Applied Economic Perspectives and Policy (2012) volume 0, number 0, pp. 1–25.
doi:10.1093/aepp/pps028

Featured Article

How Package Design and Packaged-based Marketing Claims Lead to Overeating

Pierre Chandon*

Pierre Chandon is Professor of Marketing and Director of the Social Science Research Centre at INSEAD, Fontainebleau, France.
*Correspondence may be sent to: pierre.chandon@insead.edu.

Accepted 11 June 2012.

Abstract *Because packaging reaches consumers at the critical moments of purchase and consumption, it has become an important marketing tool for food manufacturers and retailers. In this paper, I first review how the marketing, health and nutrition claims made on packaging create "health halos" that make foods appear healthier than they are, thereby leading to higher consumption yet lower perceived calorie intake. I then show how packaging design (cues, shapes, and sizes) biases people's perception of quantity and increases their preference for supersized packages and portions that appear smaller than they are. Finally, I examine the extent to which mandatory nutrition labels, stricter regulation of package claims, public promotion of mindful eating, and mindless eating nudges could limit the biasing effects of packaging on food perceptions and preferences.*

JEL Codes: I12, I18, M31, M37, M39, M83, Q18, L66.

Introduction

The way food is marketed is commonly identified as one of the primary reasons for the global obesity epidemic (Kessler 2009; Nestle and Nesheim 2012; Swinburn et al. 2011). Much of the research on the effects of food marketing on overeating and obesity has focused on advertising, particularly television commercials. Although television advertising is clearly an essential tool for food marketers, it has steadily declined in share of marketing expenditure as marketers shift resources to the Internet, social media, staged events, product placement, and the point of purchase (Chandon et al. 2009; Winer 2009).

In this paper, I focus on the role of packaging, one of the least-studied yet fastest-growing marketing tools. Once a by-product of logistical and conservation constraints, food packaging has evolved to become a communication tool in its own right (Young 2004). Packaging includes all the ways food and beverages are boxed, wrapped, arranged and presented to consumers in retail stores (e.g. in bottles, bags, boxes) or restaurants (e.g. in cups, bowls or plates). With few exceptions, such as size information or

back-of-package mandatory nutrition information (reviewed in Grunert, Bolton and Raats 2011; Kiesel, McCluskey and Villas-Boas 2011), the information displayed on the front of packages is controlled by marketers. This information includes brand names (the corporate brand, umbrella brand, and sub-brand), the brand's imagery (logo, symbols, slogans, and design elements), benefit claims, seals and endorsements (e.g. "heart healthy", "smart choice"), owned and third-party characters, nutritional information, etc. Packaging design, shape, color and materials used are also communication tools. As with other elements of the communication mix, packaging helps draw attention to the product and to create unique positive associations that differentiate it from the competition and create additional value in the consumer's mind. The biggest advantage of packaging is that, unlike traditional advertising, it reaches people at the time of purchase and of consumption, the two critical "moments of truth". No other example better demonstrates the importance of packaging as did PepsiCo's disastrous redesign of Tropicana's packaging, which led to a 20% sales decline in just two months before the old design was re-introduced (Young and Ciummo 2009).

The goal of this paper is to examine how the design of food packages and the marketing, health and nutrition claims printed on them influence food intake and lead to overeating[1]. To achieve this goal, I start by examining how the marketing, health and nutrition claims communicated on packages influence people's expectations (how good the food tastes, how healthy it is, etc.), their actual experience, and how much they consume. I then examine how the increasing sizes and changing shapes of food packages, servings and serving containers all bias perceptions of quantity, and how these biases prompt consumers to select larger meals. Finally, I discuss potential policy solutions that aim to limit the contribution of food packaging to the global obesity epidemic.

Health Halos: How Package-Based Marketing and Claims Influence Consumption

Many of the effects reviewed in this section are derived from the fact that the most important consumer benefits of food, such as pleasantness, sensory perceptions or healthiness, cannot be easily or reliably described before they are experienced, and that even the experience itself may not provide unambiguous information. Yet people overestimate the reliability of the judgments that they form through experience and fail to realize how ambiguous and malleable it can be (Hoch 2002). In the absence of reliable information about how they will experience a food, consumers tend to consider packaging-based marketing claims and design cues, especially for new foods (e.g. energy drinks) that they are unfamiliar with. This occurs primarily via one of two processes: the categorization of food into a pre-existing natural or goal-derived category (e.g. "a snack" or "healthy" food), or inferences made about what is missing from the existing attribute information (e.g. inferring calories from "reduced nutrient"

[1]*For a recent review of the effects of other marketing actions, including advertising and pricing, see Chandon, P., and B. Wansink. 2012. Does Food Marketing Need to Make us Fat? A Review and Solutions.* Nutrition Reviews *forthcoming.*

claims). Research has focused on categorization to explain the effects of branding (the effects of the description of the food and brand name), and on inference-making to explain the effects of specific health and nutrition claims. Both categorization and inference-making predict that marketing actions that emphasize one aspect of the food as being healthy lead to the creation of a "health halo", which makes the food appear healthier than it is, and in turn leads to overconsumption.

People have a strong tendency to categorize food as either healthy or tasty. For example, in one study, 48% of Americans agreed with the following statement: "Although there are some exceptions, most foods are either good or bad for health," (Rozin, Ashmore and Markwith 1996). Categorization effects are driven by the perceived "nature" of the food and are largely insensitive to the amount of food under consideration. For example, the authors of the study cited above found that a diet without any "bad" ingredients such as salt was perceived to be healthier than a diet with only traces of it, although salt is a necessary component of any diet.

Even when people do not categorize foods as "healthy" or "tasty", they often make inferences about the benefits of product attributes for which there is no information by generalizing from specific front-of-package nutrition, health, or marketing claims that a food scores highly on all nutrition or health aspects, and that they can eat more of it (Andrews, Netemeyer and Burton 1998; Kardes, Posavac and Cronley 2004). Unless they are prompted to explicitly engage in counterfactual reasoning, these claims selectively trigger consistent beliefs or associations, thereby biasing their inferences toward confirming the claims made (Mussweiler 2003). For example, reading a marketing or nutrition claim that a sandwich is "healthy" or "low in fat" facilitates the retrieval of consistent information (e.g. "this sandwich contains salad"), which confirms the claim and may prompt the consumer to infer other nutritional dimensions consistent with it (e.g. "this sandwich is not fattening").

Effects of Food Branding and Claims on Taste and Health Expectations

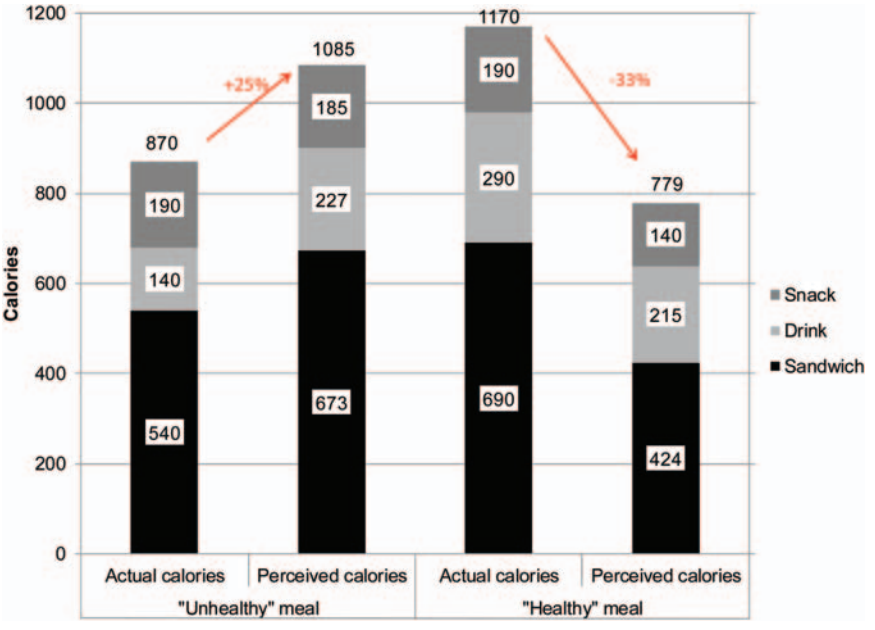
The name of the food (brand name or generic category name) and its general description strongly influences health expectations in ways that are often uncorrelated with reality (Oakes 2006). A study by Oakes (2005) found that people thought that eating one mini Snickers bar (47 calories, 2 grams of fat and 6 gram of carbs) once a day when hungry would lead to more weight gain than eating a cup of 1% fat cottage cheese, 3 carrots and 3 pears (569 calories, 6 grams of fat, and 161 grams of carbs). In a study carried out with Brian Wansink, we observed 30% lower calorie estimations for granola than for M&Ms, a product with the same caloric density, but considered less healthy (Wansink and Chandon 2006a). Similar stereotypes affect the perception of ingredients and macro-nutrients. For example, Raghunathan, Naylor and Hoyer (2006) found that crackers were expected to be tastier when they were described as containing mostly "good fat" than when described as containing mostly "bad fat", especially among consumers who expected unhealthy food to be generally tastier. The name of fast food restaurants and the foods on the menu can also create health halos (Tangari et al. 2010). For example, a study found that

Subway meals were perceived to contain about 20% fewer calories than same-calorie McDonald's meals (Chandon and Wansink 2007a).

To examine whether health halos had changed since the above studies took place, in April 2012, 192 U.S. consumers were asked to estimate the number of calories contained in sandwiches, beverages and snack foods categorized as healthy or unhealthy. As shown in figure 1, respondents underestimated the calories in the three "healthy" foods by 33%, and overestimated the number of calories of the "unhealthy" foods by 25%. As a result, even though the three "healthy" foods actually contained 34% more calories than the "unhealthy" ones, people estimated that they contained 28% fewer calories. Clearly, health halos continue to polarize calorie perceptions, making healthy foods appear healthier than they are and unhealthy foods appear less healthy than they are.

Health halos can have surprisingly strong effects when people are considering a meal that combines "healthy" and "unhealthy" food. Many studies have found that a meal combining one healthy food and one less healthy food is estimated to have fewer calories than the unhealthy food alone. For example, Chernev and Gal (2010) found that a hamburger was perceived to have 761 calories, but the same hamburger with a carrot and celery salad was thought to have only 583 calories. This effect occurs because people think in terms of average healthiness instead of adding the calories of each component of the meal. This "negative calorie" illusion is particularly strong among people who are on a diet, probably because they are more prone than others to categorize foods based on their perceived healthiness (Chernev 2011a). However, this illusion

Figure 1 Positive and Negative Health Halo Effects on Calorie Perception



Note: The "healthy" foods were one Prêt-a-Manger® brie, basil and tomato baguette sandwich, one 12 oz. Odwalla® Super Protein fruit smoothie, and two tablespoons of Jif® low sodium, 33% less sugar peanut butter. The "unhealthy foods" were one Big Mac®, a 12 oz. can of Coca-Cola® classic, and two tablespoons of Jif® regular peanut butter.

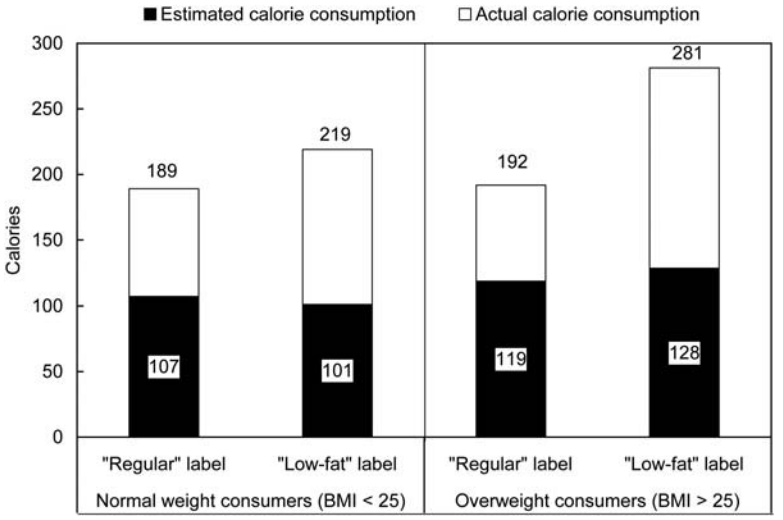
disappears when people estimate the calories perceived in each food sequentially rather than estimating the number of calories contained in the whole meal (Chernev 2011b).

Health Halo Effects on Consumption

Health halos driven by branding, marketing, health or nutrition claims do not simply change expectations but can act as a placebo and change post-intake evaluations and consumption. Robinson et al. (2007) found that children thought the same food tasted better when it was branded McDonald's. Moreover, Raghunathan et al. (2006) found that a smoothie was judged to taste better when described as a product "generally considered healthy". Lee, Frederick and Ariely (2006) found that adding vinegar improved the taste of beer, but only when it was described as a special ingredient, not when described as vinegar. Interestingly, the description had no effect when it was revealed after tasting, suggesting that ingredient branding affected preferences by influencing the experience itself rather than by acting as an independent negative input or by modifying the retrospective interpretation of the experience. Marketing descriptions can even influence biological responses. Crum et al. (2011) found that descriptions of the same milkshake as being either "indulgent" or "sensible" influenced physiological satiation as measured by gut peptide ghrelin levels. Neuroimaging studies (Plassmann et al. 2008) have shown that marketing actions influence not just self-reported liking, but also its neural representations, suggesting that these effects are not merely influenced by social desirability when reporting subjective experience.

Health halos influence the volume of food consumption and can lead to overeating, defined here as people eating more without being aware of it. For example, one study found that adding adjectives like "succulent" or "homemade" boosted sales by up to 28% (Wansink, van Ittersum and Painter 2005). Provencher, Polivy and Herman (2008) noted a 35% greater intake of the same cookie when it was described as a healthy "oatmeal snack" rather than an indulgent "gourmet cookie", regardless of the weight consciousness or dietary restraints of the participant. When Chandon and Wansink (2007a) asked people to imagine that they had received a coupon for either a McDonald's Big Mac (containing 600 calories and generally considered unhealthy) or a coupon for a foot-long Subway sandwich (a chain generally considered healthy, even though this particular sandwich contains 900 calories), participants ordered 111 calories worth of dessert and sodas to go with the "healthy" sandwich versus 48 calories with the "unhealthy" burger. The meal with the "healthy" sandwich therefore had 56% more calories than the meal with the "unhealthy" burger, yet people thought that the "healthy" meal contained 19% fewer calories than the "unhealthy" one. In another study, Wansink and Chandon (2006a) found that labeling both "healthy" and "unhealthy" foods as "low fat" reduced calorie estimation by 20% to 25%, and increased what was considered to be the "appropriate serving size" by 20%. More importantly, we found that labeling chocolate candies as "low fat" increased consumption during one meal occasion by 16% among normal-weight people and by 46% among overweight individuals, but

Figure 2 Health Halos: "Low-fat" Claims Increase Actual (but not Perceived) Snack Food Consumption



Note: Reproduced from Wansink, B., and P. Chandon. 2006. Can 'Low-Fat' Nutrition Labels Lead to Obesity? *Journal of Marketing Research* 43 (4): 605-617.

this labeling had no effect on both groups' estimates of the number of calories that they had consumed (see figure 2).

Health halos influence consumption because people feel that they can eat more of a healthy food, or can eat more unhealthy (but tasty) food after eating healthy food without suffering any adverse health consequences (Ramanathan and Williams 2007). In fact, simply considering the healthier option without actually consuming it can be enough to entice some consumers to choose the most indulgent food available because it makes them hungrier and allows them to vicariously fulfill their nutritional goals (Finkelstein and Fishbach 2010; Wilcox et al. 2009). Another explanation is that people anticipate feeling less guilt from eating foods that they perceive as healthy (Chandon and Wansink 2007a).

Moderators of Health Halo Effects

Health halos generally have a positive impact on consumption, although their effectiveness is moderated by comparisons with other foods in the same category and by how they influence flavor expectations (Kiesel and Villas-Boas 2010; Kozup, Creyer and Burton 2003). Not everybody responds in the same way to packaging-based marketing communication; the importance attached to nutrition is an important individual moderator. In a recent study, Irmak, Vallen and Robinson (2011) showed that describing the same food as a "salad special" as opposed to a "pasta special," or naming the same candy as "fruit chews" rather than "candy chews" increased perceptions of the healthfulness, tastiness and actual consumption of the food (but not its perceived "fillingness") among people who were focused on diet and weight. Interestingly, the inferences tended to be the opposite among non-dieters, and disappeared when dieters were asked to consider the actual ingredients (vs. the name), and when examining only dieters with a high need for cognition. This suggests that these

effects are driven by heuristic processing. More generally, marketing effects tend to be stronger for unfamiliar brands and products, and among people with limited experience with the taste of the different products in the category(Hoegg and Alba 2007).

Gender also accounts for differences in responses. Unlike women, who tend to pay more attention to diet and weight, men are more likely to respond negatively to health claims, particularly to "low fat" claims as opposed to more general "healthy" claims (Bowen et al. 1992). The negative association between health and taste also seems less pronounced in Europe, where people tend to associate "healthy" with freshness and quality, and thus sometimes healthier can be tastier (Fischler, Masson and Barlösius 2008; Werle et al. 2011). These brand and individual differences could explain some of the variation in the effects of health claims on consumption, including the null and opposite effects of some of the earlier studies cited (Roefs and Jansen 2004; Wardle and Solomons 1994).

Another important moderator of the effects of health claims is whether studies examine purchase or consumption decisions. Most of the studies cited here looked at the effects of marketing communication on *how much* to eat once the decision of *what to eat* had been made. The effects of health positioning on purchase decisions are probably less positive because of the negative taste inferences that some people (particularly men and non-dieters) make about "healthy" food, and because taste is a more important driver of food choice than of consumption volume (Stewart, Blisard and Jolliffe 2006).

Biased Size Impression: How Package Size and Shape Influence Consumption

Trends in Package and Serving Sizes

With a few exceptions (like wine and liquor), food and beverage manufacturers are free to choose the size and description (e.g. "medium" or "value" size) of the packages and servings that they offer on the market. Restaurants can also freely set serving sizes and the way they describe them. In 2012, for example, the Canadian chain Tim Horton added a 24 oz. "extra-large," coffee cup, renaming the old "extra-large" as "large", the old "large" as "medium," etc. Restaurants and some manufacturers (e.g. the beer industry) also often determine the size and shape of the glasses, plates, bowls or utensils that consumers use to eat with. Choosing the size and shape of the package, serving or container is therefore an important decision for food marketers.

Product package and serving sizes have grown rapidly over recent decades and are now almost invariably larger than the recommended serving sizes determined by the United State Department of Agriculture (Nielsen and Popkin 2003; Young and Nestle 2002). While this trend has been observed in much of the developed world, "supersizing" is particularly common in the United States, and has been identified as one reason why obesity has increased faster there than in other developed countries (Rozin et al. 2003). Larger package and serving sizes almost always have lower unit prices (by volume or weight), except in the rare instances when there is more competition on smaller sizes or when smaller sizes are sold

at a loss in order to draw customers to retail stores (Sprott, Manning and Miyazaki 2003). Marketers can reduce the unit price of larger sizes, and hence increase consumer value, because of their lower packaging costs. More importantly, larger servings and packages allow greater absolute margins for marketers because the marginal cost of the extra food is often minimal compared to its perceived value for the consumer. For food retailers and restaurants with high fixed costs (real estate, labor, marketing) reducing serving sizes, and hence average consumer expenditure, requires a huge increase in traffic to break even. This explains why the few restaurant chains that have tried to downsize their servings (e.g. Ruby Tuesday in 2003) often quickly stop promoting these items or stop offering them altogether. In fact, it may be profit-maximizing for food marketers to price the incremental quantity below its marginal cost if their products are bought by two distinct consumer segments: one that is willing to pay more for smaller serving sizes that help them control their intake; and another that is unconcerned about overeating and willing to buy larger quantities to obtain the lower unit price (Dobson and Gerstner 2010; Wertenbroch 1998). As a result, larger sizes are typically more profitable for food marketers, and they benefit from a higher perceived economic and environmental value – a win-win in all aspects aside from convenience and consumption control.

Marketers can also increase package and serving sizes without changing the actual packages by promoting bundles of multiple packages (e.g. "buy one, get one free" or "one for $1.00 and two for $1.50). Although one study found that removing the price advantage of menu bundles did not significantly influence caloric intake in fast-food restaurants (Harnack et al. 2008), another study found a significant effect among overweight consumers (Vermeer et al. 2010a). In the context of grocery retailing, many studies have shown that quantity discounts lead to stockpiling, which in turn accelerates consumption (for a review, see Neslin and Van Heerde 2009). Indeed, the better value of supersized packages and servings is the number one reason provided by consumers to justify their purchase (Vermeer, Steenhuis and Seidell 2010c).

Effects of Larger Package and Serving Sizes

With the exception of children under three (Rolls, Engell and Birch 2000), larger serving sizes significantly increase consumption (Devitt and Mattes 2004; Fisher, Rolls and Birch 2003; Fisher and Kral 2008), as do serving sizes in kitchens and in restaurants (Rolls, Morris and Roe 2002). Conversely, reducing portion sizes, for example by splitting cookies and candies in two, can significantly reduce consumption (Marchiori, Waroquier and Klein 2012). The increased energy intake from supersizing servings (Rolls, Roe and Meengs 2007b) as well as the decrease in energy intake from downsizing servings (Levitsky and Pacanowski 2011) are not followed by caloric compensation and can last for up to 10 days. Supersized servings can even increase the consumption of bad-tasting foods, such as 14-day-old popcorn (Wansink and Kim 2005); consumption changes of at least 30% are frequently reported (Steenhuis and Vermeer 2009). A recent meta-analysis of 67 studies estimates that consumption increases by 22% when serving size doubles (Zlatevska, Dubelaar and Holden 2012), an effect that was significantly larger for adults than

for children under 10, and slightly larger for men than women, as well as when people were not paying attention to the food being served. The volume of food matters more than the actual number of calories, which suggests that these effects are not driven by homeostasis. In fact, reducing caloric density and increasing volume without raising calories is one of the few win-win areas for both food marketing and public health (Kral, Roe and Rolls 2004; Ledikwe, Ello-Martin and Rolls 2005).

In our study of the effects of stockpiling on food consumption (Chandon and Wansink 2002), we manipulated the quantity of various ready-to-eat and non-ready-to-eat foods that consumers had in their pantry (holding prices constant) during a randomized controlled field experiment. We found higher daily consumption rates for stockpiled products, especially in the first days after the stockpiling, but only for foods that were ready to eat – there was no such increase in consumption for foods that required preparation or were an ingredient of a meal. Most of the consumption boost was explained by the higher likelihood of consuming the food over the time period rather than by a higher quantity per-consumption-occasion, and that this likelihood of higher consumption could be explained by the greater visibility of stockpiled food in people's pantries and refrigerators.

There are a few exceptions, however. Very small sizes (e.g. 100-calorie packs) may increase consumption volume more than regular sizes on a specific consumption occasion, but this effect is limited to hedonic products, restrained eaters, or people who are trying to regulate their food intake (Coelho do Vale, Pieters and Zeelenberg 2008; Scott et al. 2008). These studies show that small units "fly under the radar" and encourage lapses in self-control because their consumption fails to activate healthy eating goals. However, these effects do not seem to hold for long periods, whereupon small sizes do lead to reduced calorie intake (Stroebele, Ogden and Hill 2009).

Effects of Larger Serving Containers

Research has found similar results with respect to the supersizing of cups, bowls and plates, although the effect does not seem to hold in lab studies, where people are repeatedly asked to eat identical food (Caine-Bish et al. 2007; Rolls et al. 2007a). One study showed that people who were given a 24oz. bowl both served and consumed from 15-38% more ice cream than those given a 16oz. bowl (Wansink, van Ittersum and Painter 2006). Larger containers increase consumption even when consumers do not serve themselves; a recent study showed that increasing the size of a container of chocolate candies increased intake by 129% despite holding serving size constant. This illustrated that larger containers stimulate food intake over and above their impact on serving size (Marchiori, Corneille and Klein 2012). These results are consistent with those of an earlier study, which found that people used more spaghetti and oil when they were in a larger package, but the actual amount of product in the package was held constant (Wansink 1996).

Even "virtual" serving sizes can influence consumption. Simply adding unobtrusive partitions (e.g. colored papers between the cookies inside the package or a red chip for every seven yellow chips in a tube) can reduce intake (Cheema and Soman 2008; Geier, Wansink and Rozin 2012).

However, partitioning may only work when people pay attention to the partition. One study (Vermeer, Bruins and Steenhuis 2010b) found that 93% of the purchasers of a king-size pack containing two single-serving candy bars intended to consume both within one day, often because they had not noticed that smaller candy bar sizes were available for purchase.

Why Larger Servings Lead To Overeating: Biased Size Perceptions

There are a number of explanations regarding why large packages and servings increase consumption. Obviously these factors have an effect because people routinely eat beyond the level at which their appetite is satisfied, their motivation being the enjoyment derived from eating and the anticipated reward from continuing to eat strongly (Berridge 2009; Mela 2006). Social factors also strongly influence food intake, especially among U.S. and overweight consumers (Wansink, Payne and Chandon 2007). For example, people associate larger portions with higher social status and choose larger portions when they feel powerless and want to assert themselves (Dubois, Rucker and Galinsky 2012). People also eat more if others around them eat more, particularly if the people they are imitating are not obese (Herman and Polivy 2005; McFerran et al. 2010).

Larger serving and package sizes increase consumption because so-packaged items are typically cheaper by the unit; people respond to cheaper food prices by increasing consumption (for a review of the effects of price, see Chandon and Wansink 2012). More interestingly, perception of the price paid to purchase the food influences consumption even after the food has been consumed and is therefore an irrecoverable sunk cost that should not, rationally, influence consumption decisions (Chandon and Wansink 2002). For example, Wansink (1996) found that larger packages did not increase consumption when people did not think that the food was more cheaply priced (e.g. when a larger bottle is said to contain tap water rather than mineral water).

Consumption norms are one of the key explanations for the effects of package sizes (Wansink and van Ittersum 2007). A majority of Americans conform to the social norm of "cleaning their plate" no matter how much food they find on it (Birch et al. 1987). However, this cannot explain why large packages also increase the amount of inedible products poured, such as shampoo, cooking oil, detergent, dog food and plant food. Nor does it explain why large packages of M&Ms®, chips and spaghetti increase consumption in studies where even the smaller servings were too large to eat in one sitting (Wansink 1996). Another "normative" explanation is that people use package, serving and container sizes to determine the "normal" or "appropriate" amount to consume (Geier, Rozin and Doros 2006; Ueland et al. 2009). The consumption of people who follow a norm based on the size of the container will obviously be influenced by the size of that container.

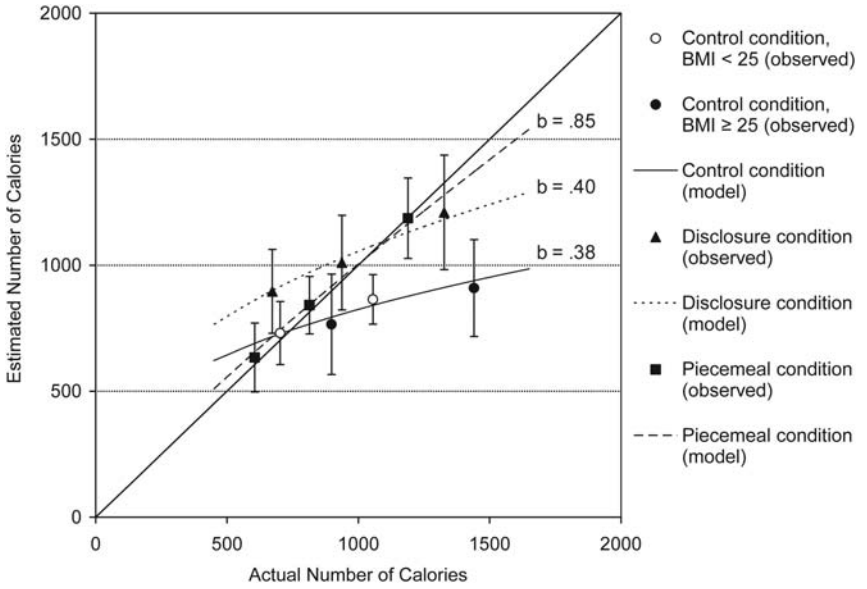
Perhaps the main explanation for the effects of supersizing is that people underestimate how large today's supersized servings and packages have become. Information about package and serving size, volume or calorie content is often not available (e.g. in restaurants or at home, once the food is no longer in its original packaging). Even in supermarkets where size information is available on the package or on the shelf tags, most people do not to read it, preferring to rely on visual estimations of

the package's weight or volume to infer the amount of product that it contains (Lennard et al. 2001). An illustration of these visual biases can be found in an experiment by Wansink, Painter and North (2005), which found that people who were served tomato soup in "bottomless" bowls that were continuously refilled ate 73% more than those eating from normal bowls, but they estimated that they ate only 4.8 calories more. The higher consumption in this study may be caused by both a perceptual bias (people not realizing how much they had eaten because the level of the soup in the bowl did not go down) and by a norm that they should consume a fixed amount of what they are served.

Many studies have shown that calorie and volume estimations exhibit diminishing sensitivity to the actual increase in size (i.e. perception changes more slowly than does reality). For example, we asked 156 students to choose between three fast-food meals that contained different sizes of chicken nuggets, sodas and fries, and to estimate the calories of their respective meals (Chandon and Wansink 2007b). As shown in figure 3 (control condition), people slightly overestimated the calories of small meals but strongly underestimated the calories of large meals. The perception of meal size follows an inelastic function of actual meal size, meaning that perceptions increase too slowly and with diminishing sensitivity as the size of the meal increases.

The underestimation of size changes has been replicated across a number of studies and participants, including trained dieticians (Chandon and Wansink 2007b; Elbel 2011; Tangari et al. 2010; Wansink and Chandon 2006b). On average, doubling the size of the food quantity (i.e. a 100% increase) leads to an increase in perceived size of only 50% to 70%. As

Figure 3 Errors in the Perceived Calories of Meals are Driven by Meal size, not Body Size, and Corrected by Piecemeal Estimation, not by Education



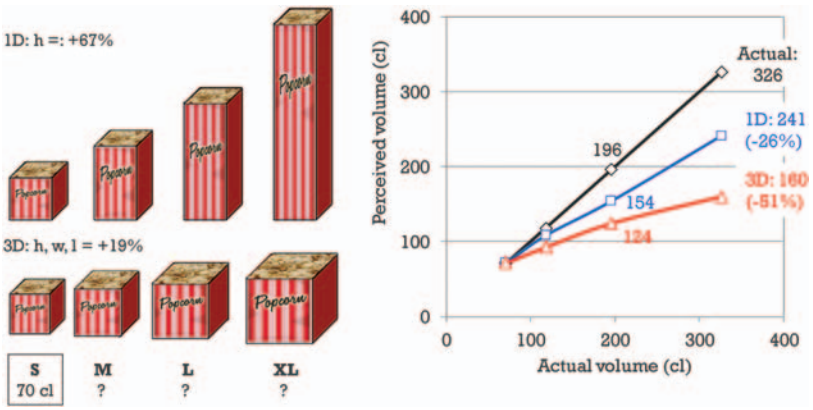
Note: Reproduced from Chandon, P., and B. Wansink. 2007. Is Obesity Caused by Calorie Underestimation? A Psychophysical Model of Meal Size Estimation. *Journal of Marketing Research* 44 (1): 84-99.

a result, whereas small servings tend to be accurately estimated, large servings are greatly underestimated. Furthermore, this underestimation of larger sizes is the same regardless of the individual's body mass or interest in nutrition. In other words, meal size – not body size – explains serving size errors. People with a high body mass are more likely to underestimate their calorie intake (Livingstone and Black 2003) because they tend to select larger meals, not because they are intrinsically worse (or biased) estimators (Wansink and Chandon 2006b).

Just like the perception of meal sizes, the perception of the size of individual packages or containers grows more slowly than it should. Moreover, the shape of the package–particularly the way the package is increased to accommodate the new quantity of food–can exacerbate this underestimation. For example, people visually overestimate the height of a cylindrical object (such as a drinking glass) compared to its width (Raghubir and Krishna 1999). Confirming this elongation bias, studies involving professional bartenders and non-dieting adults showed that this basic visual bias caused people to unknowingly pour and drink up to 88% more into a short, wide glass than into a tall, narrow one of the same volume (Wansink and Van Ittersum 2003). The size-contrast illusion is another well-known phenomenon: if 4oz. of mashed potatoes is spooned onto a 12-inch diameter plate, people estimate its size to be less than if it had spooned it onto an 8-inch plate (van Ittersum and Wansink 2012); that is, the size contrast between the potatoes and the plate is greater on the 12-inch plate than on the 8-inch plate, leading people to underestimate the amount of potatoes.

Recent studies have started to look at the interaction effects of size and shape on size perceptions and preferences (Krider, Raghubir and Krishna 2001; Krishna 2006). These authors found that the lack of sensitivity to increasing sizes was even stronger when packages and servings increased in all three dimensions (height, width, and length), compared to when they only increased in one dimension (Chandon and Ordabayeva 2009). This may explain why the effect of serving containers on consumption is stronger for cups, glasses and bowls (3D objects) than for plates (essentially 2D). For example, Nailya Ordabayeva and I asked 112 students to examine two-dimensional representations of four sizes of popcorn boxes,

Figure 4 Underestimation of Package Supersizing, Especially for Proportional Package Change



labeled S, M, L, and XL on a computer screen (see figure 4). We told the students that the volume of the smallest container was 70cl, and asked them to estimate the size of the other three containers, which were each 67% larger than the preceding one. In the 1D condition this increase was obtained by only increasing the height of the container, whereas in the 3D condition it was obtained by increasing all three dimensions proportionally. As figure 4 shows, the underestimation of the size increase was particularly severe in the 3D (proportional) increase. Similar effects are obtained with packages of different shapes (cylinders, spheres), for actual products (vs. pictures of products), when people paid a lot or a little attention, or when their accuracy was rewarded (Chandon and Ordabayeva 2009). In addition, increasing product packages or servings in all three dimensions (rather than one dimension only): decreased the unit price people were willing to pay for larger sizes by up to 57%; reduced the likelihood of buying supersized alcoholic beverages by 32%; and increased the likelihood of buying a downsized cola and popcorn by 21%. Because people underestimate volume changes that occur in three dimensions, they pour more beverage into conical containers (e.g. cocktail glasses where volume changes in three dimensions) than into cylindrical containers (where volume changes in one dimension). While some studies have shown that a portion of these effects is mediated by attention (Folkes and Matta 2004; Folkes, Martin and Gupta 1993), ongoing research suggests that they are mostly driven by biases in the estimation of size changes (e.g. people failing to observe the compound changes of multiple dimensions).

Managing Size Impressions Through Package Design, Size Names, And Context Effects

Even if the actual size of the packages remains constant, marketers can influence the perceived size by changing some of the elements of the package design, or by changing the description of the sizes, or the range of sizes available. Unusual and novel packages, because they attract more attention, are perceived to contain more product (Folkes and Matta 2004). Deng and Kahn (2009) showed that people expected packages with pictures of the product on the bottom or on the right of the package to be heavier. Simply showing more products on the packaging has been shown to increase the perception of size and consumption, especially when consumers are paying more attention (Madzharov and Block 2010).

The size descriptions used for food and beverages (e.g. "large" or "biggie") have acquired meanings among consumers, who are generally able to rank them accurately (Aydınoğlu, Krishna and Wansink 2009). In reality, these labels mask huge discrepancies because a small size from one restaurant or brand can be larger than a medium size from another (Hurley and Liebman 2009). Unlike McDonald's for example, Burger King did not abandon its largest "king" drink cup, but renamed it a "large" (Harris et al. 2010; Young and Nestle 2007). These labels are important because they influence size perceptions, preferences and actual consumption. Aydınoğlu and Krishna (2011) found that "labeling down" (labeling a "large" serving as "medium") had a stronger impact on size perception than "labeling up" (labeling a "small" serving "large"). The same authors

found that smaller labels made people eat more, but think that they had eaten less.

Finally, the effects of package size on consumption are influenced by the range of the other sizes available. For example, Sharpe, Staelin and Huber (2008) found that people avoid the largest or smallest drink sizes. Such an aversion to extremes prompts consumers to choose larger-sized drinks when the smallest drink size is dropped, or when a larger drink size is added to a set.

Policy Implications

What could and should be done to limit the potentially harmful contribution of package-based marketing claims and package design to overeating? We briefly consider four approaches: mandatory nutrition information, regulation of health claims, encouraging "mindful" consumption, and nudging people toward "mindless" healthy eating.

Mandatory Nutrition and Calorie Information

In theory, mandatory nutritional labeling should be able to correct for health halos by providing objective evidence about calories and nutrient content, thereby showing that foods with a "low fat" claim are not necessarily low in calories. In practice, however, the effects of labeling on consumer demand and on the actions of food marketers have been mixed (Grunert et al. 2011). A number of studies have examined the impact of the 1990 U.S. Nutrition and Labeling Education Act (NLEA), which made nutritional information mandatory for packaged foods, but not for food purchased in restaurants, schools, hospital cafeterias or from vending machines. Overall, field and laboratory studies have not detected that the NLEA was accompanied by major changes in consumers' search for and retention of nutritional information, except among highly motivated and less knowledgeable consumers (Balasubramanian and Cole 2002). As one would expect, nutritional information has a stronger effect among people who are concerned with their diet due to health issues (Howlett et al. 2012)

It was also expected that mandatory nutrition labeling would encourage food manufacturers to improve the nutritional quality of their products. However, recent studies suggest that the average nutritional quality of food products sold in grocery stores had actually worsened compared to pre-NLEA levels, or compared to similar food products unregulated by the NLEA (Moorman, Ferraro and Huber 2012). Although food marketers responded to the NLEA by introducing healthier lines through brand extensions, and although they have added taste-neutral positive nutrients such as vitamins, the nutritional quality of the core brands that account for a large portion of people's diets has actually slightly deteriorated (Moorman 1996; Moorman et al. 2012). Moorman et al. (2012) tested the effects of the NLEA with longitudinal nutritional data from more than 30 product categories, using a control group (foods like fresh meats that are sold in supermarkets but do not require nutritional fact labels, as well as foods sold in restaurants). They found that, on average, the NLEA actually reduced brand nutritional quality relative to the control group but increased taste (evaluated by Consumer Reports). Although the NLEA

had positive effects for firms competing in low-health categories (e.g. potato chips) or small-portion categories (e.g. peanut butter), it tended to have negative effects in brands in large-portion categories (e.g. frozen dinners), for niche brands, as well as for firms with larger market power. This may have happened because food marketers refused to compete on transparent, imitable and ambivalent nutrition attributes, choosing instead to compete on the uniformly-valued attribute of taste in order to avoid losing taste-conscious consumers who think that calories and taste are inversely correlated. This negative effect on supply may explain why the NLEA did not improve the diet (except for the fiber and iron intake) of people who read labels (Variyam 2008).

Research on the effectiveness of mandatory calorie information in restaurants is more encouraging. Recent studies suggest that, despite mixed results (Elbel et al. 2009), calorie information does, on average, improve food decisions (Downs, Loewenstein and Wisdom 2009; Harnack and French 2008; Ludwig and Brownell 2009; Roberto, Schwartz and Brownell 2009). For example, a large-scale study (Bollinger, Leslie and Sorensen 2011) found that calorie posting led to a sustained 6% reduction in average calories per transaction in Starbucks outlets. Another large-scale study found significant calorie decreases in 168 New York City fast food restaurants after the imposition of mandatory calorie labeling for all but one examined chain (Dumanovsky et al. 2011).

Differences in dietary goals and calorie-based inferences may explain the inconsistent results of calorie labeling studies. Calorie posting has a stronger effect on: high-income, highly-educated consumers; on women rather than on men; and when adults order food for their children rather than for themselves. Burton et al. (2006) found that providing nutritional information did not influence purchase intentions unless there was a nutrition label shock (i.e. when expectations were wrong). Similarly, Tangari et al. (2010) found that calorie disclosures had inconsistent effects across menu items and restaurant chains due to different perceptions and initial expectations about the calorie levels of each type of food, or of the type of food served in those chains.

Burton and Kees (2011) point out that calorie labeling, like other nutrition labels, can only be expected to influence the subset of consumers who: a) notice the labels; b) are motivated and able to process the information; c) can use this information to change their choices; d) are not already choosing low-calorie options; e) do not already know calorie content; f) are not trying to maximize calories consumed for price paid; and g) do not think that lower calories mean lower taste. Hence, we should expect that mandatory nutrition labeling will lead to only a modest reduction in overall calorie intake for the total market of diners.

Regulating Package Claims

The evidence reviewed here suggests that there is a case for stronger regulation of health and nutrition claims. These claims are not just erroneously generalized, they are also often plainly misunderstood (Mariotti et al. 2010; Williams 2005). For example, claims such as "provides energy" are often misunderstood as "energizing". More generally, consumers expect that the health benefits are monotonically related to nutrient content ("more is better"), when in reality the relationship is often

curvilinear ("moderate is better"). Moreover, consumers may not realize that they are already taking too much of a particular nutrient (e.g. protein intake in Western countries). And some claims are based on flimsy science or they overstate research findings.

These issues have led some researchers to call for an outright ban on front-of-package claims (Nestle and Ludwig 2010). Other recommendations are more nuanced but still have important practical implications. For example, Mariotti et al. (2010) recommend that only generic 'structure-function claims' should be allowed (as opposed to claims for a specific brand), and only when consumption levels are not sufficient in the population. These authors also recommend that the claims be accompanied by disclaimers explaining that health-related conditions are also influenced by many other factors, that more is not necessarily better, and that consumers should follow general dietary guidelines. This, however, would reduce the effectiveness of health claims, including those that may be truly beneficial for consumers. Acting upon these concerns, in 2006 the European Commission (EC) established a list of just 29 authorized nutritional claims[2] (Gilsenan 2011). In 2012, after consolidating the 44,000 health claims submitted by companies into a list of 4,600, the EC agreed to authorize 222 claims, rejected 1,600 claims, and asked for more scientific evidence on the rest.

Promoting Mindful Consumption

One classic approach to help people make better decisions is to educate them about potential biases and encourage them to pay more attention to nutrition when making food choices. Unfortunately, existing research has cast doubt on its effectiveness. Chandon and Wansink (2007a) found that consumers' nutritional involvement improved calorie estimations in general but did not reduce the halo effect. Similarly, Provencher et al. (2008) found that weighing people–a heavy-handed way to make people aware of the consequences of their diet–did not reduce the health halo effect.

Another approach, known as counterfactual thinking, has shown promising results. The basic idea is that since health halos are caused by the selective activation of claim-consistent information, consumers should be encouraged to question the validity of the health claims to begin with. For example, Chandon and Wansink (2007a) asked people to "consider the opposite" and to find arguments against the claim that a sandwich from a fictitious "healthy" fast-food chain ("Good Karma Healthy Foods") was also healthy. Prompting people to question the validity of health claims eliminated halo-based biases when estimating the calories of the sandwich, and led them to select more reasonable side dishes. A related idea is to shift people's attention away from "qualitative" health-based

[2]*The 29 nutrition claims authorized in the European Union are: low energy, energy-reduced, energy-free, low fat, fat-free, low saturated fat, saturated fat-free, low sugars, sugars-free, with no added sugars, low sodium/salt, very low sodium/salt, sodium-free or salt-free, source of fibre, high fibre, source of protein, high protein, source of [name of vitamin/s] and/or [name of mineral/s], high [name of vitamin/s] and/or [name of mineral/s], contains [name of the nutrient or other substance], increased [name of the nutrient], reduced [name of the nutrient], light/lite, naturally/natural, source of omega-3 fatty acids, high omega-3 fatty acids, high monounsaturated fat, high polyunsaturated fat, and high unsaturated fat.*

categorization and encourage them to consider the "quantitative" size of the meal. Chernev and Gal (2010) showed that the "negative calorie illusion" disappeared when people were first asked to think about the size (as opposed to the healthiness) of various meals.

Reducing biases in serving size perception is generally more difficult than reducing biases created by health halos. This is because psychophysical-based errors are more automatic and less likely than association-based errors to be corrected by incentives (Arkes 1991). For example, we (Chandon and Wansink 2007b) found that educating people about their diminishing sensitivity to increasing meal sizes led to a general increase in calorie estimates but did not improve people's sensitivity to changes in quantity (see figure 4). Rather than trying to "debias" perceptions of magnitude, a more effective approach consists of using the properties of the psychophysical curve to help people spontaneously obtain a more accurate estimate. For example, we (Chandon and Wansink 2007b) exploited the fact that quantity perceptions are highly sensitive to small meals. In a piecemeal estimation condition we asked people to provide separate estimates for the number of calories of the chicken, fries and soda in their meal (three estimates of small quantities) instead of asking them to estimate the number of calories of the entire meal (a large quantity, likely to be underestimated). We found that piecemeal estimation effectively removed quantity biases and enabled people to accurately perceive increases in meal sizes.

Mindless Healthy Eating Nudges

We cannot expect that most people will adopt cognitively-costly mindful eating for the dozens of automatic food decisions that they make every day. Even if smart mindful consumption strategies are learned, and people do question health claims or think about food quantity and not just its nutritional quality, it is not clear that they will be willing to sustain this over the three years that are usually necessary to lose weight and reach a new equilibrium (Hall et al. 2011).

Evidence of the unobtrusive effects of environmental factors suggests another complementary approach, focusing on changing the choice environment at both the time of purchase and the time of consumption (Thaler and Sunstein 2003). This is consistent with the current "small steps" approach to obesity prevention, which recognizes that obesity is not a moral weakness but a normal response to the changing environment (Hill 2009; Swinburn et al. 2011). This stands in contrast with traditional public education efforts that exhort people through didactic and sometimes moralizing appeals to change their dietary habits.

The small-steps approach focuses on adopting smaller, more sustainable goals; it recognizes that self-control is a limited, often absent resource and focuses less on persuasion and more on environmental interventions that "nudge" consumers into making slightly better but repeated food choices without thinking. This is done mostly by altering the eating environment, for example by substituting calorie-dense drinks like soft drinks with calorie-light drinks like water or diet soft drink in cafeterias, surreptitiously improving food composition, encouraging people to prefer smaller package sizes by promoting them on menus (or by eliminating quantity discounts and adding an extra-small size to the range), storing tempting

food out of reach and healthier alternatives within reach, using smaller cups and bowls, and pre-plating food instead of using family-style service. The small-steps approach is not designed to achieve major weight loss among the obese, but rather to prevent obesity among the 90% of the population that is gradually becoming fat by consuming an excess of less than 100 calories per day (Hill et al. 2003).

Conclusion

Packaging has become an important way for food manufacturers to market their products and influence food choices. In this paper we have illustrated the many ways that packaged-based marketing claims create health halos, which influence people's taste and healthiness expectations, their sensory experience, and their consumption. We have also shown that the size and shape of packages, servings and containers influence consumption volume by changing people's perception of how much food is served, and of how much they have eaten. In both cases, we find that the effects on short-term consumption are meaningful, with many instances of up to 30% changes in consumption. Remarkably, people do not believe that packaging influences how much they eat and are largely unaware when it does. For example, we found that people believed that a combination of three "healthy" foods had 28% fewer calories than three "unhealthy" meals; although in reality the combination of healthy foods contained 34% more calories (see figure 1). Labeling chocolate candies as "low-fat" increased actual calorie intake by 46% among overweight people, but increased their perceived calorie intake by only 8% (see figure 2). Finally, people overlooked up to 50% of the quantity increase in large meals and packages despite their best efforts (see figures 3 and 4). These effects stand in contrast to other marketing actions like price change (which influence consumers through conscious decisions) or advertising (which consumers know attempt to persuade them) – both of which are persuasive attempts familiar to adult consumers.

Policy intervention designed to regulate the effects of packaged-based marketing can be justified on the grounds that such marketing creates misperceptions instead of just changing preferences. Encouraging consumers to think about food quantity (not just quality), and prompting them to question the validity of health claims works better than simply informing them about health halos. Unfortunately, most consumers are unlikely to engage in such high-involvement reasoning on a habitual basis. In this context, it makes sense to generalize size, calorie, and nutritional labeling to away-from-home consumption and to impose restrictions on health and nutrition claims similar to those adopted by the EC. However, this information is only likely to influence the behavior of the subset of consumers who are willing to pay attention and who are actually interested in healthier eating. Moreover, regulations may encourage some food marketers to compete on taste rather than on health, which would negate most of the consumer-based benefits of better information. In light of these limitations, a promising approach may be to change the choice context at the points of purchase and consumption so that the healthy choice becomes the easy choice. Obviously, a combination of smart regulation, promotion of mindful eating, and mindless nudges is more likely to work than any of them in isolation.

Among the many unresolved questions, future research should jointly study the behavior of marketers and consumers and explicitly account for heterogeneity in beliefs and goals. The same change (e.g. reduced fat, sugar, and salt) can be seen positively by those who worry about their weight and health and negatively by those who focus on taste. On the supply side, some companies may choose to focus on improving the nutritional quality of their foods, whereas others would focus on taste, price or convenience. In addition, there is clearly a need to examine whether the findings reviewed here, which were often conducted among young, educated North American consumers, apply to different cultures.

One of the most important areas for future research would be to examine how the short-term effects reviewed here hold across time. Longer time horizons are particularly important because habituation and compensation can offset short-term effects. Ideally, these new studies would combine the best characteristics of consumer research (including rich psychological insights and multi-method testing), nutrition (including longitudinal designs, representative participants, biomarkers of calorie intake and expenditures), and economics (including population-level interventions and analyses, and policy implications).

References

Andrews, J. C., R. G. Netemeyer, and S. Burton. 1998. Consumer Generalization of Nutrient Content Claims in Advertising. *Journal of Marketing* 62(4): 62–75.

Arkes, H. R. 1991. Costs and Benefits of Judgment Errors: Implications for Debiasing. *Psychological Bulletin* 110(3): 486–498.

Aydınoğlu, N. Z., and A. Krishna. 2011. Guiltless Gluttony: The Asymmetric Effect of Size Labels on Size Perceptions and Consumption. *Journal of Consumer Research* 37 (April): 1095–1112.

Aydınoğlu, N. Z., A. Krishna, and B. Wansink. (2009), "Do Size Labels Have a Common Meaning Among Consumers?" In *Sensory Marketing: Research on the Sensuality of Products*, ed. A. Krishna, New York, NY: Routledge, pp. 343–360.

Balasubramanian, S. K., and C. Cole. 2002. Consumers' Search and Use of Nutrition Information: The Challenge and Promise of the Nutrition Labeling and Education Act. *Journal of Marketing* 66(3): 112–127.

Berridge, K. C. 2009. 'Liking' and 'wanting' food rewards: Brain substrates and roles in eating disorders. *Physiology and Behavior* 97(5): 537–550.

Birch, L. L., L. MCPhee, B. C. Shoba, L. Steinberg, and R. Krehbiel. 1987. 'Clean Up Your Plate': Effects of Child Feeding Practices on the Conditioning of Meal Size. *Learning and Motivation* 18(3): 301–317.

Bollinger, B., P. Leslie, and A. Sorensen. 2011. Calorie Posting in Chain Restaurants. *American Economic Journal: Economic Policy* 3(1): 91–128.

Bowen, D. J., N. Tomoyasu, M. Anderson, M. Carney, and A. Kristal. 1992. Effects of Expectancies and Personalized Feedback on Fat Consumption, Taste, and Preference. *Journal of Applied Social Psychology* 22(13): 1061–1079.

Burton, S., E. H. Creyer, J. Kees, and K. Huggins. 2006. Attacking the Obesity Epidemic: The Potential Health Benefits of Providing Nutrition Information in Restaurants. *American Journal of Public Health* 96(9): 1669–1675.

Burton, S., and J. Kees. 2011. Flies in the Ointment? Addressing Potential Impediments to Population-Based Health Benefits of Restaurant Menu Labeling Initiatives. *Journal of Public Policy & Marketing*: 1–8.

Caine-Bish, N., L. Feiber, K. L. Gordon, and B. Scheule. 2007. P25: Does Plate Size Effect Portion Sizes When Children Self-Select Food and Drink? *Journal of Nutrition Education and Behavior* 39(4, Supplement 1): S114–S115.

Chandon, P., J. W. Hutchinson, E. T. Bradlow, and S. H. Young. 2009. Does In-Store Marketing Work? Effects of the Number and Position of Shelf Facings on Brand Attention and Evaluation at the Point of Purchase. *Journal of Marketing* 73(6): 1–17.

Chandon, P., and N. Ordabayeva. 2009. Supersize in One Dimension, Downsize in Three Dimensions: Effects of Spatial Dimensionality on Size Perceptions and Preferences. *Journal of Marketing Research* 46(6): 739–753.

Chandon, P., and B. Wansink. 2002. When Are Stockpiled Products Consumed Faster? A Convenience–Salience Framework of Postpurchase Consumption Incidence and Quantity. *Journal of Marketing Research* 39(3): 321–335.

——. 2007a. The Biasing Health Halos of Fast-Food Restaurant Health Claims: Lower Calorie Estimates and Higher Side-Dish Consumption Intentions. *Journal of Consumer Research* 34(3): 301–314.

——. 2007b. Is Obesity Caused by Calorie Underestimation? A Psychophysical Model of Meal Size Estimation. *Journal of Marketing Research* 44(1): 84–99.

——. 2012. Does Food Marketing Need to Make us Fat? A Review and Solutions. *Nutrition Reviews* forthcoming.

Cheema, A., and D. Soman. 2008. The Effect of Partitions on Controlling Consumption. *Journal of Marketing Research* 45(6): 665–675.

Chernev, A.. 2011a. The Dieter's Paradox. *Journal of Consumer Psychology* 21(2): 178–183.

——. 2011b. Semantic Anchoring in Sequential Evaluations of Vices and Virtues. *Journal of Consumer Research* 37(5): 761–774.

Chernev, A., and D. Gal. 2010. Categorization Effects in Value Judgments: Averaging Bias in Evaluating Combinations of Vices and Virtues. *Journal of Marketing Research* 47(4): 738–747.

Coelho do Vale, R., R. Pieters, and M. Zeelenberg. 2008. Flying under the Radar: Perverse Package Size Effects on Consumption Self-Regulation. *Journal of Consumer Research* 35(3): 380–390.

Crum, A. J., W. R. Corbin, K. D. Brownell, and P. Salovey. 2011. Mind over milk-shakes: Mindsets, not just nutrients, determine ghrelin response. *Health Psychology* 30(4): 424–429.

Deng, X., and B. E. Kahn. 2009. Is Your Product on the Right Side? The 'Location Effect' on Perceived Product Heaviness and Package Evaluation. *Journal of Marketing Research* 46 (December): 725–738.

Devitt, A. A., and R. D. Mattes. 2004. Effects of food unit size and energy density on intake in humans. *Appetite* 42(2): 213–220.

Dobson, P. W., and E. Gerstner. 2010. For a Few Cents More: Why Supersize Unhealthy Food? *Marketing Science* 29(4): 770–778.

Downs, J. S., G. Loewenstein, and J. Wisdom. 2009. Strategies for Promoting Healthier Food Choices. *American Economic Review* 99(2): 159–164.

Dubois, D., D. D. Rucker, and A. D. Galinsky. 2012. Super Size Me: Product Size as a Signal of Status. *Journal of Consumer Research* 38(6): 1047–1062.

Dumanovsky, T., C. Y. Huang, C. A. Nonas, T. D. Matte, M. T. Bassett, and L. D. Silver. 2011. Changes in energy content of lunchtime purchases from fast food restaurants after introduction of calorie labelling: cross sectional customer surveys. *BMJ* 343.

Elbel, B. 2011. Consumer Estimation of Recommended and Actual Calories at Fast Food Restaurants. *Obesity* 19(10): 1971–1978.

Elbel, B., R. Kersh, V. L. Brescoll, and L. B. Dixon. 2009. Calorie Labeling And Food Choices: A First Look At The Effects On Low-Income People In New York City. *Health Affairs* 28(6): w1110–w1121.

Finkelstein, Stacey R., and A. Fishbach. 2010. When Healthy Food Makes You Hungry. *Journal of Consumer Research* 37(3): 357–367.

Fischler, C., E. Masson, and E. Barlösius. 2008. *Manger : Français, Européens et Américains face à l'alimentation*. (O. Jacob, Paris).

Fisher, J., B. J. Rolls, and L. L. Birch. 2003. Children's bite size and intake of an entree are greater with large portions than with age-appropriate or self-selected portions. *American Journal of Clinical Nutrition* 77(5): 1164–1170.

Fisher, J. O., and T. V. E. Kral. 2008. Super-size me: Portion size effects on young children's eating. *Physiology and Behavior* 94(1): 39–47.

Folkes, V., and S. Matta. 2004. The Effect of Package Shape on Consumers' Judgments of Product Volume: Attention as a Mental Contaminant. *Journal of Consumer Research* 31(2): 390–401.

Folkes, V. S., I. M. Martin, and K. Gupta. 1993. When to Say When: Effects of Supply on Usage. *Journal of Consumer Research* 20 (December): 467–477.

Geier, A., B. Wansink, and P. Rozin. 2012. Red potato chips: Segmentation cues can substantially decrease food intake. *Health Psychology*.

Geier, A. B., P. Rozin, and G. Doros. 2006. Unit Bias. *Psychological Science* 17(6): 521–525.

Gilsenan, M. B. 2011. Nutrition & health claims in the European Union: A regulatory overview. *Trends in Food Science & Technology* 22(10): 536–542.

Grunert, K. G., L. E. Bolton, and M. M. Raats. (2011), "Processing and acting upon nutrition labeling on food: The state of knowledge and new directions for transformative consumer research." In *Transformative Consumer Research for Personal and Collective Well-Being*, ed. D. G. Mick, S. Pettigrew, J. L. Ozanne, and C. Pechmann, New York: Routledge.

Hall, K. D., G. Sacks, D. Chandramohan, C. C. Chow, Y. C. Wang, S. L. Gortmaker, and B. A. Swinburn. 2011. Quantification of the effect of energy imbalance on bodyweight. *Lancet* 378(9793): 826–837.

Harnack, L., and S. 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.

Harnack, L., S. French, J. M. Oakes, M. Story, R. Jeffery, and S. Rydell. 2008. Effects of calorie labeling and value size pricing on fast food meal choices: Results from an experimental trial. *International Journal of Behavioral Nutrition and Physical Activity* 5(1): 63.

Harris, J. L., M. B. Schwartz, K. D. Brownell, V. Sarda, A. Ustjanauskas, J. Javadizadeh, M. Weinberg, C. Munsell, S. Speers, E. Bukofzer, A. Cheyne, P. Gonzalez, J. Reshetnyak, H. Agnew, and P. Ohri-Vachaspati. 2010. *Fast Food Facts: Evaluating Fast Food Nutrition and Marketing to Youth*. (New Haven, CT).

Herman, C. P., and J. Polivy. 2005. Normative influences on food intake. *Physiology and Behavior* 86(5): 762–772.

Hill, J. O. 2009. Can a small-changes approach help address the obesity epidemic? A report of the Joint Task Force of the American Society for Nutrition, Institute of Food Technologists, and International Food Information Council. *The American Journal of Clinical Nutrition* 89(2): 477–484.

Hill, J. O., H. R. Wyatt, G. W. Reed, and J. C. Peters. 2003. Obesity and the Environment: Where Do We Go from Here? *Science* 299 (February 7): 854–855.

Hoch, S. J.. 2002. Product Experience Is Seductive. *Journal of Consumer Research* 29(3): 448–454.

Hoegg, J., and J. W. Alba. 2007. Taste Perception: More than Meets the Tongue. *Journal of Consumer Research* 33(4): 490–498.

Howlett, E., S. Burton, A. H. Tangari, and M. Bui. 2012. Hold the Salt! Effects of Sodium Information Provision, Sodium Content, and Hypertension on Perceived Cardiovascular Disease Risk and Purchase Intentions. *Journal of Public Policy & Marketing* 31(1): 4–18.

Hurley, J., and B. Liebman. 2009. Big: Movie Theaters Fill Buckets . . . .and Bellies. *Nutrition Action* 36(2): 1–5.

Irmak, C., B. Vallen, and S. R. Robinson. 2011. The Impact of Product Name on Dieters' and Nondieters' Food Evaluations and Consumption. *Journal of Consumer Research* 38(2): 390–405.

Kardes, F. R., S. S. Posavac, and M. L. Cronley. 2004. Consumer Inference: A Review of Processes, Bases, and Judgment Contexts. *Journal of Consumer Psychology* 14(3): 230–256.

Kessler, D. A. 2009. *The End of Overeating: Taking Control of the Insatiable American Appetite*. (Rodale, Emmaus, Pa.).

Kiesel, K., J. J. McCluskey, and S. B. Villas-Boas. 2011. Nutritional Labeling and Consumer Choices. *Annual Review of Resource Economics* 3(1): 141–158.

Kiesel, K., and S. B. Villas-Boas. 2010. Can information costs affect consumer choice? Nutritional labels in a supermarket experiment. *International Journal of Industrial Organization* (0).

Kozup, J. C., E. H. Creyer, and S. Burton. 2003. Making Healthful Food Choices: The Influence of Health Claims and Nutrition Information on Consumers' Evaluations of Packaged Food Products and Restaurant Menu Items. *Journal of Marketing* 67(2): 19–34.

Kral, T. V., L. S. Roe, and B. J. Rolls. 2004. Combined effects of energy density and portion size on energy intake in women. *American Journal of Clinical Nutrition* 79(6): 962–968.

Krider, R. E., P. Raghubir, and A. Krishna. 2001. Pizzas: Pi or Square? Psychophysical Biases in Area Comparisons. *Marketing Science* 20(4): 405–425.

Krishna, A.. 2006. Interaction of Senses: The Effect of Vision versus Touch on the Elongation Bias. *Journal of Consumer Research* 32(4): 557–566.

Ledikwe, J. H., J. A. Ello-Martin, and B. J. Rolls. 2005. Portion Sizes and the Obesity Epidemic. *Journal of Nutrition* 135(4): 905–909.

Lee, L., S. Frederick, and D. Ariely. 2006. Try It, You'll Like It: The Influence of Expectation, Consumption, and Revelation on Preferences for Beer. *Psychological Science* 17(12): 1054–1058.

Lennard, D., V.-W. Mitchell, P. McGoldrick, and E. Betts. 2001. Why consumers under-use food quantity indicators. *International Review of Retail, Distribution & Consumer Research* 11(2): 177–199.

Levitsky, D. A., and C. Pacanowski. 2011. Losing weight without dieting. Use of commercial foods as meal replacements for lunch produces an extended energy deficit. *Appetite* 57(2): 311–317.

Livingstone, M. B. E., and A. E. Black. 2003. Markers of the Validity of Reported Energy Intake. *Journal of Nutrition* 133(3): 895S–920S.

Ludwig, D. S., and K. D. Brownell. 2009. Public Health Action Amid Scientific Uncertainty: The Case of Restaurant Calorie Labeling Regulations. *Journal of the American Medical Association* 302(4): 434–435.

Madzharov, A. V., and L. G. Block. 2010. Effects of product unit image on consumption of snack foods. *Journal of Consumer Psychology* 20(4): 398–409.

Marchiori, D., O. Corneille, and O. Klein. 2012. Container size influences snack food intake independently of portion size. *Appetite* 58(3): 814–817.

Marchiori, D., L. Waroquier, and O. Klein. 2012. "Split Them!" Smaller Item Sizes of Cookies Lead to a Decrease in Energy Intake in Children. *Journal of Nutrition Education and Behavior* 44(3): 251–255.

Mariotti, F., E. Kalonji, J. F. Huneau, and I. Margaritis. 2010. Potential pitfalls of health claims from a public health nutrition perspective. *Nutrition Reviews* 68(10): 624–638.

McFerran, B., D. W. Dahl, G. J. Fitzsimons, and A. C. Morales. 2010. I'll Have What She's Having: Effects of Social Influence and Body Type on the Food Choices of Others. *Journal of Consumer Research* 36(6): 915–929.

Mela, D. J.. 2006. Eating for pleasure or just wanting to eat? Reconsidering sensory hedonic responses as a driver of obesity. *Appetite* 47(1): 10–17.

Moorman, C. 1996. A quasi experiment to assess the consumer and informational determinants of nutrition information. *Journal of Public Policy & Marketing* 15(1): 28–44.

Moorman, C., R. Ferraro, and J. Huber. 2012. Unintended Nutrition Consequences: Firm Responses to the Nutrition Labeling and Education Act. *Marketing Science* Forthcoming.

Mussweiler, T. 2003. Comparison Processes in Social Judgment: Mechanisms and Consequences. *Psychological Review* 110(3): 472–489.

Neslin, S. A., and H. J. Van Heerde. 2009. Promotion Dynamics. *Foundations and Trends in Marketing* 3(4): 177–268.

Nestle, M., and D. S. Ludwig. 2010. Front-of-Package Food Labels: Public Health or Propaganda? *Journal of the American Medical Association* 303(8): 771–772.

Nestle, M., and M. C. Nesheim. 2012. *Why calories count : from science to politics*. (University of California Press, Berkeley).

Nielsen, S. J., and B. M. Popkin. 2003. Patterns and Trends in Food Portion Sizes, 1977–1998. *Journal of the American Medical Association* 289(4): 450–453.

Oakes, M. E.. 2005. Stereotypical Thinking about Foods and Perceived Capacity to Promote Weight Gain. *Appetite* 44(3): 317–324.

——. 2006. Filling yet fattening: Stereotypical beliefs about the weight gain potential and satiation of foods. *Appetite* 46(2): 224–233.

Plassmann, H., J. O'Doherty, B. Shiv, and A. Rangel. 2008. Marketing actions can modulate neural representations of experienced pleasantness. *Proceedings of the National Academy of Sciences of the United States of America* 105(3): 1050–1054.

Provencher, V., J. Polivy, and C. P. Herman. 2008. Perceived healthiness of food. If it's healthy, you can eat more! *Appetite* 52(2): 340–344.

Raghubir, P., and A. Krishna. 1999. Vital Dimensions in Volume Perception: Can the Eye Fool the Stomach? *Journal of Marketing Research* 36(3): 313–326.

Raghunathan, R., R. W. Naylor, and W. D. Hoyer. 2006. The Unhealthy = Tasty Intuition and Its Effects on Taste Inferences, Enjoyment, and Choice of Food Products. *Journal of Marketing* 70(4): 170–184.

Ramanathan, S., and P. Williams. 2007. Immediate and Delayed Emotional Consequences of Indulgence: The Moderating Influence of Personality Type on Mixed Emotions. *Journal of Consumer Research* 34(2): 212–223.

Roberto, C. A., M. B. Schwartz, and K. D. Brownell. 2009. Rationale and Evidence for Menu-Labeling Legislation. *American Journal of Preventive Medicine* 37(6): 546–551.

Robinson, T. N., D. L. G. Borzekowski, D. M. Matheson, and H. C. Kraemer. 2007. Effects of Fast Food Branding on Young Children's Taste Preferences. *Archives of Pediatrics and Adolescent Medicine* 161(8): 792–797.

Roefs, A., and A. Jansen. 2004. The effect of information about fat content on food consumption in overweight/obese and lean people. *Appetite* 43(3): 319–322.

Rolls, B. J., D. Engell, and L. L. Birch. 2000. Serving Portion Size Influences 5-Year-Old but Not 3-Year-Old Children's Food Intakes. *Journal of the American Dietetic Association* 100(2): 232–234.

Rolls, B. J., E. L. Morris, and L. S. Roe. 2002. Portion size of food affects energy intake in normal-weight and overweight men and women. *American Journal of Clinical Nutrition* 76(6): 1207–1213.

Rolls, B. J., L. S. Roe, K. H. Halverson, and J. S. Meengs. 2007a. Using a smaller plate did not reduce energy intake at meals. *Appetite* 49(3): 652–660.

Rolls, B. J., L. S. Roe, and J. S. Meengs. 2007b. The Effect of Large Portion Sizes on Energy Intake Is Sustained for 11 Days. *Obesity* 15(6): 1535–1543.

Rozin, P., M. Ashmore, and M. Markwith. 1996. Lay American Conceptions of Nutrition: Dose Insensitivity, Categorical thinking, Contagion, and the Monotonic mind. *Health Psychology* 15(6): 438–447.

Rozin, P., K. Kabnick, E. Pete, C. Fischler, and C. 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): 450–454.

Scott, M. L., S. M. Nowlis, N. Mandel, and A. C. Morales. 2008. The Effects of Reduced Food Size and Package Size on the Consumption Behavior of Restrained and Unrestrained Eaters. *Journal of Consumer Research* 35(3): 309–323.

Sharpe, Kathryn M., R. Staelin, and J. Huber. 2008. Using Extremeness Aversion to Fight Obesity: Policy Implications of Context Dependent Demand. *Journal of Consumer Research* 35(3): 406–422.

Sprott, D. E., K. C. Manning, and A. D. Miyazaki. 2003. Grocery Price Setting and Quantity Surchages. *Journal of Marketing* 67(3): 34–46.

Steenhuis, I., and W. Vermeer. 2009. Portion size: review and framework for interventions. *International Journal of Behavioral Nutrition and Physical Activity* 6(1): 58–67.

Stewart, H., N. Blisard, and D. Jolliffe. 2006. Americans weigh taste, convenience, and nutrition. *Economic Information Bulletin* 19 (October): 1–10.

Stroebele, N., L. G. Ogden, and J. O. Hill. 2009. Do calorie-controlled portion sizes of snacks reduce energy intake? *Appetite* 52(3): 793–796.

Swinburn, B. A., G. Sacks, K. D. Hall, K. McPherson, D. T. Finegood, M. L. Moodie, and S. L. Gortmaker. 2011. The global obesity pandemic: shaped by global drivers and local environments. *The Lancet* 378 (August 27): 804–814.

Tangari, A. H., S. Burton, E. Howlett, Y.-N. Cho, and A. Thyroff. 2010. Weighing in on Fast Food Consumption: The Effects of Meal and Calorie Disclosures on Consumer Fast Food Evaluations. *Journal of Consumer Affairs* 44(3): 431–462.

Thaler, R. H., and C. Sunstein. 2003. Libertarian Paternalism. *The American Economic Review* 93(2): 175–179.

Ueland, Ø., A. V. Cardello, E. P. Merrill, and L. L. Lesher. 2009. Effect of Portion Size Information on Food Intake. *Journal of the American Dietetic Association* 109(1): 124–127.

van Ittersum, K., and B. Wansink. 2012. Plate Size and Color Suggestibility: The Delboeuf Illusion's Bias on Serving and Eating Behavior. *Journal of Consumer Research* forthcoming.

Variyam, J. N. 2008. Do nutrition labels improve dietary outcomes? *Health Economics* 17(6): 695–708.

Vermeer, W. M., E. Alting, I. H. M. Steenhuis, and J. C. Seidell. 2010a. Value for money or making the healthy choice: the impact of proportional pricing on consumers' portion size choices. *European Journal of Public Health* 20(1): 65–69.

Vermeer, W. M., B. Bruins, and I. H. M. Steenhuis. 2010b. Two pack king size chocolate bars. Can we manage our consumption? *Appetite* 54(2): 414–417.

Vermeer, W. M., I. H. M. Steenhuis, and J. C. Seidell. 2010c. Portion size: a qualitative study of consumers' attitudes toward point-of-purchase interventions aimed at portion size. *Health Education Research* 25(1): 109–120.

Wansink, B. 1996. Can package size accelerate usage volume? *Journal of Marketing* 60(3): 1–14.

Wansink, B., and P. Chandon. 2006a. Can 'Low-Fat' Nutrition Labels Lead to Obesity? *Journal of Marketing Research* 43(4): 605–617.

——. 2006b. Meal Size, Not Body Size, Explains Errors in Estimating the Calorie Content of Meals. *Annals of Internal Medicine* 145(5): 326–332.

Wansink, B., and J. Kim. 2005. Bad Popcorn in Big Buckets: Portion Size Can Influence Intake as Much as Taste. *Journal of Nutrition Education and Behavior* 37(5): 242–245.

Wansink, B., J. E. Painter, and J. North. 2005. Bottomless Bowls: Why Visual Cues of Portion Size May Influence Intake. *Obesity Research* 13(1): 93–100.

Wansink, B., C. R. Payne, and P. Chandon. 2007. Internal and External Cues of Meal Cessation: The French Paradox Redux? *Obesity* 15(12): 2920–2924.

Wansink, B., and K. Van Ittersum. 2003. Bottoms Up! The Influence of Elongation on Pouring and Consumption Volume. *Journal of Consumer Research* 30(3): 455–463.

——. 2007. Portion Size Me: Downsizing Our Consumption Norms. *Journal of the American Dietetic Association* 107(7): 1103–1106.

Wansink, B., K. van Ittersum, and J. E. Painter. 2005. How descriptive food names bias sensory perceptions in restaurants. *Food Quality and Preference* 16(5): 393–400.

Wansink, B., K. van Ittersum, and J. E. Painter. 2006. Ice Cream Illusions: Bowls, Spoons, and Self-Served Portion Sizes. *American Journal of Preventive Medicine* 31(3): 240–243.

Wardle, J., and W. Solomons. 1994. Naughty but Nice: A Laboratory Study of Health Information and Food Preferences in a Community Sample. *Health Psychology* 13(2): 180–183.

Werle, C. O. C., G. Ardito, O. Trendal, A. Mallard, and P. Nat. 2011. Unhealthy Food is Not Tastier for Everybody: The "Healthy = Tasty" French Intuition. *Actes du Congrès de l'AFM*.

Wertenbroch, K.. 1998. Consumption Self Control by Rationing Purchase Quantities of Virtue and Vice. *Marketing Science* 17(4): 317–337.

Wilcox, K., B. Vallen, L. Block, and Gavan J. Fitzsimons. 2009. Vicarious Goal Fulfillment: When the Mere Presence of a Healthy Option Leads to an Ironically Indulgent Decision. *Journal of Consumer Research* 36(3): 380–393.

Williams, P. 2005. Consumer Understanding and Use of Health Claims for Foods. *Nutrition Reviews* 63(7): 256–264.

Winer, R. S. 2009. New Communications Approaches in Marketing: Issues and Research Directions. *Journal of Interactive Marketing* 23(2): 108–117.

Young, L. R., and M. Nestle. 2002. The Contribution of Expanding Portion Sizes to the US Obesity Epidemic. *American Journal of Public Health* 92(2): 246–249.

Young, L. R., and M. Nestle. 2007. Portion Sizes and Obesity: Responses of Fast-Food Companies. *Journal of Public Health Policy* 28(2): 238–248.

Young, S. 2004. Breaking down the barriers to packaging innovation. *Design Management Review* 15(1): 68–73.

Young, S., and V. Ciummo. 2009. Managing Risk in a Package Redesign: What Can We Learn From Tropicana? *Brand Packaging* (August): 18–21.

Zlatevska, N., C. Dubelaar, and S. S. Holden. 2012. Increasing serving size increases amount consumed: Catch-22. Working Paper.