std. Deviation)	(75.26)	(94.15)	(829.25)	(1185.87)
Diet Coke	Median	130.00	133.00	1766.00	1775.00
	(Std. Deviation)	(104.50)	(106.33)	(1277.56)	(1444.60)
Fanta	Median	133.00	132.00	1728.00	1788.00
	(Std. Deviation)	(122.15)	(121.39)	(1474.10)	(1701.93)
Oasis	Median	67.00	68.00	918.00	891.00
	(Std. Deviation)	(55.73)	(55.77)	(649.72)	(733.77)
Sprite Zero	Median	51.00	52.00	723.00	702.00
	(Std. Deviation)	(47.58)	(48.10)	(552.81)	(596.35)
Total Number	Median	842.00	829.00	10806.00	10786.00
	(Std. Deviation)	(717.22)	(694.18)	(8449.81)	(9515.17)

Figure 2. The median change between the number of soft drinks sold the week pre-intervention and the week post-intervention

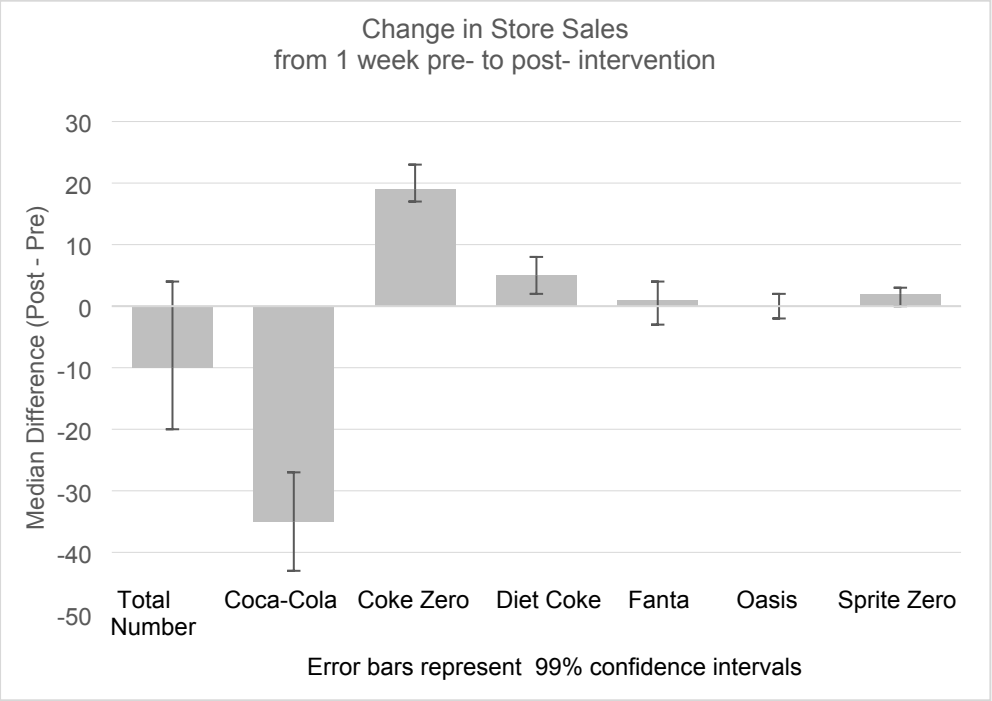

Figure 3. The median change between the number of soft drinks sold the 12 weeks pre-intervention and the 12 weeks post-intervention