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Leveraging the Happy Meal Effect: Substituting Food With Modest Nonfood Incentives Decreases Portion Size Choice

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Despite much effort to decrease food intake by altering portion sizes, "super-sized" meals are the preferred choice of many. This research investigated the extent to which individuals can be subtly incentivized to choose smaller portion sizes. Three randomized experiments (2 in the lab and 1 in the field) established that individuals' choice of full-sized food portions is reduced when they are given the opportunity to choose a half-sized version with a modest nonfood incentive. This substitution effect was robust across different nonfood incentives, foods, populations, and time. Experiment 1 established the effect with children, using inexpensive headphones as nonfood incentives. Experiment 2—a longitudinal study across multiple days—generalized this effect with adults, using the mere chance to win either gift cards or frequent flyer miles as nonfood incentives. Experiment 3 demonstrated the effect among actual restaurant customers who had originally planned to eat a full-sized portion, using the mere chance to win small amounts of money. Our investigation broadens the psychology of food portion choice from perceptual and social factors to motivational determinants.

Keywords: psychology of food choice, portion size, choice substitution, inexpensive toy incentives, uncertain monetary incentives

In many societies, escalations in the incidence of obesity can be observed with high costs to individuals and health care systems (Ng et al., 2014). Medical research provides a solution to this problem by suggesting that people should eat less (Lamberg, 2006). Yet, this advice is easier to give than to either follow or enforce in societies that value freedom of choice. One stream of research shows that smaller portion sizes can drastically decrease the overall quantity of food consumed (e.g., Geier, Rozin, & Doros, 2006; Geier, Wansink, & Rozin, 2012; Levitsky & DeRosimo, 2010; Rolls, Roe, & Meengs, 2006; Rozin, Kabnick, Pete, Fischler, & Shields, 2003). The possibility of decreasing food intake by altering portion sizes has been previously investigated, using several different yet related presentations, such as smaller containers (e.g., Wansink, 1996; Wansink & Kim, 2005) and smaller dishes (e.g., van Ittersum & Wansink, 2012; Wansink & Cheney, 2005; Wansink & van Ittersum, 2013). Yet, "super-sized" meals (Nielsen & Popkin, 2003), "family-sized" cereal cartons (Wansink & van Ittersum, 2007), and "all-you-can-eat" buffets (Wansink & Payne, 2008) are frequently chosen, suggesting that many individuals lack the motivation to choose less. Moreover, although smaller portion sizes can help individuals to cut their overall food intake, marketplace demand for such products is low, raising concerns from food providers about profitability (Jain, 2012). As a result, some food providers have withdrawn smaller portion sizes from the marketplace (Sharpe, Staelin, & Huber, 2008). Is there a way to provide individuals with *modest incentives* to choose smaller portion sizes in order for food providers to maintain or reintroduce smaller portions to menus and shelves? In other words, could we leverage the effect of a toy in a "Happy Meal" to motivate consumers to choose not the large meal but a smaller food portion?

The present research is the first to argue and show that individuals can indeed be so motivated by exchanging parts of a food with a *modest* nonfood incentive. To illustrate, individuals who are given a choice of eating a full-sized sandwich may be willing to substitute half of the sandwich for the *mere* chance of winning a small $10 lottery. Our studies provide empirical evidence supporting this effect. Our research thus contributes to and extends prior research that shows that money can incentivize individuals to stay off drugs (Higgins et al., 1991; cf. a review by Lussier, Heil, Mongeon, Badger, & Higgins, 2006), quit smoking (Volpp et al., 2009), lose weight (Kullgren et al., 2013), and choose healthier food options (Just & Price, 2013; but see Gneezy, Meier, & Rey-Biel, 2011, for situations in which incentives may not modify behavior).

Whereas prior research provides important preliminary insights into the effectiveness of exchanging both natural and artificial substances (food, nicotine, cocaine) with money, participants in

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these studies were—more often than not—paid large amounts of money to motivate a healthier choice. Clearly, providing *large* monetary incentives with *sure* payouts to motivate individuals to choose less food can quickly become uneconomical for food providers, health insurers, or workplace wellness programs. Our research works around this issue by showing that motivating smaller portion choices can be accomplished even with *nominal* incentives and with incentives whose receipt is *uncertain*. That is, we show that an inexpensive gadget (earphones) or the mere chance to win a modest amount of money suffice in motivating voluntary choice and consumption of smaller food portions. This is an important extension of earlier research, which has rewarded large amounts of money (e.g., hundreds of dollars) for meeting weight-loss goals in clinical settings (Kullgren et al., 2013). Instead, our research implies that food providers can offer small, uncertain incentives to get individuals to choose less food and remain profitable because the payouts are nominal and costs can be distributed over dozens of customers.

Theoretical Background

Choosing Smaller Food Portions

Much research in the area of portion choice has focused on size perception and size processing as determinants of smaller portion choice. For example, smaller bowls and plates and more slender glasses have been shown to reduce chosen serving sizes (e.g., Wansink & Cheney, 2005). These effects have often been explained by cognitive biases (Geier & Rozin, 2009; Geier et al., 2006) and perceptual illusions (van Ittersum & Wansink, 2012; Wansink & van Ittersum, 2013).

Notably, there is a dearth of research on how individuals can be incentivized and, thus, *motivated* to deliberately choose smaller portions. This research gap aroused our curiosity because in today's marketplace many factors seem to encourage larger portion choice. For example, individuals perceive that larger-sized versions offer more value for money (Steenhuis & Vermeer, 2009). Additionally, their perceptions of what constitutes a "normal" portion size are distorted; many individuals perceive larger portion sizes as the more appropriate amount to consume (Steenhuis & Vermeer, 2009). Individuals are also often socially influenced to choose larger-sized food portions (e.g., McFerran, Dahl, Fitzsimons, & Morales, 2010). Is it possible to override these potent mechanisms?

Choice Substitution as a Motivational Determinant of Smaller Portion Choice

Little research has investigated motivational drivers of healthy decision making (Suri, Sheppes, Leslie, & Gross, 2014). To address the aforementioned research gap, the present investigation introduces a novel motivational determinant of smaller food portion choice. We labeled this determinant *choice substitution*; that is, the extent to which choice options in fundamentally different categories can be seen as equivalent to, and hence substitutable for, one another.

Traditionally, only rewards that are vegetative in nature (e.g., solid and liquid foods) have been associated with appetitive and survival values (Schultz, 2006), whereas stimuli that are artificial (e.g., money) have been thought to lack such appetitive and survival values. Consequently, extant research has asked whether stimuli in one category (vegetative) would ever be substitutable with stimuli in a fundamentally different one (artificial; Drèze & Nunes, 2004; Nunes & Park, 2003; Zhang & Breugelmans, 2012). However, more recent research has shown that humans reveal similar behavioral responses (e.g., salivation) to both vegetative and artificial choice options, including money (e.g., Briers, Pandelaere, Dewitte, & Warlop, 2006) and expensive material goods such as sports cars (e.g., Gal, 2012). This similarity may be based on the fact that individuals can be conditioned to the delivery of artificial stimuli in a manner akin to the inherent desire for vegetative rewards. In that sense, artificial stimuli, such as money, can become conditioned reinforcers (Wise, 2002). This novel notion of similarity in behavioral responses to both vegetative and artificial choice options leads to the questions of whether it is possible to partially substitute a stimulus in one category (food) for one in another category (money, gadget) in the quest to alter portion size choice. If it does, one would predict the following.

> *Hypothesis 1:* Small, inexpensive, and uncertain nonfood incentives are partially substitutable for food and can motivate smaller portion choice.

Our research is the first to investigate whether individuals would eat less when offered an inexpensive material incentive (ear-bud headphones) or the mere chance to win a small sum of money (a lottery with the uncertain payout of $100). We also investigated whether this effect would be stable over time and not lead to later food compensation.

Experiment 1

Overview and Method

Experiment 1 aimed to provide initial evidence for the effect of substituting food with nonfood incentives in order to decrease portion choice. We employed real foods and a real nonfood incentive (inexpensive headphones) and sampled sixth graders for our study. We deemed this group a highly relevant population to test our effect, because children seem to crave food more than adults (Silvers et al., 2014), because more than one third of schoolchildren suffer from overweight and obesity (Centers for Disease Control and Prevention; CDC; 2014), and because schools' lunch meals and portion sizes have repeatedly come under public scrutiny (Epstein et al., 2006; Nestle, 2013).

Experiment 1 employed a between-subjects experimental design with *nonfood incentive* (absent; present) as the independent variable and *full-sized portion choice* as the dependent variable. One hundred twelve sixth-grade schoolchildren from a school district in a major metropolitan area (64 girls; M_{age} = 10.92 years, SD_{age} = 0.33, ranging from 10–12 years) participated in this study individually with parental disclosure and teacher approval. The sample consisted of multiple classes of sixth graders, which the school district had assigned to our study, thereby determining the sample size. Two weeks prior to the date of the experiment, the school teachers asked students whether they would prefer either an avocado, ham, roast beef, tuna, or turkey sandwich for an upcoming lunch. According to children's preferences, we ordered sandwiches from the popular sandwich restaurant Togo's and picked them up on the day of the study. Data from the full sample was usable and none of the collected cases were excluded from further analyses.

At lunchtime, participants were randomly assigned to one of two conditions. We set up a mock-up cafeteria in two different classrooms. In the "nonfood incentive absent" condition, participants were offered the choice between either a full-sized version of their preferred sandwich (9 in.) or exactly half of that sandwich (4.5 in.). In the "nonfood incentive present" condition, participants were offered the choice between either a full-sized version of their preferred sandwich (9 in.) or the combination of exactly half of that sandwich (4.5 in.) and a pair of inexpensive ear-bud headphones. We had previously purchased the headphones for $1.33 apiece from a retailer. The average value of the full-sized sandwich was $7.58 (including tax). Therefore, the combination of half portion and headphone was less valuable ($3.79 + $1.33 = $5.12) than the full portion alone (= $7.58). From a utility maximization perspective, participants should thus choose the full-sized portion. Participants were asked to mark on a sheet of paper which portion size they would prefer to eat. Figure 1 illustrates the choice options. Participants also reported their gender, age, height, weight, and hunger level (1 = *not at all hungry*; 5 = *very hungry*). After handing in their choice sheet, participants claimed their sandwich or, respectively, sandwich/headphone combination and proceeded to the lunch area. Choice served as the dependent variable. Half-sized portion choices were coded as 0 and full-sized portion choices were coded as 1. We calculated the body-mass-index (BMI) of each participant using a standard age-adjusted formula for children (CDC, 2015b).

Results

Effect of nonfood incentive on full-sized portion choice. We analyzed the extent to which participants would choose half-sized portions (over full-sized portions) if the half-sized portions were paired with nonfood incentives. We regressed nonfood incentive on full-sized portion choice by estimating a binary logistic regression model. The regression model revealed a significant negative effect of nonfood incentive on full-sized portion choice ($B = -2.31$, $SE = .44$, Wald = 26.98, $p < .001$): participants in the "nonfood incentive present" condition chose the full-sized sandwich to a significantly lesser extent (22% chose the full-sized portion) compared with participants in the "nonfood incentive absent" condition (74% chose the full-sized portion; $\chi^2 = 30.16$, $p < .001$).

Control variables. We mean-centered the variables gender, BMI, and hunger level. We then calculated interaction terms: Nonfood Incentive × Gender, Nonfood Incentive × BMI, and Nonfood Incentive × Hunger Level. We did not include age in the regression model because we had already controlled for age by sampling from the same age group (sixth graders with an age range from 10 to 12 years). We regressed nonfood incentive, gender, BMI, hunger level, and the interaction terms on full-sized portion choice by estimating a binary logistic regression model. The regression model confirmed a significant negative effect of nonfood incentive on full-sized portion choice ($B = -1.97$, $SE = .79$, Wald = 6.16, $p = .013$). Hunger level had a significant positive effect on full-sized portion choice ($B = 1.14$, $SE = .57$, Wald = 4.09, $p = .043$), but neither gender ($p = .809$), BMI ($p = .868$),

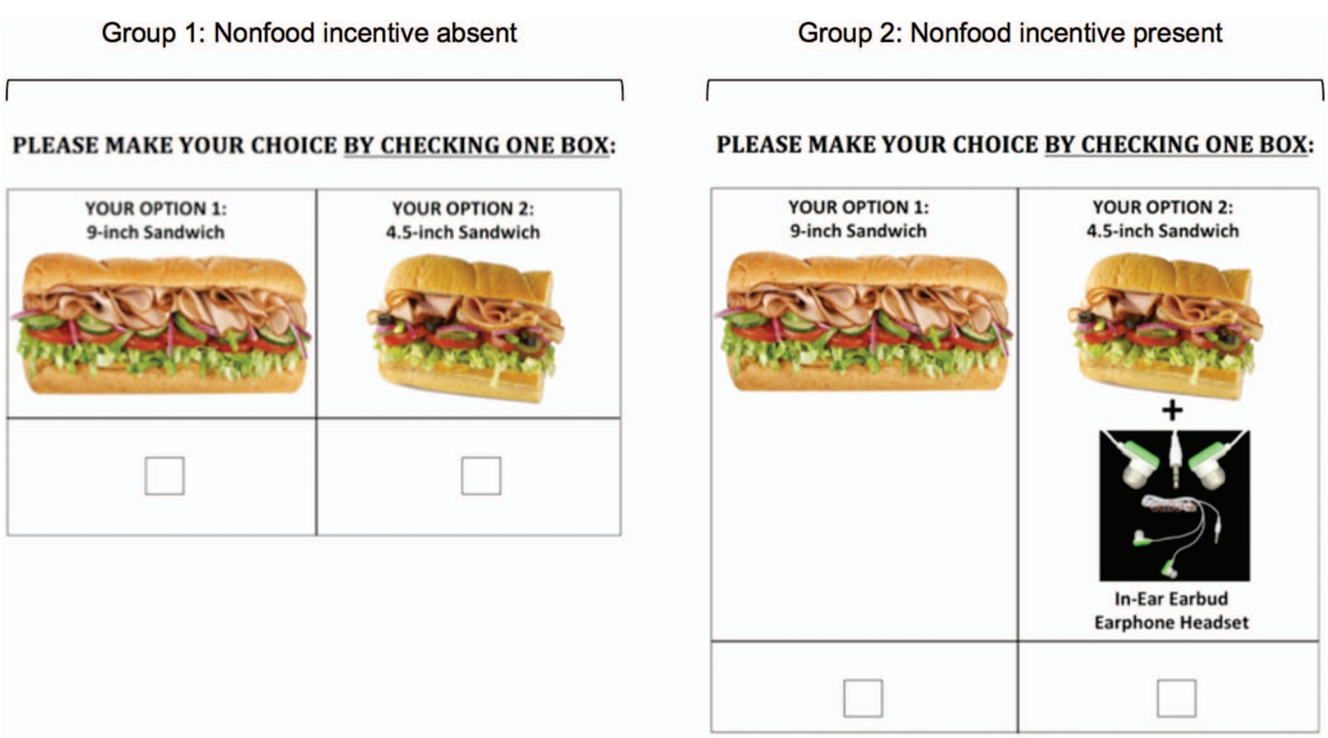

Figure 1. Experiment 1: Choice between a full-sized and half-sized portion (Group 1) and a full-sized and half-sized portion paired with headphones (Group 2). Original choice stimuli are shown. See the online article for the color version of this figure.

nor any of the interaction terms did. Thus, none of these variables completely silenced the negative effect of nonfood incentive on full-sized portion choice.

Discussion

Experiment 1 established that the majority of participants partially substitute food with a nonfood incentive (in this case, a pair of inexpensive headphones) when the half-sized portion is paired with such an item and the full-sized portion is not. Despite this promising finding, it was not yet clear whether this effect generalized to different populations and different nonfood incentives. It was also unclear whether this effect would hold with adults, and would be sustained over time when repeatedly offered to the same individuals. The following Experiment 2 dealt with these issues.

Experiment 2

Overview and Method

Experiment 2 aimed to replicate our first study in an adult population over 3 days. We again employed real foods and real nonfood incentives. Experiment 2 also measured participants' overall daily food intake for each of the 3 days of the study to see whether participants would compensate later in the day for eating less during the experiment. Moreover, we employed two different nonfood incentives (i.e., a chance to win a gift card or frequent flyer miles) to see whether the effect generalizes to different categories of nonfood incentives (i.e., gift cards, frequent flyer miles) as well as nonfood incentives with a different outcome probability (i.e., uncertain receipt of the nonfood incentive compared with a sure receipt of the incentive like in Experiment 1).

Experiment 2 employed a mixed experimental design with *nonfood incentive* (absent; a mere chance to win a $100 amazon.com gift card; a mere chance to win 10,000 frequent flyer miles) as the between-subjects independent variable, *time* (T0; T1; T2; T3) as the within-subjects independent variable, and *full-sized portion choice* as well as *daily overall energy intake* as dependent variables. Seventy-four students and staff members from a large public university (23 females; $M_{\text{age}} = 22.39$ years, $SD_{\text{age}} = 3.67$, ranging from 20 to 43 years) participated in this study individually on 3 different days (the Monday, Wednesday, and Thursday of the same week) in exchange for lunch. Students also received course credit. The number of individuals that signed up determined the sample size (of the 120 possible participation slots we received 74 sign-ups).

Prior to the experiment, participants were informed that all lunch options would be nonvegetarian and involve typical cafeteria-style fast food. Of the original 74 participants on the first day, 63 participated on the second day, and 61 participated on the third day. None of the collected cases were excluded from further analyses.

We created a mock-up cafeteria with tables and chairs and a food stand. On the first day (T1), participants were offered popular chicken nuggets (from the restaurant chain Chick-fil-A); on the second day (T2), participants were offered appealing beef tacos prepared on-the-spot (from the university's student union), and on the third day (T3), participants were offered high-end bacon-avocado sandwiches (from the sandwich restaurant Baggin's Gourmet). The nuggets were kept warm during the first lunchtime session and taken out of a mobile oven upon choice. The tacos were prepared fresh and on the spot by two servers during the second lunchtime session and served warm. The sandwiches were served cold during the third lunchtime session. The energy content of the three foods was similar ($M = 273.33$ calories, $SD = 25.17$, for the full-sized portion).[1]

All participants were present during the same timeframe and were randomly assigned to one of three conditions. Each participant remained in his or her assigned condition across all three days. In the "nonfood incentive absent" condition, participants were offered the choice between either a full-sized serving of their lunch (i.e., eight nuggets at T1, two tacos at T2, and two halves of a sandwich at T3) or exactly half of that serving (i.e., four nuggets at T1, one taco at T2, and one half sandwich at T3). In the "gift card" condition, participants were offered the same lunch choices across the three time points, but the half-sized portions were all paired with the chance to win a $100 amazon.com gift card. In the "frequent flyer miles" condition, participants were also offered the same lunch choices across the three time points, but the half-sized portions were all paired with the chance to win 10,000 frequent flyer miles accepted by all major airline loyalty programs. According to different travel websites, the value of one mile equals about one cent (e.g., Winship, 2011). As such, the value of the $100 gift card and the 10,000 frequent flyer miles (10,000 miles $\times$ 1 cent = $100) were assumed to be similar.

Participants in the gift card and frequent flyer miles conditions were told that their name would be included in the raffle after the study. Participants were not able to calculate the odds of winning because they did not know how many subjects were participating in the study. After the study was completed, an independent judge blindly drew the names of two winners and we paid out $100 each. Participants marked their choice on a sheet of paper (which they returned to us to claim their lunch). Participants also reported their gender, age, height, weight, and hunger level (1 = *not at all hungry*; 5 = *very hungry*).[2] Choice served as the primary depen-

[1] Nutritional information was available for the eight chicken nuggets from the restaurant Chick-fil-A (also see www.chick-fil-a.com): 270 calories; 13 g fat; 2.5 g saturated fat; 0 g trans fat; 70 mg cholesterol; 1,060 mg sodium; 10 g carbohydrates; 1 g fiber; 1 g sugar; and 28 g protein. Nutritional information was neither available for the submarine sandwich from the restaurant Baggin's Gourmet nor for the two tacos from the student union, which is why we approximated calories using a standard calorie counter (Wing & Gillis, 1996). The calorie counter approximates 300 calories for two ground beef tacos and 250 calories for the two halves of the sandwich.

[2] We had also collected data on variables that our other studies did not include but which we would like to briefly discuss here. For each day, participants also reported how satisfied they were with their choice (1 = *not satisfied*; 5 = *very satisfied*), and how enjoyable they found it (1 = *not enjoyable*; 5 = *very enjoyable*). Participants also rated how attractive and novel they found the full-sized portion alone, the half-sized portion alone, and the nonfood incentive alone (all measured from 1 = *not*; 5 = *very*). Participants' willingness-to-pay for their choice (in $) and value perceptions of their choice (1 = *little*; 5 = *lots of value*) were also assessed. For each of these variables, we submitted data to repeated-measures analyses of variance with nonfood incentive as between-subjects independent variable, time as within-subjects independent variable, and the aforementioned variables as dependent variable. The analyses did not reveal significant effects, except a significant inverse *V*-shaped effect of time on willingness-to-pay ($p = .046$) and a significant negative effect of time on value perceptions ($p = .045$). There was also a significant effect of nonfood incentive on attractiveness ($p = .031$). All other effects were nonsignificant.

dent variable. Half-sized portion choices were coded as 0 and full-sized portion choices were coded as 1. We calculated the BMI of each participant using a standard formula for adults: (weight/height in inches^2) × .703 (CDC, 2015a).

Participants' overall daily food intake was also measured. To have a basis for comparison, we asked participants to record their daily food intake for the day prior to the start of the experiment (which we called T0). This day served as the baseline (i.e., participants' typical food intake) to which we compared the following three days on which the experiment took place. Participants also recorded their food intake on each of the three days of the experiment (which we called T1, T2, and T3). To measure participants' food intake, we provided each participant with a sheet on which they could record what food they had consumed at breakfast, snack 1, lunch, snack 2, dinner, and snack 3 (participants reported back the information on the following day). Participants reported the type and amount of food consumed, the type and amount of condiments consumed, and the type and amount of beverage consumed.

To aid participants in specifying the amount of food consumed (and to ensure amounts were similar between subjects), we displayed size comparisons such as a half a cup equaling a tennis ball. Two independent coders (undergraduate psychology students, who were previously trained in professional data coding and blind to the study's hypotheses) translated the reported foods, condiments, and beverages into caloric values. To do so, the two coders used a standard calorie counter developed by Wing and Gillis (1996), which was based on the Nutrient Data System from the University of Minnesota Nutrition Coordinating Center. The calorie counter allowed the two coders to identify the caloric value of hundreds of different foods, condiments, and beverages. Interrater reliability was high. The Cronbach's αs before coders discussed their codes ranged from .910 to .949. The Cronbach's αs after coders discussed their codes ranged from .991 to .997.

At T0 (baseline), female participants consumed 1,527 calories on average (SD = 543), whereas at T1, T2, and T3 they only consumed 1,320 calories on average (SD = 479). Male participants were observed to have a higher average energy intake: at T0 (baseline), male participants consumed 2,090 calories on average (SD = 858), whereas at T1, T2, and T3 they only consumed 1,898 calories on average (SD = 692). As a word of caution, an underestimation bias in self-reported energy intake data may exist (De Vries, Zock, Mensink, & Katan, 1994); for example, in our study, female participants possibly underestimated their energy intake by reporting an average of only 1,527 consumed calories on a normal day.

Results

Effects of nonfood incentive on full-sized portion choice. We first analyzed the extent to which participants would choose half-sized portions (over full-sized portions) if the half-sized portions were paired with nonfood incentives. We regressed nonfood incentive on full-sized portion choice by estimating a random-intercept logistic regression model with subject as clustering variable and trial number as time variable (Rabe-Hesketh & Skrondal, 2012). The regression model revealed significant negative effects of both gift card ($B = -2.40$, $SE = .71$, $z = -3.40$, $p = .001$) and frequent flyer miles ($B = -1.53$, $SE = .59$, $z = -2.59$, $p = .010$) on full-sized portion choice, with "nonfood incentive absent" condition as the baseline.

A closer look at each individual time point of this longitudinal experiment revealed a consistent picture (see Figure 2). At T1, choice of the full-sized portion was significantly greater for participants in the "nonfood incentive absent" condition (69%) compared with those in the "nonfood incentive present" conditions (32% for the gift card condition and 31% for the frequent flyer miles condition; $\chi^2 = 9.85$, $p = .007$). Similar results were observed for time points T2 and T3. At T2, choice of the full-sized portion was again significantly greater for participants in the "nonfood incentive absent" condition (57%) compared with those in the "nonfood incentive present" conditions (16% for the gift card condition and 26% for the frequent flyer miles condition; $\chi^2 = 8.53$, $p = .014$). At T3, once again, a greater percentage of participants chose the full-sized portion in the "nonfood absent condition" (48%) compared with the "nonfood absent present" conditions (11% and 33% for the gift card and frequent flyer miles conditions, respectively; $\chi^2 = 6.47$, $p = .039$). Figure 2 illustrates the results.

Control variables. We mean-centered the variables gender, age, BMI, hunger level, and trial number. We then calculated interaction terms: Gift Card × Gender, Gift Card × Age, Gift Card × BMI, Gift Card × Hunger Level, Gift Card × Trial Number, Frequent Flyer Miles × Gender, Frequent Flyer Miles × Age, Frequent Flyer Miles × BMI, Frequent Flyer Miles × Hunger Level, and Frequent Flyer Miles × Trial Number. We regressed nonfood incentive, gender, age, BMI, hunger level, trial number, and the interaction terms on full-sized portion choice by estimating a random-intercept logistic regression model with subject as clustering variable and trial number as time variable. The regression model confirmed significant negative effects of both gift card ($B = -2.09$, $SE = .70$, $z = -2.99$, $p = .003$) and frequent flyer miles on full-sized portion choice ($B = -1.16$, $SE = .57$, $z = -2.04$, $p = .041$), with "nonfood incentive absent" condition as the baseline. Hunger level had a significant positive effect on full-sized portion choice ($B = 1.01$, $SE = .24$, $z = 4.20$,

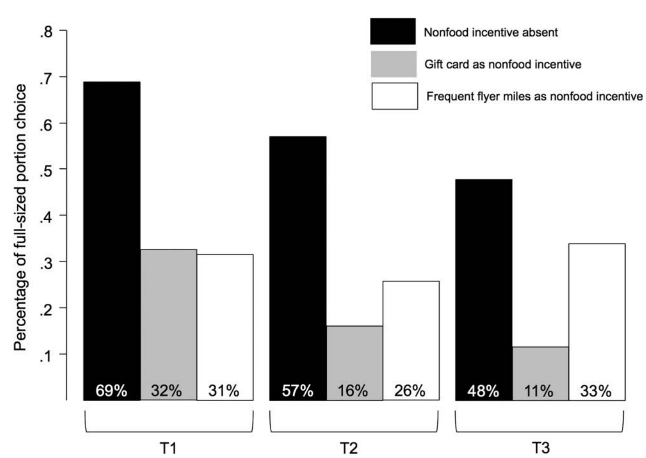

Figure 2. Experiment 2: Individuals in the two "nonfood incentive present" conditions consistently chose less food compared with those individuals in the "nonfood incentive present" condition on all 3 days. T1 = Day 1; T2 = Day 2; T3 = Day 3.

$p < .001$), but neither gender ($p = .134$), age ($p = .734$), BMI ($p = .593$), nor trial number ($p = .238$) did. The interaction terms Frequent Flyer Miles × Gender ($B = 3.24$, $SE = 1.55$, $z = 2.09$, $p = .037$),[3] Gift Card × Hunger Level ($B = -1.18$, $SE = .57$, $z = -2.06$, $p = .040$), Frequent Flyer Miles × Hunger Level ($B = -1.20$, $SE = .51$, $z = -2.37$, $p = .018$) but none of the other interaction terms were significant. Thus, neither gender, age, BMI, hunger level, nor trial number completely silenced the negative effect of nonfood incentive on full-sized portion choice. Importantly, the regression model revealed nonsignificant effects for both the interaction term Gift Card × Trial Number ($p = .462$) and Frequent Flyer Miles × Trial Number ($p = .661$), showing that the negative effect of nonfood incentive on full-sized portion choice was robust over time in this longitudinal experiment.

Effects of choosing half-sized portions on daily energy intake. We examined whether those participants who chose *half-sized portions* would compensate for choosing less food during the experiment by consuming additional food later in the day. Three separate paired-samples *t* test, one for each day of the experiment, compared the energy intake of each of the days of the experiment (i.e., T1, T2, and T3) to the baseline day (i.e., T0), one by one. At T1, those individuals choosing the half-sized portion ate less at T1 compared with T0 ($M_{\text{daily energy intake T0}} = 1,852$ calories, $SD = 722$, 95% confidence interval [CI] around mean [1,651, 2,116] vs. $M_{\text{daily energy intake T1}} = 1,638$ calories, $SD = 789$, 95% CI around mean [1,380, 1,917]), $t(35) = 1.70$, $p = .099$, marginally significant, Cohen's $d = .28$.

At T2, those individuals choosing the half-sized portion consumed less at T2 compared with T0 ($M_{\text{daily energy intake T0}} = 1,861$ calories, $SD = 902$, 95% CI around mean [1,616, 2,147] vs. $M_{\text{daily energy intake T2}} = 1,526$ calories, $SD = 564$, 95% CI around mean [1,358; 1,713]), $t(40) = 2.66$, $p = .011$, Cohen's $d = .46$.

At T3, those individuals choosing the half-sized portion again ate less at T3 compared with T0 ($M_{\text{daily energy intake T0}} = 2,171$ calories, $SD = 980$, 95% CI around mean [1,867, 2,530] vs. $M_{\text{daily energy intake T3}} = 1,733$ calories, $SD = 885$, 95% CI around mean [1,436, 2,038]), $t(33) = 2.35$, $p = .025$, Cohen's $d = .47$. Notably though, those individuals who chose *full-sized portions* consumed approximately the same number of calories in T1, T2, and T3 when compared with T0, as becomes evident in the nonsignificant differences in energy intake for those participants ($p_{\text{T0 vs. T1}} = .242$, $p_{\text{T0 vs. T2}} = .903$, $p_{\text{T0 vs. T3}} = .925$). Table 1 summarizes these results and also compares between female and male participants.

Discussion

Experiment 2 replicated the effect established in Experiment 1 among adults. The results provided convergent behavioral support that individuals partially substitute food with a nonfood incentive (in this case, either an uncertain possibility of winning a $100 gift card or receiving frequent flyer miles) when the half-sized portion is paired with such an incentive and the full-sized portion is not.

Above and beyond replicating Experiment 1, Experiment 2 revealed that the effect is stable over several time points; that is, across repeated choices made on different days. Before conducting Experiment 2, we had wondered whether participants would become weary of the combination of half-sized portion and nonfood incentive when being repeatedly offered. Experiment 2's results suggested that the answer is no.

Another finding of Experiment 2 was that participants who chose the combination of half-sized portion and nonfood incentive did not compensate later in the day for their smaller food portion choice during the experiment. In fact, these participants consumed fewer total calories compared with their baseline day. This finding is interesting as it supports earlier research that found that reductions in portion size are additive and lead to prolonged decreases in food intake (Levitsky & DeRosimo, 2010; Rolls et al., 2006). On the other hand, and as expected, participants who chose the full-sized portion consumed approximately the same number of calories as they did on the baseline day.

Because participants in Experiments 1 and 2 did not have to pay for their choice, we conducted Experiment 3 in a field setting where respondents paid for their meals.

Experiment 3

Overview and Method

Experiment 3 aimed to assess the extent to which the previous results could be replicated in a natural context; here, among restaurant patrons who had originally planned to consume and pay for a full-sized sandwich. We were able to work with a major sandwich restaurant chain that allowed us to introduce a new product: the combination of half a sandwich and a nonfood incentive. Over several weeks, we approached the customers of a sandwich restaurant in a metropolitan area as they began to order (we had waited at the counter). Data were collected all day between 10 a.m. and 11 p.m. with peaks around lunchtime and dinner. Each customer was asked individually whether he or she intended to order the full-sized (12-in.) portion or the half-sized (6-in.) portion of his or her preferred sandwich. Our data collection rule specified that we collect data from adults who had planned to eat a full-sized sandwich.

Experiment 3 employed a one-way experimental design with *magnitude of the nonfood incentive* (€10; €50; €100 lotteries) as the between-subjects independent variable and *full-sized portion choice* as dependent variable. Five hundred sixty-five adult restaurant customers (222 females; $M_{\text{age}} = 29.05$ years of age, $SD_{\text{age}} = 9.58$, ranging from 18 to 77) had planned to order the full-sized sandwich and hence were eligible to participate in our study. The number of individuals who agreed to participate determined the sample size (we aimed to collect a representative sample of at least 500 consumers). Our goal was to investigate whether we could incentivize adult "full-sized-portion customers" to eat less. Initially, 626 customers had been approached; however, 61 of those were under the age of 18 or had planned to eat other foods. Because these individuals did not meet our study criteria, they were excluded from further analyses.

In addition to the option of choosing the full-sized portion (i.e., the originally intended choice), we offered all eligible participants

[3] Running subgroup analyses by gender, the effect of frequent flyer miles on full-sized portion choice was more pronounced among males ($B = -1.51$, $SE = .66$, $z = -2.29$, $p = .022$) than among females ($B = .17$, $SE = 1.34$, $z = .13$, $p = .899$).

Table 1
Experiment 2: Individuals Who Chose Half-Sized Portions Did Not Compensate for the Decrease in Energy Intake Later in the Day (Compared With Baseline)

Calories consumed in T1 vs. T0				Calories consumed in T2 vs. T0				Calories consumed in T3 vs. T0			
Choice half (n = 36)		Choice full (n = 23)		Choice half (n = 41)		Choice full (n = 19)		Choice half (n = 34)		Choice full (n = 18)	
1,638 vs. 1,852 calories* → drop in energy intake from T0 to T1: no energy intake compensation after choosing less		1,858 vs. 2,073 calories† → nonsignificant change		1,526 vs. 1,861 calories** → drop in energy intake from T0 to T2: no energy intake compensation after choosing less		2,081 vs. 2,103 calories† → nonsignificant change		1,733 vs. 2,171 calories** → drop in energy intake from T0 to T3: no energy intake compensation after choosing less		1,591 vs. 1,578 calories† → nonsignificant change	
Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
1,309 vs. 1,560	1,967 vs. 2,143	1,004 vs. 1,274	1,940 vs. 2,149	1,253 vs. 1,486	1,740 vs. 2,153	1,544 vs. 1,844	2,225 vs. 2,173	1,386 vs. 1,686	1,859 vs. 2,346	1,286 vs. 1,296	1,786 vs. 1,758

Note. Paired-sampled t-tests. Choice half = Choice of half-sized portion; Choice full = Choice of full-sized portion. T0 = baseline day; T1 = Day 1; T2 = Day 2; T3 = Day 3.
† *ns*. * $p \leq .10$. ** $p \leq .05$. *** $p \leq .01$.

the option of choosing a half-sized portion paired with a lottery ticket. Each customer, who could participate in the study only once, was randomly assigned to one of three conditions: (a) full-sized portion versus half-sized portion paired with a €10 lottery ticket, (b) full-sized portion versus half-sized portion paired with a €50 ticket, or (c) full-sized portion versus half-sized portion paired with a €100 ticket. The price of the full-sized version was identical to the price of the half-sized version with the lottery ticket—both were priced at €5.

After participants made their choices, the lottery was conducted on the spot by having the participant reach into an opaque bag (approximately 8 in. wide × 20 in. high) full of 70 regular table tennis balls, draw one ball, and return the ball into the bag. One of the balls featured the winning amount. Participants were not able to see or guess the number of table tennis balls and, thus, were not able to calculate the odds of winning. One participant won and received €100 (after which the winning ball was returned into the bag for the next participant). There were no winners in the other two conditions. Participants also reported their gender, age, height, weight, and hunger level (−3 = *satiated*; 3 = *very hungry*).[4] It is important to note that only one participating restaurant customer returned to the counter and ordered more food after choosing the half-sized sandwich and participating in the lottery; all other customers left the restaurant after consuming the half-sized portion. Half-portion choice was again coded 0 and full-portion choice was coded 1. BMI was calculated identically to Experiment 2.

Results

Effect of magnitude of the nonfood incentive on full-sized portion choice. We analyzed the extent to which participants would choose half-sized portions (over originally planning to choose full-sized portions) if the half-sized portions were paired with nonfood incentives. We regressed magnitude of the nonfood incentive (€10; €50; €100) on full-sized portion choice by estimating a binary logistic regression model. The regression model revealed a significant negative effect of magnitude of the nonfood incentive on full-sized portion choice ($B = -.01$, $SE = .00$, Wald = 5.88, $p = .015$), showing that the choices of full-sized sandwiches decreased with increasing lottery amounts. Specifically, participants in the €100 lottery condition chose and consumed full-sized sandwiches to a lesser extent (88% chose the full-sized portion) than participants in both the €50 lottery condition (92% chose the full-sized portion) and the €10 lottery condition (95% chose the full-sized portion; $\chi^2 = 6.06$, $p = .048$).

Control variables. We mean-centered the variables gender, age, BMI, and hunger level. We then calculated interaction terms: Magnitude × Gender, Magnitude × Age, Magnitude × BMI, and Magnitude × Hunger Level. We regressed magnitude of the nonfood incentive, gender, age, BMI, hunger level, and the interaction terms on full-sized portion choice by estimating a binary logistic regression model. The regression model confirmed a significant negative effect of magnitude of the nonfood incentive on full-sized portion choice ($B = -.01$, $SE = .01$, Wald = 4.28, $p = .039$). Gender had a significant positive effect on full-sized portion choice ($B = 1.16$, $SE = .44$, Wald = 6.92, $p = .009$), such that women chose the full-sized portion comparatively more often (96%) than men (88%), but neither age ($p = .133$), BMI ($p = .119$), hunger level ($p = .339$), nor any of the interaction terms did, suggesting that neither gender, age, BMI, nor hunger level com-

[4] We had also collected data on variables that our other studies did not include but which we would like to briefly discuss here. Participants also reported likability of food (1 = *not at all*; 6 = *very much*), desirability of food (1 = *not at all*; 6 = *very much*), familiarity with food (*no*; *yes*), and whether they had just worked out as the restaurant was next to a gym (*no*; *yes*). A binary logistic regression with magnitude, gender, age, BMI, hunger level, likability, desirability, familiarity, workout, and interaction terms between each of these variables and magnitude on full-sized portion confirmed a significant negative effect of magnitude ($B = -.01$, $SE = .01$, Wald = 4.73, $p = .030$). Gender ($B = 1.20$, $SE = .46$, Wald = 6.93, $p = .008$), BMI ($B = .10$, $SE = .05$, Wald = 3.15, $p = .076$), and likability ($B = -.32$, $SE = .19$, Wald = 2.72, $p = .099$) had (marginally) significant effects but none of the other variables did.

pletely silenced the negative effect of magnitude of the nonfood incentive on full-sized portion choice.

Discussion

Experiment 3 provided additional ecological validity for our account. Yet, the percentages of individuals switching from the full-sized to the half-sized sandwich were smaller than in our previous studies, likely because we focused our analysis on the magnitude effect between the three lottery ticket conditions of €10, €50, and €100 and did not include the baseline condition (i.e., no ticket). The restaurant chose not to include a baseline condition because they did not want to offer the full-sized and half-sized portions at the same price of €5. Another explanation for the difference in magnitude between our studies is that, unlike Experiments 1 and 2, Experiment 3 purposely focused only on those restaurant customers who planned to eat the full-sized (12-in.) sandwich before entering the restaurant. This strategy was a conservative test of our account. Another explanation for the smaller effect sizes observed in Experiment 3 is that restaurant customers had well-defined goals of appeasing their hunger and had already invested a substantial amount of time and effort to acquire a desired meal option by visiting the restaurant.

As a field study, Experiment 3 had some limitations in controlling for other factors. For example, Experiment 3 did not control for mealtime (as Experiments 1 and 2 did), because Experiment 3 was conducted at various times throughout the day. Nor did it measure energy intake later in the day (as Experiment 2 did). Nonetheless, Experiment 3 confirms our account in the field under conservative conditions, showing that the effect can be observed in a real-life restaurant environment in that a substantial overall percentage of restaurant customers did switch to the smaller portion.

General Discussion

Three experiments offer several insights by applying behavioral principles of choice substitution to food portion choice. First, we found convergent evidence that offering *modest doses* of nonfood incentives bundled with smaller food portions as an alternative to full-sized food portions can substantially decrease chosen portion sizes. This effect is robust across *nonfood incentive categories* (material good in Experiment 1, monetary gift card or frequent flyer miles in Experiment 2, and monetary lotteries of different magnitudes in Experiment 3), *foods* (submarine sandwiches, chicken nuggets, tacos), and *populations* (children in Experiment 1 and adults in Experiments 2 and 3). Second, we found that the effect holds across multiple days in the same sample of participants (our longitudinal Experiment 2). Third, in Experiment 2, participants who had chosen the combination did not compensate later in the day.

Comparing the sizes of the observed effect across our studies, we noted variations between them (very large effect in Experiment 1; larger effect in Experiment 2; smaller effect in Experiment 3). We attribute this variation to the fact that Experiment 1 employed a nonfood incentive that participants were *sure* to get, whereas Experiments 2 and 3 employed nonfood incentives whose receipt was *uncertain*. Further, in Experiment 3, we did not include a baseline, and we only recruited participants that planned to eat the full-sized portion. Moreover, participants in Experiment 3 paid for their meals.

Contributions

The present research makes several substantive and theoretical contributions. Substantively, we contribute to the psychology of food choice, particularly portion size research, by introducing a novel *motivational* determinant of smaller portion choice—choice substitution. Recent research has called for further application of motivational theories to healthy decision making (Suri et al., 2014), and the present work is heeding this call. This research provides initial empirical evidence that attempts to promote the choice of smaller food portions can involve greater levels of motivational potency compared with full-sized portion alone if modest nonfood incentives are offered as partial substitutes.

Our finding also resonates with clinical work on substance abuse therapy, which has argued that paying drug users money for each negative drug test can help them to stay off drugs (Higgins et al., 1991). Recently, neuroscientists have argued that drug addiction and "food addiction" may have their roots in one and the same brain system (e.g., Berridge, 2009; Pelchat, 2009). It thus stands to reason that what may work (i.e., incentives) in one addiction setting (drugs of abuse) may be applicable in another one (food).

Our research shows that even *small* incentives (i.e., inexpensive headphones) or *uncertain* ones (i.e., a mere chance to win $10) motivate less food intake. Applying our findings to clinical intervention programs for lowering food intake (e.g., Corwin & Grigson, 2009; Rogers & Smit, 2000) could have a substantial impact on individuals' goal of implementing healthier lifestyles.

The present work also speaks to the theory of reason-based choice, which argues that individuals often search for persuasive rationales to choose one alternative over another (Shafir, Simonson, & Tversky, 1993; Simonson & Nowlis, 2000; Simonson, Nowlis, & Simonson, 1993). We contribute to this work by showing that small, inexpensive, and even uncertain nonfood incentives can provide powerful reasons for preferring one over another alternative, even in situations of conflicting and difficult choices, such as choosing less over more food.

Our findings also have broader implications for motivational theories. Most traditional theories of motivation depict a hierarchical structure of needs wherein lower order needs (e.g., food) must be satisfied before higher order needs (e.g., play) can arise (Kenrick, Griskevicius, Neuberg, & Schaller, 2010). However, our results provided evidence that choice substitution can work across need hierarchy levels, supporting an alternative characterization of needs that has long been overlooked (but see Alderfer, 1969). As the present research showed, even hungry individuals can switch from the bigger to the smaller portion size when the smaller portion is paired with an appealing gamble to win money.

The present research also speaks to economic theory. The canonical economic model assumes that money is a simple counter that is valued only for the goods or services it can buy. Accordingly, money should not be rewarding in and of itself and, therefore, food and money should be viewed as being incommensurable. Our findings provide relevant evidence that monetary and nonmonetary choice options can be behaviorally substituted for each other, implying that common utilities exist psychologically.

Future Research

The limitations of this research stimulate ideas for future research. First, although the present investigation was focused on studying and providing support for the choice substitution effect, future research could examine *why* this effect occurs. One possible explanation for the choice substitution effect is the notion that different choice options, even those belonging to entirely different categories such as food and money, are translated into a common currency—the neurochemical dopamine—at the brain level (e.g., Kim, Shimojo, & O'Doherty, 2011; Montague & Berns, 2002; Reimann, in press). Neurophysiologically, both food and money might thus automatically be given a "dopaminergic value," which enables their substitution and motivates choice of less food when the smaller portion is paired with a relevant nonfood incentive. Future investigations could ask participants to make food choices while undergoing functional magnetic resonance imaging (fMRI) to shed light on whether brain regions that receive dopamine projections show similar activation for the bundle of half-sized portion and frequent flyer miles when compared with the full-sized portion alone.

Second, in all three studies, we employed the choice between a half-sized portion versus a full-sized portion as the control group, and the choice between a half-sized portion plus a nonfood incentive versus a full-sized portion as the treatment group. Future research might consider including another condition that offers a half-sized portion and another food item (e.g., a bag of chips or a cookie) versus a full-sized portion to see whether individuals simply prefer two items (independent of whether the second item is food or not food) over one larger food item. This design could possibly yield interesting insights of whether variety seeking is another explanation of the choice substitution effect.

Third, the experimental design of our studies includes only two data points for the portion sizes (i.e., half-sized vs. full-sized). This design does not allow for comparing the utility for portion sizes with the utility for money in greater nuance. It might be interesting to see whether the utility for the portion sizes follows a different trajectory than the utility for money (e.g., nonlinear vs. linear).

Fourth, future research could particularly focus on how the choice substitution effect works among individuals suffering from obesity and compare them to a sample of healthy-weight individuals. We hypothesize that the effect would not be muted by BMI. If this were indeed the case, it would be interesting to see if the choice substitution effect holds over longer periods of time (e.g., half a year) in a weight-loss intervention among individuals with obesity. Analogously, future research could manipulate hunger levels to see whether higher hunger levels mute the choice substitution effect. In all of the present studies, neither body-mass-index nor hunger completely silenced the effect of nonfood incentive on full-sized portion choice, which could be the result of the fact that our subjects were neither suffering from obesity nor starved. Future research may investigate more extreme cases. Along similar lines, future investigations may consider studying how dispositional variables (e.g., preference for or rejection of certain foods) or situational factors (e.g., dieting or exercising) impact the choice substitution effect.

Fifth, the finding that even uncertain incentives make participants downsize their meal warrants further research. Prior work has shown that individuals derive pleasure from uncertainty (Goldsmith & Amir, 2010), which could be one reason for why even uncertain incentives are effective at stimulating smaller portion choice (as shown in the present work). As such, future investigations could compare the effectiveness of uncertain incentives (with unknown probabilities of winning), risky incentives (with known probabilities of winning), and certain incentives (with a sure receipt) in motivating smaller portion choice.

Policy Implications

This research also provides policy implications. Restaurants and food producers have recently eliminated smaller portion sizes due to decreased demand (Sharpe et al., 2008). It can be inferred from our findings that it may be economically feasible for firms to maintain smaller-sized portions that are also desirable alternatives to larger-sized options. We suggested that keeping smaller portion sizes on shelves and menus can be accomplished by substituting part of the food offering with small monetary incentives (e.g., the possibility of winning a nominal lottery or additional loyalty points) or an inexpensive nonmonetary incentive (e.g., small toys, gadgets). Although such rewards are common in the marketplace they have not yet been bundled with smaller food offerings. Introducing such bundles to the marketplace might, in turn, reduce policymakers' controversial desires to enact laws and regulations that prohibit firms from selling excessively large portion sizes, as was the case when the City of San Francisco argued that the portion size of McDonald's Happy Meals were too large for the target group of children and stopped the company from selling it (Bernstein, 2010).

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