

Does food marketing need to make us fat? A review and solutions

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Food marketing is often singled out as the leading cause of the obesity epidemic. The present review examines current food marketing practices to determine how exactly they may be influencing food intake, and how food marketers could meet their business objectives while helping people eat healthier. Particular attention is paid to the insights provided by recently published studies in the areas of marketing and consumer research, and those insights are integrated with findings from studies in nutrition and related disciplines. The review begins with an examination of the multiple ways in which 1) food pricing strategies and 2) marketing communication (including branding and food claims) bias food consumption. It then describes the effects of newer and less conspicuous marketing actions, focusing on 3) packaging (including the effects of package design and package-based claims) and 4) the eating environment (including the availability, salience, and convenience of food). Throughout, this review underscores the promising opportunities that food manufacturers and retailers have to make profitable “win-win” adjustments to help consumers eat better.

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INTRODUCTION

Biology and natural selection have created strong food preferences. Individuals around the world want easy access to a variety of tasty, convenient, inexpensive, and safe foods that can be eaten in large quantities. By catering to, and stimulating, these biological interests, food marketers have been accused of contributing to the growing problem of global obesity.¹⁻⁵ After all, the food industry (which includes food and beverage producers, as well as retailers, restaurants, and food services companies) employs savvy and creative marketers who have pioneered many of the tools of modern marketing.^{6,7} At the same time, it is important to understand that the marketers and the executives who guide them are torn between satisfying the desires of various consumers, the demands of their shareholders, and the concerns of public health organizations, which largely perceive the food industry as the new tobacco industry (because both industries have used

similar tactics, such as emphasizing personal responsibility, massive lobbying, pre-emptive self-regulation, etc.).^{8,9} For these reasons, it is useful to review and integrate much of the overlooked evidence on how food marketing influences food intake and to examine how food marketers could continue to grow their profits without growing their customer's body mass index (BMI).

This review article examines and integrates the literature from marketing, consumer research, and related social science disciplines, which is not in the commonly referenced databases for health and medicine, such as PubMed, and is therefore often unknown to nutrition researchers. By incorporating this information, this review updates the existing reviews in the field,^{10,11} which are rapidly becoming outdated given the breadth of more current research. For the purpose of this review, marketing is defined in accordance with the definition of the American Marketing Association as “the activity, set of institutions, and processes for creating, communicating,

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delivering, and exchanging offerings that have value for customers, clients, partners, and society at large.” This article focuses on the direct effects of marketing activity under the direct control of food marketers, often referred to as the 4 Ps of “product,” “price,” “promotion,” and “place.” Specific focus is placed on the factors that influence how much consumers eat, and in particular, whether they overeat (which is defined as eating more than one realizes). Yet, it is important to remember that food/energy intake is not synonymous with weight gain, let alone obesity.¹² Because of this review’s focus on marketing and food intake, many influencers of food intake that are not under the direct control of food marketers are excluded (e.g., physical activity, pro-social marketing, personal, cultural, and social norms about food, eating, dieting, incidental emotions, etc.).

Food marketers influence the volume of food consumption through four basic mechanisms that vary in their conspicuousness. 1) The short- and long-term price of food, as well as the type of pricing (e.g., a straight price cut or quantity discount), can influence how much people purchase and eventually consume. Pricing efforts are generally conspicuous and lead to deliberate decisions. 2) Marketing communications, including advertising, promotion, branding, nutrition, and health claims, can influence a consumer’s expectations of the sensory and non-sensory benefits of the food. Marketing communications comprise the most recognized form of influence and the one most closely scrutinized by marketing and non-marketing researchers. The influence of marketing communication can sometimes be as conspicuous as price changes, but consumers are not always aware of some of the newest forms of marketing communication (e.g., “advergaming,” package design, or social media activities) and, even when they are aware of the persuasive intent behind these tools, they may not realize that their consumption decisions are being influenced. 3) The product itself, including its quality (composition, sensory properties, calorie density, and variety) and quantity (packaging and serving sizes) also influence in a variety of ways how much of the product consumers eat. This area has been frequently researched as marketing communication. 4) The eating environment, including the availability, salience, and convenience of food, can be altered by marketers. Compared to the breadth of the domain, this is the least frequently studied area, yet it is the one most likely to be driven by automatic, visceral effects outside the awareness and volitional control of consumers.

PRICING: HOW LONG- AND SHORT-TERM PRICE REDUCTIONS STIMULATE INTAKE

Some food products like milk, meats, fruits, and vegetables are often sold as commodities. With commodities,

short-term prices are determined by supply and demand on world markets and long-term price changes are determined by efficiency gains in the production, transformation, and distribution of food rather than by marketers. The most notable change in this respect is the relative steep decline in the price of food over the last 50 years, particularly for branded, processed foods that are high in sugar and fat, and for ready-to-eat foods, which are prepared away from home.^{13–17}

Yet most food products are *not* commodities; instead, they are branded products that are differentiated in the eyes of consumers thanks to the ways in which they are advertised, formulated, packaged, distributed, and so on. With these branded products, marketers can establish their own price depending on which consumer segment they wish to target. Advances in marketing segmentation have enabled companies to direct price cuts to only the most susceptible consumer segments, which increases their efficiency. Table 1 summarizes key findings about the effects of price on overeating, innovative solutions tested by marketers to mitigate its effects, and suggestions for using price to improve food consumption decisions.

Effects of long-term price changes

Econometric studies suggest that lower food prices have led to increased energy intake.^{13–17} Even though the average price elasticity of food consumption is low (–0.78), it can be quite high in some categories (e.g., –1.15 for soft drinks) and for food prepared away from home. For example, one econometric study¹⁸ using data from the 1984–1999 national Behavioral Risk Factor Surveillance System found that a 10% increase in prices at fast-food and full-service restaurants was associated with a 0.7% decrease in the obesity rate.

These conclusions are reinforced by the results of randomized controlled trials which demonstrate the causal effects of price changes. Longitudinal field experiments in cafeterias^{19–21} have found that price changes above 25% significantly influence consumption of beverages or snacks, but also of fruit and vegetables, and they have stronger effects than nutrition labeling, which sometimes backfire because of negative taste inferences. One of the most thorough studies²² also varied food budgets over time and found strong and comparable same-price elasticity in two studies for healthy (–1 and –1.7, respectively) and unhealthy (–0.9 and –2.1, respectively) foods. In contrast, the cross-price elasticities were four times smaller and only occurred when children had a very low budget, showing that children do not consider healthy foods to be a substitute for healthier ones.

The only exception to the rule that higher prices reduce consumption comes from a study showing that higher prices at an all-you-can-eat pizza restaurant led to

Table 1 Pricing and consumer welfare.

Findings indicating how pricing can negatively influence consumer choices and behavior	Examples of positive pricing initiatives by food companies to help consumers make healthy choices ^a	Win-win considerations for the future
<p>Long-term price changes</p> <ul style="list-style-type: none"> • Lower retail food prices lead to increased energy intake,^{14,17–19,22,29} with the possible exception of all-you-can-eat buffets.²³ • Ready-to-eat foods high in sugar and fat have experienced the steepest price decline over the years.^{13,16} • The price of food prepared away from home has declined significantly.^{14,15} • Prices for vending machine items have declined while prices at full-service restaurants have increased.¹⁵ • A 10% increase in fast-food prices is associated with a 0.7% decrease in obesity rate.¹⁸ • Substantial price reductions in cafeterias significantly increase the consumption of snacks, fruits, and vegetables over time,^{19,21} and in one situation substantial price increases reduced soft drink sales.²⁰ • Children with large budgets responded to an increase in the price of unhealthy food by buying less of the healthy food.²² • Price is generally unrelated to the perceived quality of packaged food brands, except for ambiguous products like wine.^{25,26} 	<ul style="list-style-type: none"> • TGI Friday's: "Right Portion, Right Price" menu. • Au Bon Pain: bite-sized baked goods. • Applebee's: half-size portions for 70% of the price. • PepsiCo India: rural strategy to introduce new affordable beverages that target known regional health problems.²⁶⁵ • Chili's: \$20 dinner for two – each person gets an entree but they split an appetizer instead of getting one each. • Walmart: heavy promotion of fresh produce with frequent price deals. 	<ul style="list-style-type: none"> • Reduce retail price of healthy food through more efficient production and distribution, e.g., lower spoilage with better packaging. • Provide quantity discounts through bulk packaging of fruits and vegetables like at membership warehouse clubs such as Sam's Club and Costco.
<p>Temporary price changes</p> <ul style="list-style-type: none"> • Temporary price reductions can increase energy intake.²⁸ • People accelerate consumption of products they believe were purchased at a lower price, even after the food has already been purchased.^{27,29,30} • Quantity discounts lead to stockpiling, which accelerates consumption.³² • Consumers prefer price discounts to bonus packs for "vice" foods but prefer bonus packs to price discounts for "virtue" foods.³⁵ • Price reductions mitigate guilt, increasing the incentive to buy unhealthy foods.³⁷ 	<ul style="list-style-type: none"> • Chiquita: Banana Bites coupon distributed on its Chiquita Banana Facebook page • Family Tree Farms: produce sold in bulk with an attractive design on the crate • Wendy's: \$1 off coupon for Wendy's Berry Almond Chicken Salad. • TGI Friday's: \$5 deal for any sandwiches or salads for a limited time. 	<ul style="list-style-type: none"> • Offer "free quantity" promotions for healthy food (e.g., larger packs, buy-one-get-one-free, etc.). • Give coupons or discounts on fruit and vegetables, such as \$1 off salads; buy salad get a free small fry; buy one salad get another half off. • Use social media to promote healthy food choices.

^a Information on specific company products and initiatives was obtained through the companies' websites on November 11, 2011. URLs can be obtained in the working paper written by the authors (with the same title) and available through SSRN.

higher consumption of pizza, probably because of the psychology of "sunk costs," which leads people to try to eat "their money's worth."²³ Interestingly, monetary (and normative) rewards do not seem to have any adverse effects on children's intrinsic motivation for the food.²⁴ In general, consumers appear to have learned that lower-priced foods are as hedonically satisfying as higher-priced foods, with the exception of a few categories, such as wine, for which determining good taste is ambiguous.²⁵ For example, in a recent study, Austrian consumers thought that price was unrelated to the quality of foods, which is not surprising

given that the correlation between price and quality in that country was estimated by experts at only 0.07.²⁶

Effects of temporary price promotions and quantity discounts

Until recently, it was believed that price promotions simply shifted sales across brands or across time. However, it has now become clear that temporary sales promotions can lead to a significant increase in consumption.^{27,28} Probably the best evidence of this comes

from a randomized controlled field experiment involving 1,104 shoppers.²⁹ This study found that a 12.5% temporary price discount on healthier foods increased the purchase volume of these foods by 11% among the low-income consumers who received the coupons. The effect persisted even 6 months after the promotion had been stopped. In comparison, nutrition education and suggestions for substituting healthier food for less healthy food had no effect, whether alone or combined with the price discounts. However, the discounts on healthy food did not reduce purchases of unhealthy food.

Price deals can influence the speed of consumption even when the food has already been purchased (such as by another family member) and is, therefore, an irreversible sunk cost; this should not, in theory, influence consumption because the cost cannot be recovered, no matter when, or how quickly, the food is consumed. Nevertheless, studies have found that people accelerate the consumption of products perceived to have been purchased at a lower price.³⁰ This happens because a reduced past price is seen as an indication that the product will be discounted again in the future³¹ or simply because the reduced sunk cost means that consumers feel they do not have to wait for a special occasion to consume the product perceived to be cheaper.³²

Marketers also reduce the relative price of food by offering quantity discounts with larger package sizes or multi-unit packs, which is a powerful driver of supersizing.³³ Although there are exceptions, most studies found that quantity discounts generally lead to stockpiling and increased consumption, especially for overweight consumers.^{27,34} One study found that during weeks in which multi-unit packages were purchased, consumption of orange juice increased by 100% and cookies by 92%, but there was no change in consumption of non-edible products.³² The authors replicated this effect in a field experiment in which the quantity of food was randomly manipulated while keeping its price constant; they found that large purchase quantities influenced consumption by making the food salient in the pantry or fridge, and not just by reducing its price.

Beyond the degree of the incentive, the form of the promotion and the payment mechanism can also influence energy intake. One study suggests that consumers prefer price discounts to bonus packs for guilt-inducing “vice” foods, but preferred bonus packs to price discounts for “virtue” foods because it is easy to justify buying them in larger quantity.³⁵ By definition, “vices” are foods that are preferred when considering only the immediate consequences of consumption and holding delayed consequences fixed, whereas the opposite is true for “virtues.”³⁶ The greater difficulty of justifying purchases of unhealthy foods also explains why they are more likely to be purchased when people pay for their grocery purchases via

credit card than when they pay cash – a more painful form of payment which elicits a higher need for justification.³⁷ On the other hand, people are more likely to purchase and consume indulgent high-calorie ice-creams when paying cash than when paying with a credit card,³⁸ possibly because in this case they have the opposite goal of rewarding themselves.

Summary

Overall, all the studies reviewed here clearly show that pricing is one of the strongest – if not *the* strongest – marketing factors predicting increased energy intake and obesity, and this is why lower-income consumers are predominantly affected by these conditions. Conversely, the power of pricing means that it holds the key to many of the “win-win” solutions detailed in Table 1. However, price is not the only determinant of food choices and it cannot alone explain rising obesity rates.¹⁸ Unlike price, which arguably influences consumption through deliberate processes that people are aware of, food communication influences food perceptions and preferences often beyond volitional control and sometimes outside conscious awareness.

PROMOTION: HOW MARKETING COMMUNICATION STIMULATES INTAKE

Advertising and promotions are one of the most visible and studied actions of food marketers. They include advertising, both on traditional media channels and on non-traditional non-media channels, such as online, in-store, in movies, television programs or games, sponsorship or organization of events, in the street, and so on. Food marketers also communicate in more indirect ways by branding the entire product category (e.g., the “Got Milk?” campaign), the ingredients (e.g., acai), and by making nutrition or health claims in their advertising or on their packages. These claims are distinct from the mandatory nutrition information about calories, nutrient levels, and serving sizes, whose effects are reviewed elsewhere.^{39–44} Table 2 summarizes the effects of marketing communication and shows how they can also improve food choices.

Marketing communication informs people about product attributes, like the price or where it can be purchased. Marketing communication also increases awareness of the brand and food, which leads consumers, particularly children, to try fewer foods and to only search for brands they already know rather than the brand that would have the highest nutritional and hedonic qualities.^{45–47} Moving beyond awareness, communication enhances a consumer’s expectations of the sensory and non-sensory benefits (such as the social and symbolic

Table 2 Marketing communications (promotion) and consumer welfare.

Findings indicating how marketing communications can negatively influence consumer choices and behavior	Examples of positive marketing communications initiatives used by food companies to help consumers make healthier choices ^a	Win-win considerations for the future
<p>Advertising and promotion effects</p> <ul style="list-style-type: none"> • Food advertising represents one-third of television advertising in children's TV programs; children are exposed to 40,000 food ads a year.^{8,52} • Most of the television advertising for food is for unhealthy foods that are high in fat, sodium, and added sugar; 72% is for candy, cereal, and fast food.^{8,50} • Food marketers are increasingly relying on nontraditional, "non-media" communication, including Internet, games, social media, events, and product placement.⁵³ • Marketing works best on consumers without fully formed preferences and loyalty to their habitual food.⁴⁶ This includes some young consumers. • In some situations, banning television advertising in children's programming reduces consumption of sugared cereals and reduces fast-food consumption frequency.^{62,63} • Children in closed environments with exposure to TV advertising for unhealthy foods are more likely to choose these products, especially obese children.^{64,65} • Overall, television advertising (not just television viewing) has a causal (but small) influence on the food intake of children (though not on teens).^{57,66-68} 	<ul style="list-style-type: none"> • McDonald's: campaigns for its healthier smoothies and salads, fruit and maple oatmeal, and "choose apple dippers and we'll plant a tree". • Wendy's: website default kid's meal is a crispy chicken sandwich with apple slices and low-fat white milk. • A Bunch of Carrot Farmers: Fun, innovative advertising for produce, like the "Eat 'em' like junk food" campaign for baby carrots on YouTube. • Produce companies such as Chiquita and Sunkist: sweepstakes in which customers can win money and prizes for visiting their site. • Produce companies (e.g., Chiquita, Sunkist, Dole, Del Monte, and General Mills): many websites have sections filled with fun, easy recipes using the produce items the company sells. • Schools: emails to notify students of the healthy options in the dining hall each day. • Chiquita and Nintendo: cross-promotion of bananas and new Donkey Kong game. 	<ul style="list-style-type: none"> • Increase messaging (in media and non-media outlets) for fruit and vegetables/salads. • Increase the online presence of produce on websites targeted at children. • Increase the use of social media and adver-gaming for healthy products. • Increase healthy eating in the media; in movies and TV shows portray characters eating healthily, especially in media geared towards children. • Co-brand healthy items with popular brands (that may not necessarily be known for being healthy).

value) associated with the purchase and consumption of a particular food. Even if it fails at changing the expected benefits of consumption, marketing communication can influence the importance of these benefits, for example, by making taste a more important goal than health. This may explain why nutrition ranks last in surveys of the drivers of food choices, after taste, cost, and convenience.^{48,49}

Advertising and promotion effects

The food industry is among the top advertisers in the US media market. Children and adolescents are exposed to increasing levels of television advertising, mostly for nutritionally poor snacks, cereals, candies, and other food with a high fat, sodium, or added sugar content.⁵⁰⁻⁵² As with all consumer goods marketers, food marketers are diverting budgets from television, print, radio, or outdoor

advertising to more recent forms of communication on new media (including web sites, all types of video games, social networks, product placement, point-of-purchase advertising, etc.) and through packaging, direct marketing, public relations, and event sponsorship.⁵³ The message communicated in these ads is that eating these foods is normal, fun, and socially rewarding.

Given how much food marketers spend on communication, and particularly television advertising, it is surprising that a link between television advertising and energy intake is still perceived to be controversial by some. Some researchers contend that television advertising only affects brand preferences and not overall energy intake, while others demand an extremely high bar before any conclusion can be drawn.⁵⁴⁻⁵⁶ Part of the explanation for the duration of the controversy is that, unlike other factors, such as price or portion size changes, advertising

Table 2 Continued

Findings indicating how marketing communications can negatively influence consumer choices and behavior	Examples of positive marketing communications initiatives used by food companies to help consumers make healthier choices ^a	Win-win considerations for the future
<p>Branding and labeling effects: food and ingredient halos</p> <ul style="list-style-type: none"> • The name and description of a food and its ingredients have a strong effect on expected and experienced taste and health perceptions, above and beyond the description of its ingredients/nutrition content.^{71–75,81} • Packages with logos, licensed characters, or special colors can increase the appeal of food.^{53,77,78} • Nutrient composition (such as fat content) and ingredients strongly influence health and taste expectations.^{70,79} • Framing influences the effect of nutrient and ingredient composition. For example, food is perceived to be leaner when labeled “75% fat-free” rather than “25% fat.”^{36,80} • The physical characteristics of the packaging itself can influence consumption.⁷⁶ • Few people access the nutrition information available to them and, overall, such information does not have a strong effect on food intake.⁴⁰ • Many health claims are confusing or are misunderstood by consumers.⁹³ • Simple front-of-package health claims and guidelines are preferred by consumers, but they are also more likely to create unwanted health halos compared to more complete ones.^{84–88} • Calorie information slightly improves food decisions overall, but only for consumers who care and when calorie counts are surprising.^{41,99} • Although it can help reduce intake, serving size information is perceived by most as arbitrary and not an indicator of appropriate serving size.^{89–91} • Health halos: when one aspect of the food is portrayed as healthy, consumers tend to categorize the entire food item as healthy, which leads them to underestimate its calories and to overeat.^{89,96–99,106} • Consumers, especially dieters, expect the combination of healthy and unhealthy food to contain fewer calories than the unhealthy food alone.^{100–102} • People expect they can eat more when marketing, nutrition, and health claims lead them to believe the target food is healthy.^{89,96,103,104,107,108} 	<p>Examples of positive marketing communications initiatives used by food companies to help consumers make healthier choices^a</p> <ul style="list-style-type: none"> • Branding of entire product categories by commodity boards or individual businesses, such as milk (got milk?) or New Zealand-grown kiwifruit (Zespri) • Partnerships between entertainment companies and fruit companies to cross-promote products (e.g., Disney characters on fruit stickers, and promotion of the movie “Rio” along with Chiquita bananas). • Yoplait: calcium campaign promoting positive health outcomes. • Subway: Eat Fresh Live Green Initiative promoting healthy living based on sustainability. • Better front-of-package nutrition labeling. • American Beverage Association: Clear on Calories initiative, displaying calorie information on the front of the bottle and for the entire bottle (if below 20 oz), not per 8-oz serving. • Family Tree Farms: hosting Flavor Tech University, a comprehensive, hands-on training course for store-level produce personnel. • Campbell’s: website that highlights the health benefits of its products. 	<p>Win-win considerations for the future</p> <ul style="list-style-type: none"> • Rebrand healthy foods on non-health-related positive benefits that non-users and children can relate to, such as safety, sustainability, social justice, anti-consumerism and anti-globalization, animal protection, even energy independence, or national security.²⁶⁴ • Co-brand and add licensed characters onto produce packaging. • Advertise produce websites on fruit stickers. • Label pre-packaged produce as “healthy” and highlight specific nutrients, such as iron. • Feature less clutter on packages to make them seem fresh and healthy. • Add descriptions to healthy foods. If the food is not packaged (like corn) add a label to it in the supermarket. • Add pictures to the front of healthy packaged food. • Leave out confusing or intimidating words. • Do not allow healthy products to touch unhealthy products.

^a Information on specific company products and initiatives was obtained through the companies’ websites on November 11, 2011. URLs can be obtained in the working paper written by the authors (with the same title) and available through SSRN.

is a complex multi-dimensional intervention. Two campaigns can vary in their reach, frequency, scheduling, targeting, message strategy, and execution. In combination, this makes it difficult to conclusively estimate reliable effects using non-experimental real-world data.

Television viewing or television advertising? The correlation between television viewing and obesity is well established. Television viewing is associated with unhealthy snacking. Eating in front of the television also distracts, and therefore slows awareness of satiety.⁵⁷⁻⁵⁹ Although television viewing also reduces calorie expenditures directly (by displacing physical activity) or indirectly (by advertising cars, games, and indoor toys that promote a sedentary lifestyle), studies suggest that the effects of television viewing on calorie expenditure are too weak to materially impact obesity.^{57,60,61} Still, these studies cannot disentangle the effects of television viewing from the effects of television advertising.

One of the reasons it is difficult to estimate how television advertising influences energy intake is because there is very little natural variation in real-world exposure to television advertising for food, requiring one to make many statistical assumptions. In this context, probably the most convincing studies use real-world data from Québec's ban on television advertising aimed at children in French-speaking television networks. A first study⁶² showed that the ban reduced the quantity of children's cereals in the homes of French-speaking children in Québec, but not for English-speaking children who continued to be exposed to the same amount of food advertising through US television stations. Another study⁶³ concluded that the Québec ban also significantly reduced fast-food consumption because French-speaking families in Québec with children eat less often in fast-food restaurants than English-speaking families with children, but no such difference are found between families without children or between French- and English-speaking families living in Ontario. These results are corroborated by other experimental studies in schools and summer camps, which showed that exposure to television advertising for unhealthy foods increased the likelihood that these foods would be chosen on a single consumption occasion as well as for longer time periods, and that the largest effects occurred among obese children.^{64,65}

In summary, reviews of this literature suggest that food advertising moderately influences the diet of children (though not of teens). There is not, however, enough evidence to rule out alternative explanations regarding its effects on obesity itself.^{57,66-68} It is also suggested that food advertising interacts with other marketing factors, such as price promotions, and with factors not directly under the control of marketers, such as social norms, to influence obesity to a degree which would be very hard to establish precisely.

Branding and labeling effects

Food and ingredient branding. Branding is the creation of names, symbols, characters, and slogans that help identify a product and create unique positive associations which differentiate it from the competition and create additional value in the consumer's mind.⁶⁹ The name of the food (brand name or generic category name) has a strong influence on how consumers' expectations of how tasty, filling, or fattening the food will be, which are often uncorrelated with reality.^{70,71} Well-known brands, but also simple descriptions like "succulent," can influence taste expectations, consumption experience, and retrospective evaluations of the taste, and then lead to increased sales, especially for non-experts.⁷²⁻⁷⁴ For example, a recent study⁷⁵ showed that branding the same food as a "salad special" versus "pasta special," or as "fruit chews" versus "candy chews" increased dieters' perceptions of the healthfulness or tastiness of the food as well as its actual consumption. Interestingly, name changes had no impact on non-dieters and disappeared when dieters were asked to consider the actual ingredients (versus the name), and when looking only at dieters with a high need for cognition. Consumers also form expectations about the product from any attribute associated with the product, from the presence of licensed or brand-owned character,⁵³ to the firmness of its container.⁷⁶

Beyond the name of the food, communication about the nutrient composition and the presence (and number) of specific macro nutrients or ingredients (especially fat content, but also energy density, fiber, sugar content, unfamiliar long-worded ingredients, and so on) can strongly impact food expectations.⁷⁷⁻⁷⁹ As with any communication, the framing of the information matters also for nutrition information. Food is perceived to be leaner and higher quality when labeled "75% fat-free" than "25% fat."^{36,80} For example, vinegar improves the taste of beer, but only when it is described as a "special ingredient," not when it is described as vinegar, and only when the description is provided prior to the consumption.⁸¹ This suggests that branding influences the interpretation of the sensory experience and does not just modify the retrospective interpretation of the experience. In fact, marketing descriptions of a milkshake as "indulgent" or "sensible" influences physiological satiation, as measured by gut peptide ghrelin.⁸² Neuroimaging studies confirm that these marketing actions influence not just self-reported liking, but also its neural representations, suggesting that these effects are not merely influenced by social cues and that marketing actions modify how much people actually enjoy consuming the food.²⁵

Health and nutrition claims. Although nutrition and health claims are regulated, the decision of whether or not

to use them rests with the food marketers. In past years, marketers have become increasingly likely to make heavy use of nutrition claims (including “low fat” or “rich in omega 3”), “structure-function” claims (“proteins are essential for growth”), health claims (“supports immunity”), vague unregulated claims or health sales (including “smart choice” or “good for you”), or the use of third-party ratings or endorsements (including “Kosher,” “Halal,” “organic,” or the heart check mark of the American Heart Association). Some of these claims can improve brand evaluation and sales, although these effects are not universal and are influenced by comparisons with other foods in the same category and by how they influence taste expectations.^{43,83}

Studies have shown that simpler, more prescriptive health claims, such as color-coded traffic lights, have stronger effects.^{84,85} A field experiment found that simple color coding of cafeteria foods with a green, yellow, or red label (for “healthy,” “less healthy,” and “unhealthy” foods) improved sales of healthy items and reduced sales of unhealthy items.⁸⁶ Providing category benchmarks for each ingredient and nutrient (average or range) helps consumers process nutrition information, while summarizing information in a graphic format is particularly helpful for illiterate consumers.^{87,88} Food marketers could also choose to provide information about recommended serving sizes (which is only mandatory in the United States). One study found that, although adding serving size information reduced granola intake for both overweight and normal-weight consumers, it had no impact if the granola was labeled as “low fat.”⁸⁹ The same authors found that promoting smaller serving sizes did not influence intake or satiety ratings, especially among overweight people. This could be because most consumers think that the entire content of the package is the appropriate serving size and perceive USDA serving sizes as an arbitrary unit designed to allow a comparison of nutrition facts across products, rather than as a general guide to how much people should consume.^{90,91}

Beyond evaluating whether health claims are scientifically true, an important question to examine is how they are understood by consumers. Recent reviews have identified many sources of confusion.^{92–94} First, although the relationship between any nutrient and health is almost always curvilinear, consumers expect it to be monotonic (“more is better”). Second, consumers may not realize that they are already taking too much of a particular nutrient (e.g., protein intake in Western countries). Third, wording can be misleading; such as when “provides energy” is understood as “energizing.” Finally, some claims are based on flimsy science, or they overstate research findings. For these reasons, health claims are likely to become even more regulated, and to be only allowed for general products as opposed to specific brands, for example.

Health halos. The branding and labeling of food often operate by relying on people’s natural tendency to categorize food as intrinsically good or bad, healthy or unhealthy, regardless of how much is eaten.⁹⁵ When branding and labeling efforts emphasize one aspect of the food as healthy, it can lead to a “health halo,” whereby people generalize that the food scores highly on all nutrition aspects, including weight gain.^{96–98} In one study,⁸⁹ we found lower calorie estimations for granola than for M&Ms, a product with the same calorie density but considered less healthy than granola. The same study also found that labeling both products as “low fat” reduced calorie estimation and increased the amount that people served themselves or consumed, especially for people with a high body mass index. In another study,⁹⁶ we found evidence for health halos created by the name of a restaurant or the food available on a restaurant menu. For example, meals from the sandwich chain SUBWAY® were perceived to contain 21% fewer calories than same-calorie meals from McDonald’s. These results were replicated with other foods and restaurant brands.⁹⁹

Related studies showed that adding a healthy food to an unhealthy food could lead to calorie estimations that were lower than for the unhealthy food alone. For example, one study found that a hamburger alone was perceived to have 761 calories but the same hamburger and a salad was thought to have only 583 calories.¹⁰⁰ This “negative calorie” illusion created by adding a healthy food to an unhealthy food is particularly strong among people who are on a diet.¹⁰¹ Different biases, or contrast effects, occur when people estimate calories sequentially instead of simultaneously.¹⁰²

Overall, the finding that people expect that they can eat more, and do, when marketing actions lead the food to be categorized as healthy is robust and is replicated independently of people’s BMI, gender, or restrained eating.^{103,104} This boomerang effect seems to occur because people feel that they can eat more of the healthy food, or can eat more unhealthy, but tasty, food after choosing healthy food without guilt and without gaining weight.^{96,105,106} In fact, simply considering the healthier option without actually consuming it, or forced choice of healthy food can be enough to allow some consumers to vicariously fulfill their nutrition goals, which makes them hungrier and entices them to choose the most indulgent food available.^{107,108}

To fully understand the effects of health claims, however, we must look at their impact on choice and purchase and not just on consumption volume when they are freely provided. When examining purchases, the results are mixed. First, studies have shown that people generally expect food presented as “unhealthy” to taste better, and that these effects persist even after actual intake,¹⁰⁹ although another study found this only among

people who are not on a diet.⁷⁵ These results, coupled with the earlier findings that taste expectations are the strongest driver of food choices, imply that positioning food as healthy may not necessarily increase total energy consumption if the higher intake per consumption occasion is compensated by fewer consumption occasions (or fewer consumers).

The net effect of health claims probably depends on brand and individual characteristics, and is stronger for some claims than others. For example, differences in taste expectations about food, specifically when described as “low fat,” as opposed to branded as “healthy” in general, have been found between men and women,¹¹⁰ and mostly influence unfamiliar brands. It is also unlikely to influence foods strongly categorized as healthy or unhealthy. This could explain the null effect of some of the studies

and some of the earlier opposite findings.^{111,112} The negative association between health and taste is less pronounced in Europe, where people tend to associate “healthy” with freshness and higher quality, and thus sometimes healthier can be tastier.^{113,114}

PRODUCT: HOW MARKETING STIMULATES INTAKE BY CHANGING THE FOOD ITSELF

Although marketing is most readily associated with communication and pricing, marketers are also closely involved with product development decisions. This includes making decisions about the “quality” of the food and also its “quantity.” The effects of changes in the product on overeating are summarized in Table 3. This table also shows how some food marketers have found

Table 3 Product and consumer welfare.

Findings indicating how product changes can negatively influence consumer choices and behavior	Examples of positive product change initiatives used by food companies to help consumers make healthy choices ^a	Win-win considerations for the future
<p>Food quality: sensory perceptions; macronutrient composition; calorie density; sensory variety; wanting vs. liking.</p> <ul style="list-style-type: none"> Increasing the amount of sugar, fat, and salt (up to a point) generally improves palatability and increases intake.^{115,125,145} Increasing the complexity of the sensory experience by adding different layers of flavors, more sensory cues, and more sensory stimuli improves palatability and increases consumption.^{119–121,245} Liquid and easy-to-eat fast-foods provide more calories than comparable solid “slow” foods of the same energy density.¹²² Colors can be more important than taste or brand information to discriminate foods.^{72,123} Adding ingredients reduces the perception that the food is natural while subtracting ingredients does not.¹³⁰ Food marketers have responded to nutrition labeling laws by introducing healthier brand extensions; however, the nutritional quality of core brands has not improved beyond adding taste-neutral nutrients like vitamins.^{131,132} People tend to eat the same quantity of food, regardless of calorie density, relying on volume cues to tell them when they are full.^{133,134,137,165} Increased food variety both within and across meals increases consumption volume by reducing sensory-specific satiety.^{138–140} Beyond hedonic liking from sensory stimulation, food intake is influenced by reward salience and distraction.^{145–148,150} 	<ul style="list-style-type: none"> Food companies have been able to reduce the amount of fat, sugar, and salt in many of their products without compromising the product’s taste. Danone: reduced the average sugar content of its products in Brazil from 13.9% in 2008 to 12.9% in 2010. Danone: between 1981 and 2009 in Germany, it reduced fat by 63%, sugar by 25%, and calories by 36% in its “FruchtZwerge” products while keeping taste constant. PepsiCo: added “better for you” products to its portfolio of “fun for you” products, including yoghurt.^{266, 267} McCain: offers Sweet Potato SuperFries as a healthier alternative to regular fries. Burger King: offers flame-broiled chicken tenders and apple fries as new menu options. Au Bon Pain: sells fruit salad as opposed to just one specific type of fruit. McDonald’s: has improved the taste and variety of their salads McDonald’s: Happy Meal will include apple slices and fewer fries.²⁶⁸ Family Tree Farms only sells its stone fruit when it is ripe, and often sacrifices cost for flavor. 	<ul style="list-style-type: none"> Develop foods that contain textures, ingredients, and nutrients that accelerate satiation (so that people stop eating faster) but extend satiety. Companies can sell more fruit salad as opposed to just whole fruit; people eat more because of the variety and convenience. More fast-food restaurants could start selling apple fries and other healthier alternatives to regular French fries. Use multi-sensory displays to help people imagine what it will feel like to eat aromatic, soft, complex, visually appealing fruits. For example, pipe in the smell of fruit to a supermarket produce section. Improve the desire for vegetables by teaching consumers how to prepare them well. Help people become more sensitive to taste changes by giving them a better consumption vocabulary.

Table 3 Continued

Findings indicating how product changes can negatively influence consumer choices and behavior	Examples of positive product change initiatives used by food companies to help consumers make healthy choices ^a	Win-win considerations for the future
<p>Food quantity: altering package and portion sizes; supersizing effects; size labeling</p> <ul style="list-style-type: none"> • Product package and portion sizes have grown rapidly over the past decades and are now almost invariably larger than the USDA recommended serving sizes.^{152–154,156} • Larger package sizes are typically more profitable for food marketers, especially if some consumers are willing to overpay small sizes that help them restrict how much they eat. They also benefit from a higher perceived economic and environmental value.^{36,159} • With few exceptions (like bite-size portions),^{176,177} larger portion and package sizes significantly increase consumption.^{30,32,91,133,160–162,164,167,168,233} • Just observing someone else eating a large portion can increase intake, particularly if that person is not obese.^{173–175,205} • People avoid ordering the largest and smallest drink sizes.¹⁷² • Containers that attract more attention, and those with more pictures of the product or pictures on the bottom are perceived to contain more.^{197–200} • Part of why larger portions make people eat more is because people underestimate how big they are.^{184,188,189} • In general, people underestimate volume changes, especially when all three dimensions (height, width, and length) of packages or portions are changed.^{183,191} • People take package size and even “virtual” partitions as a cue for appropriate serving size.^{90,91,169,170} • Labeling products as “small” makes people eat more but think that they are eating less.^{193,196} 	<p>Examples of positive product change initiatives used by food companies to help consumers make healthy choices^a</p> <ul style="list-style-type: none"> • Wendy’s: offers salads in half sizes. • Applebee’s: offers under 550 calories and Weight Watchers menus. • Au Bon Pain: offers bite-size options. • Dairy Queen: offers a 7-oz mini Blizzard, which is 5 ounces smaller than its previously smallest size. • Smaller package sizes offered by some companies with no change in price. • Increasing availability of 100-calorie-pack products. • Increasing availability of mini-size of “fun-sized” products, such as candy bars, which are smaller than the regular-sized products. • Increasing availability of innovative, fun, eco-packaging with pre-determined portion sizes, such as those for nuts sold by Diamond Foods. 	<p>Win-win considerations for the future</p> <ul style="list-style-type: none"> • Smart downsizing: reduce volume by elongating the packages (or at a minimum by reducing packages proportionally rather than just by reducing their height); this makes the size reduction less visible and increases preferences for smaller sizes. • Add a smaller size on the menu. Even if nobody chooses it, it will make other sizes look bigger and will lead people to choosing smaller sizes. • Use complex packages with displays of products on top to increase acceptance of smaller sizes. • Rebrand apple fries just like french fries: call the large size a medium, and so on. • Sell fruit and vegetables cut up and in large packages, meant for snacking. People will eat more of the fruit if it is in a large package.

^a Information on specific company products and initiatives was obtained through the companies’ websites on November 11, 2011. URLs can be obtained in the working paper written by the authors (with the same title) and available through SSRN.

ways to mitigate these changes and provide avenues for further win-win strategies.

Product quality: effects of the composition, sensory, and nutritional properties of the food

In addition to being a source of nourishment, food is a source of hedonic pleasure and stimulation. Hence, it is not surprising that one of the primary goals of food marketing is to improve the palatability of the food. At a basic

level, palatability generally increases energy intake because people in rich countries can choose to eat only what they like.¹¹⁵ Although improving palatability and the sensory and nutritional properties of food are largely driven by advances in food science, marketing plays an important role because it helps incorporate the expressed and latent desires of consumers and, above all, the role of perception. For example, advances in market research can correct for the fact that some people may not like a given amount of sweetness simply because they are not as

sensitive to it as much as others or because they have a different interpretation of a scale label such as “extremely sweet.”^{116,117} This is particularly important because taste perception and preferences are not the same for people with a high and low BMI.¹¹⁸

Food composition. Flavor is a seamless combination of taste and predominately smell, but it is also enhanced by adding different layers of flavors; combining different forms (solid or liquid), textures, colors, or temperatures also influences flavor perceptions due to multisensory taste integration as well as consumers’ expectations.^{119–121} These factors can directly impact energy intake independent of their impact on flavor. People tend to consume more calories from liquid than from comparable solid foods of the same energy density because the lower bite effort and shorter sensory exposure postpone satiation.¹²²

Because people associate certain colors with certain foods and flavors, food marketers have long used colors to improve taste expectations. For example, some colors, especially those with strong flavor expectations, can influence the perceived sweetness of food and play a very important role in helping consumers discriminate between different foods, sometimes bigger than the role played by taste or brand information.^{72,123} Even advertisements that evoke multiple sensory experiences can enhance taste perceptions.¹²⁴

Up to a certain level, adding sugar, fat, and salt, especially in combination, improves palatability, but does not increase the satiating power of the food in the same proportion.^{125,126} Accordingly, food marketers have expanded the supply of food rich in fat or added sugar, such as sweetened beverages, which have accounted for a large proportion of the added supply of calories in recent decades.^{127,128} Even though it is true that the percentage of calories consumed from fat has declined in the United States, this percentage decrease is the result of an increase in total energy intake; fat consumption itself has not decreased.¹²⁹ Interestingly, adding ingredients reduces the perception that the food is natural, which is an important criteria for food choices, whereas subtracting ingredients (e.g., skim milk) does not.¹³⁰

Food marketers have changed the composition of foods not just to increase palatability but also to respond to public concerns about a particular ingredient or to regulatory changes. Surprisingly perhaps, responses to mandatory nutrition labeling have been mixed. One study suggested that the Nutrition Labeling and Education Act of 1990 led food marketers to improve the level of taste-neutral positive nutrients, such as vitamins, in their core brands (especially those with a weak nutritional profile) and to introduce healthier brand extensions with similar levels of positive nutrients but with lower levels of negative nutrients, especially in junk food categories.^{131,132}

However, despite these advances, the average nutritional quality of food products sold in grocery stores had actually worsened compared to pre-NLEA levels and compared to similar food products unregulated by the NLEA.¹³² This is largely driven by established brands, which account for a large portion of people’s diet (e.g., dinner food) and whose nutritional quality has slightly deteriorated. This may be because companies are afraid of reducing levels of negative nutrients (e.g., fat or sodium) in their flagship brands for fear that it may decrease flavor expectations and because companies prefer to compete on taste rather than on nutrition, which can now be more easily compared.

Calorie density and sensory variety. The biggest share of marketing budgets, and most new product introductions, tend to be for calorie-dense foods with a variety of flavors.² Unfortunately from a public health perspective, it is well established that calorie density – the number of calories per unit of food – increases energy intake over the short term, such as during an afternoon snack. This happens because people prefer calorie-dense food and tend to eat the same volume of food regardless of its calorie density.^{133–135} One of the explanations for this finding is that, instead of paying attention to internal signals of satiation, they focus on external signals, which are often biased.¹³⁶ In one study, unsuspecting diners were served tomato soup in bowls that were refilled from tubing that ran under the table and up into the bottom of the bowls. People with varying BMI levels eating soup from these “bottomless” bowls ate 73% more soup than those eating from normal bowls, but these diners estimated that they ate only 4.8 calories more.¹³⁷

It is well known that food variety, both within and across meals, increases consumption volume because it reduces sensory-specific satiety within a meal and it reduces monotony across meals.^{138–140} The variety effect is independent of macronutrient content and energy density; it is also independent of individual characteristics such as gender, weight, and dietary restraints, and is only somewhat reduced with age. Research in marketing has focused on perceived (versus true) variety. It has shown that increasing the number of colors and the organization, duplication, and symmetry of an assortment can influence perceived variety, which then influences the perceived quantity of food and, ultimately, how much food is chosen.^{141–144} Food marketers have explored many ways to increase perceived variety, including distraction, varying condiments, or giving people illusory choice over what they eat.¹³⁸

Wanting versus liking. Despite the links between sensory stimulation, palatability, and consumption, the availability of tasty, highly palatable foods is neither a necessary

nor a sufficient cause of over-consumption.^{145,146} While a highly satisfying meal can lead one person to not want to eat dessert, it can trigger the desire in another person. In fact, highly palatable food samples actually enhance subsequent consumption of similar foods and may prompt people to seek any other type of rewarding food.¹⁴⁷ Even then, people eat beyond the level at which their appetite is satisfied, which is why people eat and drink less when asked to focus on taste satisfaction.¹⁴⁸ Conversely, mental stimulation can create habituation. Simply imagining eating 30 pieces of cheese reduces consumption, increases satiation for the imagined food, and reduces subsequent wanting for the food, but not its hedonic liking.¹⁴⁹

More generally, there is converging evidence that food decisions are influenced by motivational “wanting” – the salience or reinforcement value of eating – and not just by hedonic “liking” – the pleasure derived from sensory stimulation.^{150,151} So although there is no doubt that marketing has played a role in developing more complex, palatable, and rewarding foods which people cannot easily resist or stop eating,² the hedonic effects of sensory properties are again just one of many drivers of energy intake.

Product quantity: altering package and serving sizes

Trends in serving and package sizes. With the exception of some specific foods that must be sold in standardized sizes (e.g., wine and liquor), most 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 sell. Product package and serving sizes have grown rapidly over the past decades and are now almost invariably larger than the USDA recommended serving sizes.¹⁵²⁻¹⁵⁴ While this is a trend in much of the developed world, such “supersizing” is particularly common in the United States and has been identified as one reason why obesity has increased faster in the United States than in other developed countries.¹⁵⁵⁻¹⁵⁷

Larger package sizes almost always have lower unit prices (by volume or weight), except in the rare instances when there is more competition on the smaller sizes or when smaller sizes are used as loss leaders by retail stores.¹⁵⁸ Marketers can reduce the unit price of larger products and hence increase consumer value because of their lower packaging costs. More importantly, larger servings and packages provide greater absolute margins 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 (such as high real estate, labor, or marketing costs), reducing serving sizes, and hence average consumer expenditure, would require a huge increase in traffic to break even – which is why the few restaurant chains that

have tried this tactic have mostly stopped promoting these items or stopped offering them altogether. In fact, it can even be optimal for food marketers to price the incremental quantity below its marginal cost if their products are bought by two distinct consumer segments: one willing to pay more for smaller portion sizes that help them control their intake, and the other unconcerned about overeating and willing to buy larger quantities to obtain the lower unit price.^{36,159} As a result, larger package 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 but convenience and consumption control.

Supersizing effects. There is considerable evidence that, with the exception of children under 3 years of age who still self-regulate naturally, larger package and serving sizes significantly increase consumption.^{30,32,91,160-163} These studies have shown that the increased energy intake due to supersizing (as well as the decrease in energy intake due to downsizing) often reach a 30% change in calorie intake and are not followed by caloric compensation for up to 10 days.¹⁶⁴⁻¹⁶⁶ Supersized servings can even increase the consumption of bad-tasting foods, such as stale 5- and even 14-day-old popcorn.^{167,168}

Even “virtual” serving sizes can influence consumption. Simply adding unobtrusive partitions (e.g., colored papers in between the cookies inside the package or a red Pringle chip between every seven yellow ones in a tube) can reduce intake.^{169,170} However, partitioning may only work when people pay attention to the partition. One study¹⁷¹ 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 sizes of candy bars were available for purchase. This is consistent with earlier results indicating that people take package size as a cue for appropriate serving size.^{90,91}

The effects of package size on consumption are strongly influenced by the range of the other sizes available and by the serving size chosen by other consumers. One study¹⁷² found that people in hypothetical choice scenarios avoided the largest or smallest drink sizes. Such aversion to extremes causes consumers to choose larger size drinks when the smallest drink size is dropped or when a larger drink size is added to a set. Social modeling studies have shown that larger package and serving sizes can also have an indirect, passive, impact on energy intake, since people tend to imitate how much other people choose, particularly if the person that they have observed is not obese.¹⁷³⁻¹⁷⁵

There are important exceptions to this rule, however. Small units of products such as 100-calorie packs may increase consumption volume on one consumption

occasion more than regular-size packs for hedonic products and when people's self-regulatory concerns have been activated, or for restrained eaters.^{176,177} These studies show that, unlike larger package sizes, small units "fly under the radar" and encourage lapses in self-control because the consumption of these small packages 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.^{164,178}

One of the explanations for why large packages and servings increase consumption is the social norm that people should clean their plate.^{153,179} However, this norm cannot explain why large packages also increase the pouring of inedible products 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.^{30,163,180} Another explanation is that larger serving sizes are used as an indication of the "normal" or "appropriate" amount to consume. Even if people do not clean their plate or finish the package, the large size presented to them gives them the liberty to consume past the point where they might otherwise stop with a smaller but still unconstrained supply.⁹¹ This explanation is consistent with the finding that supersized servings increase energy intake even when people eat in the dark.¹⁸¹ Other studies have shown that people associate larger servings with higher status and that people are therefore more likely to supersize when they want to signal status, for example, when they are made to feel powerless.¹⁸²

A final, and important, reason is that people are simply unaware of how large the supersized servings and packages are.^{183,184} Information about food size, volume, or calorie content is not always easily available (such as in restaurants or at home once the food is no longer in its original packaging). Even in retail settings, where size information is available (on the front of the packages or on the shelf tags), few people read it, preferring to rely on visual estimations of the package's weight or volume to infer the amount of product that it contains.^{185,186} Many studies have shown that people's perception of serving sizes is inelastic (it changes more slowly than it should).¹⁸⁷⁻¹⁹¹ On average, a 100% increase in serving size only looks like a 50-70% increase. As a result, whereas small servings tend to be accurately estimated, large servings are greatly underestimated.¹⁸⁸ These perceptual biases are very robust and even trained dietitians exhibit a strong diminishing sensitivity as the size of the meal increases. They are independent of the individual's BMI or interest in nutrition, and they have been replicated by other researchers across a variety of food categories.⁹⁹ Stated simply, meal size, not body size, explains serving size errors. People with a high BMI tend to underestimate

their calorie intake more than people with a low BMI¹⁹² because they tend to select larger meals, not because they are intrinsically worse (or biased) size estimators.¹⁸⁹

Size labeling. The size labels used for food and beverages (such as "short" or "large" and also "biggie" or "petite") have acquired meanings among consumers, who are generally able to rank order them accurately.¹⁹³ In reality however, these labels mask huge discrepancies because a small size from one restaurant or brand can be larger than a medium size from another.¹⁹⁴ For example, McDonald's abandoned its supersize 42-oz beverages and 200-g fries, while other fast-food chains retained the serving size but simply renamed the "king" a "large."^{51,195} These labels are important because they influence size perceptions, preferences, and actual consumption. One study¹⁹⁶ found that "labeling down" (labeling a large serving "medium") had a stronger impact on size perception than "labeling up" (labeling a small serving "large"). In addition, these authors found that smaller labels made people eat more but think that they eat less.

A few studies have shown that marketers can influence impressions of size by changing the visual representations on the package itself. Containers that attract more attention are perceived to contain more product.¹⁹⁷ Two recent studies^{198,199} showed that people expected packages with pictures of the product on the bottom or on the right of the package to be heavier. Finally, simply showing more products on the packaging has been shown to increase size perception and consumption, especially when consumers are paying attention.²⁰⁰ It is important to note that most of these studies were conducted in lab settings or in homes and not in in-store environments. Still, the key conclusion is that the quantity of food, and not just its quality, can have large effects on short-term intake and that consumers are largely unaware of these effects.

PLACE: HOW MARKETING CHANGES TO THE EATING ENVIRONMENT STIMULATE INTAKE

In the same way that food is more than nourishment, eating is more than food intake. It is a social activity, a cultural act, and a form of entertainment. Paradoxically, eating is also mostly a mindless habitual behavior that is strongly influenced by the environment, often without volitional input.^{201,202} In this context, the most subtle and perhaps the most effective way marketing influences consumption is by altering the eating environment and making food accessible, salient, and convenient to consume. As for the other ways food marketing can influence overeating, Table 4 summarizes the key findings as well as existing and new solutions to reverse the effects of marketing changes to the eating environment.

Table 4 Eating environment (place) and consumer welfare.

Findings indicating how eating environment can negatively influence consumer choices and behavior	Examples of positive eating environment initiatives designed to help consumers make healthy food choices ^a	Win-win considerations for the future
<p>Access, salience, and convenience</p> <ul style="list-style-type: none"> • Food is now available everywhere, not just in grocery stores and restaurants, and this increased availability is a key driver of intake.^{4,203,204} • The proximity to fast-food restaurants (but not full-service restaurants or grocery stores) predicts local childhood and adult obesity rates.^{18,210–213} • A food's visibility and accessibility at home increases energy intake – food located away from the table or in opaque jars is consumed much more slowly.^{32,205,216} • Just seeing or smelling food in the store can increase hunger and purchases.^{47,48,217} • Salience can be internally generated, thinking about memories of soup led subjects to consume more soup later on.^{220,222} • The visibility of food in the pantry or in the refrigerator influences the accuracy of inventory assessment and the likelihood of repurchasing it.¹⁸⁷ • Making healthy foods easier to find on restaurant menus and more convenient to grab in cafeterias increases consumption.^{86,214,225} • Ease of preparation is a strong driver of intake.^{4,32} 	<ul style="list-style-type: none"> • Strong front-of-store produce displays in grocery stores ensure that fresh fruits and vegetables are the first thing customers see. • Positioning chocolate milk in school lunchrooms so it is less convenient to take. • New pre-packaged salads offer convenience while reducing safety risks. • Placing fruit in nice bowls in school cafeterias to attract attention. • Offering convenient, pre-sliced fruit and vegetables in supermarkets and school cafeterias. • Amusement parks offering healthier alternatives to popcorn and fries. • Volunteer initiatives, such as one in Philadelphia, where volunteers patrol streets to discourage kids from buying junk foods.²⁶⁹ • Fast-food restaurants participating in the Kids Live Well program of the National Restaurant Association. • Making healthy food easy and convenient to eat with innovative vending machines. 	<ul style="list-style-type: none"> • Restaurants should display fruits and vegetables or other healthy options near the entrance and slice and package them in an appealing way. • On dining tables at home or in restaurants, replace foods that are easy to eat, such as chips or bread, with food that is more time-consuming to eat, like peanuts. • Fast-food restaurants should display large, attractive pictures of their salads in the restaurant. • In restaurants where patrons take their beverage from a cooler, place water as the most accessible item, then the other healthy drinks, and put sugar-sweetened beverages in a more inconvenient spot. • In fast-food restaurants, make the salads very visible and put french fries in the back. • Routinely ask consumers if they want a smaller portion. • Instead of asking consumers if they want to supersize, ask if they want to add a salad or another healthy item that brings in more money. • Offer fruit or healthy snacks at the cash register as opposed to candy.
<p>Shape and size of serving container</p> <ul style="list-style-type: none"> • People use food serving containers as an external cue for how much they should eat.^{163,179,201,227} • In the field, people tend to over-serve and overeat when using bigger plates because they make food quantities appear small.^{231–233,235,236} • People over-pour into wide (vs. tall) glasses because they tend to focus on the height of the liquid and downplay its width.^{228,229} • Because people underestimate three-dimensional volume changes, they pour more into conical containers than into cylindrical ones.¹⁹¹ 	<ul style="list-style-type: none"> • Many franchised restaurants in the United States (e.g., Friendly's, TGI Friday's, Applebee's) are selling enormous, supersized salads. • Ready-to-eat, prepackaged trays of sliced apples, carrots, and other healthy items are becoming increasingly available. • Tapas restaurants serving a variety of small dishes rather than large entrees are increasing in popularity. • "Small plate" restaurants serving more manageable portions that are "perfect for sharing" are becoming more popular. 	<ul style="list-style-type: none"> • When serving a meal in a restaurant, use a big plate for the vegetable side dish, and use a small plate for starches and protein. • In restaurants, add fruits or vegetables to main entrees as garnishes to make the servings look bigger. • Serve the same size portions on smaller plates to reduce consumption and maintain satisfaction. • Use tall clear cups for drinks so people will think they're consuming more (especially with alcohol and sugary beverages). Conversely, use wide or conical glasses to serve water.

^a Information on specific company products and initiatives was obtained through the companies' websites on November 11, 2011. URLs can be obtained in the working paper written by the authors (with the same title) and available through SSRN.

Access, salience, and convenience

Access. One of the biggest goals of food marketers is to facilitate access to food by making food easier to purchase, prepare, and consume. Obviously, food availability is a key factor since food that is not available cannot be consumed.²⁰³ In addition, the sheer availability of a variety of palatable foods can derail the homeostatic system designed to regulate food intake.² For example, one study found that overweight men on a 3,000 calorie diet did not stick to their diet and consumed an average of 4,500 calories when given access to two free vending machines.²⁰⁴ This pattern also holds for healthy foods.²⁰⁵

On a more general level, convenient, ready-to-eat food is now available in many developed countries almost anytime, anywhere. One can buy food not only in restaurants, grocery stores, and coffee bars, but also in gas stations, pharmacies, kiosks, places of work, schools, and in the hospital. We can also have food delivered almost immediately at home or elsewhere. Food which used to be bought in small family-owned stores is now bought in small or large outlets belonging to multi-national corporations with strong marketing skills and vast resources. Improvements in the marketing and distribution of food, as well as food policies such as subsidies of calorie-dense sugar and starch, explain why the total supply of calories has increased tremendously since the 1970s, reaching 3,900 kcal per person and per day in the United States and between 3,400 and 3,600 kcal in other wealthy countries; the exception to this pattern is Japan, where food supply is only 2,700 kcal and where, not coincidentally, obesity is almost nonexistent.⁴

It is true that the metabolism of obese people requires a higher calorie intake and hence that the increased supply of food is a consequence, and not just a cause, of rising obesity rates.²⁰⁶ In addition, an increased part of the larger food supply is lost to waste and spoilage, although the estimates of how much is wasted vary between 25% and 40% of the food supply.^{207,208} Still, the increased calorie supply cannot be attributed entirely to increasing food waste or to the higher energy requirements of heavier bodies. In fact, many prominent obesity researchers argue⁴ that the rise in food energy supply is more than sufficient to explain the rise in obesity in the United States from the 1970s.

Access to food is greatly facilitated by the increased availability of ready-to-eat food prepared away from home, particularly in quick-service restaurants. Whereas spending on at-home food remained stable between 1982 and 2007, expenditure on away-from-home food in the United States increased by 16%, and now represents 49% of all food expenditures.²⁰⁹ Econometric studies have suggested that the increased availability of fast food (but not full-service restaurants) is a strong predictor of local

obesity trends.^{18,210,211} Other studies show that proximity to grocery stores (but not to convenience stores) was associated with a lower BMI, possibly because grocery stores offer more healthful foods.²¹² However, these findings were mitigated by a recent study²¹³ which showed that only the proximity to fast-food restaurant significantly influences BMI (particularly for women), whereas proximity to grocery stores or other restaurants does not seem to matter.

Salience. In today's cluttered stores and pantries, marketers know that availability, awareness, and even preferences are not sufficient to generate sales; food visibility must be maximized at the point of purchase and at the point of consumption. For example, eye-tracking studies^{47,48} showed that simply increasing the number of facings on a supermarket shelf or placing familiar foods on top of the shelf (versus the bottom) increased the chances that these brands would be noticed, considered, and chosen. One study²¹⁴ found that making healthy foods easier to order at a fast-food restaurant by displaying them conspicuously on the menu led to a significant increase in sales. Displaying healthier food more conspicuously in cafeterias of school lunchrooms (by placing them on eye-level shelves and conveniently at various points in the cafeteria line) also increases their consumption.⁸⁶ Finally, another study conducted at a fast-food restaurant found that a stronger manipulation of salience, asking consumers whether they would like to downsize their side dishes, was accepted by one-third of consumers and was significantly more effective than calorie labeling.²¹⁵ Importantly, the smaller side dishes were not compensated by larger entrees.

The salience (or visibility) of food at home also increases energy intake. When jars of 30 chocolate candies were placed on the desks of secretaries, those in clear jars were consumed 46% more quickly than those in opaque jars.²¹⁶ Another study³² showed that simply placing a food magnet on the refrigerator reminding people of food that they had bought in large quantities was enough to trigger consumption of ready-to-eat food. Spreading products in the pantry (versus stacking them) can increase people's awareness that the product is available and increase the likelihood of consumption.¹⁸⁷ The increased intake of visible foods occurs because their salience serves as a continuously tempting consumption reminder. While part of this may be cognitively based, part is also motivational. Simply seeing or smelling a food can increase reported hunger, devalue other goals, and stimulate salivation and consumption, even when sated.^{147,217-219} Salience can also be generated by asking people to write a detailed description of the last time they ate soup or by asking them when they intend to eat.²²⁰⁻²²²

Convenience. One of the strongest trends in food marketing is the focus on improving the convenience of food preparation and consumption. For most people, with the exception of specific festive occasions, food preparation is a cost of inconvenience that consumers are increasingly less willing to pay.²²³ Food marketers have responded to the preference for improved convenience by reducing preparation time and increasing the share of ready-to-eat food. Supporting the role of convenience, studies have shown that increased consumption is largely driven by increased consumption frequency rather than by increased consumption quantity per meal.²²³ The same study showed that between 1978 and 1996 energy intake increased more for snacks (+101%) than for breakfast (+16%), lunch (+21%), and dinner (-37%). The gains were highest among married women who now spend less time preparing food at home. This may also explain why maternal employment is associated with childhood obesity.²²⁴ Convenience also explains the success of “combo” meals at fast-food restaurants, which combine a sandwich, a side, and a beverage. In fact, one study²²⁵ showed that consumers place a higher value on a “bundled” combo meal, even after controlling for the effect of price discounts, because they reduce transaction costs and increase the saliency of the “featured” items on the menu board.

Convenience also interacts with other factors such as serving size and salience. In one study,³² we stockpiled people’s pantries with either large or moderate quantities of eight different foods. We found that stockpiling increased consumption frequency but only for ready-to-eat products, and that this effect leveled off after the eighth day, even though plenty of food remained in stock. Interestingly, we found that stockpiling increased the quantity consumed per consumption occasion of both ready-to-eat and non-ready-to-eat foods throughout the entire two-week period. With ready-to-eat foods, this was due to the higher visibility because of stockpiling.

Shape and size of serving containers

About 70% of a person’s caloric intake is consumed using serving aids such as bowls, plates, glasses, or utensils.²²⁶ The size of bowls and plates obviously influences energy intake for the 54% of Americans who say that they “clean their plates” no matter how much food they find there.²²⁷ This can influence energy intake simply because people (and not just those who clean their plates) rely on visual cues to terminate consumption. If a person decides to eat half a bowl of cereal, the size of the bowl will act as a perceptual cue that may influence how much is served and subsequently consumed. Unfortunately, many of these cues are misleading. A number of studies have shown that people in Western societies overestimate the

height of a cylindrical object (such as a drinking glass) compared to its width.^{228–230} For example, one of these studies found that the elongation caused people to unknowingly pour and drink 88% more juice or soft drink into a short, wide glass than into a tall, narrow one of the same volume.²²⁹

Another visual bias, the size-contrast or Delboeuf illusion, suggests that a given amount of product looks smaller on a larger plate than on a smaller plate.^{231–233} A study showed that people who were given 24 oz. bowls of ice cream served and consumed about 20% more ice cream than those given 16 oz. bowls.²³⁴ Larger serving containers increase consumption even when a constant amount of food is served on the bowl (versus people serving themselves).^{30,163} On the other hand, other studies^{235,236} found that using a smaller plate did not reduce energy intake in lab studies in which subjects were repeatedly eating the identical food in isolation.

Recent studies have started to link these results with work in psychophysics and to look at the interaction effects of size and shape on size perceptions and preferences.^{237,238} An important finding has been that the lack of sensitivity to increasing sizes is even stronger when packages and servings increase in all three dimensions (height, width, and length) compared to when they only increase in one dimension.¹⁹¹ This could explain why the effect is stronger for cups, glasses, and bowls (3D objects) than for plates (essentially 2D). The same authors have shown that 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). In addition, people’s preference for supersizing is higher when products grow in one dimension. Although some studies have shown that part of these effects is mediated by attention,^{180,197} other studies^{190,239} suggest that they are mostly caused by people failing to compound the changes of multiple dimensions.

Atmospherics of the purchase and consumption environments

Retailers, restaurants, and food service companies can influence the ambient characteristics of the point of purchase and of the point of consumption (e.g., its temperature, lighting, odor, noise, and so on). Some atmospheric dimensions, such as temperature, have direct physiological effects. Studies have shown that people consume more energy when the ambient temperature is outside the thermo neutral zone, the range in which energy expenditure is not required for homeothermy.²⁴⁰ For this reason, it has been argued that obesity could be linked to the reduction in the variability in ambient temperature

brought about by air conditioning.²⁴¹ For example, consumption increases more during prolonged cold temperatures than in hot temperatures because of the body's need to regulate its core temperature.²⁴²

Dimmed or soft lighting appears to influence consumption by lengthening eating duration and by increasing comfort and disinhibition. Harsh lighting makes people eat faster and reduces the time they stay in a restaurant, whereas soft or warm lighting (including candlelight) generally causes people to linger and likely enjoy an unplanned dessert or an extra drink.^{243,244} Ambient odors can influence food consumption through taste enhancement or through suppression.^{123,245} For example, one study¹⁴⁷ found that exposure to an appetizing odor increased soft drink consumption during movie-watching and that exposure to an offensive odor decreased consumption without people being aware of these effects.

The presence of background music is associated with higher food intake²⁴⁶ and it is even linked with choice in supermarkets. In the context of restaurants, soft music generally encourages a slower rate of eating, longer meal duration, and higher consumption of both food and drinks.²⁴⁷ When appealing music is played, individuals dine longer, feel more comfortable and disinhibited, and are more likely to order a dessert or another drink.²⁴⁸ This is because when it improves affective responses (environmental affect, mood or arousal), background music reduces perception of time duration.²⁴⁹ In contrast, when music or ambient noise is loud, fast, or discomforting, people tend to spend less time in a restaurant.²⁵⁰ A recent meta-analysis found that music also influences shopping in a large range of retail contexts, that slower tempo, lower volume, and familiar music increase shopping duration, whereas loud, fast, disliked music increases perceived time duration.²⁵¹

All of these findings highlight the role of distraction in influencing consumption or intake volume.⁵⁸ For example, one study found that eating while watching TV or eating with friends (but not with strangers) impaired the ability to self-monitor, decreased the attention given to the food itself, and led to higher energy intake.⁵⁹ Other studies found that eating while distracted reduced satiation and impaired memory of past consumption, which reduced the time until the next eating episode.²⁵² Indeed, amnesiac patients have been found to eat the same meal multiple times in a row if they are told that it is dinner time.^{253,254} Distraction influences taste perception (e.g., reduces sensory-specific satiety) and increases subsequent consumption volume by emphasizing the affective (versus cognitive) drivers of taste. One study²⁵⁵ found that distraction while sampling food increased enjoyment as well as the subsequent choice of the relative vice (chocolate cake) versus the relative virtue (fruit salad).

Although one of the least studied ways marketers can influence consumption, the impact of the eating environment is powerful and multifaceted – and often overlooked by consumers.^{201,256} Overall, these studies show that consumption volume is influenced by the eating environment, by facilitating access to the food, increasing its salience and the convenience of its preparation, but also by modifying the shape and size of serving containers as well as temperature, brightness, ambient odors, and music.

CONCLUSION

The food manufacturing and retailing industries have evolved tremendously and now include numerous innovative and fast-growing organizations that are either non-profit or with strong concerns for public health and the environment.²⁵⁷ However, the majority of the food eaten in developed countries is still manufactured and distributed by traditional for-profit, and often publicly listed, companies.²⁵⁸ For-profit food marketers are not focused on making people fat but on making money. In a free market, for-profit food companies that are less profitable than their competitors are likely to end up being acquired by their rivals or to go bankrupt. In this context, the mission assigned to most food marketers is to understand what different consumer segments desire and to profitably offer it to them. In general, what many people want in the short term is tasty, inexpensive, varied, convenient, and healthy foods – roughly in that order of benefit importance. The marketer's mandate is to help identify and create foods that deliver these benefits better; to communicate these benefits; to profitably package, price, and distribute these foods; and to protect these innovations by branding the food so that it acquires unique and positive associations in the mind of consumers. In this respect, food marketers have been very successful and have pioneered many marketing innovations now used in other industries.

Yet, as this review has shown, the vast ingenuity and resources of food marketers have created a myriad of ways in which food marketing influences consumption volume and, hence, may promote obesity. Although television advertising has attracted the bulk of the attention of researchers, it is merely the tip of the iceberg. It is neither the most innovative nor the most powerful way food marketing works, and its importance is declining.

To summarize how food marketing has made us fat, it is most likely through increased access to continuously cheaper, bigger, and tastier calorie-dense food. Two contentions are also offered here: 1) Researchers have overestimated the impact that deliberate decision-making has on food intake. For this reason, the effects of nutrition information, health claims, and informational

advertising, have had a smaller impact than is believed. However, this probably does not apply to price and access to food, which are two important influencers of food intake that mostly operate through deliberate decision-making. 2) Researchers have underestimated the impact that peripheral factors and mindless habitual behavior have on food intake. For this reason, the effects of brand associations; calorie density and sensory complexity of food; the size and shape of portions, packages, and serving containers; and the convenience and salience of food stimuli in the eating environment. That is, the effects of the product and the place (the eating environment) have had a greater impact than believed.

Future research opportunities

Despite decades of work, what we presently know about how food marketing influences consumption is still dwarfed by what we do not know, creating many opportunities for impactful research and ensuring that no review will ever be complete and final. Yet, we should have realistic expectations regarding what research can do. This review shows that food marketing can influence consumption in many inter-related ways and that food consumption is governed by a complex set of dynamic interactions. In this context it is unlikely that any amount of research will be able to “prove” general statements such as “front-of-package health claims improve consumption decisions” because the magnitude and direction of the effects will depend on the implementation and will vary dynamically across consumer segments, consumption occasions, and the type of food studied.

One of the most important areas for future research, therefore, is to examine how the short-term effects reviewed here, which are often investigated only in single-consumption occasions in a lab, also hold when examined 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 aspects of studies from 1) consumer research (including rich psychological insights and multi-method testing), 2) nutrition (including longitudinal designs, representative participants, biomarkers of calorie intake, and expenditures), and 3) health economics (including population-level interventions and analyses, and policy implications). As such, they would provide the necessary link between specific marketing actions, individual short-term food choices, and long-term population weight gain.

As shown in the tables, the factors leading people to eat more can also lead them to eat less, to promote consumption of healthier food, and more generally increase the importance people attach to health over taste, price, and convenience when making food decisions. For

example, we have reviewed studies showing that consumption of healthy and unhealthy food responds similarly to price reductions,²² that it is possible to incentivize children to prefer healthier food,²⁴ and that smart down-sizing can lead people to prefer smaller servings.¹⁹¹ In general, there is a wide range of profitable changes that businesses could make to help consumers eat better and eat less. What is important to understand is that these solutions need to fit both supply and demand in the food marketing value chain. In this respect, Tables 1–4 show that much of the leading thinking in this area of win-win approaches has been in food retailing, such as with supermarkets, cafeterias, and restaurants. Thanks to the longer time that consumers spend with food retailers, changes to their marketing have the highest potential to impact consumption.

Finally, it will be important to examine the interplay of marketing factors and cultural, social, and individual characteristics. Although obesity is a global problem, most of the studies reviewed here were conducted among North American consumers and often among undergraduate students. Yet, we know that culture, age, income, education, and a host of other socioeconomic factors influence food decisions. For example, there are important differences between how Americans, Europeans, and Asians approach food and eating. Beliefs that are taken for granted in a US context, for example, that unhealthy food is tastier or that external cues influence satiation, may not apply elsewhere.^{113,114,136,259}

Policy implications

After reviewing the studies outlined here, one may question the effectiveness of the policy changes being suggested by regulators. It is beyond the scope of this paper to examine all the policy interventions designed to fight obesity, and we need to be mindful of the many factors mentioned in the introduction that influence food decisions that are not under the control of food marketers. What this review underscores is that many such changes will come with either modest results or unanticipated results due to how consumers and companies respond. Consider mandatory nutrition information. As a rule, mandatory information disclosure has the intended effect when there is a consensus among consumers about the valence of the information. This occurs when an attribute (like trans-fats, or fibers) is universally seen as negative or positive. However, mandatory disclosure may backfire if the information is about attributes that are not uniformly valued – like calories, salt, fat, or sugar content – which are seen by some as a signal of rich taste. In this case, companies may actually choose to compete on less transparent attributes like taste and to target taste-conscious consumers.¹³²

By highlighting the effects of unobtrusive environmental factors on energy intake, the findings in this review support the current “small steps” approach to obesity prevention.²⁶⁰ This approach recognizes that obesity is not a moral weakness but a normal response to the changing environment. As such, it stands in contrast with traditional public health efforts that have focused on providing science-based nutrition information and have exhorted people through didactic and sometimes moralizing appeals to change their dietary habits. A small steps approach focuses on adopting smaller, more sustainable goals. It recognizes that self-control is a limited and often absent resource and focuses less on persuasion and more on benevolent interventions that “nudge” consumers into making slightly better but repeated food choices without thinking about it.²⁶¹ This is done mostly by altering the eating environment, for example, by substituting calorie-dense drinks, like soft drinks, with water or diet soft drink in cafeterias, surreptitiously improving food composition, indirectly promoting smaller packages on menus (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 to prevent obesity for the 90% of the population that is gradually becoming fat by eating 60–100 calories too many per day.^{262,263} It should be paired with smarter public education campaigns to rebrand health by associating it with stronger identity-based appeals, such as sustainability, animal welfare, or even national security.²⁶⁴

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Declaration of interest.

REFERENCES

1. Brownell KD, Battle Horgen K. *Food Fight: The Inside Story of the Food Industry, America's Obesity Crisis, and What We Can Do About It*. New York: McGraw-Hill; 2003.
2. Kessler DA. *The End of Overeating: Taking Control of the Insatiable American Appetite*. Emmaus, PA: Rodale; 2009.
3. Popkin BM. *The World Is Fat: The Fads, Trends, Policies, and Products That Are Fattening the Human Race*. New York: Avery; 2009.
4. Swinburn BA, Sacks G, Hall KD, et al. The global obesity pandemic: shaped by global drivers and local environments. *Lancet*. 2011;378:804–814.
5. Nestle M, Nesheim MC. *Why Calories Count: From Science to Politics*. Berkeley, CA: University of California Press; 2012.
6. Wengrow D. Prehistories of commodity branding. *Curr Anthropol*. 2008;49:7–34.
7. Wilkie WL, Moore ES. Scholarly research in marketing: exploring the “4 Eras” of thought development. *J Public Policy Mark*. 2003;22:116–146.
8. Mello MM, Studdert DM, Brennan TA. Obesity, the new frontier of public health law. *N Engl J Med*. 2006;354:2601–2610.
9. Brownell KD, Warner KE. The perils of ignoring history: big tobacco played dirty and millions died. How similar is big food? *Milbank Q*. 2009;87:259–294.
10. Wansink B, Huckabee M. De-marketing obesity. *Calif Manage Rev*. 2005;47:6–18.
11. Wansink B. Environmental factors that increase the food intake and consumption volume of unknowing consumers. *Annu Rev Nutr*. 2004;24:455–479.
12. Bellisle F. Nutrition and health in France: dissecting a paradox. *J Am Diet Assoc*. 2005;105:1870–1873.
13. Finkelstein EA, Ruhm CJ, Kosa KM. Economic causes and consequences of obesity. *Annu Rev Public Health*. 2005;26:239–257.
14. Powell LM. Fast food costs and adolescent body mass index: evidence from panel data. *J Health Econ*. 2009;28:963–970.
15. Christian T, Rashad I. Trends in U.S. food prices, 1950–2007. *Econ Hum Biol*. 2009;7:113–120.
16. Lakdawalla D, Philipson T, Bhattacharya J. Welfare-enhancing technological change and the growth of obesity. *Am Econ Rev*. 2005;95:253–257.
17. Drewnowski A. The real contribution of added sugars and fats to obesity. *Epidemiol Rev*. 2007;29:160–171.
18. Chou S-Y, Grossman M, Saffer H. An economic analysis of adult obesity: results from the Behavioral Risk Factor Surveillance System. *J Health Econ*. 2004;23:565–587.
19. French SA, Stables G. Environmental interventions to promote vegetable and fruit consumption among youth in school settings. *Prev Med*. 2003;37:593–610.
20. Block JP, Chandra A, McManus KD, et al. Point-of-purchase price and education intervention to reduce consumption of sugary soft drinks. *Am J Public Health*. 2010;100:1427–1433.
21. Horgen KB, Brownell KD. Comparison of price change and health message interventions in promoting healthy food choices. *Health Psychol*. 2002;21:505–512.
22. Epstein LH, Handley EA, Dearing KK, et al. Purchases of food in youth. *Psychol Sci*. 2006;17:82–89.
23. Just DR, Wansink B. The flat-rate pricing paradox: conflicting effects of “all-you-can-eat” buffet pricing. *Rev Econ Stat*. 2011;93:193–200.
24. Cooke LJ, Chambers LC, Añez EV, et al. Eating for pleasure or profit. *Psychol Sci*. 2011;22:190–196.
25. Plassmann H, O'Doherty J, Shiv B, et al. Marketing actions can modulate neural representations of experienced pleasantness. *Proc Natl Acad Sci U S A*. 2008;105:1050–1054.
26. Kirchler E, Fischer F, Hölzl E. Price and its relation to objective and subjective product quality: evidence from the Austrian market. *J Consum Policy*. 2010;33:275–286.
27. Neslin SA, Van Heerde HJ. Promotion dynamics. *FriTMKG*. 2009;3:177–268.
28. Chan T, Narasimhan C, Zhang Q. Decomposing promotional effects with a dynamic structural model of flexible consumption. *J Mark Res*. 2008;45:487–498.
29. Ni Mhurchu C, Blakely T, Jiang Y, et al. Effects of price discounts and tailored nutrition education on supermarket purchases: a randomized controlled trial. *Am J Clin Nutr*. 2010;91:736–747.
30. Wansink B. Can package size accelerate usage volume? *J Mark*. 1996;60:1–14.
31. Assunção J, Meyer RJ. The rational effect of price promotions on sales and consumption. *Manage Sci*. 1993;39:517–535.
32. Chandon P, Wansink B. When are stockpiled products consumed faster? A convenience–salience framework of postpurchase consumption incidence and quantity. *J Mark Res*. 2002;39:321–335.
33. Vermeer WM, Steenhuis IHM, Seidell JC. Portion size: a qualitative study of consumers' attitudes toward point-of-purchase interventions aimed at portion size. *Health Educ Res*. 2010;25:109–120.
34. Vermeer WM, Alting E, Steenhuis IHM, et al. Value for money or making the healthy choice: the impact of proportional pricing on consumers' portion size choices. *Eur J Public Health*. 2010;20:65–69.
35. Mishra A, Mishra H. The influence of price discount versus bonus pack on the preference for virtue and vice foods. *J Mark Res*. 2011;48:196–206.
36. Wertebroch K. Consumption self control by rationing purchase quantities of virtue and vice. *Mark Sci*. 1998;17:317–337.

37. Thomas M, Desai KK, Seenivasan S. How credit card payments increase unhealthy food purchases: visceral regulation of vices. *J Consum Res.* 2011;38:505–524.
38. Bagchi R, Block LG. Chocolate cake please! Why do consumers indulge more when it feels more expensive? *J Public Policy Mark.* 2011;30:294–306.
39. Chandon P, Wansink B. Is Food marketing making us fat? A multidisciplinary review. *FntMKG.* 2011;5:113–196.
40. Grunert KG, Bolton LE, Raats MM. Processing and acting upon nutrition labeling on food: the state of knowledge and new directions for transformative consumer research. In: Mick DG, Pettigrew S, Ozanne JL, Pechmann C, eds. *Transformative Consumer Research for Personal and Collective Well-Being.* New York: Routledge; 2011: 333–351.
41. Roberto CA, Schwartz MB, Brownell KD. Rationale and evidence for menu-labeling legislation. *Am J Prev Med.* 2009;37:546–551.
42. Burton S, Kees J. Flies in the ointment? Addressing potential impediments to population-based health benefits of restaurant menu labeling initiatives. *J Public Policy Mark.* 2011; doi :10.1509/jppm.10.104.
43. Kiesel K, McCluskey JJ, Villas-Boas SB. Nutritional labeling and consumer choices. *Annu Rev Resour Econ.* 2011;3:141–158.
44. Howlett Elizabeth A, Burton S, Bates K, et al. Coming to a restaurant near you? Potential consumer responses to nutrition information disclosure on menus. *J Consum Res.* 2009;36:494–503.
45. Hoyer WD, Brown SP. Effects of brand awareness on choice for a common, repeat-purchase product. *J Consum Res.* 1990;17:141–148.
46. Cooke LJ. The importance of exposure for healthy eating in childhood: a review. *J Hum Nutr Diet.* 2007;20:294–301.
47. Chandon P, Hutchinson JW, Bradlow ET, Young SH. Does in-store marketing work? Effects of the number and position of shelf facings on brand attention and evaluation at the point of purchase. *J Mark.* 2009;73:1–17.
48. Chandon P, Hutchinson JW, Bradlow ET, Young S. Measuring the value of point-of-purchase marketing with commercial eye-tracking data. In: Wedel M, Pieters R, eds. *Visual Marketing: From Attention to Action.* Mahwah, NJ: Lawrence Erlbaum Associates; 2007:225–258.
49. Stewart H, Blisard N, Jolliffe D. Americans weigh taste, convenience, and nutrition. *Econ Inf Bull.* 2006;19:1–10.
50. Batada A, Seitz MD, Wootan MG, et al. Nine out of 10 food advertisements shown during Saturday morning children's television programming are for foods high in fat, sodium, or added sugars, or low in nutrients. *J Am Diet Assoc.* 2008;108:673–678.
51. Harris JL, Schwartz MB, Brownell KD, et al. *Fast Food Facts: Evaluating Fast Food Nutrition and Marketing to Youth.* New Haven, CT, Rudd Center for Food Policy and Obesity; 2010.
52. Desrochers DM, Holt DJ. Children's exposure to television advertising: implications for childhood obesity. *J Public Policy Mark.* 2007;26:182–201.
53. Harris JL, Schwartz MB, Brownell KD. Marketing foods to children and adolescents: licensed characters and other promotions on packaged foods in the supermarket. *Public Health Nutr.* 2009;13:409–417.
54. Young B. Does food advertising influence children's food choices? A critical review of some of the recent literature. *Int J Advert.* 2003;22:441–459.
55. Beales JH III. *Television Advertising and Childhood Obesity.* [working paper]. 2010; The Washington, DC, George Washington University School of Business; 2010.
56. Veerman JL, Van Beeck EF, Barendregt JJ, et al. By how much would limiting TV food advertising reduce childhood obesity? *Eur J Public Health.* 2009;19:365–369.
57. Vandewater EA, Wartella EA. Food marketing, television, and video games. In: Cawley JH, ed. *The Oxford Handbook of the Social Science of Obesity.* New York: Oxford University Press; 2011:350–366.
58. Bellisle F, Dalix AM, Slama G. Non food-related environmental stimuli induce increased meal intake in healthy women: comparison of television viewing versus listening to a recorded story in laboratory settings. *Appetite.* 2004;43:175–180.
59. Hetherington MM, Anderson AS, Norton GNM, et al. Situational effects on meal intake: a comparison of eating alone and eating with others. *Physiol Behav.* 2006;88:498–505.
60. Marshall SJ, Biddle SJH, Gorely T, et al. Relationships between media use, body fatness and physical activity in children and youth: a meta-analysis. *Int J Obes.* 2004;28:1238–1246.
61. Epstein LH, Roemmich JN, Robinson JL, et al. A randomized trial of the effects of reducing television viewing and computer use on body mass index in young children. *Arch Pediatr Adolesc Med.* 2008;162:239–245.
62. Goldberg ME. A quasi-experiment assessing the effectiveness of TV advertising directed to children. *J Mark Res.* 1990;27:445–454.
63. Dhar T, Baylis K. Fast-food consumption and the ban on advertising targeting children: the Quebec experience. *J Mark Res.* 2011;48:799–813.
64. Gorn GJ, Goldberg ME. Behavioral evidence of the effects of televised food messages on children. *J Consum Res.* 1982;9:200–205.
65. Halford JC, Boyland EJ, Hughes GM, et al. Beyond-brand effect of television food advertisements on food choice in children: the effects of weight status. *Public Health Nutr.* 2008;11:897–904.
66. McGinnis JM, Gootman JA, Kraak VI, eds. *Food Marketing to Children and Youth: Threat or Opportunity?* Washington, DC: National Academies Press; 2008.
67. Harris JL, Pomeranz JL, Lobstein T, et al. A crisis in the marketplace: how food marketing contributes to childhood obesity and what can be done. *Annu Rev Public Health.* 2009;30:211–225.
68. Livingstone S. Does TV advertising make children fat? *Public Policy Res.* 2006; 13:54–61.
69. Keller KL. *Strategic Brand Management: Building, Measuring, and Managing Brand Equity*, 3rd ed. Upper Saddle River, NJ: Pearson/Prentice Hall; 2008.
70. Oakes ME. Filling yet fattening: stereotypical beliefs about the weight gain potential and satiation of foods. *Appetite.* 2006;46:224–233.
71. Oakes ME. Stereotypical thinking about foods and perceived capacity to promote weight gain. *Appetite.* 2005;44:317–324.
72. Hoegg J, Alba JW. Taste perception: more than meets the tongue. *J Consum Res.* 2007;33:490–498.
73. Robinson TN, Borzekowski DLG, Matheson DM, et al. Effects of fast food branding on young children's taste preferences. *Arch Pediatr Adolesc Med.* 2007;161:792–797.
74. Wansink B, van Ittersum K, Painter JE. How descriptive food names bias sensory perceptions in restaurants. *Food Qual Prefer.* 2005;16:393–400.
75. Irmak C, Vallen B, Robinson SR. The impact of product name on dieters' and nondieters' food evaluations and consumption. *J Consum Res.* 2011;38:390–405.
76. Krishna A, Morrin M. Does touch affect taste? The perceptual transfer of product container haptic cues. *J Consum Res.* 2008;34:807–818.
77. Wansink B. Overcoming the taste stigma of soy. *J Food Sci.* 2003;68:2604–2606.
78. Wansink B, Park S-B. Sensory suggestiveness and labeling: do soy labels bias taste? *J Sens Stud.* 2002;17:483–491.
79. Oakes ME, Slotterback CS. Too good to be true: dose insensitivity and stereotypical thinking of foods' capacity to promote weight gain. *Food Qual Prefer.* 2005;16:675–681.
80. Levin IP, Gaeth GJ. How consumers are affected by the framing of attribute information before and after consuming the product. *J Consum Res.* 1988;15:374–378.
81. Lee L, Frederick S, Ariely D. Try it, you'll like it: the influence of expectation, consumption, and revelation on preferences for beer. *Psychol Sci.* 2006;17:1054–1058.
82. Crum AJ, Corbin WR, Brownell KD, et al. Mind over milkshakes: mindsets, not just nutrients, determine ghrelin response. *Health Psychol.* 2011;30:424–429.
83. Kozup JC, Creyer EH, Burton S. Making healthful food choices: the influence of health claims and nutrition information on consumers' evaluations of packaged food products and restaurant menu items. *J Mark.* 2003;67:19–34.
84. Andrews JC, Burton S, Kees J. Is simpler always better? Consumer evaluations of front-of-package nutrition symbols. *J Public Policy Mark.* 2011;30:175–190.
85. Riis J, Ratner RK. Simplified nutrition guidelines to fight obesity. In: Batra R, Keller PA, Strecher VJ, eds. *Leveraging Consumer Psychology for Effective Health Communications: The Obesity Challenge.* Armonk, NY: M.E. Sharpe; 2010:333–343.
86. Thorndike AN, Sonnenberg L, Riis J, et al. A 2-phase labeling and choice architecture intervention to improve healthy food and beverage choices. *Am J Public Health.* 2012;102:527–533.
87. Viswanathan M, Hastak M. The role of summary information in facilitating consumers' comprehension of nutrition information. *J Public Policy Mark.* 2002;21:305–318.
88. Viswanathan M, Hastak M, Gau R. Understanding and facilitating the usage of nutritional labels by low-literate consumers. *J Public Policy Mark.* 2009;28:135–145.
89. Wansink B, Chandon P. Can "low-fat" nutrition labels lead to obesity? *J Market Res.* 2006;43:605–617.
90. Ueland Ø, Cardello AV, Merrill EP, et al. Effect of portion size information on food intake. *J Am Diet Assoc.* 2009;109:124–127.
91. Geier AB, Rozin P, Doros G. Unit bias. *Psychol Sci.* 2006;17:521–525.
92. Williams P. Consumer understanding and use of health claims for foods. *Nutr Rev.* 2005;63:256–264.
93. Mariotti F, Kalonji E, Huneau JF, et al. Potential pitfalls of health claims from a public health nutrition perspective. *Nutr Rev.* 2010;68:624–638.
94. Nestle M, Ludwig DS. Front-of-package food labels: public health or propaganda? *JAMA.* 2010;303:771–772.
95. Rozin P, Ashmore M, Markwith M. Lay American conceptions of nutrition: dose insensitivity, categorical thinking, contagion, and the monotonic mind. *Health Psychol.* 1996;15:438–447.
96. Chandon P, Wansink B. The biasing health halos of fast-food restaurant health claims: lower calorie estimates and higher side-dish consumption intentions. *J Consum Res.* 2007;34:301–314.
97. Andrews JC, Netemeyer RG, Burton S. Consumer generalization of nutrient content claims in advertising. *J Mark.* 1998;62:62–75.
98. Carels RA, Konrad K, Harper J. Individual differences in food perceptions and calorie estimation: an examination of dieting status, weight, and gender. *Appetite.* 2007;49:450–458.

99. Tangari AH, Burton S, Howlett E, et al. Weighing in on fast food consumption: the effects of meal and calorie disclosures on consumer fast food evaluations. *J Consum Aff.* 2010;44:431–462.
100. Chernev A, Gal D. Categorization effects in value judgments: averaging bias in evaluating combinations of vices and virtues. *J Market Res.* 2010;47:738–747.
101. Chernev A. The dieter's paradox. *J Consum Psychol.* 2011;21:178–183.
102. Chernev A. Semantic anchoring in sequential evaluations of vices and virtues. *J Consum Res.* 2011;37:761–774.
103. Bowen D, Green P, Vizenor N, et al. Effects of fat content on fat hedonics: cognition or taste? *Physiol Behav.* 2003;78:247–253.
104. Provencher V, Polivy J, Herman CP. Perceived healthiness of food. If it's healthy, you can eat more! *Appetite.* 2008;52:340–344.
105. Fishbach A, Dhar R. Goals as excuses or guides: the liberating effect of perceived goal progress on choice. *J Consum Res.* 2005;32:370–377.
106. Ramanathan S, Williams P. Immediate and delayed emotional consequences of indulgence: the moderating influence of personality type on mixed emotions. *J Consum Res.* 2007;34:212–223.
107. Wilcox K, Vallen B, Block L, et al. Vicarious goal fulfillment: when the mere presence of a healthy option leads to an ironically indulgent decision. *J Consum Res.* 2009;36:380–393.
108. Finkelstein Stacey R, Fishbach A. When healthy food makes you hungry. *J Consum Res.* 2010;37:357–367.
109. Raghunathan R, Naylor RW, Hoyer WD. The unhealthy = tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *J Mark.* 2006;70:170–184.
110. Bowen DJ, Tomoyasu N, Anderson M, et al. Effects of expectancies and personalized feedback on fat consumption, taste, and preference. *J Appl Soc Psychol.* 1992;22:1061–1079.
111. Wardle J, Solomons W. Naughty but nice: a laboratory study of health information and food preferences in a community sample. *Health Psychol.* 1994;13:180–183.
112. Roefs A, Jansen A. The effect of information about fat content on food consumption in overweight/obese and lean people. *Appetite.* 2004;43:319–322.
113. Fischler C, Masson E, Barlösius E. *Manger: Français, Européens et Américains face à l'alimentation.* Paris, France: O. Jacob; 2008.
114. Werle COC, Ardito G, Trendal O, et al. Unhealthy food is not tastier for everybody: the "healthy-tasty" French intuition. *Actes du Congrès de l'AFM.* 2011.
115. Sorensen LB, Moller P, Flint A, et al. Effect of sensory perception of foods on appetite and food intake: a review of studies on humans. *Int J Obes.* 2003;27:1152–1166.
116. Moskowitz HR, Reisner M. How high-level consumer research can create low-caloric, pleasurable food concepts, products and packages. In: Laurette D, Antoine B, Alain D, et al., eds. *Obesity Prevention: The Role of Brain and Society on Individual Behavior.* San Diego, CA: Academic Press; 2010:529–542.
117. Bartoshuk LM, Fast K, Snyder DJ. Differences in our sensory worlds. *Curr Dir Psychol Sci.* 2005;14:122–125.
118. Bartoshuk LM, Duffy VB, Hayes JE, et al. Psychophysics of sweet and fat perception in obesity: problems, solutions and new perspectives. *Philos Trans R Soc Lond B Biol Sci.* 2006;361:1137–1148.
119. Small D, Prescott J. Odor/taste integration and the perception of flavor. *Exp Brain Res.* 2005;166:345–357.
120. Shankar MU, Levitan CA, Spence C. Grape expectations: the role of cognitive influences in color-flavor interactions. *Conscious Cogn.* 2009;19:380–390.
121. Krishna A, Elder RS. The gist of gustation: an exploration of taste, food, and consumption. In: Krishna A, ed. *Sensory Marketing: Research on the Sensuality of Products.* New York, NY: Routledge; 2009:281–301.
122. de Graaf C, Kok FJ. Slow food, fast food and the control of food intake. *Nat Rev Endocrinol.* 2010;6:290–293.
123. Auvray M, Spence C. The multisensory perception of flavor. *Conscious Cogn.* 2008;17:1016–1031.
124. Elder Ryan S, Krishna A. The effects of advertising copy on sensory thoughts and perceived taste. *J Consum Res.* 2010;36:748–756.
125. Stubbs RJ, Whybrow S. Energy density, diet composition and palatability: influences on overall food energy intake in humans. *Physiol Behav.* 2004;81:755–764.
126. Drewnowski A. Energy intake and sensory properties of food. *Am J Clin Nutr.* 1995;62(Suppl):S1081–S1108.
127. Putnam J, Allshouse J, Kantor LS. U.S. per capita food supply trends: more calories, refined carbohydrates, and fats. *Food Rev.* 2002;25:2–15.
128. Duffey KJ, Popkin BM. High-fructose corn syrup: is this what's for dinner? *Am J Clin Nutr.* 2008;88(Suppl):S1722–S1732.
129. Kennedy ET, Bowman SA, Powell R. Dietary-fat intake in the US population. *J Am Coll Nutr.* 1999;18:207–212.
130. Rozin P, Fischler C, Shields-Argelès C. Additivity dominance: additives are more potent and more often lexicalized across languages than are "subtractives." *Judgement Decis Making.* 2009;4:475–478.
131. Moorman C. A quasi experiment to assess the consumer and informational determinants of nutrition information. *J Public Policy Mark.* 1996;15:28–44.
132. Moorman C, Ferraro R, Huber J. Unintended nutrition consequences: firm responses to the nutrition labeling and education act. *Marketing Sci.* 2012; doi: 10.1287/mksc.1110.0692.
133. Rolls BJ, Morris EL, Roe LS. Portion size of food affects energy intake in normal-weight and overweight men and women. *Am J Clin Nutr.* 2002;76:1207–1213.
134. Flood JE, Roe LS, Rolls BJ. The effect of increased beverage portion size on energy intake at a meal. *J Am Diet Assoc.* 2006;106:1984–1990.
135. Kral TV, Roe LS, Rolls BJ. Combined effects of energy density and portion size on energy intake in women. *Am J Clin Nutr.* 2004;79:962–968.
136. Wansink B, Payne CR, Chandon P. Internal and external cues of meal cessation: the French paradox redux? *Obesity.* 2007;15:2920–2924.
137. Wansink B, Painter JE, North J. Bottomless bowls: why visual cues of portion size may influence intake. *Obes Res.* 2005;13:93–100.
138. Remick AK, Polivy J, Pliner P. Internal and external moderators of the effect of variety on food intake. *Psychol Bull.* 2009;135:434–451.
139. Khare A, Inman JJ. Habitual behavior in American eating patterns: the role of meal occasions. *J Consum Res.* 2006;32:567–575.
140. Inman JJ. The role of sensory-specific satiety in attribute-level variety seeking. *J Consum Res.* 2001;28:105–120.
141. Kahn BE, Wansink B. The influence of assortment structure on perceived variety and consumption quantities. *J Consum Res.* 2004;30:519–533.
142. Hoch SJ, Bradlow ET, Wansink B. The variety of an assortment. *Marketing Sci.* 1999;18:527–546.
143. Etkin J, Ratner RK. The dynamic impact of variety among means on motivation. *J Consum Res.* 2012;38:1076–1092.
144. Redden Joseph P, Hoch Stephen J. The presence of variety reduces perceived quantity. *J Consum Res.* 2009;36:406–417.
145. Drewnowski A. Taste preferences and food intake. *Annu Rev Nutr.* 1997;17:237–253.
146. Mela DJ. Eating for pleasure or just wanting to eat? Reconsidering sensory hedonic responses as a driver of obesity. *Appetite.* 2006;47:10–17.
147. Wadhwa M, Shiv B, Nowlis SM. A bite to whet the reward appetite: the influence of sampling on reward-seeking behaviors. *J Mark Res.* 2008;45:403–413.
148. Poothullil JM. Role of oral sensory signals in determining meal size in lean women. *Nutrition.* 2002;18:479–483.
149. Morewedge CK, Huh YE, Vosgerau J. Thought for food: imagined consumption reduces actual consumption. *Science.* 2010;330:1530–1533.
150. Berridge KC. "Liking" and "wanting" food rewards: brain substrates and roles in eating disorders. *Physiol Behav.* 2009;97:537–550.
151. Yeomans MR, Blundell JE, Leshem M. Palatability: response to nutritional need or need-free stimulation of appetite? *Br J Nutr.* 2004;92(Suppl 1):S3–S14.
152. Nestle M. Increasing portion sizes in American diets: more calories, more obesity. *J Am Diet Assoc.* 2003;103:39–40.
153. Wansink B, van Ittersum K. Portion size me: downsizing our consumption norms. *J Am Diet Assoc.* 2007;107:1103–1106.
154. Schwartz J, Byrd-Bredbenner C. Portion distortion: typical portion sizes selected by young adults. *J Am Diet Assoc.* 2006;106:1412–1418.
155. Rozin P, Kabnick K, Pete E, et al. The ecology of eating: smaller portion sizes in France than in the United States help explain the French paradox. *Psychol Sci.* 2003;14:450–454.
156. Young LR, Nestle M. The contribution of expanding portion sizes to the US obesity epidemic. *Am J Public Health.* 2002;92:246–249.
157. Hannum SM, Carson L, Evans EM, et al. Use of portion-controlled entrees enhances weight loss in women. *Obes Res.* 2004;12:538–546.
158. Sprott DE, Manning KC, Miyazaki AD. Grocery price setting and quantity surcharges. *J Mark.* 2003;67:34–46.
159. Dobson PW, Gerstner E. For a few cents more: why supersize unhealthy food? *Marketing Sci.* 2010;29:770–778.
160. Fisher JO, Kral TVE. Super-size me: portion size effects on young children's eating. *Physiol Behav.* 2008;94:39–47.
161. Devitt AA, Mattes RD. Effects of food unit size and energy density on intake in humans. *Appetite.* 2004;42:213–220.
162. Rolls BJ, Engell D, Birch LL. Serving portion size influences 5-year-old but not 3-year-old children's food intakes. *J Am Diet Assoc.* 2000;100:232–234.
163. Marchiori D, Corneille O, Klein O. Container size influences snack food intake independently of portion size. *Appetite.* 2012;58:814–817.
164. Steenhuis I, Vermeer W. Portion size: review and framework for interventions. *Int J Behav Nutr Phys Act.* 2009;6:58–67.
165. Rolls BJ, Roe LS, Meengs JS. The effect of large portion sizes on energy intake is sustained for 11 days. *Obesity.* 2007;15:1535–1543.
166. Levitsky DA, Pacanowski C. Losing weight without dieting. Use of commercial foods as meal replacements for lunch produces an extended energy deficit. *Appetite.* 2011;57:311–317.
167. Wansink B, Kim J. Bad popcorn in big buckets: portion size can influence intake as much as taste. *J Nutr Educ Behav.* 2005;37:242–245.
168. Wansink B, Park S. At the movies: how external cues and perceived taste impact consumption volume. *Food Qual Prefer.* 2001;12:69–74.
169. Cheema A, Soman D. The effect of partitions on controlling consumption. *J Mark Res.* 2008;45:665–675.

170. Geier A, Wansink B, Rozin P. Red potato chips: segmentation cues can substantially decrease food intake. *Health Psychol.* 2012;31:398–401.
171. Vermeer WM, Bruins B, Steenhuis IHM. Two pack king size chocolate bars. Can we manage our consumption? *Appetite.* 2010;54:414–417.
172. Sharpe Kathryn M, Staelin R, Huber J. Using extremeness aversion to fight obesity: policy implications of context dependent demand. *J Consum Res.* 2008;35:406–422.
173. Herman CP, Roth DA, Polivy J. Effects of the presence of others on food intake: a normative interpretation. *Psychol Bull.* 2003;129:873–886.
174. McFerran B, Dahl DW, Fitzsimons GJ, et al. Might an overweight waitress make you eat more? How the body type of others is sufficient to alter our food consumption. *J Consum Psychol.* 2010;20:146–151.
175. McFerran B, Dahl DW, Fitzsimons GJ, et al. I'll have what she's having: effects of social influence and body type on the food choices of others. *J Consum Res.* 2010;36:915–929.
176. Coelho do Vale R, Pieters R, Zeelenberg M. Flying under the radar: perverse package size effects on consumption self-regulation. *J Consum Res.* 2008;35:380–390.
177. Scott ML, Nowlis SM, Mandel N, et al. The effects of reduced food size and package size on the consumption behavior of restrained and unrestrained eaters. *J Consum Res.* 2008;35:309–323.
178. Stroebele N, Ogden LG, Hill JO. Do calorie-controlled portion sizes of snacks reduce energy intake? *Appetite.* 2009;52:793–796.
179. Birch LL, MCPhee L, Shoba BC, et al. "Clean up your plate": effects of child feeding practices on the conditioning of meal size. *Learn Motiv.* 1987;18:301–317.
180. Folkes VS, Martin IM, Gupta K. When to say when: effects of supply on usage. *J Consum Res.* 1993;20:467–477.
181. Scheibehenne B, Todd PM, Wansink B. Dining in the dark. The importance of visual cues for food consumption and satiety. *Appetite.* 2010;55:710–713.
182. Dubois D, Rucker DD, Galinsky AD. Super size me: product size as a signal of status. *J Consum Res.* 2012;38:1047–1062.
183. Chernev A, Chandon P. Calorie estimation biases in consumer choice. In: Batra R, Keller PA, Strecher VJ, eds. *Leveraging Consumer Psychology for Effective Health Communications: The Obesity Challenge.* Armonk, NY: M.E. Sharpe; 2010:104–121.
184. Chandon P. Estimating food quantity: biases and remedies. In: Krishna A, ed. *Sensory Marketing: Research on the Sensuality of Products.* New York, NY: Routledge; 2009:323–342.
185. Viswanathan M, Rosa JA, Harris JE. Decision making and coping of functionally illiterate consumers and some implications for marketing management. *J Mark.* 2005;69:15–31.
186. Lennard D, Mitchell V-W, McGoldrick P, et al. Why consumers under-use food quantity indicators. *Int Rev Retail Distrib Consum Res.* 2001;11:177–199.
187. Chandon P, Wansink B. How biased household inventory estimates distort shopping and storage decisions. *J Mark.* 2006;70:118–135.
188. Chandon P, Wansink B. Is obesity caused by calorie underestimation? A psychophysical model of meal size estimation. *J Mark Res.* 2007;44:84–99.
189. Wansink B, Chandon P. Meal size, not body size, explains errors in estimating the calorie content of meals. *Ann Intern Med.* 2006;145:326–332.
190. Ordbayeva N, Chandon P. The additive change heuristic: A model to predict product size impressions and optimize packaging design. *J Mark.* 2012, 67:218–227.
191. Chandon P, Ordbayeva N. Supersize in one dimension, downsize in three dimensions: effects of spatial dimensionality on size perceptions and preferences. *J Mark Res.* 2009;46:739–753.
192. Livingstone MBE, Black AE. Markers of the validity of reported energy intake. *J Nutr.* 2003;133(Suppl):S895–S920.
193. Aydinoglu NZ, Krishna A, Wansink B. Do size labels have a common meaning among consumers? In: Krishna A, ed. *Sensory Marketing: Research on the Sensuality of Products.* New York, NY: Routledge; 2009:343–360.
194. Hurley J, Liebman B. Big: movie theaters fill buckets. . . and bellies. *Nutr Action.* 2009;36:1–5.
195. Young LR, Nestle M. Portion sizes and obesity: responses of fast-food companies. *J Public Health Policy.* 2007;28:238–248.
196. Aydinoglu NZ, Krishna A. Guiltless gluttony: the asymmetric effect of size labels on size perceptions and consumption. *J Consum Res.* 2011;37:1095–1112.
197. Folkes V, Matta S. The effect of package shape on consumers' judgments of product volume: attention as a mental contaminant. *J Consum Res.* 2004;31:390–401.
198. Kahn BE, Deng X. Effects on visual weight perceptions of product image locations on packaging. In: Krishna A, ed. *Sensory Marketing: Research on the Sensuality of Products.* New York, NY: Routledge; 2009:259–278.
199. Deng X, Kahn BE. Is your product on the right side? The "location effect" on perceived product heaviness and package evaluation. *J Mark Res.* 2009;46:725–738.
200. Madzharov AV, Block LG. Effects of product unit image on consumption of snack foods. *J Consum Psychol.* 2010;20:398–409.
201. Wansink B. *Mindless Eating: Why We Eat More Than We Think.* New York, NY: Bantam Books; 2006.
202. Cohen DA, Farley TA. Eating as an automatic behavior. *Prev Chronic Dis.* 2008;5:1–7.
203. Cullen KW, Baranowski T, Owens E, et al. Availability, accessibility, and preferences for fruit, 100% fruit juice, and vegetables influence children's dietary behavior. *Health Educ Behav.* 2003;30:615–626.
204. Larson D, Rising R, Ferraro R, et al. Spontaneous overfeeding with a "cafeteria diet" in men: effects on 24-h energy expenditure and substrate oxidation. *Int J Obes.* 1995;19:331–337.
205. Engell D, Kramer M, Malafi T, et al. Effects of effort and social modeling on drinking in humans. *Appetite.* 1996;26:129–138.
206. Hall KD, Sacks G, Chandramohan D, et al. Quantification of the effect of energy imbalance on bodyweight. *Lancet.* 2011;378:826–837.
207. Kantor LS, Lipton K. Estimating and addressing America's food losses. *Food Rev.* 1997;20:2–12.
208. Hall KD, Guo J, Dore M, et al. The progressive increase of food waste in America and its environmental impact. *PLoS ONE.* 2009;4:e7940.
209. Shames L. *U.S. Agriculture: Retail Food Prices Grew Faster Than the Prices Farmers Received for Agricultural Commodities, but Economic Research Has Not Established That Concentration Has Affected These Trends.* Washington, DC: Government Accountability Office; 2009.
210. Rashad I. Whose fault is it we're getting fat? Obesity in the United States. *Public Policy Res.* 2005;12:30–36.
211. Currie J, DellaVigna S, Moretti E, et al. The effect of fast food restaurants on obesity and weight gain. *Am Econ J Econ Policy.* 2010;2:32–63.
212. Powell LM, Auld MC, Chaloupka FJ, et al. Associations between access to food stores and adolescent body mass index. *Am J Prev Med.* 2007;33(Suppl 1):S301–S307.
213. Block JP, Christakis NA, O'Malley AJ, et al. Proximity to food establishments and body mass index in the Framingham Heart Study offspring cohort over 30 years. *Am J Epidemiol.* 2011;174:1108–1114.
214. Downs JS, Loewenstein G, Wisdom J. Strategies for promoting healthier food choices. *Am Econ Rev.* 2009;99:159–164.
215. Schwartz J, Riis J, Elbel B, et al. Inviting consumers to downsize fast-food portions significantly reduces calorie consumption. *Health Aff.* 2012;31:399–407.
216. Painter JE, Wansink B, Hieggelke JB. How visibility and convenience influence candy consumption. *Appetite.* 2002;38:237–238.
217. Peck J, Childers TL. If I touch it I have to have it: individual and environmental influences on impulse purchasing. *J Bus Res.* 2006;59:765–769.
218. Cornell CE, Rodin J, Weingarten H. Stimulus-induced eating when satiated. *Physiol Behav.* 1989;45:695–704.
219. Brendl CM, Markman AB, Messner C. The devaluation effect: activating a need devalues unrelated objects. *J Consum Res.* 2003;29:463–473.
220. Wansink B. Antecedents and mediators of eating bouts. *Fam Consum Sci Res J.* 1994;23:166–182.
221. Chandon P, Smith RJ, Morwitz VG, et al. When does the past repeat itself? The interplay of behavior prediction and personal norms. *J Consum Res.* 2011;38:420–430.
222. Wansink B, Deshpande R. Out of sight, out of mind: pantry stockpiling and brand-usage frequency. *Market Lett.* 1994;5:91–100.
223. Cutler DM, Glaeser EL, Shapiro JM. Why have Americans become more obese? *J Econ Perspect.* 2003;17:93–118.
224. Anderson PM, Butcher KF, Levine PB. Maternal employment and overweight children. *J Health Econ.* 2003;22:477–504.
225. Sharpe KM, Staelin R. Consumption effects of bundling: consumer perceptions, firm actions, and public policy implications. *J Public Policy Mark.* 2010;29:170–188.
226. Wansink B. *Marketing Nutrition – Soy, Functional Foods, Biotechnology, and Obesity.* Champaign, IL: University of Illinois Press; 2005.
227. Collins K. *New Survey on Portion Size: Americans Still Cleaning Plates.* Washington, DC: American Institute for Cancer Research; 2006.
228. Raghuraj P, Krishna A. Vital dimensions in volume perception: can the eye fool the stomach? *J Mark Res.* 1999;36:313–326.
229. Wansink B, Van Ittersum K. Bottoms up! The influence of elongation on pouring and consumption volume. *J Consum Res.* 2003;30:455–463.
230. Krishna A. Interaction of senses: the effect of vision versus touch on the elongation bias. *J Consum Res.* 2006;32:557–566.
231. van Ittersum K, Wansink B. Plate size and color suggestibility: the Delboeuf illusion's bias on serving and eating behavior. *J Consum Res.* 2012;39:215–228.
232. van Ittersum K, Wansink B. Do children really prefer large portions? Visual illusions bias their estimates and intake. *J Am Diet Assoc.* 2007;107:1107–1110.
233. Sobal J, Wansink B. Kitchenscapes, tablescape, platescapes, and foodscapes – influences of microscale built environments on food intake. *Environ Behav.* 2007;39:124–142.
234. Wansink B, van Ittersum K, Painter JE. Ice cream illusions: bowls, spoons, and self-served portion sizes. *Am J Prev Med.* 2006;31:240–243.
235. Caine-Bish N, Feiber L, Gordon KL, et al. P25: does plate size effect portion sizes when children self-select food and drink? *J Nutr Educ Behav.* 2007;39(Suppl 1):S114–S115.

236. Rolls BJ, Roe LS, Halverson KH, et al. Using a smaller plate did not reduce energy intake at meals. *Appetite*. 2007;49:652–660.
237. Krider RE, Raghurir P, Krishna A. Pizzas: pi or square? Psychophysical biases in area comparisons. *Marketing Sci*. 2001;20:405–425.
238. Krishna A. An integrative review of sensory marketing: engaging the senses to affect perception, judgment and behavior. *J Consum Psychol*. 2012;22:332–351.
239. Krishna A. Spatial perception research: an integrative review of length, area, volume and number perception. In: Wedel M, Pieters R, eds. *Visual Marketing: From Attention to Action*. New York: Lawrence Erlbaum Associates; 2007:167–193.
240. Westerterp-Plantenga MS, Lichtenbelt WD, Cilissen C, et al. Energy metabolism in women during short exposure to the thermoneutral zone. *Physiol Behav*. 2002;75:227–235.
241. Keith SW, Redden DT, Katzmarzyk P, et al. Putative contributors to the secular increase in obesity: exploring the roads less traveled. *Int J Obes*. 2006;30:1585–1594.
242. Herman CP. Effects of heat on appetite. In: Marriott BM, ed. *Nutritional Needs in Hot Environments: Applications for Military Personnel in Field Operations*. Washington, DC: National Academy Press; 1993:187–214.
243. Stroebele N, De Castro JM. Effect of ambience on food intake and food choice. *Nutrition*. 2004;20:821–838.
244. Lyman B. *A Psychology of Food: More Than A Matter of Taste*. New York: Van Nostrand Reinhold Co.; 1989.
245. Rozin P. Psychology and sensory marketing, with a focus on food. In: Krishna A, ed. *Sensory Marketing: Research on the Sensuality of Products*. New York, NY: Routledge; 2009:303–322.
246. Stroebele N, de Castro JM. Listening to music while eating is related to increases in people's food intake and meal duration. *Appetite*. 2006;47:285–289.
247. Caldwell C, Hibbert SA. The influence of music tempo and musical preference on restaurant patrons' behavior. *Psychol Market*. 2002;19:895–917.
248. Milliman RE. The influence of background music on the behavior of restaurant patrons. *J Consum Res*. 1986;13:286–289.
249. Morrin M, Chebat J-C, Gelinias-Chebat C. The impact of scent and music on consumer perceptions of time duration. In: Krishna A, ed. *Sensory Marketing: Research on the Sensuality of Products*. New York, NY: Routledge; 2009:123–134.
250. North AC, Hargreaves DJ. The effects of music on responses to a dining area. *J Environ Psychol*. 1996;16:55–64.
251. Garlin FV, Owen K. Setting the tone with the tune: a meta-analytic review of the effects of background music in retail settings. *J Bus Res*. 2006;59:755–764.
252. Higgs S, Woodward M. Television watching during lunch increases afternoon snack intake of young women. *Appetite*. 2009;52:39–43.
253. Rozin P, Dow S, Moscovitch M, et al. What causes humans to begin and end a meal? A role of memory for what has been eaten, as evidenced by a study of multiple meal eating in amnesic patients. *Psychol Sci*. 1998;9:392–396.
254. Higgs S. Cognitive influences on food intake: the effects of manipulating memory for recent eating. *Physiol Behav*. 2008;94:734–739.
255. Shiv B, Nowlis SM. The effect of distractions while tasting a food sample: the interplay of informational and affective components in subsequent choice. *J Consum Res*. 2004;31:599–608.
256. Wansink B, Payne CR, Shimizu M. "Is this a meal or snack?" Situational cues that drive perceptions. *Appetite*. 2010;54:214–216.
257. Pearson D, Henryks J, Trott A, et al. Local food: understanding consumer motivations in innovative retail formats. *Br Food J*. 2011;113:886–899.
258. Martinez SW. *The U.S. food marketing system: recent developments, 1997–2006*. ERR-42. U.S. Dept. of Agriculture. Econ Res Serv. 2007.
259. Rozin P, Fischler C, Imada S, et al. Attitudes to food and the role of food in life in the U.S.A., Japan, Flemish Belgium and France: possible implications for the diet-health debate. *Appetite*. 1999;33:163–180.
260. Hill JO. 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. *Am J Clin Nutr*. 2009;89:477–484.
261. Wansink B. *Slim by Design: Mindless Eating Solutions for Everyone, Everywhere*. New York: William Morrow; 2012.
262. Hill JO, Wyatt HR, Reed GW, et al. Obesity and the environment: where do we go from here? *Science*. 2003;299:854–855.
263. Wang YC, Orleans T, Gortmaker SL. Reaching the healthy people goals for reducing childhood obesity: closing the energy gap. *Am J Prev Med*. 2012;42:437–444.
264. Robinson TN. Stealth interventions for obesity prevention and control: motivating behavior change. In: Dubé L, Antoine B, Alain D, et al., eds. *Obesity Prevention: The Role of Brain and Society on Individual Behavior*. San Diego, CA: Academic Press; 2010:319–327.
265. Banerjee R. Pepsi's rural strategy: New healthy beverage with low price. *The Economic Times*. July 20, 2011.
266. Seabrook J. Snacks for a Fat Planet: PepsiCo takes stock of the obesity epidemic. *New Yorker*. May 16, 2011.
267. Ingredients Network. PepsiCo and Muller team up to launch US yoghurt brand. October 17, 2011.
268. Jargon J. Under pressure, McDonald's adds apples to kids meals. *Wall Street Journal*. July 27, 2011.
269. Moss M. Philadelphia school battles students' bad eating habits, on campus and off. *The New York Times*. March 27, 2011.