YANN CORNIL and PIERRE CHANDON*

Research on overeating assumes that pleasure must be sacrificed for the sake of good health. Contrary to this view, the authors show that focusing on sensory pleasure can make people happier and willing to spend more for less food, a triple win for public health, consumers, and companies alike. In five experiments, the authors ask U.S. and French adults and children to imagine vividly the taste, smell, and texture of three hedonic foods before choosing a portion size of another hedonic food. Compared with a control condition, this "multisensory imagery" intervention led hungry and nondieting people to choose smaller food portions, and they anticipated greater eating enjoyment and were willing to pay more for them. This occurred because multisensory imagery prompted participants to evaluate portions on the basis of expected sensory pleasure, which peaks with smaller portions, rather than hunger. In contrast, health-based interventions led people to choose a smaller portion than the one they expected to enjoy most—a hedonic cost for them and an economic cost for food marketers.

Keywords: food consumption, health, portion size, nutrition, mental imagery

Online Supplement: http://dx.doi.org/10.1509/jmr.14.0299

Pleasure as a Substitute for Size: How Multisensory Imagery Can Make People Happier with Smaller Food Portions

> A wise person does not simply choose the largest amount of food but the most pleasing food.
>
> —Epicurus (341–270 BC), *Letter to Menoeceus*

In most fast-food restaurants and on an increasing number of other eating occasions, customers ordering a beverage or dessert must choose between different portion sizes. Most portions are much larger than the U.S. Department of Agriculture's recommended serving size, contributing to overeating, obesity, and food waste (Hall et al. 2009; Ledikwe, Ello-Martin, and Rolls 2005; Nestle 2003; Rolls, Roe, and Meengs 2007; Zlatevska, Dubelaar, and Holden 2014). So the question is, How can people be encouraged to choose—and actually prefer—smaller food portions, and can this be done without hurting either eating enjoyment or food sales?

To curb supersizing, governments and public health institutions have advocated portion size limits and health appeals (e.g., warnings, food labeling) designed to encourage people to trade off the expected enjoyment of hedonic foods against the health benefits (Belei et al. 2012; Raghunathan, Naylor, and Hoyer 2006; Shiv and Fedorikhin 1999). Such efforts have had limited success because they come at a hedonic cost for consumers who like to eat larger portions of pleasurable foods (Patterson et al. 2001) and imply an economic cost for food marketers that typically extract higher profits from larger portions (Dobson and Gerstner 2010).

This research explores ways to make people who have already decided to eat a hedonic food actually prefer (not

*Yann Cornil is Assistant Professor of Marketing, Sauder School of Business, University of British Columbia, Vancouver, Canada (e-mail: yann.cornil@sauder.ubc.ca). Pierre Chandon is L'Oréal Chaired Professor of Marketing, Innovation and Creativity, INSEAD, Fontainebleau, France (e-mail: pierre.chandon@insead.edu). The authors thank Quentin André, Dimitri Vasiljevic, Beth Pavlicek, and Nicolas Manoharan for research assistance. They thank the teachers and staff of Ecole Le Petit Prince (France) and the staff at the INSEAD Sorbonne Behavioural Lab (France) for their help with some of the data collection. They acknowledge the financial support of the Sheth Foundation (2014 ACR/Sheth Foundation Dissertation Grant). Finally, they thank the Institute for Cardio-metabolism and Nutrition. Deborah Small served as associate editor for this article.

ISSN: 0022-2437 (print)
1547-7193 (electronic)

Journal of Marketing Research
Vol. LIII (October 2016), 847–864
DOI: 10.1509/jmr.14.0299

just choose) smaller food portions, at no hedonic cost to themselves and no economic cost to producers. Challenging the assumption that sensory pleasure is the enemy of healthful eating, we design and test a new intervention, multisensory mental imagery, as an alternative to health warnings. Our intervention asks people to vividly imagine the multisensory pleasure (taste, smell, and texture) of three hedonic foods before choosing the size of another hedonic food and can be implemented with simple instructions or more vivid menu descriptions. A series of experiments show that multisensory imagery leads people (as long as they are not sated or dieting) to choose smaller portions of chocolate cake or soft drinks than people in a control condition. We replicate this effect among children and adults and among French and U.S. consumers. We also show that unlike health warnings, multisensory imagery makes consumers expect at least as much enjoyment from (and willing to pay at least the same price for) the smaller portions chosen as the larger portions chosen in a control condition. Because smaller portions are *actually* more enjoyable, multisensory imagery improves the calibration between expected and actual enjoyment.

Our proposed mechanism is that multisensory imagery helps people realize that sensory pleasure peaks with smaller portions and declines with larger portions, a phenomenon called "sensory-specific satiation." Furthermore, multisensory imagery increases the relative importance of sensory pleasure when choosing portion sizes and reduces the relative importance of otherwise more salient criteria of choice such as hunger or dieting constraints for dieters. By default (i.e., in a control condition), people naturally choose large food portions when they are hungry and not on a diet and smaller food portions when they are sated or on a diet. Thus, because focusing on sensory pleasure enhances the appeal of smaller portions, sensory imagery leads hungry and nondieting people (i.e., most restaurant patrons) to choose smaller portions than in the control condition when they would normally focus on satisfying their hunger. However, sensory imagery does not have this effect when people are sated or dieting and therefore already choose small portions in the control condition.

In summary, compared with health warnings, focusing on sensory pleasure can achieve a better balance among consumer enjoyment, business goals, and public health. Our research offers suggestive support for an intervention that may achieve a "greater good" in the real world, though additional research is necessary to test the size and reliability of the effect in more realistic settings. Our findings contribute to the debate on the sustainability of the food industry—particularly fast-food restaurants—notably its ability to grow without exacerbating the obesity epidemic (Chandon and Wansink 2012; Ludwig and Nestle 2008). They extend research on "mindful eating" (Kidwell, Hardesty, and Childers 2008; Papies et al. 2012), which focuses on impulsive eating but has neglected portion size choice. They also advance understanding of the behavioral consequences of simulated eating, showing that some forms of simulated eating (multisensory imagery) can increase the anticipated pleasure of eating while others (repeated simulated eating) can reduce it (Larson, Redden, and Elder 2014; Morewedge, Huh, and Vosgerau 2010). Overall, our results are in line with the movement advocating a paradigm shift from "food as health" to "food as well-being" and with the call for pleasure to be given a more holistic and positive role in food consumption (Block et al. 2011).

CONCEPTUAL BACKGROUND: MULTISENSORY PLEASURE AND PORTION SIZE

Although the current obesity epidemic is largely driven by ever-increasing food portion sizes, public policy and related research efforts have tended to focus on *what* people choose to eat rather than *how much* they choose to eat (Chandon and Wansink 2012). In particular, the role of sensory pleasure on portion size choice (after people know what they want to eat) is not well understood.

Portion Size Preferences: The Role of Hunger, Health, and Sensory Pleasure

When choosing between a small or large food portion, leaving aside price considerations, consumers are influenced by at least three expectations: (1) Will it satiate their hunger? (2) How will it affect their health and weight? and (3) How pleasurable will it be? Hunger tends to lead people to choose larger portion sizes (Herman and Polivy 1983). Indeed, portion size choice is governed primarily by expectations of the food's capacity to satiate hunger (Brunstrom 2014; Brunstrom and Rogers 2009; Brunstrom and Shakeshaft 2009). However, hunger is not the only factor influencing portion choice (Herman and Polivy 2014); concerns about health also influence food choices and portion size choices, particularly for chronic dieters (Glanz et al. 1998; Van Strien et al. 1986) or when prompting people to think about their health and weight (Giuliani, Calcott, and Berkman 2013). For example, providing calorie and nutrition information can reduce the calorie count of food ordered in fast-food restaurants—though it is unclear whether this reduction comes from choosing smaller portions or choosing different types of food (Bollinger, Leslie, and Sorensen 2011; Harnack and French 2008).

Research has found that the expectation of sensory pleasure influences what food people choose to eat (e.g., Raghunathan, Naylor, and Hoyer 2006), but its effect on portion size choice (when different sizes of the same food are available) is less well understood. Although most food advertisements, especially those for fast-food restaurants, suggest that consuming more food will bring more pleasure (Harris et al. 2010), research on the physiology of eating suggests the exact opposite: Sensory pleasure peaks at the first few mouthfuls and declines with each additional mouthful. This phenomenon, called "sensory-specific satiation," is clearly distinct from hunger satiation and is experienced by adults and infants alike (Mennella and Beauchamp 1999; Rolls et al. 1981), particularly for hedonic foods (Redden and Haws 2013; Sorensen et al. 2003).

Sensory-specific satiation does not simply mean that subsequent bites are enjoyed less than the first one (i.e., marginally diminishing pleasure); it also means that smaller portions can actually be more enjoyable than larger ones. This is because the overall retrospective enjoyment of a food is not an accumulation of pleasure from each bite but rather the average pleasure over all bites (Rode, Rozin, and Durlach 2007; Tully and Meyvis 2016; Van Kleef, Shimizu, and Wansink 2013) or even perhaps only the pleasure experienced from the last bite (Garbinsky, Morewedge, and Shiv 2014). Regardless of whether it is influenced by the last or the average bite, the retrospective overall eating enjoyment is lower after larger than smaller food portions.

A wealth of research has explored how to prevent pleasure satiation, for example, by managing interruptions (Galak, Kruger, and Loewenstein 2013; Galak, Redden, and Kruger 2009; Quoidbach and Dunn 2013; Redden 2008), while somewhat less research has investigated how sensory-specific satiation can help maximize enjoyment by consuming less. Studies on mindful eating have shown that training people to pay more attention to their emotions and sensations while eating can reduce impulsive eating (Kristeller and Wolever 2010; Poothullil 2002), but they have overlooked the effect of mindfulness on expected eating enjoyment and preintake portion size preferences. Yet studying portion size choices is important because when chosen, people tend to eat the whole portion even when they are no longer hungry (for a review, see Zlatevska, Dubelaar, and Holden 2014). Moreover, mindful eating training can take up to 45 minutes and may require too much concentration to be applied to the 200 food decisions that consumers typically make every day (Wansink and Chandon 2014).

In summary, extant research suggests that hunger leads people to prefer larger portions, whereas a health focus or dieting tendencies prompt them to choose smaller portions but expect less eating enjoyment. Focusing on sensory pleasure should, we predict, lead people to prefer smaller portions (because they provide the most pleasurable sensory experience), but the association between sensory pleasure expectations and choice of portion size is not well understood. In the following subsection, we describe a short intervention that applies mindful eating techniques to simulated (vs. actual) consumption and explain how it increases the preference for smaller portions.

Hypotheses: Portion Size Choice

We design a new intervention, "multisensory imagery," which involves encouraging consumers to vividly imagine the multisensory pleasures (taste, smell, and texture) that they would experience from eating familiar hedonic foods. This deliberate form of imagery (Krishna and Schwarz 2014) is designed to mentally simulate the multisensory hedonic experience of eating indulgent food, be it in a restaurant or school setting (e.g., through imagery-rich descriptions on the menu).

Our intervention is based on mental imagery because imagined attributes can be more immediately used as the criteria of choice and evaluation (Holbrook and Hirschman 1982; McGill and Anand 1989). By focusing on sensory pleasure, multisensory imagery should therefore increase the relative importance of sensory pleasure over other criteria, such as hunger or dieting, in driving portion choice. Furthermore, evidence shows that simulating eating through mental imagery emulates the mental processes (emotions, cognition, and sensations) engaged in actual eating (Barsalou 2008; Elder and Krishna 2012; Krishna and Schwarz 2014; Morewedge, Huh, and Vosgerau 2010). By emulating these mental processes, mental imagery helps people reconstruct past experiences as well as more vividly and accurately anticipate future experiences (Hoeffler 2003; Moulton and Kosslyn 2009). Therefore, multisensory imagery should help them anticipate greater sensory pleasure from smaller portions.

Our suggested mechanism is that multisensory imagery will increase the relative importance of sensory pleasure when choosing portion sizes and reduce the relative importance of otherwise more salient criteria such as hunger or dieting constraints for dieters. By default (i.e., in the control condition), people choose large food portions when they are hungry and not on a diet and smaller portions when they are sated or on a diet. Thus, because focusing on sensory pleasure enhances the appeal of smaller portions, sensory imagery should lead hungry and nondieting people to choose smaller portions than in the control condition when they normally focus on satiating their hunger. However, sensory imagery should not lead consumers to reduce portion size when they are sated or dieting and therefore already choose small portions in the control condition. Formally:

H_{1a}: Compared with a control condition, multisensory imagery leads hungry people (but not sated people) to choose smaller food portions.

H_{1b}: Compared with a control condition, multisensory imagery leads normal eaters (but not dieters) to choose smaller food portions.

Hypotheses: Expected Enjoyment of Eating Small Versus Large Portions

Another important aspect of our proposed mechanism is that multisensory imagery modifies the expected enjoyment of eating different portion sizes. In general, expectations of hunger relief lead hungry people to expect greater eating enjoyment from larger portions (Cabanac 1971, 1985). However, sensory pleasure, which actually peaks with smaller portions, can also influence the expected eating enjoyment. Thus, focusing on sensory pleasure (through multisensory imagery) should make people evaluate the enjoyment anticipated from eating different portions from a sensory pleasure standpoint rather than from a hunger relief standpoint and therefore anticipate greater enjoyment from smaller portions. This implies that multisensory imagery should make hungry people expect at least as much enjoyment from (and be willing to pay at least the same price for) a smaller portion they choose as the larger portion chosen in the control condition.

These are important predictions because they rule out the alternative explanation that multisensory imagery mentally satiates people by simulating consumption (Larson, Redden, and Elder 2014; Morewedge, Huh, and Vosgerau 2010). Research on simulated satiation shows that asking people to imagine eating one M&M candy 30 times in a row or to evaluate the expected taste of 60 snacks in a row makes them eat less in a subsequent taste test. Whereas both interventions rely on some kind of simulated eating, our intervention involves imagining the multisensory pleasure of only three hedonic foods, something that people typically do in two to five minutes. In addition, although we posit that both multisensory imagery and simulated satiation will make hungry people choose smaller portions, simulated satiation should also reduce the expected eating enjoyment for any food portion. In contrast, we expect that sensory imagery will actually increase the expected enjoyment of eating small food portions. Formally:

H_{2a}: Multisensory imagery increases the expected enjoyment of small portions, compared with a control condition and compared with a simulated satiation condition.

H_{2b}: Multisensory imagery makes hungry nondieters expect at least as much enjoyment from and be willing to pay at least the same price for their smaller chosen portions as the larger portions chosen in a control condition.

Hypotheses: Calibration of Expected and Actual Enjoyment

Finally, although both sensory pleasure expectations and hunger can influence *expected* enjoyment, the satisfaction of hunger has a limited impact on *actual* enjoyment (Van Kleef, Shimizu, and Wansink 2013), which is mostly driven by the sensory qualities of food and by sensory-specific satiation. This explains why actual enjoyment decreases with food quantity. Therefore, because multisensory imagery increases reliance on sensory pleasure (rather than hunger), multisensory imagery should also improve the calibration between the expected and actual enjoyment of food portions. Consequently, multisensory imagery should also increase the likelihood that people choose a portion that they will actually enjoy more (i.e., a smaller portion).

H_3: Multisensory imagery improves the calibration of expected and actual enjoyment of food portion sizes.

Study Overview

We tested these predictions in five experimental studies involving diverse populations: French and U.S. populations, adults, young adults, and children. In all studies, the main task was to choose among different portion sizes of a chocolate cake (and an indulgent drink in Study 1). All portions were presented simultaneously and were visibly cut from the same cake, ruling out any inferences that smaller portions might be of higher quality. Study 1, run in a school, demonstrated the basic effect on portion size choice among hungry French children. Study 2 replicated the effect with U.S. adult consumers and compared the effect of multisensory imagery and simulated satiation. Study 3 tested the underlying mechanism that multisensory imagery modifies the relative influence of sensory pleasure and hunger satiation expectations on portion choice. In Study 4, we compared the effects of sensory imagery and health imagery (vs. a control condition) on portion choice, expected (preconsumption) eating enjoyment, and actual (postconsumption) enjoyment among dieting and nondieting French women. In Study 5, we manipulated sensory and health imagery with simple menu descriptions and examined their effects on the portion size preferences of U.S. adults.

STUDY 1: EFFECTS OF SENSORY IMAGERY ON THE PORTION SIZE CHOICES OF HUNGRY FIVE-YEAR-OLDS

Study 1 tested whether multisensory imagery would make hungry children choose smaller portions of a brownie and smaller glasses of a soft drink, using both hypothetical and actual choices. We conducted this study among young children from a middle-class French public school to rule out two alternative explanations: (1) that small portions are associated with higher sensory quality because they are often served in high-end restaurants and (2) that sensory imagery primes dieting goals (Trope and Fishbach 2000). Children of this age and background are unlikely to have experienced high-end restaurants or to have dieting goals. In contrast, even infants experience sensory-specific satiation (Mennella and Beauchamp 1999). This age group also enabled us to test our intervention at a time when children begin forming their own perceptions of food (Rozin 1990).

Method

Forty-two children (52% female) aged four and five years from two preschool classes in France participated in the study (with the authorization of their parents and the school board). None of the children suffered from an eating disorder or obesity. The study took place between 10:00 A.M. and 11:15 A.M. over two days, to ensure that none of the children were sated during the study and to ensure minimal variance in hunger. Children were randomly assigned to a food or nonfood (control) sensory imagery condition and participated in the experiment in groups of four.

In the food sensory imagery condition, children saw photos of three hedonic foods (chocolate cereal, chocolate waffle, and chocolate candies). The children were reminded about the five senses (covered in class during the school year) and, on seeing each picture, were asked to cover their eyes with their hands and to imagine the multisensory consequences of eating each food (e.g., the sound made by the cereals when eaten, the sensation when chocolate melts in the mouth, the smell of the waffle). The children in the control condition went through a nonfood imagery procedure and saw three photos of children at the beach, playing with dead leaves, and making a snowman. They, too, were reminded about the five senses and, after covering their eyes, were asked to imagine the multisensory consequences of the nonfood experiences (e.g., the sound of walking on dead leaves, the taste of a snowflake on the tongue, the warmth of the sun on their skin). In both conditions, the intervention lasted approximately five minutes.

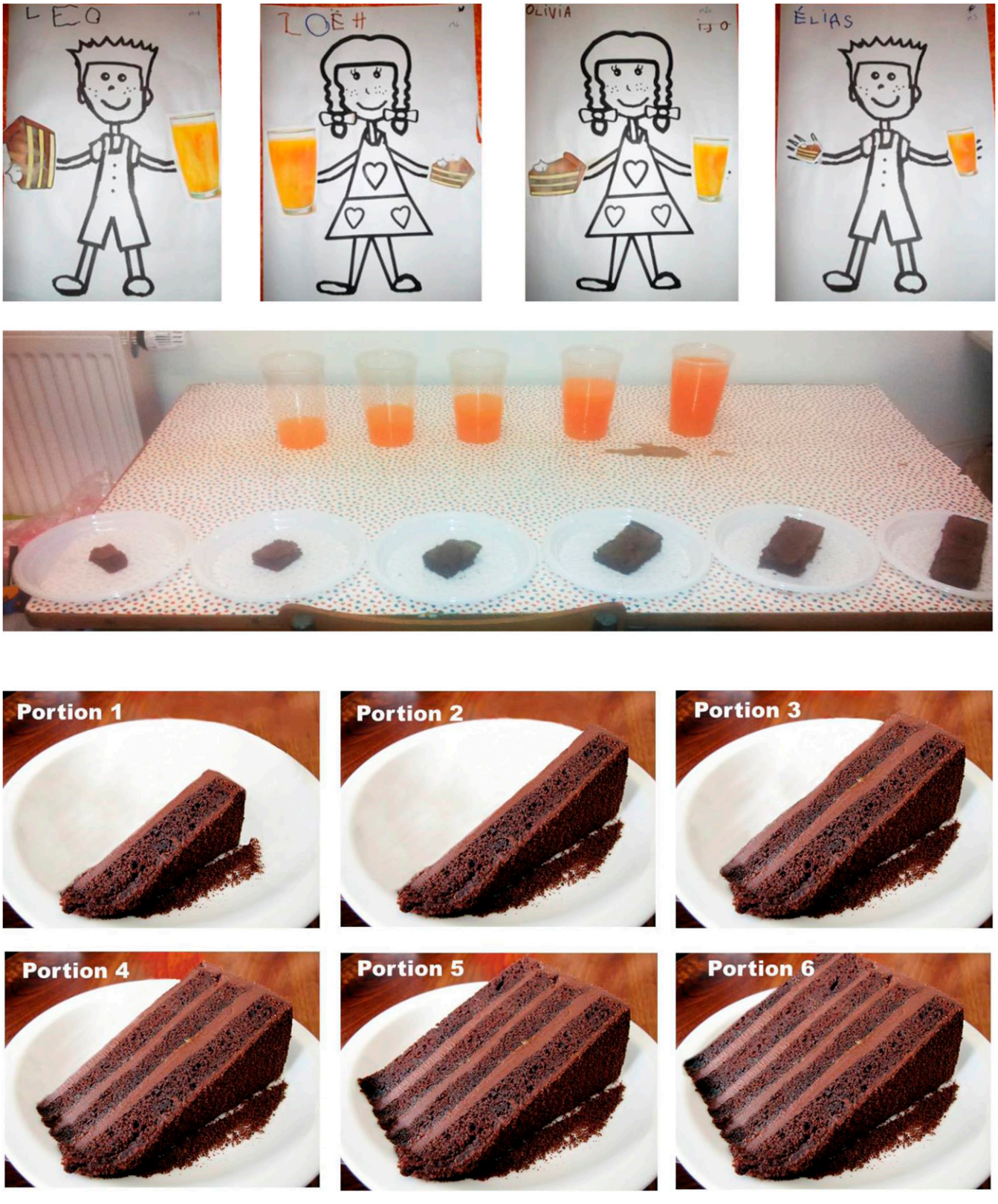
We first measured hypothetical portion size choices for a projected self (Gripshover and Markman 2013). The children were given drawings of a little girl or a little boy, were told that the drawing represented them, and were asked to write their name on the poster. They were then asked to choose one of five stickers representing portions of cake of different sizes and one of five stickers representing glasses of a soft drink and to place them in each hand of their self-character (for examples of the drawings with stickers, see Figure 1).

We then measured actual portion size choices. The children were taken one by one into a separate room with a table displaying six portions of a chocolate brownie and five glasses of a soft drink, in increasing order of size, as shown in Figure 1. Following discussions with parents, we had selected the Brossard brand of packaged brownie cake and the Oasis brand of soft drink because they were both familiar and appealing to children. Portions of the brownie ranged from .5 oz. (60 calories, as much as in one Oreo cookie) to 3.2 oz. (410 calories, as much as a Starbucks regular brownie). Glasses of soft drink ranged from 10 cl (40 calories) to 80 cl (350 calories). The children were told that they could choose one portion of cake and one glass for their afternoon snack and were asked to point at their preferred portions. The children were then asked whether they thought that the chocolate cake and the juice were "not good," "pretty good," or "very good." In the afternoon (after the experiment), the children were told the purpose of the experiment by the school teachers and, for ethical reasons, received the same age-appropriate portions instead of their chosen portions.

Results and Discussion

We analyzed children's choices with four ordered logit regressions, with portion size as the dependent variable and

Figure 1
STIMULI FOR STUDY 1 (TOP) AND STUDIES 2 AND 3 (BOTTOM)



imagery condition and gender as independent variables.[1] No participant was excluded from analysis. The results were identical when using a linear regression (which assumes equal spacing between portion sizes) and when pooling the four estimates into a single random-effect hierarchical regression accounting for the panel structure of the data.

The results revealed that the children chose smaller portions in the food sensory imagery condition than in the control condition across all four replications: cake stickers (M = 3.21, SD = 1.45 vs. M = 4.09, SD = 1.31; $\beta = -1.50$, $z = -2.34$, $p = .02$), drink stickers (M = 3.58, SD = 1.42 vs. M = 4.35, SD = 1.15; $\beta = -1.36$, $z = -2.10$, $p = .04$), real cake (M = 3.16, SD = 1.77 vs. M = 5.23, SD = 1.26; $\beta = -2.48$, $z = -3.56$, $p < .001$), and real drink (M = 3.16, SD = 1.50 vs. M = 4.36, SD = 1.00; $\beta = -1.80$, $z = -2.81$, $p = .005$). The random-effect regression further found that sensory imagery was equally effective for the hypothetical and real choices ($p = .24$) and for the foods and beverage ($p > .50$). Finally, almost all the children expected the chocolate cake and the drink to taste "very good" whether in the food or nonfood sensory imagery condition (cake: 95% vs. 81%; $\chi^2(1) = .70$, $p = .40$; drink: 100% vs. 90%; $\chi^2(1) = .42$, $p = .50$).

Overall, Study 1 found that a brief intervention by school teachers had sizable effects on children's choice of food portions, without requiring adults to restrict children's options. Food sensory imagery led hungry children to choose smaller portions of a hedonic food and drink (H_{1a}). The effect held whether the target food shared common sensory characteristics with the imagined food (chocolate cake) or not (soft drink) and whether the choice was hypothetical or not. The effects were as strong for the last choice as for the first choice and showed no evidence of compensation from the first choice to the subsequent ones.

Because children in both experimental conditions engaged in forming a mental image of pleasurable activities, the results of Study 1 cannot be attributed to differences in mood, mental resources, or an affective mindset (Hsee and Rottenstreich 2004). In Study 2, we aimed to replicate the experiment among adults and to collect additional evidence about subsequent food compensation. Study 2 also enabled us to test our hypothesis that multisensory imagery reduces the influence of hunger on portion choice, leading hungry (but not sated) adults to choose smaller portions, and to rule out the alternative explanation of simulated satiation (Morewedge, Huh, and Vosgerau 2010) by analyzing the effect of multisensory imagery on expected enjoyment.

STUDY 2: EFFECTS OF SENSORY IMAGERY, SIMULATED SATIATION, AND HUNGER ON ADULTS' PORTION SIZE CHOICES AND EXPECTED ENJOYMENT

Method

We assigned 200 U.S. online panelists (Amazon Mechanical Turk [MTurk]; mean age = 34 years; 62% female) to one of three between-subjects conditions: sensory imagery, simulated satiation, and control. We first asked participants how hungry they felt (1 = "not hungry at all," and 9 = "extremely hungry") and when they had last eaten. In the sensory imagery condition, we showed participants three pictures of hedonic desserts (a strawberry pie, vanilla ice cream, and chocolate mousse) and asked them to imagine as vividly as possible each dessert's taste, smell, and texture in the mouth. We used a different control condition from that in Study 1: instead of engaging in nonfood mental imagery, participants saw the same three pictures of hedonic desserts as in the sensory imagery condition but were merely asked to look at them (Papies et al. 2014). The simulated satiation condition was a close replication of the intervention developed by Morewedge, Huh, and Vosgerau (2010). Participants saw a picture of a bite-size piece of chocolate cake and then imagined eating it; this task was repeated 30 times.

In a second task, we asked participants to choose a portion size of chocolate cake. To give the impression that all the portions were cut from the same cake, we selected (after pretesting) a slice of delicious-looking chocolate cake and created five other portion sizes with Photoshop (see Figure 1). We showed the six portions in increasing order of size and asked participants to choose the portion they wanted to eat. On the next page, we showed the photo of the chosen portion and asked participants to estimate how much they expected to enjoy eating it, ranging from 1 ("I would not enjoy eating it at all") to 9 ("I would enjoy eating it a lot").

We then asked participants to imagine that they had eaten their chosen portion, that four hours had passed, and that they had the option to eat vanilla ice cream. We asked them how many scoops—from zero to ten—they would eat (they saw a photo of a scoop of vanilla ice cream). At the end of the study, we asked about participants' height and weight to compute their body mass index (BMI).

Results and Discussion

We used two attention checks in all studies: Participants were asked how often they listen to classical music (toward the beginning of the questionnaire) and to choose a specific number of cake slices (toward the end of the questionnaire). Each time, the participants were instructed to show that they had carefully read the question by selecting a specific answer. In Study 2, we excluded 14 participants who failed these tests from further analysis. We also excluded 5 participants who reported that they had not eaten for a full day before the study because such prolonged fasting is symptomatic of eating disorders (Fairburn 2008; Hilbert, De Zwaan, and Braehler 2012; Lavender, De Young, and Anderson 2010). We applied this exclusion criterion to all studies.[2] The mean hunger score was 3.49 (on a nine-point scale) with a large standard deviation (2.05). We used spotlight analyses (Irwin and McClelland 2001) to detect the effects of our manipulations in sated (one standard deviation below the mean hunger score, M = 1.44 on the nine-point hunger scale) and hungry (one standard deviation above, M = 5.64) participants.

[1] We controlled for gender (and body mass index [BMI] when available) in all the studies because they typically influence food decisions. To facilitate reading comprehension, we report their effects in only the few cases when they moderated the effect of sensory imagery. We computed all test statistics after accounting for the covariates.

[2] In Study 2, H_{1a}, H_{2a}, and H_{2b} were supported even when we kept the participants who had fasted for a full day. H_{2a} and H_{2b}, but not H_{1a}, were also supported even when we kept the participants who had failed the attention check.

Portion size choice. We analyzed portion size choice with an ordered logit model. We used contrast-coded independent variables that capture the effect of multisensory imagery (vs. control) and of simulated satiation (vs. control), gender, and continuous variables for hunger and BMI. We report the results in Figure 2.

There was no significant main effect of multisensory imagery (vs. control) on portion choice ($z = -1.32$, $p = .19$) but a positive main effect of hunger ($z = 2.21$, $p = .03$) and, more important, a significant interaction between hunger and multisensory imagery ($z = -2.05$, $p = .04$). Hunger was a significant predictor of choice in the control condition ($z = 2.98$, $p = .003$) but not in the sensory imagery condition ($z = 1.52$, $p = .13$). As we predicted, sensory imagery (vs. control) made hungry participants choose smaller portions ($M = 3.54$, $SD = 1.45$ vs. $M = 4.70$, $SD = 1.44$; $\beta = -1.56$, $z = -2.26$, $p = .02$) but had no significant effect on sated participants ($M = 3.51$, $SD = 1.45$ vs. $M = 3.12$, $SD = 1.44$; $\beta = .49$, $z = .85$, $p = .40$).

There was a main effect of simulated satiation (vs. control) on portion choice ($z = -2.53$, $p = .01$), qualified by an interaction with hunger ($z = -2.24$, $p = .03$). As Figure 2 shows, simulated satiation, just like sensory imagery, made hungry participants choose smaller portions than in the control condition ($M = 3.37$, $SD = 1.75$ vs. $M = 4.70$, $SD = 1.44$; $\beta = -1.82$, $z = -3.15$, $p = .002$) but had no effect on sated participants ($M = 3.09$, $SD = 1.75$ vs. $M = 3.12$, $SD = 1.44$; $\beta = -.09$, $z = -.17$, $p = .86$).

Expected enjoyment of the chosen portion. We regressed expected enjoyment of the chosen portion on the same independent variables as in the choice analysis. Hunger increased expected enjoyment ($t(179) = 2.50$, $p = .01$) but did not significantly interact with our manipulations (ps > .60). Sensory imagery did not significantly affect expected enjoyment compared with the control condition ($M = 7.81$, $SD = 1.47$ vs. $M = 7.43$, $SD = 1.83$; $\beta = .38$, $t(179) = .92$, $p = .4$). Thus, as we predicted and show in Figure 2, sensory imagery made hungry participants expect at least as much eating enjoyment from their smaller chosen portion as from the larger portion chosen in the control condition ($M = 8.27$, $SD = 1.47$ vs. $M = 7.97$, $SD = 1.83$; $\beta = .30$, $t(179) = .53$, $p = .6$). In contrast, simulated satiation significantly decreased expected enjoyment compared with the control condition ($M = 6.67$, $SD = 2.77$ vs. $M = 7.43$, $SD = 1.83$; $\beta = -.76$, $t(179) = -2.05$, $p = .04$). Additional analyses showed that simulated satiation also sharply decreased expected enjoyment compared with sensory imagery ($\beta = -1.14$, $t(179) = -2.74$, $p = .007$).

Compensatory choice. On average, participants chose 2.78 ($SD = 1.39$) scoops of ice cream. We regressed the number of scoops on the same independent variables as in the previous analyses. We found only a marginally significant main effect of hunger ($z = 1.83$, $p = .07$) but no effect of sensory imagery or simulation satiation (vs. control) and no interaction with hunger (ps > .20). In other words, consistent with Study 1, we found no evidence that people who had chosen a smaller portion of chocolate cake because of multisensory imagery (or simulated satiation) would compensate for this first hypothetical choice by choosing a larger portion of ice cream in a second hypothetical choice.

Discussion. Overall, both sensory imagery and simulated satiation reduced the influence of hunger on portion choice and made hungry participants (but not sated participants) choose smaller portions than participants in the control condition (H_{1a}). However, sensory imagery and simulated satiation yielded different results regarding expected enjoyment. Consistent with the work of Morewedge, Huh, and Vosgerau (2010), simulated satiation sharply decreased expected enjoyment compared with the other two conditions (H_{2a}). In contrast, sensory imagery made participants expect at least as much enjoyment, even from the smaller portion they had chosen when hungry, as the larger portions chosen in the control condition (H_{2b}). These results suggest that the effect of sensory imagery on portion choice could not be attributed to feelings of satiation, which by definition are associated with decreased eating enjoyment expectations.

STUDY 3: EFFECTS OF SENSORY IMAGERY AND EXPECTATIONS OF SENSORY PLEASURE AND HUNGER SATIATION ON PORTION CHOICE AND WILLINGNESS TO PAY

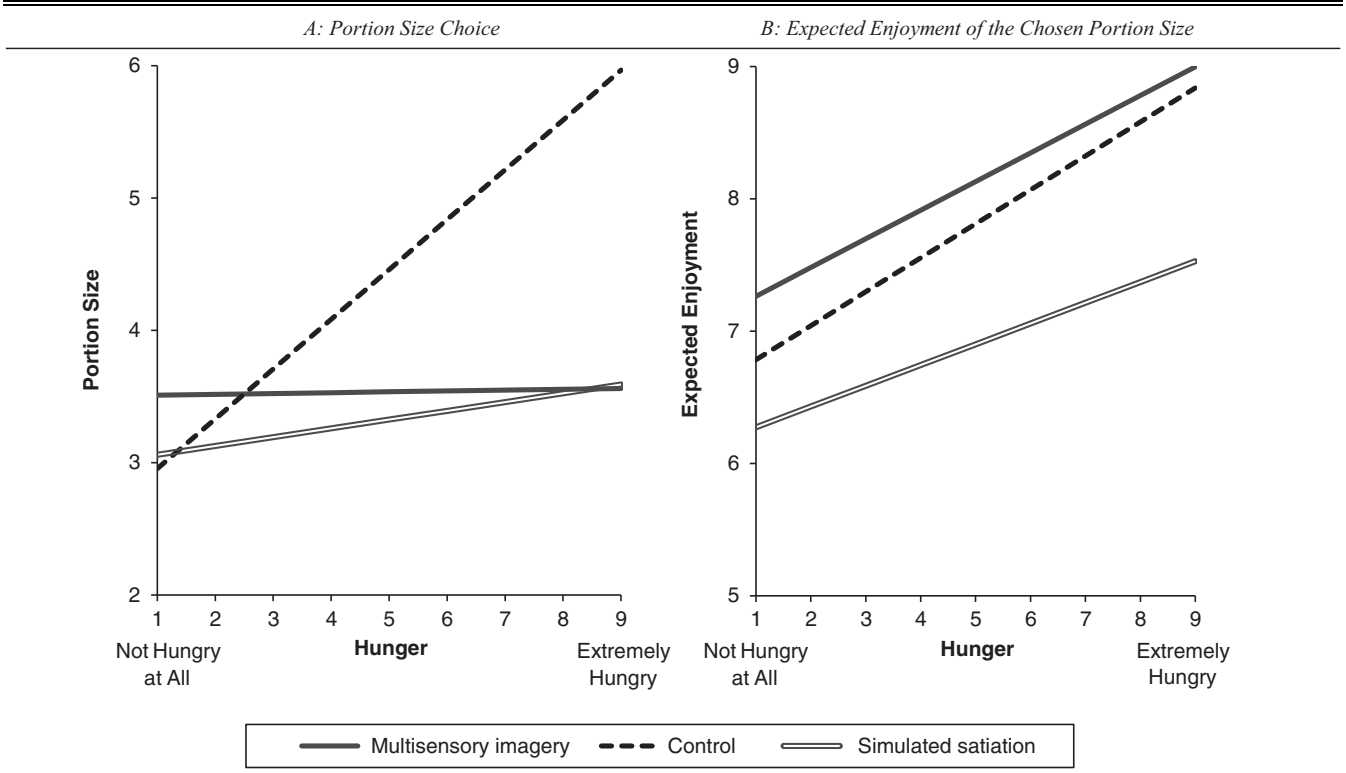
The primary goal of Study 3 was to test the proposed mechanism that sensory imagery increases the influence of sensory pleasure expectations over hunger satiation expectations in portion size choice. To achieve this goal, we measured expectations of sensory pleasure and hunger satiation for each portion size one week before the intervention and examined the explanatory power of these ratings in driving the portion size choices of participants in the sensory imagery versus the control condition one week later. Study 3 also enabled us to examine the effects of sensory imagery on the willingness to pay for the chosen portion.

Method

For the first phase of the study, we recruited 100 participants on MTurk (60% female, mean age = 34 years) and showed them six portion sizes of chocolate cake in increasing order (the same as in Study 2). We asked them to rate how much they agreed that each portion was "just right" in terms of hunger satiation (i.e., to choose a higher rating if the size was just right and a lower rating if it was too small or too large). For each of the six portions, we measured expected hunger satiation with three items on a scale ranging from 1 ("not at all") to 9 ("absolutely"): "This portion would be just right for me to feel comfortably full for dessert," "This portion would be just right for me to be satiated for dessert," and "This portion would be just right to satisfy my appetite for dessert" (Cronbach's $\alpha = .92$). In a similar manner, we asked the participants to rate each portion in terms of sensory pleasure, with three items: "This portion would be just right for me to have a pleasurable sensory experience," "This portion would be just right for me to enjoy the taste of this cake," and "This portion would be just right for me to savor the cake" (Cronbach's $\alpha = .89$). We counterbalanced the order of the questions across participants.

One week later, we recontacted all the participants to take part in the main study; 79 participants replied. These participants were not statistically different from those who did not reply in terms of age, gender, and food ratings (ps > .5). We first asked participants how hungry they felt (1 = "not hungry at all," and 9 = "extremely hungry") and when they

Figure 2
STUDY 2: EFFECTS OF MULTISENSORY IMAGERY AND SIMULATED SATIATION ON PORTION SIZE CHOICE AND EXPECTED ENJOYMENT OF CHOSEN PORTION



had last eaten. In the sensory imagery condition, we used the same manipulation as in Study 2. In the control condition, we used a nonfood sensory imagery intervention (as in Study 1) by showing participants pictures of three comfortable armchairs and asking them to imagine as vividly as possible how they would feel if they sat in each chair.

We then showed participants the same six portions of chocolate cake as in the first part of the study. We asked them to choose one portion and to indicate the probability of choosing each portion, from 1 ("highly unlikely") to 9 ("highly likely"). Next, we showed them the photo of the chosen portion and asked them to state the maximum price they would be willing to pay for it.

Finally, as a manipulation check, we asked participants whether they had evaluated portion sizes on the basis of expected sensory pleasure or expected hunger satiation, using three bipolar scales (e.g., "I was thinking of eating this cake as a sensory experience" vs. "I was wondering whether the portion would make me comfortably full"; Cronbach's $\alpha = .79$). We also asked participants whether they were thinking about their health or weight when evaluating the portions of chocolate cake. At the end of the study, we asked about their height and weight to compute their BMI.

Results and Discussion

From the 79 participants who participated in the prestudy and the main study, we excluded 4 who failed to pass the attention checks and 6 who had not eaten for a full day before the study.[3] The mean hunger score in the main study was 4.01 (on a nine-point scale) with a large standard deviation (2.40). As in Study 2, we used spotlight analyses to detect the effects of our manipulations on sated participants (one standard deviation below the mean hunger score, M = 1.61 on the nine-point hunger scale) and hungry participants (one standard deviation above, M = 6.41).

As a manipulation check, we verified that (compared with the control condition) sensory imagery led people to evaluate the portions on the basis of their expected sensory enjoyment rather than expected hunger satiation (control: M = 4.89, SD = 2.48; sensory: M = 3.63, SD = 2.29; $\beta = -1.26$, $t(67) = -2.17$, $p = .03$, on a ten-point scale, where a lower number indicated evaluation based on sensory enjoyment and a higher number indicated evaluation based on hunger satiation). There were no differences between the control and sensory imagery condition in terms of how much participants thought about their health and weight when evaluating the portions ($t < 1$).

Portion choice and willingness to pay. We analyzed portion size choice with an ordered logit model, with the imagery condition, hunger, gender, and BMI as independent variables. There was no main effect of sensory imagery on portion choice ($z = .15$, $p = .90$), a positive main effect of

[3]In Study 3, H_{1a} and H_{2b} were supported even when we kept the participants who had fasted for a full day and those who failed the attention checks.

hunger ($z = 2.30$, $p = .02$), and an interaction between sensory imagery and hunger ($z = -2.65$, $p = .008$). As Figure 3 shows, hunger was a strong predictor of choice in the control condition ($z = 3.91$, $p < .001$) but not in the sensory imagery condition ($z = -.03$, $p > .9$). As we predicted, sensory imagery made hungry participants choose smaller portions than in the control condition ($M = 3.55$, $SD = .85$ vs. $M = 4.28$, $SD = 1.32$; $\beta = -1.74$, $z = -2.16$, $p = .03$). However, sensory imagery made sated participants choose significantly larger portions than in the control condition ($M = 3.75$, $SD = .85$ vs. $M = 2.91$, $SD = 1.32$; $\beta = 1.91$, $z = 2.01$, $p = .05$). The choice probability data yielded similar results.

A regression of willingness to pay revealed a main effect of hunger ($t(65) = 3.35$, $p = .001$) and a main effect of sensory imagery ($t(65) = 3.26$, $p = .002$), with no interaction between the two ($t < 1$, $p > .40$). On average, sensory imagery increased willingness to pay for chosen portions compared with the control condition ($M = \$4.57$, $SD = 1.64$ vs. $M = \$3.50$, $SD = 1.63$). As we predicted and show in Figure 3, sensory imagery made hungry participants willing to pay directionally *more* for their smaller chosen portion than for the larger portions chosen in the control condition ($M = \$4.85$, $SD = 1.64$ vs. $M = \$3.98$, $SD = 1.63$; $\beta = .85$, $t(65) = 1.47$, $p = .14$), thus increasing willingness to pay per quantity unit by 47%.

The role of sensory pleasure and hunger satiation expectations. As Figure 4 shows, there was an inverted U-shaped relationship between portion size and both types of expectations. In addition, participants rated the three smallest portions more favorably in terms of sensory pleasure than in terms of hunger satiation (respectively, $t(69) = 4.21$, $p < .001$; $t(69) = 4.18$, $p < .001$; $t(69) = 2.66$, $p = .01$). The reverse occurred for the larger fourth and fifth portions, which participants rated more favorably in terms of hunger satiation than in terms of sensory pleasure (respectively, $t(69) = -1.97$, $p = .06$; $t(69) = -2.61$, $p = .01$). Participants rated the largest portion similarly low in both conditions ($p = .33$). As another test, we determined for each participant the portion with the highest rating from either perspective. Across participants, the optimal portion from a sensory perspective was smaller than the optimal portion from a hunger satiation perspective ($M = 3.35$, $SD = 1.47$ vs. $M = 3.98$, $SD = 1.29$; $\beta = -.61$, $t(69) = -3.86$, $p < .001$). Overall, these results show that people expect sensory pleasure to be greater for smaller portions.

To examine whether sensory pleasure more strongly influences portion size in the multisensory imagery condition, we regressed the choice probability data for each portion (from the main study) on a binary variable measuring the effects of the intervention (sensory imagery vs. control), hunger (measured just before the intervention), expected sensory pleasure and expected hunger satiation (measured in the first phase), and all two-way interactions. The regression (which controlled for the panel structure of the data) showed that both sensory pleasure expectations ($z = 2.58$, $p = .01$) and hunger satiation expectations ($z = 11.9$, $p < .001$) influenced choice probabilities. Hunger had a negative interaction effect with sensory

Figure 3
STUDY 3: PORTION SIZE CHOICE AND WILLINGNESS TO PAY FOR CHOSEN PORTION

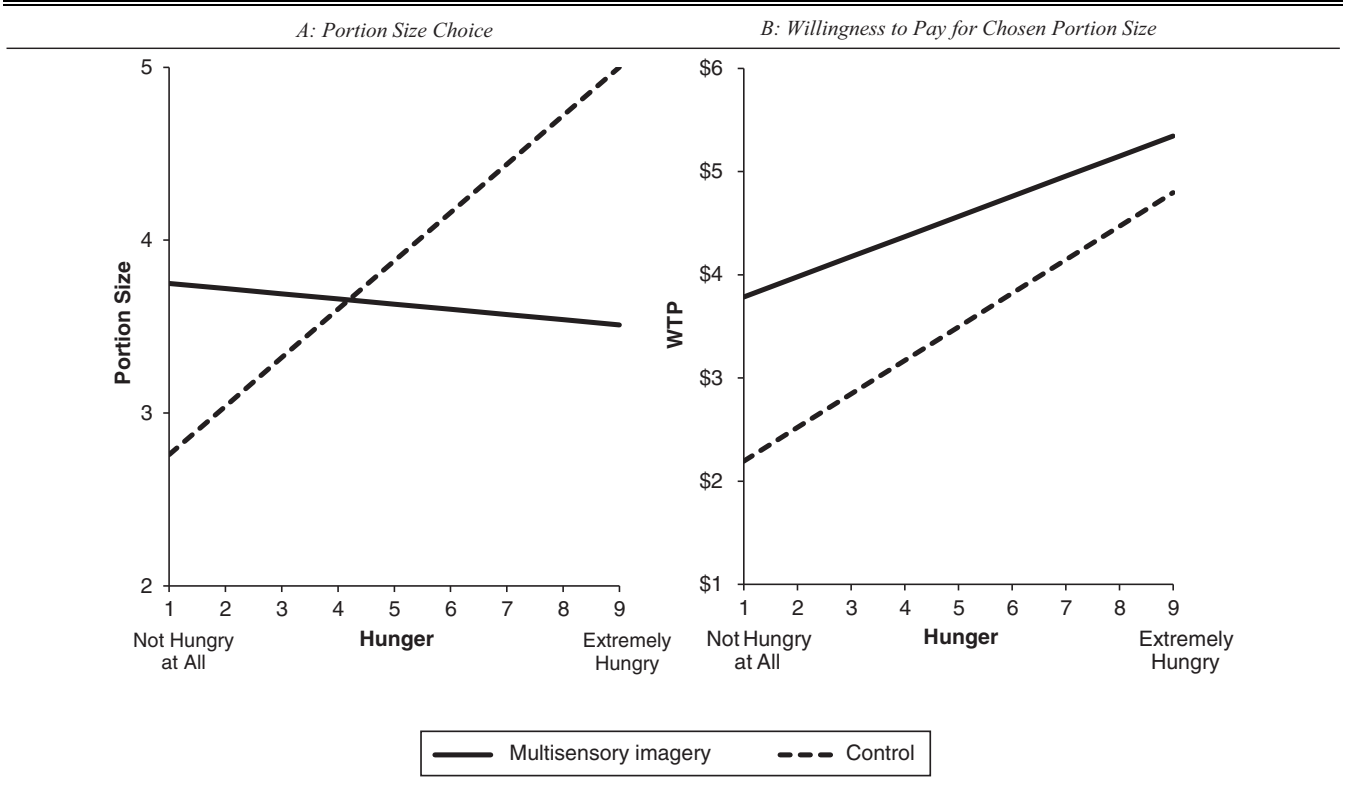
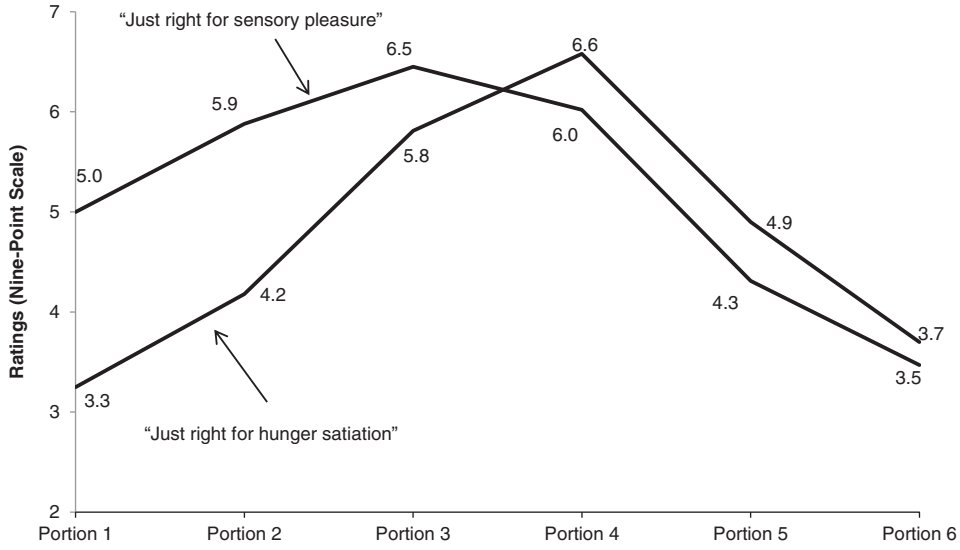


Figure 4
STUDY 3: PREINTERVENTION EVALUATIONS OF PORTIONS BASED ON EXPECTED SENSORY PLEASURE AND HUNGER SATIATION



expectations (z = −2.18, p = .03) and a positive interaction effect with hunger satiation expectations (z = 2.72, p = .01), meaning that, on average, hungry people relied less on their own expectations of sensory pleasure and more on their expectations of hunger satiation. More importantly, the interaction between the multisensory imagery intervention and sensory pleasure expectations was positive and statistically significant (z = 2.25, p = .02), whereas the other effects were not (ps > .6). Expected sensory pleasure had a positive impact on portion size choice in the sensory imagery condition (z = 2.96, p = .003) but a weaker and not statistically significant impact in the control condition (z = 1.48, p = .14). This means that multisensory imagery increased the importance of sensory pleasure expectations on choice and explains why it made people choose smaller portions, especially when hungry.

Discussion. Consistent with Study 2, Study 3 showed that multisensory food imagery reduced the influence of hunger on portion choice, made hungry consumers choose smaller portions (H_{1a}), and made them willing to pay at least as much for these smaller portions as consumers in the control condition were willing to pay for their larger portions (H_{2b}). However, there was a backlash effect among sated consumers for whom sensory imagery increased portion size and willingness to pay.

Study 3 also provides support for the suggested underlying mechanism linking sensory imagery with preference for smaller portions. First, it measured people's expectations and found that the optimal portion was smaller from a sensory pleasure perspective than from a hunger satiation perspective. Second, it showed that multisensory imagery increased the influence of sensory pleasure expectations on portion size choice probability. This suggests that asking people to imagine the multisensory sensations of eating hedonic foods makes them more likely to rely on their own expectations of sensory pleasure (rather than on the normally more important expectations of hunger satiation) when choosing portion sizes.

Study 3 had some limitations. First, it did not directly test the effects of multisensory food imagery on the overall enjoyment expected from each portion size, and thus it did not test H_{2a} that sensory imagery increases the expected enjoyment from eating smaller (but not larger) portions. Second, it did not measure actual (postintake) eating enjoyment. Third, it did not examine the hypothesized moderating effects of dieting, because there were too few dieters in the sample. We addressed these limitations in Study 4, in which we also compared the effectiveness of our intervention with that of health imagery.

STUDY 4: EFFECTS OF SENSORY AND HEALTH IMAGERY ON EXPECTED AND ACTUAL EATING ENJOYMENT FOR ADULT DIETERS AND NORMAL EATERS

We prescreened the participants in Study 4 to ensure that all were hungry, but with high heterogeneity in dieting tendencies. As with hunger, we expected that sensory imagery would reduce the effects of dieting in portion size choice and would lead normal eaters (but not dieters) to choose smaller portions of cake than those in a control condition. In addition, given that smaller portions *actually* maximize enjoyment, we expected sensory imagery to reduce the gap between expected eating enjoyment (measured in a group of "forecasters") and actual eating enjoyment (measured in a group of "experiencers"), improving the calibration of enjoyment expectations.

Study 4 also enabled us to compare sensory imagery with the standard health appeals recommended by researchers and used by governments to encourage people to choose smaller food portions. We specifically tested the effects of health imagery by asking some participants to imagine the effects of hedonic foods on their health and weight. We expected health imagery to also lead people to choose smaller portions, but out of a concern for health and not because they anticipated smaller portions to be more enjoyable. Therefore,

in contrast with sensory imagery, health imagery should lead people to choose a smaller portion than the portion they expect to be the most enjoyable to eat.

Method

We recruited 367 young French women (mean age = 22 years) in exchange for €8. We chose this group because, in general, they are more receptive than men to health appeals and more likely to diet (Rolls, Fedoroff, and Guthrie 1991), enabling us to better test our hypotheses. We were careful to recruit only hungry participants: We asked them to refrain from eating for at least one hour before the study. During the prestudy screening, participants who said that they were not hungry were not included (but were compensated for showing up). The study took place between 10.30 A.M. and 12:00 P.M. or between 3:00 P.M. and 6:30 P.M. (the time of day had no significance on the results). We used a 3 (food sensory imagery, health imagery, and control) × 4 (forecasters, experiencers of small portions, experiencers of medium portions, and experiencers of large portions) between-subjects design.

In the center of the room where participants took the tests, we displayed five portions of the same brownie as in Study 1, in increasing order of size. The five portions contained 70, 140, 210, 280, and 350 calories, respectively, but no calorie information was made available. After looking at the portions, participants sat in front of a computer and reported their hunger (1 = "not hungry at all," and 9 = "extremely hungry") and when they had last eaten.

The sensory imagery manipulation was the same as in Studies 2 and 3. In line with Giuliani, Calcott, and Berkman's (2013) procedure, participants in the health imagery condition looked at the same three photos of hedonic foods as in the sensory imagery condition and were asked to imagine the negative impact of these foods on their health and body. Participants in the control condition saw pictures of three comfortable office chairs and were asked to imagine sitting in them.

Participants assigned to the "forecaster" condition were then asked to choose one of the five portions of brownies and told that they would be able to take their chosen portion with them at the end of the study. We also measured their expected enjoyment by asking them to rate how enjoyable it would be to eat each of the five portions on scales ranging from 1 ("not at all") to 10 ("very much"). Participants assigned to the three "experiencer" conditions were asked to eat entirely the smallest (Portion 1), the medium (Portion 3), or the largest (Portion 5) portion. Only two experiencers were unable to finish their portion, but excluding them from the analyses did not affect the results. We then asked the experiencers to rate how much they had enjoyed eating the brownie on the same scale the forecasters used. Finally, we measured dieting tendency with the Dutch Eating Behavior Questionnaire (Van Strien et al. 1986) and asked about participants' height and weight to compute their BMI.

Results and Discussion

We excluded 11 participants because of an error when cutting the portions on one day, 7 participants who said that they were so full that they could not eat anything (despite the prescreen test), and 6 participants who had not eaten since the day before the study.[4] The final sample of 343 participants had an mean dieting score of 2.8 (SD = .95) on a five-point scale, with a fairly even distribution between normal eaters and dieters. The mean hunger rating was 5.2 on a nine-point scale, with a small standard deviation of 1.3, indicating that we succeeded in selecting a sample of only hungry participants.

Expected enjoyment. Consistent with the results of Study 3, portion size had an inverted U-shaped effect on expected eating enjoyment (see Figure 5). To test our hypothesis, we analyzed expected enjoyment separately for small portions (Portions 1 and 2) and for large portions (Portions 4 and 5). The independent variables were contrast-coded variables measuring the effects of food sensory imagery (vs. control) and health imagery (vs. control), dieting tendencies, hunger, and BMI.

As we predicted, sensory imagery increased expected eating enjoyment for the two smaller portions ($z = 2.25$, $p = .02$) but not for the two larger portions ($z = .21$, $p = .80$). In contrast, health imagery had no effect on expected eating enjoyment regardless of portion size ($ps > .6$). Hunger did not influence the expected enjoyment of smaller portions ($p > .70$) but increased the expected enjoyment of larger portions ($z = 4.51$, $p < .001$), even though all participants were hungry, with little variance in hunger level. Both sensory imagery and health imagery decreased the influence of hunger on expected enjoyment for larger portions (respectively, $z = -2.49$, $p = .01$; $z = -1.96$, $p = .05$). None of the other effects were statistically significant ($ps > .40$).

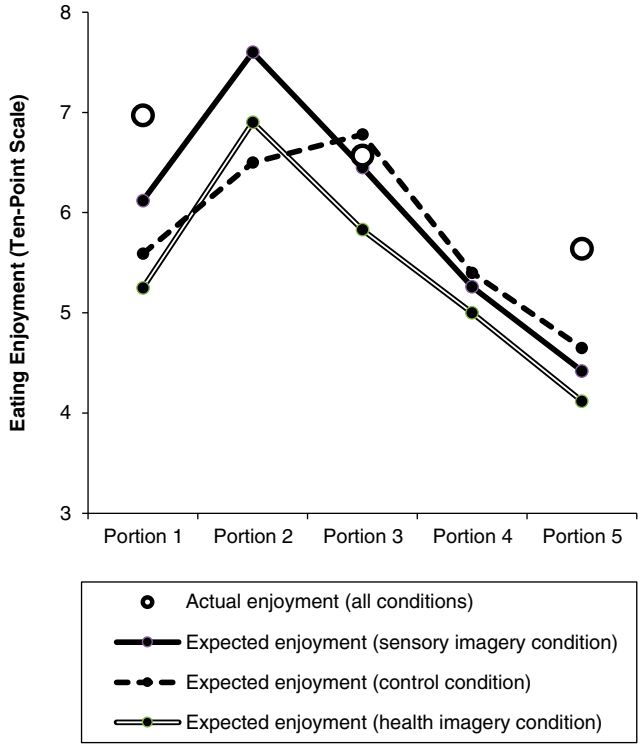
Actual enjoyment. As Figure 5 shows, portion size had a monotonically negative effect on the actual eating enjoyment of the experiencers. We regressed actual eating enjoyment on portion size (using linear coding), the same two binary variables capturing the interventions, dieting tendencies, hunger, and BMI. Actual eating enjoyment sharply decreased with portion size ($t(240) = -4.68$, $p < .001$). The only other significant effect was hunger, which increased actual eating enjoyment ($t(240) = 5.05$, $p < .001$). None of the other effects were statistically significant ($ps > .10$). In particular, in contrast with expected eating enjoyment, the sensory and health imagery interventions did not affect actual eating enjoyment.

Calibration of expected and actual enjoyment. We now analyze how well forecasters were able to predict that enjoyment would decrease with portion size. Recall that we measured the expected enjoyment of five portion sizes *within* participants assigned to the "forecaster" condition, whereas we measured the actual enjoyment of Portions 1, 3, and 5 *between* participants assigned to the three "experiencer" conditions. A mixed design was necessary to test our hypothesis regarding the expected enjoyment of small versus large portions across imagery conditions. Such a design replicates real-life evaluations when consumers first estimate their expected enjoyment of different portions and only evaluate the actual enjoyment of eating the portion they have chosen.

As we showed previously, among experiencers, actual enjoyment decreased with portion size (i.e., Portion 1 was the most enjoyed, followed by Portion 3 and then Portion 5) in all conditions. A good calibration between expected and actual enjoyment means that forecasters are able to predict this pattern. Therefore, we analyzed the expected enjoyment of Portion 1 versus Portion 3 versus Portion 5 in each of the three imagery conditions. In the control condition, we found a poor calibration between expected and actual eating

[4] In Study 4, H_{2a} and H_3 were supported, but H_{1b} became only marginally significant when we kept the participants who had fasted for a full day.

Figure 5
STUDY 4: EFFECTS OF SENSORY IMAGERY AND HEALTH IMAGERY ON EXPECTED AND ACTUAL EATING ENJOYMENT



enjoyment with respect to portion size. As Figure 5 shows, participants erroneously expected Portion 3 to be more enjoyable than Portion 1 (M = 6.78, SD = 2.61 vs. M = 5.59, SD = 2.72; $\beta = 1.20$, $z = 1.93$, $p = .05$) and failed to predict that Portion 5 would be significantly less enjoyable than Portion 1 (M = 4.65, SD = 2.56; $\beta = -.93$, $z = -1.50$, $p = .13$). Sensory imagery was able to reduce the gap between actual and expected eating enjoyment. Participants in the sensory imagery condition expected to be indifferent between Portions 1 and 3 (M = 6.11, SD = 2.25 vs. M = 6.45, SD = 2.42; $\beta = .35$, $z = .53$, $p = .6$) and correctly expected to prefer Portion 1 to Portion 5 (M = 4.42, SD = 2.80; $\beta = -1.69$, $z = -2.56$, $p = .003$). In the health imagery condition, participants expected to be indifferent between Portions 1 and 3 (M = 5.29, SD = 3.02 vs. M = 5.83, SD = 2.59; $\beta = .63$, $z = .90$, $p = .5$) and failed to predict that Portion 1 would be more enjoyable than Portion 5 (M = 4.13, SD = 2.90; $\beta = -1.09$, $z = -1.57$, $p = .12$).

Portion size choice. We analyzed portion size choice with an ordinal logit model with the same independent variables as for enjoyment expectations. The results, plotted in Figure 6, showed no significant effect of sensory imagery ($p > .60$) and dieting tendencies ($z = -1.09$, $p = .27$) but a significant interaction between them ($z = 2.85$, $p = .004$). Dieting tendencies predicted portion choice in the control condition ($z = -2.30$, $p = .02$) but not in the sensory imagery condition ($z = .05$, $p = .60$). A spotlight analysis revealed that sensory imagery led normal eaters (one standard deviation below the mean dieting score) to choose smaller portions than those in the control condition (M = 2.17, SD = .89 vs. M = 2.85, SD = 1.04; $\beta = -1.81$, $z = -2.23$, $p = .02$), as we predicted. Sensory imagery slightly backfired among dieters (one standard deviation above the mean), leading them to choose marginally larger portions than those in the control condition (M = 2.48, SD = .89 vs. M = 1.92, SD = 1.04; $\beta = 1.36$, $z = 1.77$, $p = .08$).

Despite having no effect on enjoyment, health imagery (vs. control) made all participants choose smaller portions (M = 1.90, SD = .87 vs. M = 2.40, SD = 1.04; $\beta = -1.34$, $z = -2.27$, $p = .02$), and the effect was marginally stronger among nondieters (interaction with dieting: $z = 1.72$, $p = .09$). Hunger made participants choose larger portions ($z = 3.71$, $p < .001$) but did not interact with any of the two interventions ($ps > .19$), probably because all participants were at least moderately hungry.

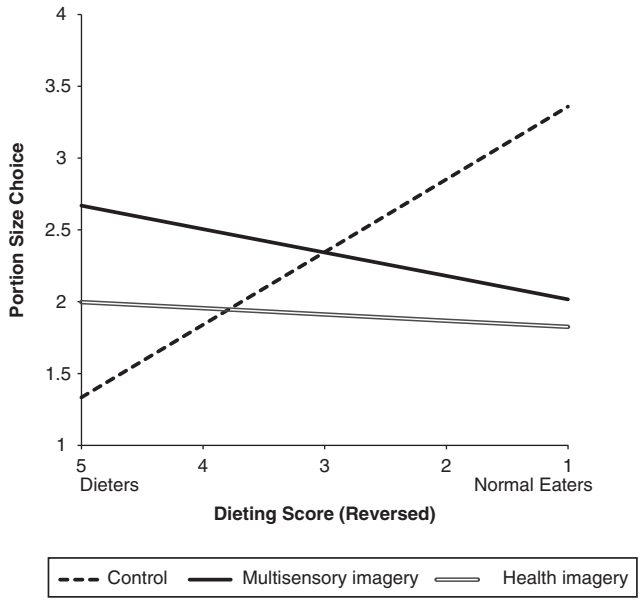
Is portion choice based on expected enjoyment? We next test our hypothesis that sensory imagery makes normal eaters choose a smaller portion because they expect it to maximize enjoyment, whereas health imagery makes participants choose smaller portions despite expecting them to be less enjoyable (i.e., a trade-off between health and expected enjoyment). We used McFadden's conditional logit model, with a binary variable indicating whether the portion had been chosen as the dependent variable. The independent variables were the expected enjoyment for each portion, contrast-coded variables capturing the effects of sensory imagery versus control and sensory imagery versus health imagery, and continuous measures of dieting, hunger, and BMI.

Overall, expected enjoyment was strongly predictive of choice ($z = 6.41$, $p < .001$). Still, there were significant three-way interactions among expected enjoyment, dieting, and sensory imagery versus the control ($z = -2.30$, $p = .02$) and among expected enjoyment, dieting, and sensory versus health imagery ($z = -2.87$, $p = .004$). Among normal eaters, expected enjoyment predicted portion size choice better in the sensory imagery condition (odds ratio = 8.19) than in the control condition (odds ratio = 1.59) or the health imagery condition (odds ratio = .54). In the sensory imagery condition, the portion chosen by normal eaters (M = 2.17, SD = .89) was almost exactly the same as the portion that they expected to enjoy the most (M = 2.21, SD = 1.15, computed as the portion size with the highest expected enjoyment, averaged across participants). In the control condition, normal eaters chose a slightly smaller portion than the one predicted to be most enjoyable (chosen portion: M = 2.85, SD = 1.04; portion with the highest expected enjoyment: M = 3.12, SD = 1.19). The gap was even larger in the health imagery condition, in which participants chose a much smaller portion (M = 1.88, SD = .87) than the one expected to maximize enjoyment (M = 2.61, SD = 1.21). Among dieters, there were no differences across imagery conditions.

Discussion. In Study 4, all participants were hungry, but there was a large degree of heterogeneity in dieting tendencies. We found that sensory imagery reduced the effect of dieting on portion size but still made normal eaters choose smaller portions than those in the control (H_{1b}). Sensory imagery made strong dieters choose marginally larger portions (vs. control), suggesting that it made participants choose on the basis of sensory pleasure rather than concerns about body weight.

Similar to sensory imagery, health imagery made normal eaters choose smaller portions than those in the control

Figure 6
STUDY 4: EFFECTS OF SENSORY AND HEALTH IMAGERY ON PORTION SIZES CHOSEN BY DIETERS AND NORMAL EATERS



condition, but for different reasons. Indeed, sensory imagery increased the expected enjoyment of smaller (but not larger) portions (H_{2a}), making participants more likely to choose the (small) portion expected to maximize enjoyment. In contrast, health imagery did not modify enjoyment expectations and made participants choose a smaller portion than the one they expected to enjoy most—implying a hedonic cost because people traded off enjoyment against health.

Finally, Study 4 showed that sensory imagery improved participants' ability to predict that enjoyment *actually* decreased with portion size. In other words, it improved the calibration between expected and actual eating enjoyment (H_3), and it also increased the chance that a smaller, actually more enjoyable, portion would be chosen. Note, however, that though the decrease in actual enjoyment of portion size is consistent with prior research on sensory satiation (Rolls et al. 1981), an alternative explanation may be that experiencers assigned to eating the largest portion felt compelled to eat this large quantity of cake and thus felt resentful.

In Study 5, we examine the applicability of our results for restaurants and school or workplace cafeterias by testing whether simple menu descriptions can create multisensory imagery (Elder and Krishna 2010; Tuorila et al. 1994). We also compare the effectiveness of multisensory labeling with that of nutrition labeling, a much debated intervention intended to nudge people to choose smaller food portions (Howlett et al. 2009).

STUDY 5: SENSORY MENU DESCRIPTIONS AND PORTION CHOICE

Method

We assigned 190 U.S. online panelists (MTurk; mean age = 37 years; 60% female) to one of three between-subjects conditions: multisensory labeling, nutrition labeling, and control (no label). We first asked participants how hungry they felt and when they had last eaten. All participants saw the same six photos of chocolate cake slices as in Studies 2 and 3 (see Figure 1). In the control condition, the cake was simply described as "a chocolate cake." In the nutrition labeling condition, we added information about the calorie and fat content of each portion, which ranged from 80 calories and 3g of fat to 570 calories and 23g of fat. In the multisensory labeling condition, we added the following description: "The chocolate has a smell of roasted coffee, a bitter-sweet balance taste, with natural aromas of honey and vanilla, and a light aftertaste of blackberry." We then asked participants which portion of cake they wanted to eat. On the next page, we showed them the photo of the chosen portion size and asked them the maximum price they would be willing to pay for it. We finally asked about their height and weight to compute their BMI.

Results and Discussion

We excluded 13 participants who failed to pass the attention checks and 11 participants who reported not having eaten since the day before the study, which yielded 166 valid participants.[5] The mean hunger score was 3.69 (on a nine-point scale), with a standard deviation of 2.10. As in Studies 2 and 3, we considered participants "sated" at one standard deviation below the mean hunger score (M = 1.59) and "hungry" at one standard deviation above (M = 5.79).

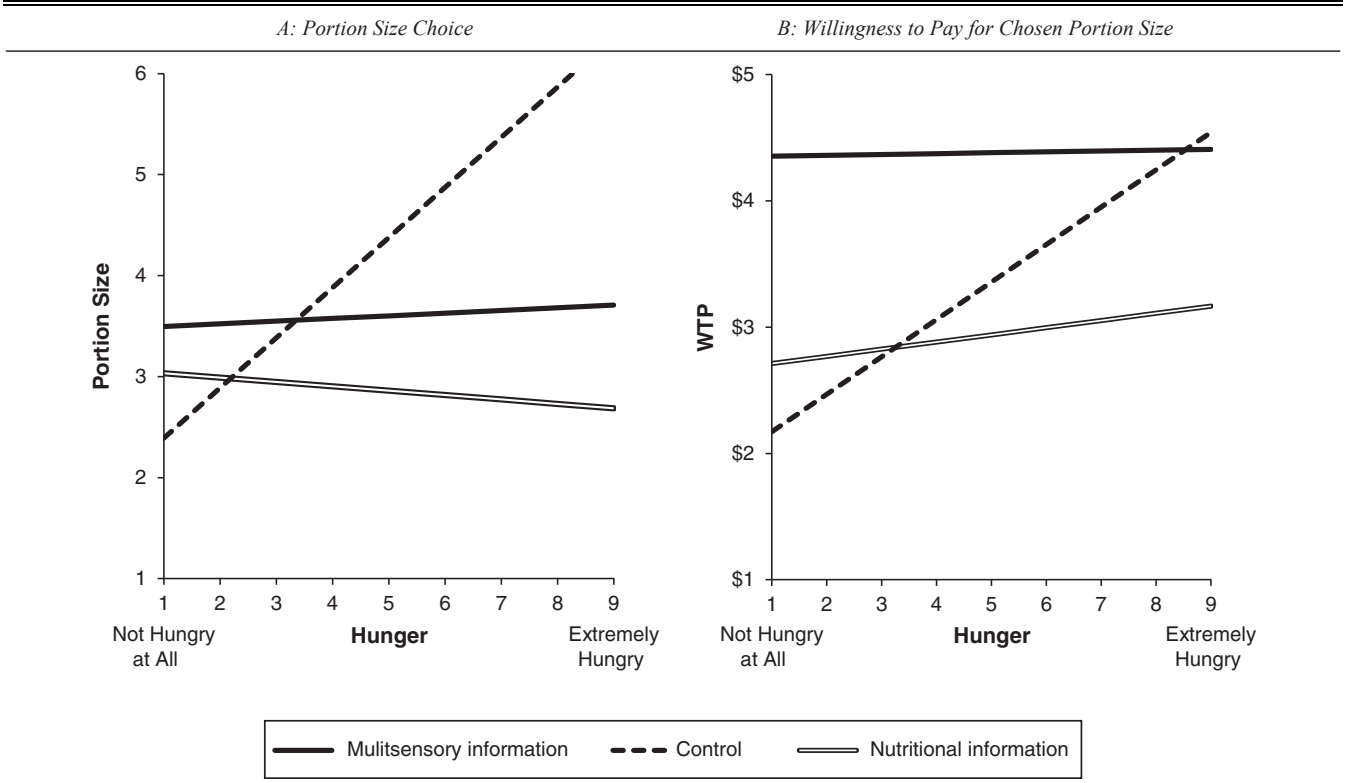
We first analyzed the impact of product information and hunger on portion choice with an ordered logit model. The independent variables were contrast-coded variables capturing the effects of multisensory information (vs. control) and nutrition information (vs. control), hunger, gender, and BMI. We report the results in Figure 7.

There was no significant main effect of multisensory information (vs. control) on portion choice ($z = -.43$, $p = .70$) but a positive main effect of hunger ($z = 2.71$, $p = .007$) and, more importantly, a significant interaction between the two variables ($z = -3.05$, $p = .002$). Hunger was a significant predictor of choice in the control condition ($z = 3.86$, $p < .001$) but not in the multisensory information condition ($z = .30$, $p = .80$). As we predicted, multisensory menu description made hungry participants choose smaller portions (M = 3.64, SD = 1.61 vs. M = 4.75, SD = 1.42; $\beta = -1.45$, $z = -2.58$, $p = .01$) but made sated participants choose marginally larger portions (M = 3.53 SD = 1.61 vs. M = 2.66, SD = 1.42; $\beta = 1.11$, $z = 1.92$, $p = .054$). Health information made all participants choose smaller portions (M = 2.91, SD = 1.47 vs. M = 3.71, SD = 1.42; $\beta = -.96$, $z = -2.39$, $p = .02$), especially when participants were hungry (interaction effect: $z = -3.21$, $p = .001$). Unlike in all the other studies, multisensory information interacted with BMI ($z = 1.95$, $p = .05$) and had a stronger effect on low-BMI participants.

Regression analyses of willingness to pay with the same independent variables revealed a strong main effect of

[5]In Study 5, H_{1a} and H_{2b} were supported even when we kept the participants who failed the attention checks. H_{2b}, but not H_{1a}, was also supported even when we kept the participants who had fasted for a full day. In addition, a meta-analysis of the five studies shows that the effects of sensory imagery on portion size choice are statistically significant even when we kept the participants who failed the attention checks and those who had fasted for a full day.

Figure 7
STUDY 5: EFFECT OF MULTISENSORY INFORMATION AND NUTRITION INFORMATION ON PORTION SIZE CHOICE AND WILLINGNESS TO PAY FOR CHOSEN PORTION



multisensory information (t(156) = 4.34, $p < .001$), a marginal effect of hunger (t(156) = 1.85, $p = .07$), and a marginal interaction between the two (t(156) = −1.71, $p = .09$). As we predicted, providing rich sensory information (vs. control) marginally increased how much hungry people were willing to pay for their chosen portion (M = $4.37, SD = 1.96 vs. M = $3.24, SD = 1.58; $\beta = .90$, t(156) = 1.76, $p = .08$), despite having chosen a significantly smaller portion. Unsurprisingly, sensory information (vs. control) also increased how much sated people were willing to pay for their (larger) chosen portion (M = $4.36, SD = 1.96 vs. M = $2.68, SD = 1.58; $\beta = 2.15$, t(156) = 4.31, $p < .001$). The main effect and interaction effects of nutrition information (vs. control) on willingness to pay were not statistically significant ($ps > .30$). However, additional analyses showed that multisensory information made people willing to pay a higher price than health information (t(156) = 3.78, $p < .001$) and that hunger did not moderate this effect ($p > .20$).

In Study 5, providing rich and vivid multisensory information decreased the influence of hunger, made hungry (but not sated) consumers choose a smaller portion (H_{1a}), and made them willing to pay an actually higher price for their small portion than the larger portion chosen in the control condition (H_{2b}). It could be argued that multisensory information increased the perceived quality of the cake. In the absence of price information, however, quality perception should have led people to choose a larger (not smaller) portion of cake. Finally, although nutrition information led everyone to choose a smaller portion, they were willing to pay a lower price than for similarly small portions in the multisensory labeling condition. Given that margins are typically smaller for smaller portion sizes (Dobson and Gerstner 2010), sensory information achieved the same portion control goals as nutrition information, but without negatively affecting the restaurant's profitability.

GENERAL DISCUSSION

To counteract the current supersizing of hedonic food portions, research has focused on how people can choose health over eating enjoyment (e.g., Giuliani, Calcott, and Berkman 2013) or how they can satiate their desire for hedonic foods (Larson, Redden, and Elder 2014; Morewedge, Huh, and Vosgerau 2010). Unfortunately these strategies both undermine eating pleasure and go against the economic interest of food marketers that extract higher profits from supersized portions.

This study offers suggestive support for an alternative pleasure-based approach that may prompt hungry nondieters to choose and actually prefer less food without making a hedonic trade-off or hurting food manufacturers' profitability. Insofar as this intervention leads to the same effect sizes in more naturalistic settings than in our studies, this would constitute a triple win for consumers, marketers, and public health. The pleasure-based approach to portion control builds on the idea that—counterintuitively—larger portions are not more pleasurable than smaller ones because sensory enjoyment peaks at the first mouthful and declines with each additional one

(Garbinsky, Morewedge, and Shiv 2014; Rode, Rozin, and Durlach 2007; Rolls et al. 1981; Van Kleef, Shimizu, and Wansink 2013).

Drawing from mental imagery research (Barsalou 1999; Krishna and Schwarz 2014), we tested a new intervention, multisensory imagery, which involves prompting people to vividly imagine the pleasant multisensory features of hedonic foods, either through direct instructions or simply by using vivid multisensory product descriptions on menus. Across five studies, we found that multisensory imagery made consumers (as long as they were neither sated nor dieting) choose smaller portions, regardless of their cultural background (French in Studies 1 and 4 and American in Studies 2, 3, and 5) and age (children in Study 1, young adults in Study 4, and adults in Studies 2, 3, and 5). Remarkably, we found that multisensory imagery made people willing to pay at least as much (Studies 3 and 5) for and expect at least as much eating enjoyment (Studies 2 and 4) from a portion smaller than the one they would otherwise choose. Multisensory imagery also reduced the gap between enjoyment expectations and actual enjoyment and made people choose the smaller portions that provided the best actual eating experience (Study 4).

We suggest a possible underlying mechanism in Studies 3 and 4. In Study 3, people recognized that the smaller portions were better than the larger ones from a pure sensory pleasure perspective, though larger portions were better for hunger satiation. Multisensory imagery also increased the relative influence of sensory pleasure over hunger satiation on portion size choice. These results were confirmed in Study 4, in which multisensory imagery increased the overall enjoyment expected from eating small portions but not large portions. Although these findings are consistent with research suggesting that mental imagery helps people anticipate more accurately future experiences (Hoeffler 2003; Moulton and Kosslyn 2009), we acknowledge that our studies do not provide definite evidence of the cognitive or affective processes by which sensory imagery helps people better anticipate that smaller portions will be more pleasant.

It is also possible that our findings are driven by demand effects. However, two results mitigate this risk. First, Study 1 showed that multisensory imagery was effective with five-year-old children who are unlikely to have the sophisticated reasoning required for these kinds of demand responses. Second, we investigated demand by measuring the lay intuitions about the effect of sensory imagery on portion size choice among 49 MTurk participants similar to those in Studies 2 and 3. The scenario involved John and Jim, two hungry nondieters about to choose a slice of chocolate cake. The scenario then described the sensory imagery intervention as follows: "Before making their choice, John (but not Jim) is shown pictures of desserts and asked to imagine vividly the taste, the smell, and the texture in mouth of these desserts." The vast majority of participants (67%) erroneously predicted that John (the character who engaged in sensory imagery) would choose a larger slice than Jim. This suggests that demand effects would lead to the opposite results of what we found in Studies 1–5. Thus, although people expect that focusing on sensory pleasure leads to smaller cake portions (as we show in Study 3) they do not make the association between the sensory imagery manipulation and focusing on sensory pleasure, which contradicts demand effects.

As a benchmark, we examined the effects of alternative interventions intended to encourage people to choose smaller portions of hedonic foods: simulated satiation (imagining eating 30 times the same food; Study 2), health imagery (imagining the negative impact of hedonic foods on health and body; Study 4), and nutrition labeling (information about calories and fat content; Study 5). Although these interventions also made people choose smaller portions, their choices were hedonically costly for the consumer, economically costly for business, or both. Simulated satiation reduced the anticipated eating enjoyment of any portion of food. Health appeals led people to sacrifice pleasure and choose portions that were smaller than those they expected to enjoy the most. Nutrition labeling reduced the willingness to pay for the food compared with multisensory imagery.

There are boundary conditions to the effects of sensory imagery. By increasing the importance of sensory pleasure and decreasing the importance of hunger or dieting considerations as drivers of portion size choice, sensory imagery backfired (though not consistently and not significantly across studies) among sated consumers and dieters who would have otherwise chosen small portions. We acknowledge that encouraging sated people to choose larger portions is indeed a problem from a healthful eating standpoint. For dieters, however, the finding that sensory imagery leads them to choose larger (but still reasonable) portions of hedonic food may actually be less problematic than it seems. Evidence shows that most dieters eventually fail to follow their dieting regime, and that when that happens, the backlash negates the benefits of their previous sacrifices (Bublitz, Peracchio, and Block 2010; Fedoroff, Polivy, and Herman 1997; Stroebe et al. 2013). Choosing moderate portions of hedonic food, especially when done because of pleasure expectations, may therefore be more conducive to a more healthful diet in the long run than strict but unsustainable cognitive restraint followed by extreme overeating. To that point, Studies 1 and 2 provided preliminary evidence that pleasure-based choices of smaller portions do not lead to subsequent compensation, at least in a second hypothetical choice. Although prior research has investigated compensation effects in food choices using consecutive hypothetical choices (e.g., Laran 2010), additional research is necessary to determine compensation effects after actual intake and in the long run. Furthermore, chronic dieting is associated with feelings of anxiety and of less well-being and happiness in general (Block et al. 2011; Coveney 2006), whereas a tendency to value the sensory pleasure of eating is associated with greater well-being and happiness (Jose, Lim, and Bryant 2012; Quoidbach et al. 2010). This suggests that pleasure-based arguments can be an effective alternative to health or dieting arguments to achieve healthful eating and contribute to overall "food well-being" (Block et al. 2011).

IMPLICATIONS FOR FURTHER RESEARCH

Our research opens new avenues for further research. First, our focus was on portion size choice, conditional on people having decided to eat. Additional research could examine the effects of multisensory food imagery on consumption incidence (when to eat) and food choice (what to eat). Such research would indicate whether, from a public health perspective, multisensory imagery interventions are only warranted when people have already decided to eat (e.g., while waiting at a restaurant or sitting down at the family

table) or if they can also be used in situations when people have not yet decided what and when to eat (e.g., in supermarkets). In the latter cases, it is possible that multisensory imagery, by emphasizing sensory pleasure, leads people to choose tastier over more healthful foods, which may partially or totally negate the health benefits of choosing smaller portions. The overall effect of sensory imagery on healthful eating (the combination of what, when, and how much to eat) is therefore uncertain and open to further investigations.

Furthermore, we compared the effect of multisensory imagery among hungry versus sated people who were all normal eaters (Studies 2, 3, and 5) and among normal eaters versus dieters who were all hungry (Study 4). We found a moderate backlash effect among hungry dieters and among nondieting sated people, who naturally tended to choose smaller portions in the control condition and larger portions in the multisensory imagery condition. Research could examine the effect of multisensory imagery when both hunger and dieting vary and, in particular, the extent of the backlash effect among sated dieters. More importantly, research should aim to better understand this backlash effect. We suggested that multisensory imagery negates the impact of being sated or of dieting by making people choose portions on the basis of sensory pleasure expectations rather than how hungry they are or their dietary goals. Another explanation, especially regarding the backlash effect among dieters, may be that sensory imagery creates ambivalent attitudes and conflicts between hedonic goals and dieting goals, resulting in self-control failure (Cornil et al. 2014; Stroebe et al. 2013).

In this article, we focus on hedonic, calorie-dense foods because of their negative impact on health. From a theoretical perspective, we would expect multisensory imagery to have a weaker effect on staple foods such as bread or rice or on healthful snacks such as cereals, which exhibit less sensory-specific satiation (Redden and Haws 2013; Sorensen et al. 2003). Further research should test whether multisensory imagery has the dual advantage of limiting the intake of hedonic foods but not more healthful foods. It would also be useful to test our interventions when a variety of food is available—such as served buffet style—given that people exhibit less sensory satiation when food is varied (Rolls et al. 1981). Similarly, research could explore the impact of multisensory imagery on nonfood experiential consumption (e.g., music). In many instances, pleasure diminishes with repetition but, in general, people fail to predict this hedonic adaptation effect (Wang, Novemsky, and Dhar 2009).

In addition, research could explore other consequences of multisensory imagery. For example, training children to focus on the multisensory experiences of eating may encourage them to approach novel foods or to learn to appreciate the hedonic value of eating fruits and vegetables (Hong et al. 2011). Finally, multisensory imagery could be extended to nonsensory aspects of eating pleasure, for example, by prompting people to consider the aesthetic and symbolic dimensions of eating pleasure, such as the pleasure derived from beautifully presented dishes and tables (Hoyer and Stokburger-Sauer 2012; Zellner et al. 2014) or learning about the food's origin and preparation (Korsmeyer 1999).

In conclusion, our results question a rich cultural and philosophical tradition that deems sensory pleasure as immoral and taste as an impoverished sense responsible for bodily intemperance (Cornil and Chandon 2015; Coveney 2006; Korsmeyer 1999). Alba and Williams (2013) observe that this tradition is perpetuated in modern research on consumer behavior, for example, when food choices are framed as vices or virtues. Our findings suggest that it is time to stop caricaturing eating enjoyment as the simple fulfillment of visceral impulses and to rehabilitate the pleasure of eating, as experienced in countries such as France, Italy, Japan, and South Korea, where the prevalence of obesity and eating disorders is noticeably low (Rozin et al. 2003; Rozin, Remick, and Fischler 2011).

ADDITIONAL STATEMENT

We have reported the total number of observations excluded, the criteria for exclusion, and all experimental conditions. We have also reported all measures, except for demographic data (age, income, and education) not used in the analyses. We aimed for large sample sizes (>50) per condition in studies run on MTurk (Studies 2, 3, and 5). In Study 1, we had access to only two classes of children, for a total of 21 participants per condition. In Study 4, we were also constrained by the limited number of female participants in the subject pool who were interested in a study involving actual consumption of commercial chocolate cake, and we reached 30 participants in each of the 12 conditions.

REFERENCES

Alba, Joseph W. and Elanor F. Williams (2013), "Pleasure Principles: A Review of Research on Hedonic Consumption," *Journal of Consumer Psychology*, 23 (1), 2–18.

Barsalou, Lawrence W. (1999), "Perceptual Symbol Systems," *Behavioral and Brain Sciences*, 22 (4), 577–609, discussion 10–60.

——— (2008), "Grounded Cognition," *Annual Review of Psychology*, 59, 617–45.

Belei, Nina, Kelly Geyskens, Caroline Goukens, Suresh Ramanathan, and Jos Lemmink (2012), "The Best of Both Worlds? Effects of Attribute-Induced Goal Conflict on Consumption of Healthful Indulgences," *Journal of Marketing Research*, 49 (December), 900–09.

Block, Lauren G., Sonya A. Grier, Terry L. Childers, Brennan Davis, Jane E.J. Ebert, Shiriki Kumanyika, et al. (2011), "From Nutrients to Nurturance: A Conceptual Introduction to Food Well-Being," *Journal of Public Policy & Marketing*, 30 (Spring), 5–13.

Bollinger, Bryan, Phillip Leslie, and Alan Sorensen (2011), "Calorie Posting in Chain Restaurants," *American Economic Journal. Economic Policy*, 3 (1), 91–128.

Brunstrom, Jeffrey M. (2014), "Mind over Platter: Pre-Meal Planning and the Control of Meal Size in Humans," *International Journal of Obesity*, 38, S9–S12.

——— and Peter J. Rogers (2009), "How Many Calories Are on Our Plate? Expected Fullness, Not Liking, Determines Meal-Size Selection," *Obesity*, 17 (10), 1884–90.

——— and Nicholas G. Shakeshaft (2009), "Measuring Affective (Liking) and Non-Affective (Expected Satiety) Determinants of Portion Size and Food Reward," *Appetite*, 52 (1), 108–14.

Bublitz, Melissa G., Laura A. Peracchio, and Lauren G. Block (2010), "Why Did I Eat That? Perspectives on Food Decision Making and Dietary Restraint," *Journal of Consumer Psychology*, 20 (3), 239–58.

Cabanac, Michel (1971), "Physiological Role of Pleasure," *Science*, 173 (4002), 1103–07.

——— (1985), "Preferring for Pleasure," *American Journal of Clinical Nutrition*, 42 (5, Suppl), 1151–55.

Chandon, Pierre and Brian Wansink (2012), "Does Food Marketing Need to Make Us Fat? A Review and Solutions," *Nutrition Reviews*, 70 (10), 571–93.

Cornil, Yann and Pierre Chandon (2015), "Pleasure as an Ally of Healthy Eating? Contrasting Visceral and Epicurean Pleasure and Their Association with Portion Size Preferences and Wellbeing," *Appetite*, (published electronically September 10), [DOI: 10.1016/j.appet.2015.08.045].

——— Nailya Ordabayeva, Ulrike Kaiser, Bernd Weber, and Pierre Chandon (2014), "The Acuity of Vice: Attitude Ambivalence Improves Visual Sensitivity to Increasing Portion Sizes," *Journal of Consumer Psychology*, 24 (2), 177–87.

Coveney, John (2006), *Food, Morals, and Meaning: The Pleasure and Anxiety of Eating*, 2nd ed. Abingdon, UK: Routledge.

Dobson, Paul W. and Eitan Gerstner (2010), "For a Few Cents More: Why Supersize Unhealthy Food?" *Marketing Science*, 29 (4), 770–78.

Elder, Ryan S. and Aradhna Krishna (2010), "The Effects of Advertising Copy on Sensory Thoughts and Perceived Taste," *Journal of Consumer Research*, 36 (5), 748–56.

——— and ——— (2012), "The 'Visual Depiction Effect' in Advertising: Facilitating Embodied Mental Simulation Through Product Orientation," *Journal of Consumer Research*, 38 (6), 988–1003.

Fairburn, Christopher G (2008), *Cognitive Behavior Therapy and Eating Disorders*. New York: Guilford Press.

Fedoroff, Ingrid C., Janet Polivy, and C. Peter Herman (1997), "The Effect of Pre-Exposure to Food Cues on the Eating Behavior of Restrained and Unrestrained Eaters," *Appetite*, 28 (1), 33–47.

Galak, Jeff, Justin Kruger, and George Loewenstein (2013), "Slow Down! Insensitivity to Rate of Consumption Leads to Avoidable Satiation," *Journal of Consumer Research*, 39 (5), 993–1009.

———, Joseph P. Redden, and Justin Kruger (2009), "Variety Amnesia: Recalling Past Variety Can Accelerate Recovery from Satiation," *Journal of Consumer Research*, 36 (4), 575–84.

Garbinsky, Emily, Carey K. Morewedge, and Baba Shiv (2014), "Interference of the End: Why Recency Bias in Memory Determines When a Food Is Consumed Again," *Psychological Science*, 25 (7), 1466–74.

Giuliani, Nicole R., Rebecca D. Calcott, and Elliot T. Berkman (2013), "Piece of Cake. Cognitive Reappraisal of Food Craving," *Appetite*, 64, 56–61.

Glanz, Karen, Michael Basil, Edward Maibach, Jeanne Goldberg, and D.A.N. Snyder (1998), "Why Americans Eat What They Do: Taste, Nutrition, Cost, Convenience, and Weight Control Concerns as Influences on Food Consumption," *Journal of the American Dietetic Association*, 98 (10), 1118–26.

Gripshover, Sarah J. and Ellen M. Markman (2013), "Teaching Young Children a Theory of Nutrition: Conceptual Change and the Potential for Increased Vegetable Consumption," *Psychological Science*, 24 (8), 1541–53.

Hall, Kevin D., Juen Guo, Michael Dore, and Carson C. Chow (2009), "The Progressive Increase of Food Waste in America and Its Environmental Impact," *PLoS One*, 4 (11), e7940.

Harnack, Lisa and Simone French (2008), "Effect of Point-of-Purchase Calorie Labeling on Restaurant and Cafeteria Food Choices: A Review of the Literature," *International Journal of Behavioral Nutrition and Physical Activity*, 5 (1), 51.

Harris, Jennifer L., Marlene B. Schwartz, Kelly D. Brownell, Vishnudas Sarda, Amy Ustjanauskas, Johanna Javadizadeh, et al. (2010), *Fast Food Facts: Evaluating Fast Food Nutrition and Marketing to Youth.* Hartford, CT: UConn Rudd Center for Food Policy & Obesity.

Herman, C. Peter and Janet Polivy (1983), "A Boundary Model for the Regulation of Eating," *Psychiatric Annals*, 62, 141–56.

——— and ——— (2014), "Models, Monitoring, and the Mind: Comments on Wansink and Chandon's 'Slim by Design,'" *Journal of Consumer Psychology*, 24 (3), 432–37.

Hilbert, Anja, Martina de Zwaan, and Elmar Braehler (2012), "How Frequent Are Eating Disturbances in the Population? Norms of the Eating Disorder Examination-Questionnaire," *PLoS One*, 7 (1), e29125.

Hoeffler, Steve (2003), "Measuring Preferences for Really New Products," *Journal of Marketing Research*, 40 (November), 406–20.

Holbrook, Morris B. and Elizabeth C. Hirschman (1982), "The Experiential Aspects of Consumption: Consumer Fantasies, Feelings, and Fun," *Journal of Consumer Research*, 9 (2), 132–40.

Hong, Phan Y., David A. Lishner, Kim H. Han, and Elizabeth A. Huss (2011), "The Positive Impact of Mindful Eating on Expectations of Food Liking," *Mindfulness*, 2 (2), 103–13.

Howlett, Elizabeth A., Scot Burton, Kenneth Bates, and Kyle Huggins (2009), "Coming to a Restaurant Near You? Potential Consumer Responses to Nutrition Information Disclosure on Menus," *Journal of Consumer Research*, 36 (3), 494–503.

Hoyer, Wayne D. and Nicola E. Stokburger-Sauer (2012), "The Role of Aesthetic Taste in Consumer Behavior," *Journal of the Academy of Marketing Science*, 40 (1), 167–80.

Hsee, Christopher K. and Yuval Rottenstreich (2004), "Music, Pandas, and Muggers: On the Affective Psychology of Value," *Journal of Experimental Psychology. General*, 133 (1), 23–30.

Irwin, Julie R. and Gary H. McClelland (2001), "Misleading Heuristics and Moderated Multiple Regression Models," *Journal of Marketing Research*, 38 (February), 100–09.

Jose, Paul E., Bee T. Lim, and Fred B. Bryant (2012), "Does Savoring Increase Happiness? A Daily Diary Study," *Journal of Positive Psychology*, 7 (3), 176–87.

Kidwell, Blair, David M. Hardesty, and Terry L. Childers (2008), "Emotional Calibration Effects on Consumer Choice," *Journal of Consumer Research*, 35 (4), 611–21.

Korsmeyer, Carolyn (1999), *Making Sense of Taste: Taste, Food, and Philosophy*. Ithaca, NY: Cornell University Press.

Krishna, Aradhna and Norbert Schwarz (2014), "Sensory Marketing, Embodiment, and Grounded Cognition: A Review and Introduction," *Journal of Consumer Psychology*, 24 (2), 159–68.

Kristeller, Jean L. and Ruth Q. Wolever (2010), "Mindfulness-Based Eating Awareness Training for Treating Binge Eating Disorder: The Conceptual Foundation," *Eating Disorders*, 19 (1), 49–61.

Laran, Juliano (2010), "Choosing Your Future: Temporal Distance and the Balance Between Self-Control and Indulgence," *Journal of Consumer Research*, 36 (6), 1002–15.

Larson, Jeffrey S., Joseph P. Redden, and Ryan S. Elder (2014), "Satiation from Sensory Simulation: Evaluating Foods Decreases Enjoyment of Similar Foods," *Journal of Consumer Psychology*, 24 (2), 188–94.

Lavender, Jason M., Kyle P. De Young, and Drew A. Anderson (2010), "Eating Disorder Examination Questionnaire (EDE-Q): Norms for Undergraduate Men," *Eating Behaviors*, 11 (2), 119–21.

Ledikwe, Jenny H., Julia A. Ello-Martin, and Barbara J. Rolls (2005), "Portion Sizes and the Obesity Epidemic," *Journal of Nutrition*, 135 (4), 905–09.

Ludwig, David S. and Marion Nestle (2008), "Can the Food Industry Play a Constructive Role in the Obesity Epidemic?" *Journal of the American Medical Association*, 300 (15), 1808–11.

McGill, Ann L. and Punam Anand (1989), "The Effect of Imagery on Information Processing Strategy in a Multiattribute Choice Task," *Marketing Letters*, 1 (1), 7–16.

Mennella, Julie A. and Gary K. Beauchamp (1999), "Experience with a Flavor in Mother's Milk Modifies the Infant's Acceptance

of Flavored Cereal," *Developmental Psychobiology*, 35 (3), 197–203.

Morewedge, Carey K., Young Eun Huh, and Joachim Vosgerau (2010), "Thought for Food: Imagined Consumption Reduces Actual Consumption," *Science*, 330 (6010), 1530–33.

Moulton, Samuel T. and Stephen M. Kosslyn (2009), "Imagining Predictions: Mental Imagery as Mental Emulation," *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364 (1521), 1273–80.

Nestle, Marion (2003), "Increasing Portion Sizes in American Diets: More Calories, More Obesity," *Journal of the American Dietetic Association*, 103 (1), 39–40.

Papies, Esther K., Lawrence W. Barsalou, and Ruud Custers (2012), "Mindful Attention Prevents Mindless Impulses," *Social Psychological & Personality Science*, 3 (3), 291–99.

———, Tila M. Pronk, Mike Keesman, and Lawrence W. Barsalou (2014), "The Benefits of Simply Observing: Mindful Attention Modulates the Link Between Motivation and Behavior," *Journal of Personal Social Psychology*, 108 (1), 148–70.

Patterson, Ruth E., Jessie A. Satia, Alan R. Kristal, Marian L. Neuhouser, and Adam Drewnowski (2001), "Is There a Consumer Backlash Against the Diet and Health Message?" *Journal of the American Dietetic Association*, 101 (1), 37–41.

Poothullil, John M. (2002), "Role of Oral Sensory Signals in Determining Meal Size in Lean Women," *Nutrition (Burbank, Los Angeles County, Calif.)*, 18 (6), 479–83.

Quoidbach, Jordi, Elizabeth V. Berry, Michel Hansenne, and Moïra Mikolajczak (2010), "Positive Emotion Regulation and Well-Being: Comparing the Impact of Eight Savoring and Dampening Strategies," *Personality and Individual Differences*, 49 (5), 368–73.

——— and Elizabeth W. Dunn (2013), "Give It Up: A Strategy for Combating Hedonic Adaptation," *Social Psychological & Personality Science*, 4 (5), 563–68.

Raghunathan, Rajagopal, Rebecca Walker Naylor, and Wayne D. Hoyer (2006), "The Unhealthy = Tasty Intuition and Its Effects on Taste Inferences, Enjoyment, and Choice of Food Products," *Journal of Marketing*, 70 (October), 170–84.

Redden, Joseph P. (2008), "Reducing Satiation: The Role of Categorization Level," *Journal of Consumer Research*, 34 (5), 624–34.

Redden, Joseph P. and Kelly L. Haws (2013), "Healthy Satiation: The Role of Decreasing Desire in Effective Self-Control," *Journal of Consumer Research*, 39 (5), 1100–14.

Rode, Elizabeth, Paul Rozin, and Paula Durlach (2007), "Experienced and Remembered Pleasure for Meals: Duration Neglect but Minimal Peak, End (Recency) or Primacy Effects," *Appetite*, 49 (1), 18–29.

Rolls, Barbara J., Ingrid C. Fedoroff, and Joanne F. Guthrie (1991), "Gender Differences in Eating Behavior and Body Weight Regulation," *Health Psychology*, 10 (2), 133–42.

———, Liane S. Roe, and Jennifer S. Meengs (2007), "The Effect of Large Portion Sizes on Energy Intake Is Sustained for 11 Days," *Obesity*, 15 (6), 1535–43.

———, Edmund T. Rolls, Edward A. Rowe, and Kevin Sweeney (1981), "Sensory Specific Satiety in Man," *Physiology & Behavior*, 27 (1), 137–42.

Rozin, Paul (1990), "Development in the Food Domain," *Developmental Psychology*, 26 (4), 555–62.

———, Kimberly Kabnick, Erin Pete, Claude Fischler, and Christy Shields (2003), "The Ecology of Eating: Smaller Portion Sizes in France Than in the United States Help Explain the French Paradox," *Psychological Science*, 14 (5), 450–54.

———, Abigail K. Remick, and Claude Fischler (2011), "Broad Themes of Difference Between French and Americans in Attitudes to Food and Other Life Domains: Personal Versus Communal Values, Quantity Versus Quality, and Comforts Versus Joys," *Frontiers in Psychology*, 2, 177.

Shiv, Baba and Alexander Fedorikhin (1999), "Heart and Mind in Conflict: The Interplay of Affect and Cognition in Consumer Decision Making," *Journal of Consumer Research*, 26 (3), 278–92.

Sorensen, Lone Brinkmann, Per Møller, A. Flint, Magni Martens, and A. Raben (2003), "Effect of Sensory Perception of Foods on Appetite and Food Intake: A Review of Studies on Humans," *International Journal of Obesity*, 27 (10), 1152–66.

Stroebe, Wolfgang, Guido M. Van Koningsbruggen, Esther K. Papies, and Henk Aarts (2013), "Why Most Dieters Fail but Some Succeed: A Goal Conflict Model of Eating Behavior," *Psychological Review*, 120 (1), 110–38.

Trope, Yaacov and Ayelet Fishbach (2000), "Counteractive Self-Control in Overcoming Temptation," *Journal of Personality and Social Psychology*, 79 (4), 493–506.

Tully, Stephanie and Tom Meyvis (2016), "Questioning the End Effect: Endings Are Not Inherently Over-Weighted in Retrospective Evaluations of Experiences," *Journal of Experimental Psychology: General*, 145 (5), 630–42.

Tuorila, Hely, Herbert L. Meiselman, Rick Bell, Armand V. Cardello, and William Johnson (1994), "Role of Sensory and Cognitive Information in the Enhancement of Certainty and Linking for Novel and Familiar Foods," *Appetite*, 23 (3), 231–46.

Van Kleef, Ellen, Mitsuru Shimizu, and Brian Wansink (2013), "Just a Bite: Considerably Smaller Snack Portions Satisfy Delayed Hunger and Craving," *Food Quality and Preference*, 27 (1), 96–100.

Van Strien, Tatjana, Jan E.R. Frijters, Gerard P.A. Bergers, and Peter B. Defares (1986), "The Dutch Eating Behavior Questionnaire (DEBQ) for Assessment of Restrained, Emotional, and External Eating Behavior," *International Journal of Eating Disorders*, 5 (2), 295–315.

Wang, Jing, Nathan Novemsky, and Ravi Dhar (2009), "Anticipating Adaptation to Products," *Journal of Consumer Research*, 36 (2), 149–59.

Wansink, Brian and Pierre Chandon (2014), "Slim by Design: Redirecting the Accidental Drivers of Mindless Overeating," *Journal of Consumer Psychology*, 24 (3), 413–31.

Zellner, Debra A., Christopher R. Loss, Jonathan Zearfoss, and Sergio Remolina (2014), "It Tastes as Good as It Looks! The Effect of Food Presentation on Liking for the Flavor of Food," *Appetite*, 77, 31–35.

Zlatevska, Natalina, Chris Dubelaar, and Stephen S. Holden (2014), "Sizing Up the Effect of Portion Size on Consumption: A Meta-Analytic Review," *Journal of Marketing*, 78 (May), 140–54.

SUPPLEMENTARY WEB APPENDIX

Stimuli and Questionnaires for:

PLEASURE AS A SUBSTITUTE FOR SIZE: HOW MULTISENSORY IMAGERY CAN MAKE PEOPLE HAPPIER WITH SMALLER FOOD PORTIONS

YANN CORNIL
yann.cornil@sauder.ubc.ca

PIERRE CHANDON
pierre.chandon@insead.edu

Contents

STUDY 1 (in French)

Oral instructions by the experimenter.
The children gather in groups of 4 around a table and are encouraged to participate.

[All conditions]
« Aujourd'hui, on va travailler sur les sens. Vous vous souvenez des cinq sens? »
« Les yeux pour … regarder, le nez pour … sentir, la bouche pour … goûter, les oreilles pour … écouter, les doigts pour … toucher ».
[Montrer les cartes avec les cinq sens.]

[Condition « Food Sensory Imagery »]
« Ensemble, on va parler de la nourriture et des sens. »
[Montrer la photo Gaufrette chocolat.]
« Qu'est-ce que c'est ? »
« Quand on mange une gaufrette, on utilise les yeux, le nez, les oreilles, et la bouche »
« D'abord, on utilise les yeux [*montrer la carte Yeux*]. Vous trouvez que cette gaufrette est jolie ? ».
« Ensuite on utilise le nez [*montrer la carte Nez*]. Qu'est-ce qu'on fait avec le nez ? Est-ce que vous croyez que cette gaufrette sent bon ? »
« Ensuite on croque dans la gaufrette, et on entend avec les oreilles [*montrer la carte oreille*]. Qu'est-ce que ça fait comme bruit quand on croque dans une gaufrette ? »
« Enfin, on utilise la bouche [*montrer la carte bouche*]. Qu'est-ce qu'on fait avec la bouche ? Quel goût on a dans la bouche quand on mange une gaufrette ? »
« Maintenant, on va jouer à imaginer dans sa tête les sens : la vue [*montrer la carte Yeux*], l'odeur [*montrer la carte Nez*], le bruit [*montrer la carte oreille*] et le goût [*montrer la carte bouche*]. Je vais vous montrer des photos de nourriture que vous aimez, et on va faire comme si on les mangeait, et on va penser dans sa tête, au goût, à l'odeur et au bruit des aliments».
« Ecoutez bien, c'est très important »
« Regardez bien. Qu'est-ce que c'est ? Regardez bien».
[Montrer la photo céréales et attendre 10 secondes.]
« On met les mains devant les yeux, cachez bien vos yeux c'est important».
« Ecoutez bien. On va imaginer dans sa tête l'odeur des céréales et du lait. Est-ce que vous arrivez à imaginer dans la tête cette odeur ? Ca sent bon ?»
« Maintenant, on imagine dans sa tête qu'on prend une grande cuiller de lait et de céréales, on la met dans sa bouche, et on croque ! Faites le bruit quand on croque dans des céréales ! »
« Maintenant, on imagine dans sa tête qu'on goûte les céréales, vous arrivez à imaginer les goûts ? Ca a quel goût ? Le bon goût du chocolat et du lait froid. »
« Vous pouvez retirer vos mains et regarder la photo suivante. Qu'est-ce-que c'est ? Regardez bien »
[Montrer la photo smarties et attendre 10 secondes]
« On met les mains devant les yeux, cachez vos yeux ».
« D'abord on va imaginer dans sa tête qu'on met des smarties dans sa bouche, sans les croquer. Qu'est-ce qu'il se passe ? Est-ce que ça fond ? Ca a quel goût ? »
« Ensuite on va croquer. Imaginez dans votre tête que vous croquez dans les smarties. Ca fait quel bruit ? »
« Et maintenant, ça a quel goût ? Est-ce que vous sentez le goût du chocolat ? «
« Vous pouvez retirer vos mains. Bravo ! ».

[Condition « Non Food Sensory Imagery »]
« Ensemble, on va parler des saisons ».
[Montrer la photo automne.]

« C’est quelle saison ?
« Pourquoi on voit que c’est l’automne ? » *[Montrer la carte yeux.]*
« Que font les enfants ? »
« Qu’est-ce qu’il se passe dans les arbres en automne ? »
« De quelle couleur sont les feuilles en automne ? »
« Ca fait quel bruit quand on marche sur les feuilles mortes ? On écoute le bruit des feuilles avec quoi ? Faites le bruit des feuilles mortes quand on marche dessus». *[Montrer la carte oreille]*
« Les enfants sont dans la forêt, ça sent bon la forêt ? Ca sent bon les arbres ? On sent les arbres avec quoi ?». *[Montrer la carte nez]*
« Maintenant, on va jouer à imaginer dans sa tête les saisons avec la vue [*montrer la carte Yeux*], l’odeur [*montrer la carte Nez*], le bruit [*montrer la carte oreille*] et le goût [*montrer la carte bouche*]. Je vais vous montrer des photos, et on va imaginer dans sa tête ce qu’il se passe ».
[Montrer la photo hiver et attendre 10 secondes.]
« C’est quelle saison ? »
« Pourquoi on voit que c’est l’hiver »
« que font les enfants ? »
« Vous aimez jouer avec la neige ? »
« Ecoutez bien, c’est très important »
« On met les mains devant les yeux, cachez bien vos yeux c’est important».
« Ecoutez bien. On va imaginer dans sa tête qu’on joue avec la neige ».
« Imaginez que vous touchez la neige avec les doigts. Vous y arrivez ? C’est comment ? »
« Maintenant essayez d’imaginer que la neige fond dans la main. Vous y arrivez ? C’est comment ? ».
« Maintenant on met un peu de neige sur la langue. Vous y arrivez ? Ca a quel goût ? ».
« Vous pouvez retirer vos mains et regarder la photo suivante. Qu’est-ce-que c’est ? Regardez bien »
[Montrer la photo été et attendre 10 secondes.]
« C’est quelle saison ? »
« Pourquoi on voit que c’est l’été »
« que font les enfants ? »
« Vous aimez le soleil? »
« Ecoutez bien, c’est très important »
« On met les mains devant les yeux, cachez bien vos yeux c’est important».
« Imaginez qu’il y a du soleil. Ca fait comment quand on sent le soleil sur la peau ? Ça vous plaît ? »
« Imaginez que vous touchez le sable avec vos doigts. Vous y arrivez ? »
« Et maintenant imaginez que vous vous approchez de la mer. Vous sentez l’odeur de la mer ? Ça vous plaît ?
« Imaginez que vous touchez l’eau avec vos doigts de pieds. Vous y arrivez ? »
« Vous pouvez retirer vos mains. Bravo ! ».

[All conditions]
« Maintenant prenez chacun une image d’enfant, les filles prenez une fille, les garçons prenez un garçon ».
« On va faire semblant que l’enfant sur l’image c’est vous, alors écrivez bien votre nom sur l’image. »
« Je vais mettre sur la table des images de gâteaux de différentes tailles, parce qu’il y a des enfants qui aiment les grands gâteaux et des enfants qui aiment les petits gâteaux ».
« Maintenant, choisissez la part de gâteau que vous préférez, et collez la dans la main de l’enfant. Réfléchissez bien avant de choisir. Vous pouvez choisir le gâteau que vous voulez, un grand si vous voulez un grand gâteau, un petit si vous voulez un petit gâteau. »
« Maintenant, je vais mettre sur la table des images de verres avec du jus de fruit. Parfois il y en a un peu, parfois plus.».
« Prenez le verre que vous préférez, et collez la dans l’autre main de l’enfant. Réfléchissez bien avant de choisir. »

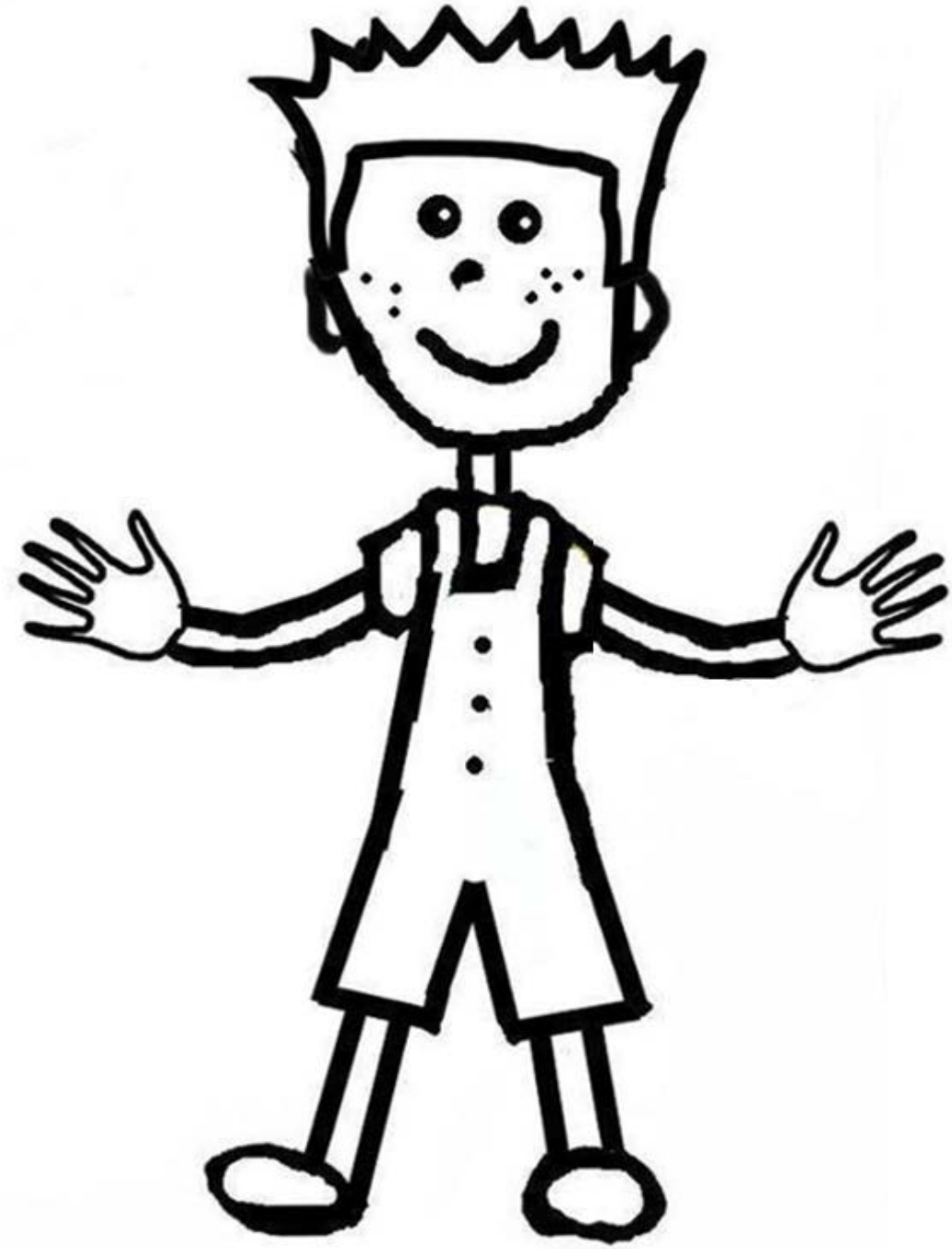
« Maintenant on va se préparer le goûter de l'après-midi. Je vais emmener un enfant à la fois dans le bureau de la maîtresse pour choisir le goûter. Les autres enfants resteront pour écrire leur nom sur la feuille. »
[Accompagner chaque enfant, un par un, dans le bureau]
« On a préparé 5 parts de gâteau. Quelle part tu voudras prendre ? réfléchis bien à ce que tu préfères, car j'écris ton choix sur mon papier à côté de ton prénom. ».
« A ton avis, ce gâteau est-il pas bon, un peu bon ou très bon ? »
« On a aussi préparé 5 verres de jus de fruits. Quel verre tu voudras prendre ? réfléchis bien à ce que tu préfères, car j'écris ton choix sur mon papier a cote de ton prénom. ».
« At ton avis, ce jus de fruits est-il pas bon, un peu bon ou très bon ? »

Five senses cards (used in all conditions)

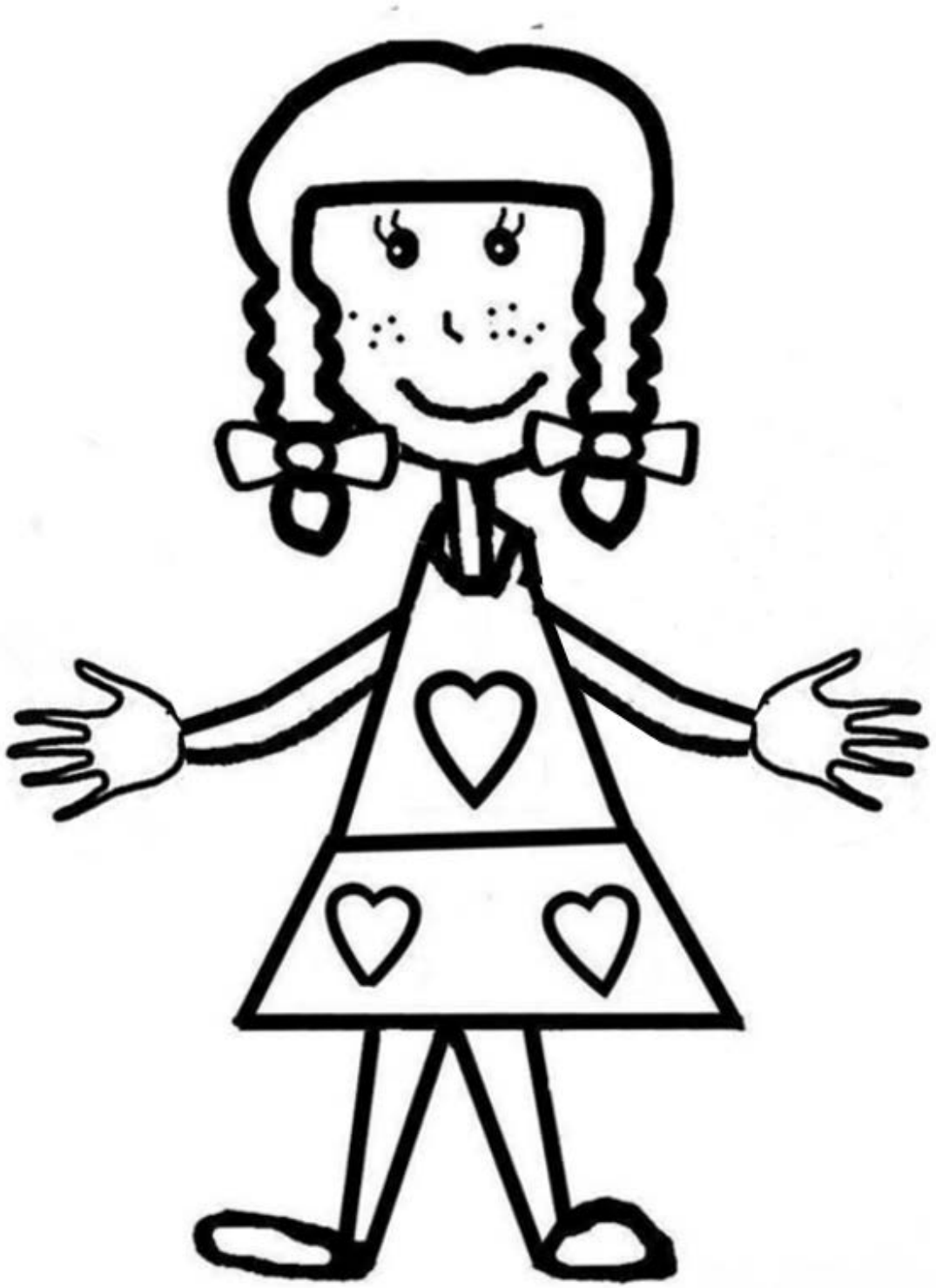
Pictures used in the “Food Sensory Imagery” condition

Pictures used in the “Non-Food Sensory Imagery” condition

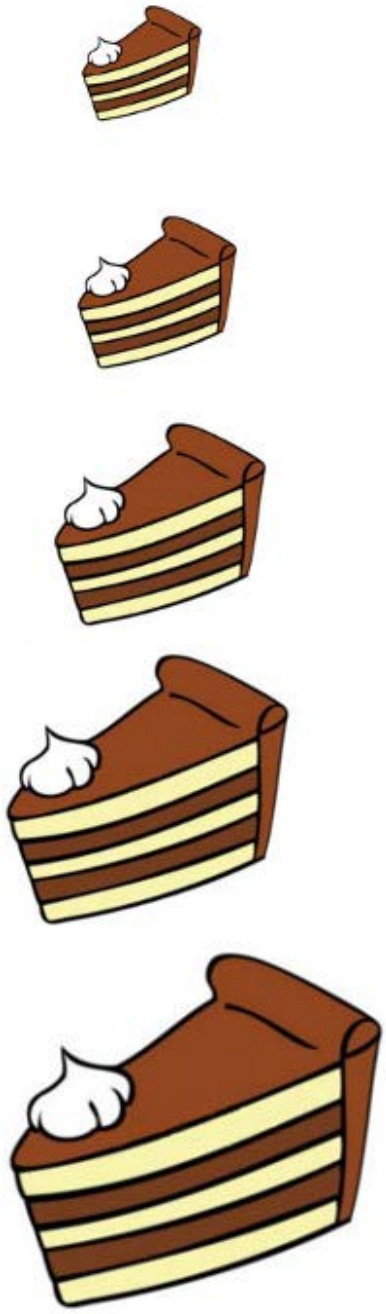
Drawing of little boy (used in all conditions)



Drawing of little girl (used in all conditions)



Chocolate cake stickers (used in all conditions)



Soft drink stickers (used in all conditions)

Food display

STUDY 2

[All conditions]

When was the last time you ate approximately?
__ minute(s) ago
__ hour(s) ago
__ day(s) ago

[end of page]

Are you hungry now? Please rate your level of hunger on the following scale
❍ 1 Absolutely not
❍ 2
❍ 3
❍ 4
❍ 5
❍ 6
❍ 7
❍ 8
❍ 9 Absolutely

[end of page]

[Sensory Imagery Conditions]

In the following pages, you will be shown pictures of desserts. You will be asked to imagine eating these desserts, and especially to imagine vividly the tastes, the smells, the textures, all the sensory feelings you can experience when eating these desserts. It is very important that you try to imagine as vividly as possible all the sensory feelings provided by these desserts. Take all the time you need to have a "mental image" as detailed as possible of the taste, smell and textures of the desserts. Through your imagination, you should be able to experience sensations as realistic as possible, as if you were actually tasting these desserts.

[end of page]

Take all the time you need to imagine as vividly as possible the taste, smell and texture in mouth of this dessert.

How vividly can you imagine the TASTE of this dessert ?
- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

How vividly can you imagine the SMELL of this dessert ?
- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

How vivid can you imagine the TEXTURE IN MOUTH of this dessert ?
- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

[end of page]

Take all the time you need to imagine as vividly as possible the taste, smell and texture in mouth of this dessert.

How vividly can you imagine the TASTE of this dessert ?
- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

How vividly can you imagine the SMELL of this dessert ?
- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

How vividly can you imagine the TEXTURE IN MOUTH of this dessert ?
- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

[end of page]

Take all the time you need to imagine as vividly as possible the taste, smell and texture in mouth of this dessert.

How vividly can you imagine the TASTE of this dessert ?
- o I think of it, but do not have an image before me
- o vague and unclear
- o not so clear and vivid but still recognizable
- o Vivid and almost as clear as in reality
- o Very vivid and clear as in reality

How vividly can you imagine the SMELL of this dessert ?
- o I think of it, but do not have an image before me
- o vague and unclear
- o not so clear and vivid but still recognizable
- o Vivid and almost as clear as in reality
- o Very vivid and clear as in reality

How vividly can you imagine the TEXTURE IN MOUTH of this dessert ?
- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

[end of page]

[Control Condition]

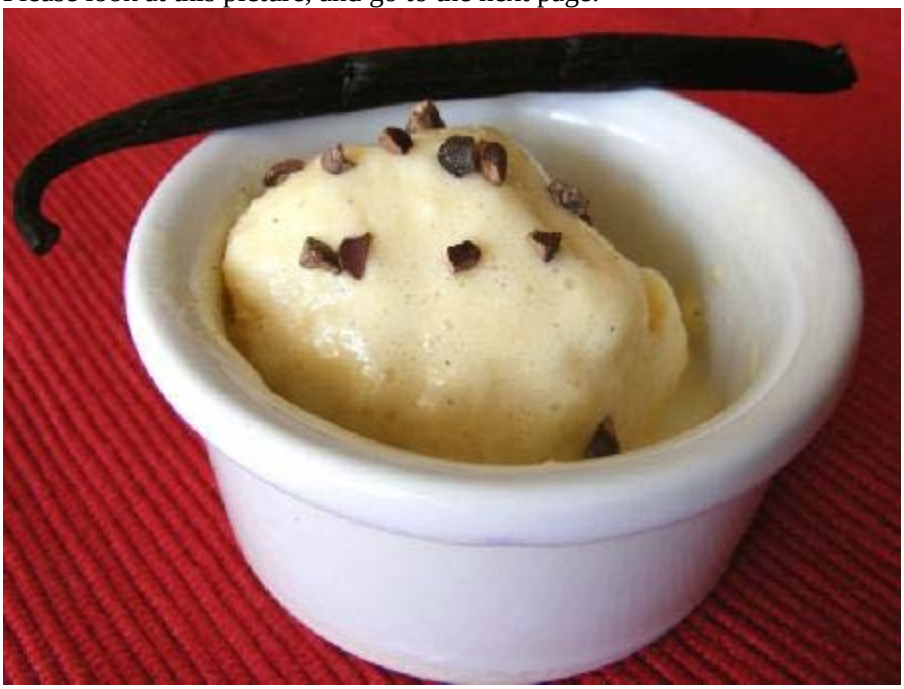
In the following pages, you will be shown pictures of desserts. Please look at these pictures closely.

[end of page]

Please look at this picture, and go to the next page.

[end of page]

Please look at this picture, and go to the next page.



[end of page]

Please look at this picture, and go to the next page.

[end of page]

[Simulated Satiation Condition]

We are going to start with a mind clearing task. To "clear up your mind", you will be asked to imagine eating a bite-sized chocolate cake thirty times. To really clear up your mind, it is very important that you imagine as vividly as possible eating the bite-sized chocolate cake, every time! Please go to the next page to start.

[end of page]

Please imagine eating this bite-sized chocolate cake. Then, go to the next page.

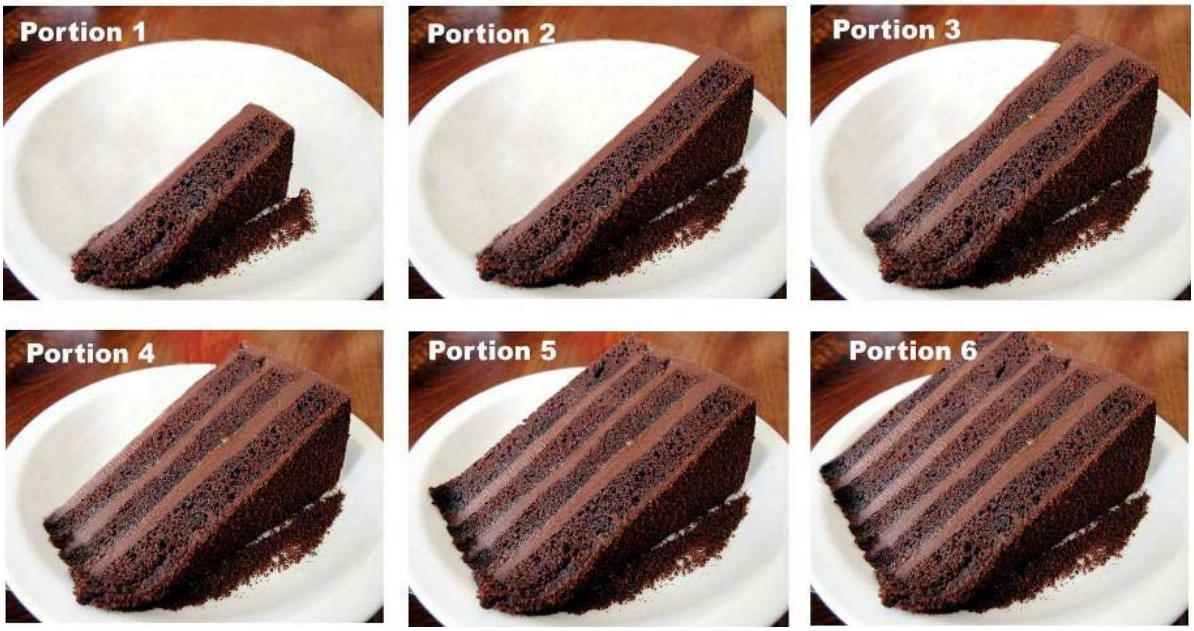
[end of page]
[The page with the question and the picture above was displayed thirty times].

Thank you very much! Please continue.

[end of page]

[All Conditions]

Chocolate Cake



Please look at these different portions of Chocolate Cake.

Imagine that you have the option to eat one of these six portions of chocolate cake right now. If you could choose one portion and eat it all right now, which portion would you choose?

- o Portion 1
- o Portion 2
- o Portion 3
- o Portion 4
- o Portion 5
- o Portion 6

[end of page]

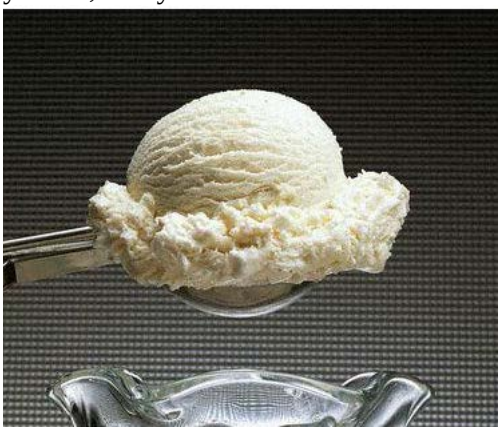
[Show photo of the chosen portion]

How much do you expect to enjoy eating the portion of cake you just chose ? Please evaluate your expected enjoyment on a scale from 1 (I would not enjoy eating it at all) to 9 (I would enjoy eating it a lot).

- ❍ 1 I would not enjoy eating it at all
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7
- ❍ 8
- ❍ 9 I would enjoy eating it a lot

[end of page]

Now imagine that you have eaten the portion of cake that you chose. Four hours have passed, and you have the option to eat some vanilla ice cream, like the one below. How many scoops of ice cream would you eat, if any?



- ❍ 0 scoop
- ❍ 1 scoop
- ❍ 2 scoops
- ❍ 3 scoops
- ❍ 4 scoops
- ❍ 5 scoops
- ❍ 6 scoops
- ❍ 7 scoops
- ❍ 8 scoops
- ❍ 9 scoops (
- ❍ More (please indicate a number below) _____

[end of page]

STUDY 3

[PHASE 1 – All Conditions]

Are you hungry now ?
- ❍ 1 Absolutely not
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7
- ❍ 8
- ❍ 9 Absolutely

[end of page]

When was the last time you ate approximately?
__ minute(s) ago
__ hour(s) ago
__ day(s) ago

[end of page]

Please read this text attentively. There are two different types of pleasure when eating: One type of pleasure comes when you were hungry and you are not hungry anymore as a result of eating. Think for instance of the comforting and pleasant sensation of being full or satiated (but not stuffed) after eating. One other type of pleasure comes from the "sensory experience" of eating. By "sensory experience", we mean, savoring the food, for instance, feeling the taste on your tongue and your palate, feeling the texture of the food in your mouth, etc. In the following pages, you will be asked to evaluate the pleasantness of different portions of chocolate cake, sometimes according to whether the portion would satisfy your hunger, and sometimes according to whether the portion would give you an enjoyable sensory experience.

[end of page]

Please look at these different portions of Chocolate Cake.

Chocolate Cake

Please state whether you agree or disagree with the following sentences, for each of the portions. To state your agreement or disagreement, it is very important that you think of eating as a sensory experience. By "sensory experience", we mean, for instance, feeling the taste of chocolate on your tongue and your palate, feeling the texture of the chocolate cake in your mouth, feeling the chocolate melting in your mouth, etc.

This portion would be just enough for me to have a pleasurable sensory experience
Tip: Choose a high rating if the portion is just right, and a lower rating if it is not enough or if it is too much!

	Not at all1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	Totally 9 (9)
Portion 1 (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 2 (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 3 (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 4 (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 5 (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 6 (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

This portion would be just enough for me to enjoy the taste of chocolate cake.
Tip: Choose a high rating if the portion is just right, and a lower rating if it is not enough or if it is too much!

	Not at all1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	Totally9 (9)
Portion 1 (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 2 (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 3 (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 4 (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 5 (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 6 (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

This portion would be just enough for me to savor the cake.
Tip: Choose a high rating if the portion is just right, and a lower rating if it is not enough or if it is too much!

	Not at all1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	Totally9 (9)
Portion 1 (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 2 (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 3 (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 4 (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 5 (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 6 (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

[end of page]

Please look at these different portions of Chocolate Cake.

Chocolate Cake

Please state whether you agree or disagree with the following sentences, for each of the portions. To state your agreement or disagreement, it is very important that you think of eating as the satisfaction of an appetite or the satisfaction of hunger. Think for instance of the comforting sensation of being full or satiated (but not stuffed) after eating.

"This portion would be just enough to feel comfortably full for dessert."
Tip: Choose a high rating if the portion is just right, and a lower rating if it is not enough or if it is too much!

	Not at all1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	Totally9 (9)
Portion 1 (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 2 (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 3 (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 4 (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 5 (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 6 (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

This portion would be just enough for me to be satiated for dessert.
Tip: Choose a high rating if the portion is just right, and a lower rating if it is not enough or if it is too much!

	Not at all1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	Totally9 (9)
Portion 1 (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 2 (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 3 (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 4 (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 5 (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 6 (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

This portion would be just enough to satisfy my appetite for dessert.
Tip: Choose a high rating if the portion is just right, and a lower rating if it is not enough or if it is too much!

	Not at all1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	Totally9 (9)
Portion 1 (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 2 (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 3 (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 4 (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 5 (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 6 (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

[PHASE 2 – ONE WEEK LATER]

[Sensory Imagery Condition]

In the following pages, you will be shown pictures of desserts. You will be asked to imagine vividly the tastes, the aromas, the textures, all the sensory feelings you can experience when eating these desserts. It is very important that you try to imagine as vividly as possible all the sensory feelings provided by these desserts. Take all the time you need to have a mental image as detailed as possible of the taste, smell and

textures of the desserts. Through your imagination, you should be able to experience sensations as realistic as possible, as if you were actually tasting these desserts. Take all the time you need!

[end of page]

Take all the time you need to imagine as vividly as possible the taste, smell and texture in mouth of this dessert.

How vividly can you imagine the TASTE of this dessert ?

- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

How vividly can you imagine the SMELL of this dessert ?

- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

How vivid can you imagine the TEXTURE IN MOUTH of this dessert ?

- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

[end of page]

Take all the time you need to imagine as vividly as possible the taste, smell and texture in mouth of this dessert.

How vividly can you imagine the TASTE of this dessert ?
- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

How vividly can you imagine the SMELL of this dessert ?
- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

How vividly can you imagine the TEXTURE IN MOUTH of this dessert ?
- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

[end of page]

Take all the time you need to imagine as vividly as possible the taste, smell and texture in mouth of this dessert.

How vividly can you imagine the TASTE of this dessert ?
- o I think of it, but do not have an image before me
- o vague and unclear
- o not so clear and vivid but still recognizable
- o Vivid and almost as clear as in reality
- o Very vivid and clear as in reality

How vividly can you imagine the SMELL of this dessert ?
- o I think of it, but do not have an image before me
- o vague and unclear
- o not so clear and vivid but still recognizable
- o Vivid and almost as clear as in reality
- o Very vivid and clear as in reality

How vividly can you imagine the TEXTURE IN MOUTH of this dessert ?
- ❍ I think of it, but do not have an image before me
- ❍ vague and unclear
- ❍ not so clear and vivid but still recognizable
- ❍ Vivid and almost as clear as in reality
- ❍ Very vivid and clear as in reality

[end of page]

[Control Condition]

In the following pages, you will be shown pictures of chairs. You will be asked to imagine sitting on them. It is very important that you try to imagine as vividly as possible how it feels to sit on those chairs. Take all the time you need!

[end of page]

How vividly can you imagine the sitting on this chair ?

- o I think of it, but do not have an image before me
- o vague and unclear
- o not so clear and vivid but still recognizable
- o Vivid and almost as clear as in reality
- o Very vivid and clear as in reality

[end of page]

How vividly can you imagine the sitting on this chair ?

- o I think of it, but do not have an image before me
- o vague and unclear
- o not so clear and vivid but still recognizable
- o Vivid and almost as clear as in reality
- o Very vivid and clear as in reality

[end of page]

How vividly can you imagine the sitting on this chair ?

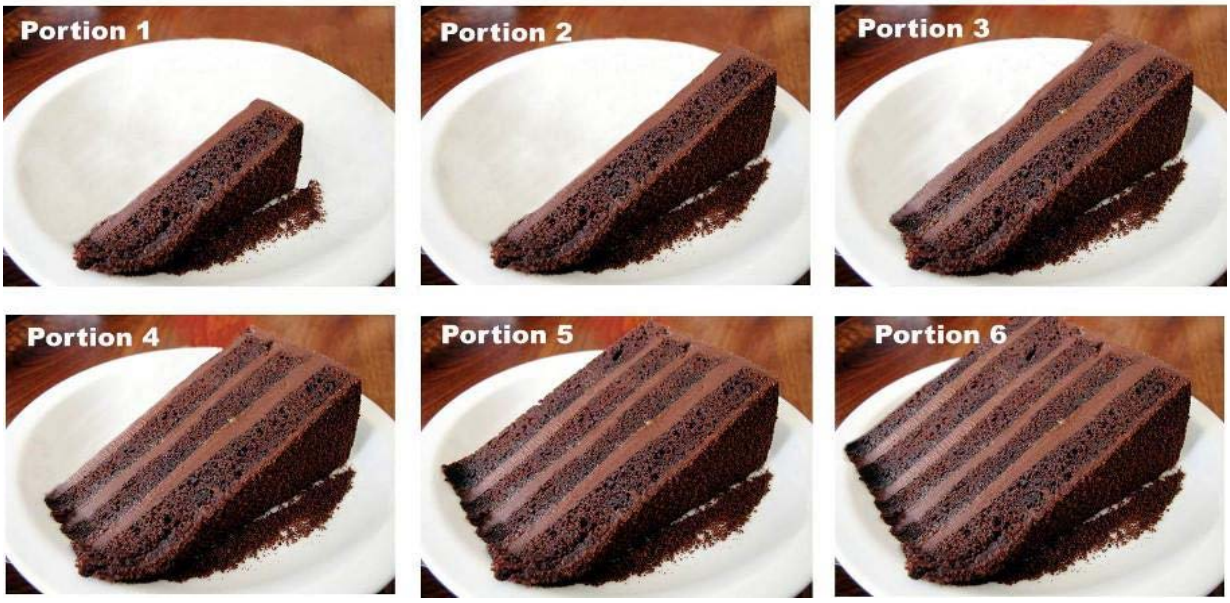
- o I think of it, but do not have an image before me
- o vague and unclear
- o not so clear and vivid but still recognizable
- o Vivid and almost as clear as in reality
- o Very vivid and clear as in reality

[end of page]

[All Conditions]

Please look at these different portions of Chocolate Cake.

Chocolate Cake



Please state whether you agree or disagree with the following sentences, for each of the portions.

If you could choose one portion and eat it all right now, which portion would you choose?

- ❍ Portion 1 (1)
- ❍ Portion 2 (2)
- ❍ Portion 3 (3)
- ❍ Portion 4 (4)
- ❍ Portion 5 (5)
- ❍ Portion 6 (6)

Look at each portion size, and estimate how likely you would be to choose the portion.
Tip: Choose a high rating if the portion is just right and you would definitely choose it, and a lower rating if it is not enough or if it is too much, and you would probably not choose it.

	Highly unlikely (1)	2 (2)	3 (3)	4 (4)	5 (5)	6 (6)	7 (7)	8 (8)	Highly likely (9)
Portion 1 (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 2 (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 3 (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 4 (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 5 (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 6 (6)	❍	❍	❍	❍	❍	❍	❍	❍	❍

[end of page]

[Show photo of the chosen portion]

In the previous questions, you said that you would rather choose Portion *[Insert number]*. What would be the maximum price (in USD) that you would be willing to pay for this portion?

[end of page]

In the previous questions, we asked you to choose a portion of chocolate cake. When you were giving your answers, what were you thinking: satisfying your hunger or enjoying the taste of the cake?
IMPORTANT INSTRUCTIONS: On top each of the scales below, we suggest two sentences which may reflect what your were thinking when choosing the portions. If one sentence reflects what you were thinking more than the other, move the cursor toward that sentence. The more the sentence reflects what you were thinking, the more you will move the cursor toward that sentence. If none of the sentences is relevant, or if both sentences are equally relevant, leave the cursor in the middle.

When evaluating the portions of cake…
I was thinking of the cake's tastiness ---------- I was wondering whether the portion would satisfy my appetite

When evaluating the portions of cake…
I was thinking of eating the cake as a sensory experience ---------- I was wondering whether the portion would make me feel comfortably full

When evaluating the portions of cake…
I was thinking of how I would savor the cake ---------- I was wondering whether the portion would make me feel pleasantly satiated.

[end of page]

When evaluating the pleasantness of each portion, were you thinking of its impact on your health or weight ?

- ❍ 1 Not at all
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7 Absolutely

STUDY 4 (in French)

[All conditions]

Avant de commencer, merci de répondre à ces questions: Avez-vous faim en ce moment?
- ❍ Je n'ai pas faim du tout
- ❍ J'ai très peu faim
- ❍ J'ai un peu faim
- ❍ J'ai modérément faim
- ❍ J'ai assez faim
- ❍ J'ai très faim
- ❍ J'ai extrêmement faim

[end of page]

Quand avez-vous mangé pour la dernière fois?
Il y a __ minute(s)
Il y a __ heure(s) ago
Il y a __ jour(s)

[end of page]

Dans cette étude, nous nous intéressons à la perception de la taille des portions alimentaires. C'est pour cette raison qu'il y a plusieurs portions de brownies disposées derrière vous. Nous allons évaluer si vous parvenez à estimer le poids de ces portions. Nous cherchons également à savoir si la perception de la taille d'une portion change quand on l'a mangée ou pas. C'est la raison pour laquelle certains d'entre vous (après tirage au sort), seront amenés à manger une de ces portions. Merci de passer à la page suivante.

[end of page]

[Health Imagery condition]

Dans les pages qui vont suivre, vous allez estimer le poids (en grammes) de différents desserts à haute teneur en sucre et en matières grasses. Attention, pour que le test soit concluant, vous devez au préalable imaginer les conséquences pour votre poids et votre santé si vous mangez régulièrement et sans modération ce type de desserts.
« Pour votre santé, évitez de manger trop gras, trop sucré, trop salé »
« Pour votre santé, mangez au moins 5 fruits et légumes par jour »

[end of page]

Prenez votre temps pour imaginer les conséquences sur votre poids et votre santé, si vous mangez trop et trop souvent ce type de dessert.

Selon vous, si vous consommez ce dessert régulièrement et sans modération ...
- ❍ ça ne me ferait pas prendre de poids
- ❍ ça me ferait prendre un peu de poids
- ❍ ça me ferait prendre du poids
- ❍ ça me ferait prendre beaucoup de poids

Selon vous, si vous consommez ce dessert régulièrement et sans modération ...
- ❍ ça n'aurait aucun impact sur ma santé
- ❍ ça aurait un impact un peu négatif sur ma santé
- ❍ ça aurait un impact négatif sur ma santé
- ❍ ça aurait aucun un impact très négatif sur ma santé

Quel est selon vous le poids de ce dessert (en grammes)?

[end of page]

Prenez votre temps pour imaginer les conséquences sur votre poids et votre santé, si vous mangez trop et trop souvent ce type de dessert.

Selon vous, si vous consommez ce dessert régulièrement et sans modération ...
- ça ne me ferait pas prendre de poids
- ça me ferait prendre un peu de poids
- ça me ferait prendre du poids
- ça me ferait prendre beaucoup de poids

Selon vous, si vous consommez ce dessert régulièrement et sans modération ...
- ça n'aurait aucun impact sur ma santé
- ça aurait un impact un peu négatif sur ma santé
- ça aurait un impact négatif sur ma santé
- ça aurait aucun un impact très négatif sur ma santé

Quel est selon vous le poids de ce dessert (en grammes)?

[end of page]

Prenez votre temps pour imaginer les conséquences sur votre poids et votre santé, si vous mangez trop et trop souvent ce type de dessert.

Selon vous, si vous consommez ce dessert régulièrement et sans modération ...
- ça ne me ferait pas prendre de poids
- ça me ferait prendre un peu de poids
- ça me ferait prendre du poids
- ça me ferait prendre beaucoup de poids

Selon vous, si vous consommez ce dessert régulièrement et sans modération ...
- ça n'aurait aucun impact sur ma santé
- ça aurait un impact un peu négatif sur ma santé
- ça aurait un impact négatif sur ma santé
- ça aurait aucun un impact très négatif sur ma santé

Quel est selon vous le poids de ce dessert (en grammes)?

[end of page]

[Sensory Imagery condition]

Dans les pages qui vont suivre, vous allez estimer le poids (en grammes) de différents desserts. Attention, pour que le test soit concluant, vous devez au préalable imaginer le plus clairement possible le goût, les saveurs, les arômes, et les textures en bouche (croquant, moelleux, fondant...) de ces desserts. Prenez tout le temps nécessaire pour avoir une "image mentale" la plus détaillée possible de ces goûts, saveurs, arômes et textures. Par l'imagination, vous devez parvenir à des sensations aussi réalistes que possible, comme si vous goûtiez ces desserts. Prenez tout le temps nécessaire pour y parvenir!

[end of page]

Prenez votre temps pour imaginer le plus clairement et distinctement possible les goûts, saveurs, arômes et textures en bouche de cette tarte aux fraises.

Comment vous apparaît le goût de ce dessert (dans votre imagination)?
- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Comment vous apparaît l'arôme de ce dessert (dans votre imagination)?
- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Comment vous apparaît la texture en bouche (par exemple, le croquant, le moelleux, le fondant) de ce dessert (dans votre imagination)?

- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Quel est selon vous le poids de ce dessert (en grammes)?

[end of page]

Prenez votre temps pour imaginer le plus clairement et distinctement possible les goûts, saveurs, arômes et textures en bouche de cette glace vanille.

Comment vous apparaît le goût de ce dessert (dans votre imagination)?

- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Comment vous apparaît l'arôme de ce dessert (dans votre imagination)?

- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Comment vous apparaît la texture en bouche (par exemple, le croquant, le moelleux, le fondant) de ce dessert (dans votre imagination)?

- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Quel est selon vous le poids de ce dessert (en grammes)?

[end of page]

Prenez votre temps pour imaginer le plus clairement et distinctement possible les goûts, saveurs, arômes et textures en bouche de cette mousse au chocolat.

Comment vous apparaît le goût de ce dessert (dans votre imagination)?

- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Comment vous apparaît l'arôme de ce dessert (dans votre imagination)?
- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Comment vous apparaît la texture en bouche (par exemple, le croquant, le moelleux, le fondant) de ce dessert (dans votre imagination)?
- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Quel est selon vous le poids de ce dessert (en grammes)?

[end of page]

[Control condition]

Nous allons d'abord évaluer votre perception du poids d'objets non-alimentaires. Regardez ces différentes chaises de bureau. Etudiez-les très attentivement, imaginez que vous vous asseyez dessus, puis estimez leur poids en bas de la page.

[end of page]

Parvenez-vous à imaginer vous asseoir sur cette chaise?
- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Quel est selon vous le poids de cette chaise (en kilos) ?

[end of page]

Parvenez-vous à imaginer vous asseoir sur cette chaise?
- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Quel est selon vous le poids de cette chaise (en kilos) ?

[end of page]

Parvenez-vous à imaginer vous asseoir sur cette chaise?
- ❍ Aussi clairement et distinctement que dans la réalité.
- ❍ Presqu'aussi clairement que dans la réalité.
- ❍ Pas très clair ni très distinct, mais reconnaissable
- ❍ Vague et peu distinct
- ❍ J'y pense, mais je n'arrive pas à l'imaginer

Quel est selon vous le poids de cette chaise (en kilos) ?

[end of page]

Merci pour vos réponses. Passez à la page suivante lorsque vous serez prêt(e) à continuer.

[end of page]

[Forecaster condition]

Nous allons maintenant évaluer votre perception des portions de brownies. Regardez attentivement les 5 portions de brownies disposées sur la table centrale, puis passez à la page suivante.

[end of page]

Vous pouvez choisir la portion de brownie que vous souhaitez manger. Choisissez la portion uniquement selon votre envie! Vous devrez la manger sur place, à la fin de ce questionnaire (vous ne pourrez pas l'emporter avec vous). Quelle portion voulez-vous?
- ❍ Portion 1
- ❍ Portion 2
- ❍ Portion 3
- ❍ Portion 4
- ❍ Portion 5

[end of page]

Merci d'évaluer, sur une échelle de 1 à 10, le plaisir que vous auriez à manger chacune de ces portions.

	Je n'éprouverais aucun Plaisir 1 (1)	2 (2)	3 (3)	4 (4)	J'éprouverais moyennement du plaisir5 (5)	6 (6)	7 (7)	8 (8)	9 (9)	J'éprouverais énormément de Plaisir 10 (10)
Portion 1 (1)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 2 (2)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 3 (3)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 4 (4)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍
Portion 5 (5)	❍	❍	❍	❍	❍	❍	❍	❍	❍	❍

[end of page]

Quel est selon vous le poids (en grammes) de chaque portion de brownie ?

Portion 1 (1)
Portion 2 (2)
Portion 3 (3)
Portion 4 (4)
Portion 5 (5)

[Experiencer condition]

Nous allons vous proposer une portion de brownie choisie au hasard. Cette portion sera déterminée aléatoirement par l'ordinateur. Vous devrez ensuite manger cette portion en entier, puis en évaluer le poids. Passez à la page suivante pour connaître la portion qui vous est attribuée.

[end of page]

L'ordinateur vous a attribué la Portion *[1, 3 or 5]* Veuillez appeler le chargé de recherche pour qu'il vous apporte cette portion de brownie. Ensuite, passez à la page suivante.

[end of page]

Vous pouvez maintenant manger votre brownie tout en regardant cette vidéo sur la vie sous-marine (sans le son). Veuillez appuyer sur "play" pour visualiser la vidéo. Nous vous demanderons votre avis sur la qualité des images. Comme cette étude mesure votre perception de la taille du brownie, il est important que vous mangiez la totalité de la portion. Passez à la page suivante dès que vous aurez terminé votre brownie. N'attendez pas que la vidéo soit terminée si vous avez fini de manger, et passez directement à la page suivante.

[end of page]

Merci d'évaluer la qualité des images de la vidéo
- Qualité médiocre
- Qualité moyenne
- Qualité satisfaisante
- Qualité excellente

[end of page]

Q33 Avez-vous mangé toute votre portion?
- Oui
- Non

[end of page]

Evaluez, sur une échelle de 1 à 10, le plaisir que vous avez éprouvé à manger cette portion.
- 1 Je n'ai éprouvé aucun plaisir
- 2
- 3
- 4
- 5 J'ai éprouvé moyennement du plaisir
- 6
- 7
- 8
- 9
- 10 J'ai éprouvé énormément de plaisir

[All conditions]

Veuillez répondre aux questions suivantes en étant aussi sincère que possible

jamais (1)	rarement (2)	parfois (3)	souvent (4)	très souvent. (5)

Quand vous avez pris un peu de poids, mangez-vous moins que d'habitude ?
Aux repas, essayez-vous de manger moins que vous auriez envie de manger ?
Vous arrive-t-il de refuser de la nourriture ou des boissons que l'on vous offre parce que vous voulez faire attention à votre poids ?
Surveillez-vous exactement ce que vous mangez ?
Mangez-vous volontairement des nourritures peu caloriques ?
Quand vous avez trop mangé, mangez-vous moins le lendemain que d'habitude?
Mangez-vous volontairement un peu moins pour ne pas grossir ?
Essayez-vous de ne pas manger entre les repas parce que vous surveillez votre poids ?
Pendant la soirée, essayez-vous de ne pas manger parce que vous surveillez votre poids ?
Lorsque vous mangez, tenez-vous compte de votre poids ?

STUDY 5

[All conditions]

Are you hungry now ?
- ❍ 1 Absolutely not
- ❍ 2
- ❍ 3
- ❍ 4
- ❍ 5
- ❍ 6
- ❍ 7
- ❍ 8
- ❍ 9 Absolutely

When was the last time you ate approximately?
__ minute(s) ago
__ hour(s) ago
__ day(s) ago

[end of page]

[Sensory information condition]

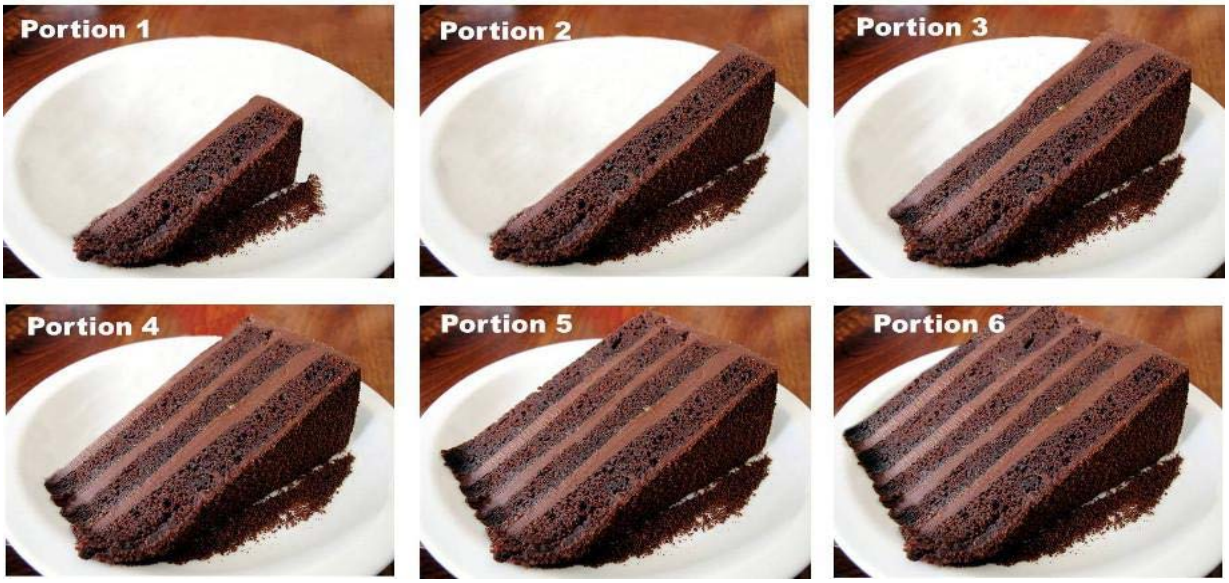
Please read carefully the following text.
In the following page, you will see the picture of a chocolate cake. This cake is made from Ecuador Cacao beans. This cacao yields a singular chocolate smell which reminds the smell of roasted coffee. Regarding the taste, this cacao yields a chocolate with a bitter-sweet balance, natural aromas that remind honey and vanilla, and a light aftertaste of blackberry. The cake comes in different portions. On the next page, you will see the different portion sizes, and you will be asked to select the one you would like to eat right now.

[end of page]

Please look at these different portions of the Chocolate Cake. Take your time to read the information on the taste, the smell and the texture in mouth before choosing a portion.

Chocolate Cake

Made from Ecuador Cacao Beans. The chocolate has a smell of roasted coffee, a bitter-sweet balance taste, with natural aromas that remind honey and vanilla, and a light aftertaste of blackberry



Which portion would you choose?

- ❍ Portion 1
- ❍ Portion 2
- ❍ Portion 3
- ❍ Portion 4
- ❍ Portion 5
- ❍ Portion 6

[end of page]

In the previous question, you said that you would rather choose *[Portion Chosen]*. What would be the maximum price (in USD) that you would be willing to pay for this portion ?

[end of page]

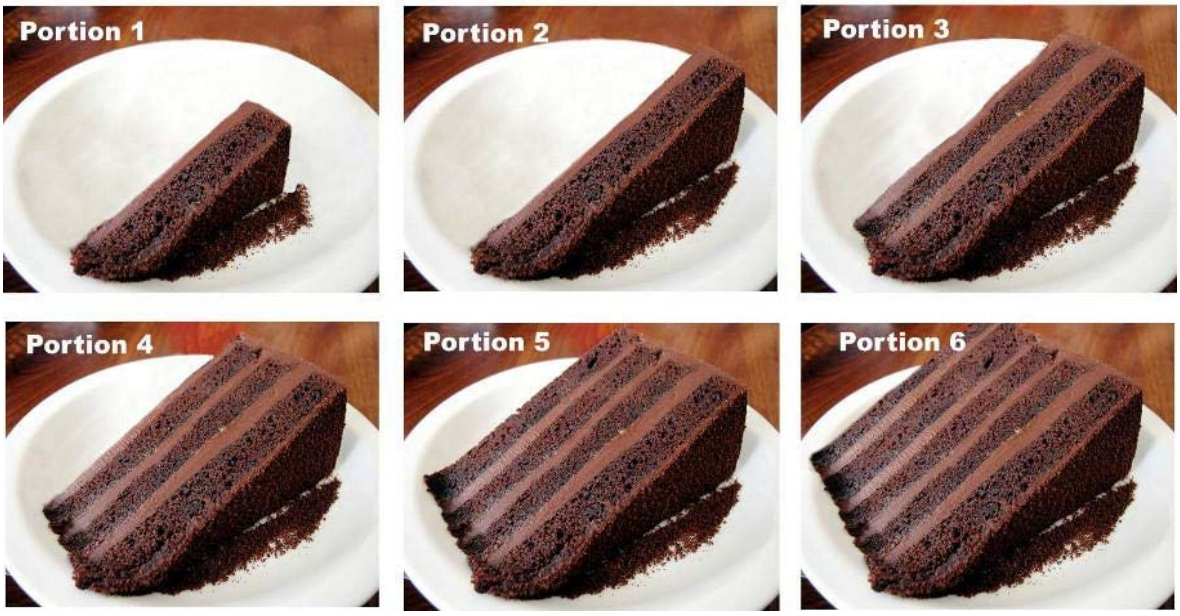
[Control condition]

Please read carefully the following text
In the following page, you will see the picture of a chocolate cake. The cake comes in different portions. On the next page, you will see the different portion sizes, and you will be asked to select the one you would like to eat right now.

[end of page]

Please look at these different portions of the Chocolate Cake, then select the one you would most likely choose

Chocolate Cake



Which portion would you choose?

- ❍ Portion 1
- ❍ Portion 2
- ❍ Portion 3
- ❍ Portion 4
- ❍ Portion 5
- ❍ Portion 6

[end of page]

In the previous question, you said that you would rather choose *[Portion Chosen]*. What would be the maximum price (in USD) that you would be willing to pay for this portion ?

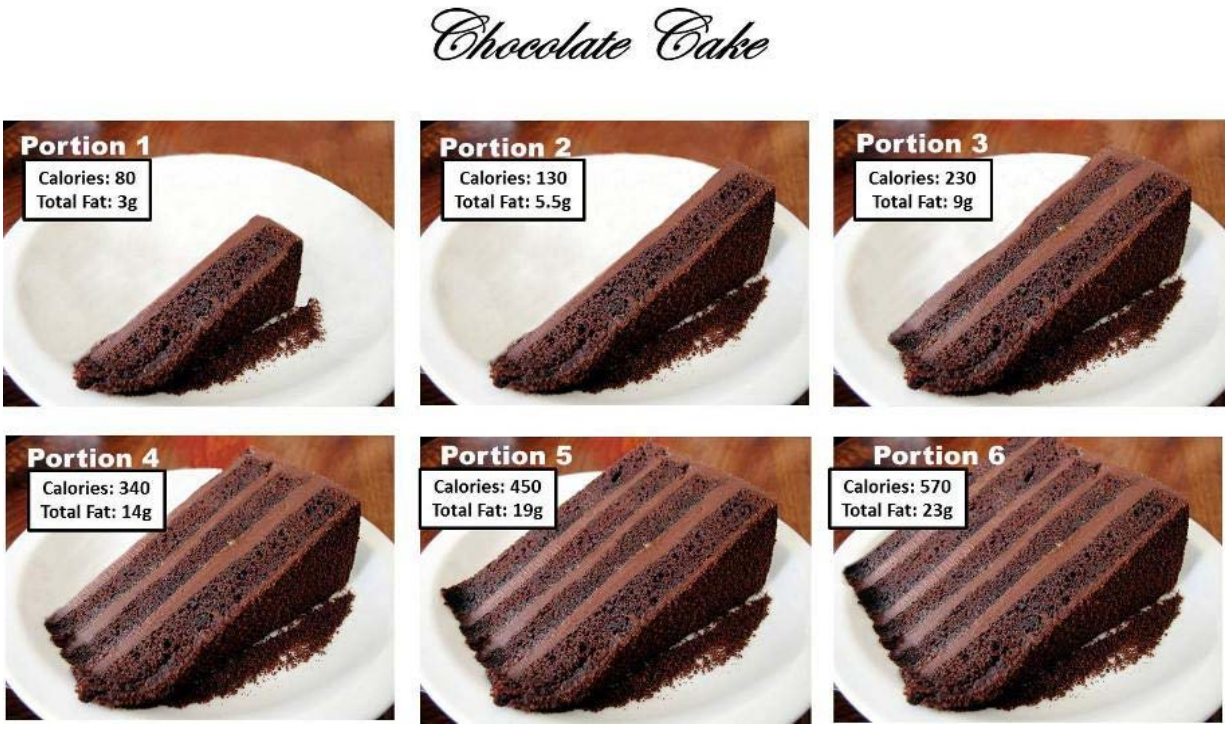
[end of page]

[Health information condition]

Please read carefully the following text
In the following page, you will see the picture of a chocolate cake. The cake comes in different portions. On the next page, you will see the different portion sizes (with calorie and fat content information), and you will be asked to select the one you would like to eat right now.

[end of page]

Please look at these different portions of the Chocolate Cake, then select the one you would most likely choose.



Which portion would you choose?
- ❍ Portion 1
- ❍ Portion 2
- ❍ Portion 3
- ❍ Portion 4
- ❍ Portion 5
- ❍ Portion 6

[end of page]

In the previous question, you said that you would rather choose *[Portion Chosen]*. What would be the maximum price (in USD) that you would be willing to pay for this portion ?

[end of page]

Additional study addressing demand effects

Please read carefully this scenario, and answer the question.

John and Jim want a slice of chocolate cake. They are both hungry and none of them is on a diet. They notice that there are slices of different sizes, some smaller ones, and some larger ones. .

Before choosing a slice, someone approaches John, shows him pictures of desserts, and asks him to imagine vividly the taste, the smell, and the texture in mouth of these desserts.

Jim chooses directly his slice, without imagining anything beforehand.

Remember that both John and Jim are hungry, but John (and not Jim) imagines the taste, smell and texture in mouth of desserts before choosing a slice of chocolate cake.

Who will choose a larger slice of chocolate cake?

- John will choose a larger slice than Jim
- Jim will choose a larger slice than John
- John and Jim will choose similar sizes

Results

	Lay Intuitions about choosing after sensory imagery	
	N	%
John will choose a larger slice than Jim	34	69%
Jim will choose a larger slice than John	11	22%
John and Jim will choose similar sizes	4	8%
TOTAL	49	100%