

CHAPTER 4

CALORIE ESTIMATION BIASES IN CONSUMER CHOICE

ALEXANDER CHERNEV AND PIERRE CHANDON

Despite the increase in the number of healthy options available to consumers, the proportion of overweight individuals has increased as well (Chandon 2009; Heini and Weinsier 1997; Wansink 2006). Calorie overconsumption has been identified as one of the primary sources contributing to this obesity epidemic (CDC 2006; Olshansky et al. 2005). Reduced-calorie diets result in clinically meaningful weight loss regardless of which macronutrients (fat or carbohydrates) they emphasize (Sacks et al. 2009). Managing calorie intake has been singled out by the U.S. Department of Health and Human Services as the primary method to maintain optimal body weight (Thompson and Veneman 2005). Assessment of calorie intake has also been documented as playing a central role in the prevention and treatment of many diseases, including diabetes, coronary heart disease, and some forms of cancer (Allison et al. 1999; Goodhart and Shils 1980; Keys 1997; Must et al. 1999; USDA 2008).

To encourage individuals to consume fewer calories, the majority of nutritional programs recommend specific daily calorie intakes. Most packaged goods are now required by the Food and Drug Administration to display their calorie content, a measure designed to regulate calorie intake. Despite the availability of nutritional information for many products, however, calculating one's actual calorie intake is not a trivial task. Indeed, while the calorie content of packaged goods is usually readily available, restaurants are not required by the FDA to provide nutrition information. Although many chains—including McDonald's, Burger King, Dunkin' Donuts, and Starbucks—already provide calorie information on their websites, posters, or tray liners, this information is rarely available to consumers at the time of food selection and food intake.

Even when nutritional information is readily available, it typically describes the calorie content per serving of one item, rather than the content of the entire meal consumed by individuals. This further complicates the estimation of the total calorie intake since the packaging of most foods and drinks involves multiple servings, and consumers are typically unaware of or unable to determine the recommended serving size. Furthermore, the overall calorie count is often not available for meals

comprising multiple items. The unavailability of meal-specific nutritional information at the time of food selection raises the question of how consumers evaluate the calorie content of individual food items and how they integrate these estimates into an overall estimate of the calories contained in a particular meal.

Given that consumers make food-related decisions every day, one could argue that they should be able to estimate more or less accurately the calorie content of popular meal options, such as fast-food meals, snacks, and soft drinks. Recent evidence, however, has questioned the accuracy of consumers' estimates of calorie intake. It has been shown that people—even trained dietitians—tend to make large errors in estimating both calories and the quantity of food consumed (Chandon and Wansink 2007b; Lansky and Brownell 1982; Lichtman et al. 1992). Multiple studies have further documented people's tendency to underestimate their calorie intake (see Livingstone and Black 2003 for a review). Despite the overwhelming evidence for this underestimation bias in evaluating calorie intake, little is known about its antecedents.

This chapter offers an overview of recent consumer research that sheds light on categorization-based factors biasing estimation of the calorie content of food-related items.¹ It reviews research showing that calorie underestimation can be attributed to two types of categorization-driven decision biases: the halo bias and the averaging bias. The halo bias refers to the tendency of a particular feature of the food, such as nutrition labels or marketing claims that it is healthy, to influence the overall estimation of the calorie content of the food item or of an entire meal. The averaging bias refers to people's tendency to average the calorie content of combinations of healthy and unhealthy items. Although driven by different psychological processes, both biases stem from people's tendency to categorize food-related items according to a healthy/unhealthy dichotomy.

The notion that people tend to categorize food-related information according to a good/bad dichotomy of healthy and unhealthy has been advanced by researchers in different domains, including psychology (Chernev 2009; Rozin, Ashmore, and Markwith 1996), marketing (Raghunathan, Naylor, and Hoyer 2006; Wertenbroch 1998), and nutrition (Oakes 2005; Oakes and Slotterback 2001). These studies show that asking consumers to rate the health benefits of different foods leads to a bimodal distribution, indicating the use of good/bad categorization. Thus, foods such as fruits and vegetables tend to be classified as inherently healthy, whereas candy, bacon, and popcorn are considered to be inherently indulgent and unhealthy.

The healthy/unhealthy categorization is influenced not just by the nature of the food, but by nutrition-related information communicated by the name of the brand or by the specific claims or qualifiers used to describe the food. Foods described as organic, light, fat-free, and low-fat tend to be classified as healthy, whereas options described by qualifiers such as regular, rich, creamy, and decadent are more likely to be classified as unhealthy. Similarly, people tend to classify restaurants according to the degree of their perceived healthiness, whereby outlets such as Jamba Juice and Subway are perceived to be healthier than Burger King and McDonald's.

The remainder of this chapter is organized as follows. We first examine calorie estimation biases in cases when people evaluate meals comprising either healthy or unhealthy items. In this context, we show that nutrition labels or marketing claims lead to a halo bias categorization of food-related items as healthy and unhealthy such that people tend to overweight categorization-consistent features but discount the categorization-inconsistent ones. We then show that combining both healthy and unhealthy items leads to an averaging bias in which people underestimate the calorie content of the combined meal. The chapter concludes with a discussion of the public policy implications of calorie estimation biases, focusing on ways to correct these biases and improve food-related decision-making.

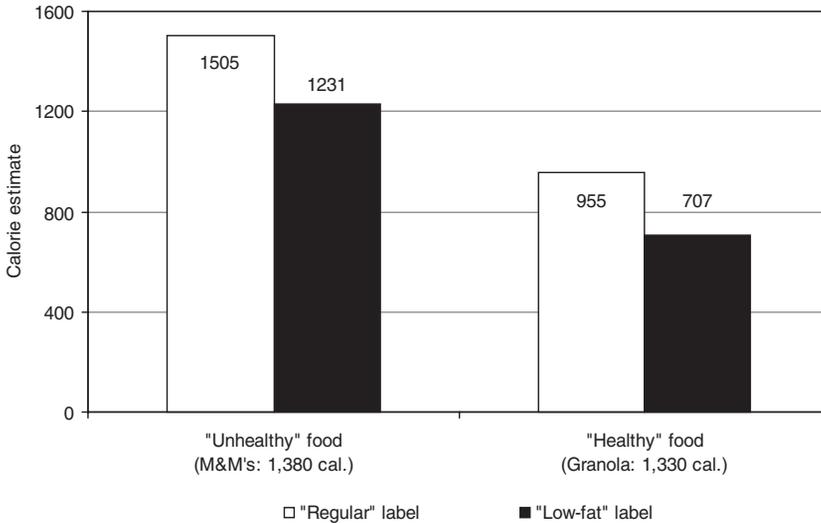
HALO BIAS IN ESTIMATING THE CALORIE CONTENT OF EITHER HEALTHY OR UNHEALTHY FOOD AND MEALS

In the absence of salient, unambiguous calorie information, people infer calorie content from other cues. A plethora of research (e.g., Kardes, Posavac, and Cronley 2004) has shown that consumers frequently draw inferences about missing attributes from other attributes (e.g., “What is the fat content?”), from the brand’s overall positioning (e.g., “Does it claim to be healthy or not?”), or from the attributes of comparable products (e.g., “What else is on this restaurant’s menu?”). According to selective accessibility models of information processing, unless consumers are specifically asked to do the opposite, these cues increase the accessibility of category-consistent information on the target food or meal, leading to the assimilation of calorie estimations toward the cue (for a review, see Mussweiler 2003). The result is a halo bias, which leads to lower calorie estimates when people rely on cues suggesting that an item is healthy than when cues suggest that the item is unhealthy.

Prior research on health halos has shown that people tend to generalize specific health claims inappropriately—for example, believing that foods low in cholesterol are also low in fat (Andrews, Netemeyer, and Burton 1996). The results of some of these studies, however, are inconclusive because they did not control for differences in the calorie content of healthy and unhealthy food (e.g., studies 1 and 3 in Wansink and Chandon 2006). For example, Burton et al. (2006) found that people underestimated the calorie content of a number of relatively healthy foods (including chicken breasts and turkey sandwiches) by 9 percent but underestimated the calorie content of relatively unhealthy foods (including fettuccine Alfredo, hamburgers, and fries) by 93 percent. A potential problem with these findings is that the unhealthy food used in the study contained significantly more calories than the healthy food (1336 vs. 543, on average). This is problematic because Chandon and Wansink (2007b) have established that calorie underestimation increases with actual calorie content, which implies that the above findings could be attributable to the higher calorie content of unhealthy food rather than to health halos.

To control for the potential confound between health halos and calorie content,

Figure 4.1 Health Halo Effects in Food Portion Estimations

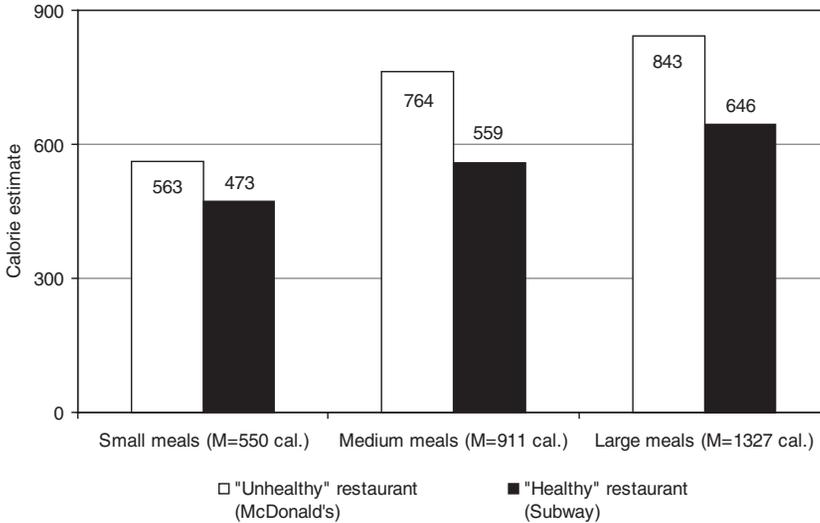


Note: Calorie estimates are lower for foods perceived as healthy and labeled as “low-fat.”

Wansink and Chandon (2006) asked consumers to estimate the number of calories contained in two ten-ounce cups, one containing M&M’s (1,380 calories) and the other containing granola (1,330 calories). The two snacks were chosen based on pretests indicating that although both foods have similar calorie density, granola is perceived as healthier and less indulgent than M&M’s. Consistent with the halo hypothesis, participants underestimated the calorie content of the relatively healthy granola by 28 percent but overestimated the calorie content of the relatively unhealthy M&M’s by 9 percent (Figure 4.1).

Wansink and Chandon (2006) further examined the effects of another health halo source: “low-fat” nutrition claims.² They found that health halos created by “low-fat” labels reduced calorie estimation by a similar amount for both products (18 percent for M&M’s and 26 percent for granola). They also observed that the health halo effects caused by food stereotyping (M&M’s vs. granola) and by nutrition claims (“low-fat” vs. “regular” labels) equally affected both overweight and normal-weight participants. This suggests that health halos are not driven by the individual differences typically observed between these two groups (e.g., restrained eating, gender, socioeconomic level, and appearance self-esteem).

In a related series of studies, Chandon and Wansink (2007a) examined the effects of the health claims of fast-food restaurant brands on the perceived caloric content of entire meals, not just of single food portions. To illustrate, in one experiment, the authors asked people who had just finished eating a meal at either Subway (a fast-food chain that claims to serve healthy meals) or McDonald’s (a fast-food

Figure 4.2 **Health Halo Effects in Fast-Food Meal Estimations**

Note: People eating at Subway, a restaurant claiming to serve healthy meals, underestimate the caloric content of their meals more than people eating at McDonald's, a restaurant not making health claims, regardless of the size of their meal.

chain that does not make that claim) to estimate the caloric content of their meal. The researchers then recorded the type and size of the foods and drinks from the wrappings left on the trays and obtained information about the actual number of calories in the foods and beverages from the restaurant's website. To increase the comparability of McDonald's and Subway meals, they only analyzed meals consisting of a sandwich, a soft drink, and a side order. The data summarized in Figure 4.2 show the mean calorie estimate of people eating small, medium, or large meals (categorized on the basis of actual number of calories) at either Subway or McDonald's. On average, Subway meals were perceived to contain 21.3 percent fewer calories than same-calorie McDonald's meals. These results were replicated in a scenario in which the health positioning of the fast-food restaurant was empirically manipulated, rather than measured.

AVERAGING BIAS IN ESTIMATING THE CALORIE CONTENT OF MEALS COMBINING HEALTHY AND UNHEALTHY ITEMS

Conventional wisdom suggests that deriving calorie estimates of combinations of food items should be fairly trivial: The calorie content of a meal comprising several individual items should be equal to the sum of the individual estimates of these items. Recent research has shown, however, that this is not always the case

and that individuals display systematic biases in evaluating the calorie content of combinations of items (Chernev and Gal 2010). In particular, when evaluating combinations of items representing indulgence and health goals, consumers tend to underestimate their calorie content.

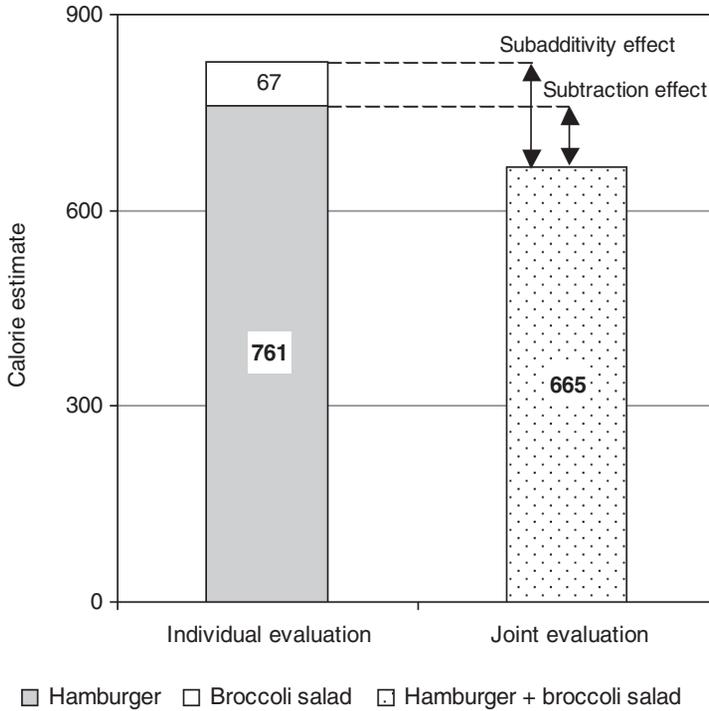
Consider a calorie-conscious person who is choosing between two meals: a lone hamburger or the same hamburger with a green salad on the side. After some deliberation, the consumer chooses the second meal even though, objectively, the two-item meal contains more calories and is, therefore, inconsistent with the primary goal of consuming fewer calories. Despite its inconsistency with a consumer's weight-management goals, the preference for combinations of healthy and indulgent items is not unusual and has been documented in multiple studies.

What motivates consumers to act in a way that is inconsistent with their goals? Building on the notion that people tend to automatically classify food items into healthy and unhealthy (Chandon and Wansink 2007b; Krider, Raghubir, and Krishna 2001), Chernev and Gal (2010) argue that when evaluating combinations of healthy and unhealthy food items, people tend to average their benefits, which leads them to believe that the combination of a healthy and an unhealthy item is healthier than the unhealthy item alone. To illustrate, people tend to think that a hamburger and a salad is healthier than the hamburger alone.

Furthermore, in the absence of readily available calorie information, people are inclined to rely on their impressions of a meal's overall healthiness to infer its calorie content. Because health halos lead people to believe that healthier meals have fewer calories than unhealthy meals, adding healthier items can make the overall meal seem healthier, which in turn can lower its perceived calorie content. This line of reasoning leads to the erroneous conclusion that because the combination of a healthy and an unhealthy item seems healthier than the unhealthy item alone, the combined meal is likely to have fewer calories.

The paradox here is that adding a healthy option can lower the perceived calorie content of the combined meal even in cases when the actual number of calories has not changed or even has increased. For example, people might think that a meal comprising a cheeseburger and a green salad has 500 calories even though they believe the cheeseburger alone to have 600 calories when they evaluate it separately. This, in turn, might lead to the erroneous belief that by consuming a healthy item (e.g., salad) in addition to an unhealthy one (e.g., cheeseburger), a person can actually decrease rather than increase the amount of calories consumed.

Consumers' tendency to perceive that a meal containing both a healthy and an unhealthy item has fewer calories than the unhealthy item by itself has been documented in numerous experiments. In one study (Chernev and Gal 2010), respondents were randomly assigned to estimate the calorie content of a hamburger alone, a broccoli salad alone, or a meal containing both. Respondents estimated that the hamburger by itself had 761 calories and that the broccoli salad by itself had 67 calories. Logically, one would expect that the combined meal would, therefore, have approximately 830 calories. In contrast, respondents estimated that the

Figure 4.3 **Averaging Bias in Combining Healthy and Indulgent Items**

Note: Adding a healthy item to an unhealthy one decreases the perceived calorie content of the combined meal.

hamburger-and-broccoli meal would have 583 calories, which was not only lower than the combined estimates of both dishes but also lower than the perceived calorie content of the hamburger by itself (Figure 4.3). Thus, adding a broccoli salad to the hamburger lowered the estimated calorie content of the entire meal by an average of 96 calories, or 12.6 percent. The fact that respondents evaluated the broccoli salad separately as having positive calories indicates that these data cannot be attributed to the popular belief that broccoli has “negative” calories because the energy used to digest it exceeds its caloric content.

Chernev and Gal (2010) further showed that the observed averaging bias is particular to combinations of healthy and indulgent items and does not hold for a combination of two indulgent items. They asked a separate set of respondents from the same population to estimate the caloric content of a meal comprising the same burger paired with a chocolate chip cookie. The data show that adding a cookie instead of the broccoli salad had the opposite effect of increasing rather than decreasing the perceived calorie content of the combined meal. In particular, respondents perceived the burger/cookie combination to have 859

calories, significantly more than the burger alone. Thus, adding a cookie to the hamburger increased the perceived calorie content of the entire meal by 98 calories, or 12.9 percent.

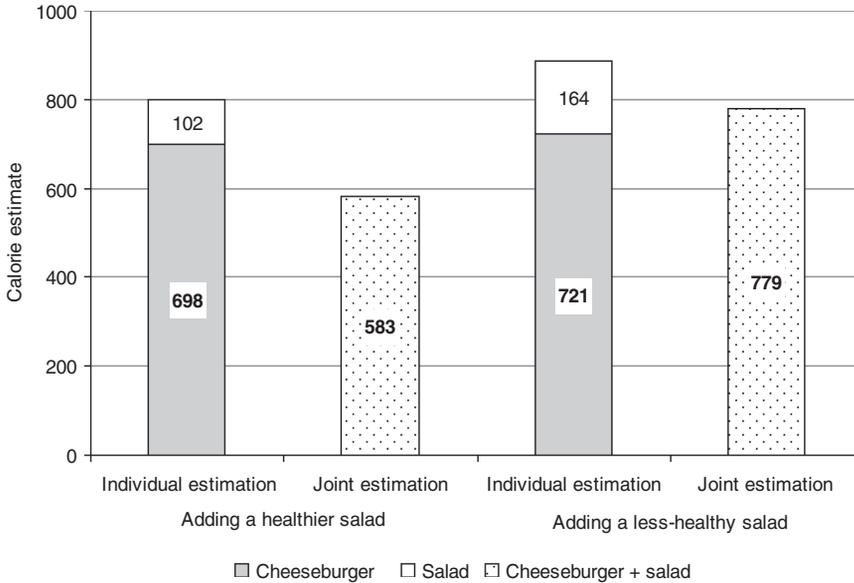
These data indicate that the averaging bias is conceptually different from a simple psychophysical summation bias, whereby a meal is perceived to have fewer calories than the sum of the estimates of its individual components (Chandon and Wansink 2007b; Krider, Raghurir, and Krishna 2001). Indeed, whereas summation bias can predict the subadditivity of the estimates of the individual components of a meal, it cannot account for the subtraction effect in which the perceived calorie content of the combined meal is estimated to be less than the unhealthy item alone (Figure 4.3). Moreover, summation bias cannot account for the fact that the subtraction effect occurs only when combining healthy and indulgent items but not when combining two indulgent items. These findings suggest that averaging bias is conceptually independent from a simple summation bias.

The averaging bias is a function of the degree to which people classify options as healthy or indulgent: combining options that are perceived to be more extreme in their healthiness or indulgence should produce a greater averaging bias. To illustrate, in one experiment (Chernev and Gal 2010) respondents were randomly assigned to estimate the calorie content of a cheeseburger alone, a Caesar salad alone, or a meal containing both. The degree of the perceived healthiness of the Caesar salad was manipulated by giving respondents an evaluation task in which they were asked to compare the healthiness of the Caesar salad to a reference meal. Some of the respondents were asked to evaluate the healthiness of the Caesar salad relative to a broccoli salad, whereas others were asked to evaluate the healthiness of the Caesar salad relative to a black bean chili salad. The rationale for this manipulation was that comparing the Caesar salad to a chili salad would highlight its healthiness, whereas comparing it to a broccoli salad would make the Caesar salad appear less healthy.

The data summarized in Figure 4.4 show that respondents perceived a meal comprising a cheeseburger and a “healthier” (compared to a black bean chili salad) Caesar salad to have fewer calories than the cheeseburger alone (583 vs. 698 calories). In contrast, combining the cheeseburger with the “less healthy” (compared to a broccoli salad) Caesar salad resulted in a directionally opposite effect (779 vs. 721 calories).

Note that even though the subtraction bias (estimating the calorie content of the combined meal as lower than one of its components) was observed only in the presence of the healthier option (Caesar salad compared to chili salad), both conditions produced an averaging bias whereby the combined meal was perceived to have fewer calories than the sum of its individual components ($583 < [698 + 102]$ and $779 < [721 + 164]$). This finding lends further support to the proposition that people tend to underestimate the calorie content of combinations of healthy and unhealthy items.

Figure 4.4 **Averaging Bias as a Function of the Perceived Healthiness of the Combined Items**



Note: The underestimation bias resulting from combining a healthy and an unhealthy item is a function of the degree of perceived healthiness of the items.

POLICY IMPLICATIONS

The reported decision biases have important public policy implications stemming from the fact that people's beliefs about the calorie content of food items influence their purchase and consumption behavior. Below, we review some of the key public policy implications following from the calorie-estimation biases.

Studies have shown that health halos increase consumption and lead people to choose high-calorie beverages, side dishes, and desserts. Wansink and Chandon (2006) found that labeling food as "low-fat" strongly increases intake during a single consumption occasion, especially if the food is categorized as healthy. For example, they found that moviegoers who were given granola labeled as "low-fat" consumed 50.1 percent more granola than moviegoers who were given granola labeled as "regular." Chandon and Wansink (2007a) found that consumers chose beverages, side dishes, and desserts containing up to 131 percent more calories when the main course was a supposedly healthy twelve-inch Italian BLT Subway sandwich compared to when it was a supposedly unhealthy McDonald's Big Mac (even though the Subway sandwich already contained 50 percent more calories than the Big Mac). As a result, they found that meals ordered from "healthy" restaurants could unknowingly contain more calories than meals ordered from "unhealthy" restaurants.

The averaging bias associated with combining healthy and unhealthy options also influences people's choice of a meal. To illustrate, in one experiment (Chernev 2009) respondents were given a choice between two meals—a lone hamburger or a hamburger with an apple. The choice task involved two different hamburgers: a moderately unhealthy cheeseburger or a very unhealthy cheeseburger with bacon. Some respondents saw the apple paired with the moderately unhealthy cheeseburger, while others saw the apple paired with the very unhealthy bacon cheeseburger. Among respondents who saw the bacon cheeseburger by itself, only 9 percent indicated that a calorie-conscious person would choose it. When the same bacon cheeseburger was paired with the apple, however, the percentage of participants who chose the bacon cheeseburger-and-apple meal over the lone cheeseburger increased to 28.6 percent. Thus, moving the apple from the moderately unhealthy burger to the very unhealthy burger resulted in a nearly 20 percent increase in the number of people who thought the bacon cheeseburger meal would have fewer calories. The paradox here is that even though the apple alone was estimated to contain a positive number of calories, adding it to a cheeseburger increased rather than decreased the preference for this burger among consumers concerned with minimizing their calorie intake.

The ubiquity of the halo and averaging biases in calorie estimation and their strong impact on people's consumption decisions raise the question of identifying strategies that will attenuate, if not eliminate, these biases. Below we discuss five such strategies:

1. motivating consumers to pay more attention to nutrition information,
2. mandating the disclosure of calorie information in away-from-home consumption,
3. counterfactual thinking,
4. piecemeal evaluation of meals comprised of multiple items, and
5. de-emphasizing categorical thinking by focusing on quantitative estimates such as meal size.

We then review the existing evidence on the effectiveness of the first three strategies for reducing health halos and of the last two strategies for reducing averaging halos.

Nutrition Involvement

Encouraging consumers to pay more attention to nutrition information is a widespread goal of government intervention. Unfortunately, existing research has cast doubt on its effectiveness. In one study, Chandon and Wansink (2007a) measured consumers' nutrition involvement using a five-item scale that included statements such as "I pay close attention to nutrition information." They then asked consumers with high or low levels of nutrition involvement to estimate the caloric content of typical calorie-equivalent

foods from supposedly healthy (Subway) or unhealthy (McDonald's) restaurants. They found that although nutrition involvement improved the quality of calorie estimations, it did not reduce the halo effects of the restaurant brand's health positioning. Similarly, Provencher, Polivy, and Herman (2008) found that neither dietary restraint nor weight salience moderated health halos. In their study, cookies were perceived to contain fewer calories and were consumed in larger quantities when they were described as "healthy snacks" than when they were described as "gourmet cookies," regardless of whether people were weighed before or after the calorie estimation task and whether or not they were trying to restrict their food consumption.

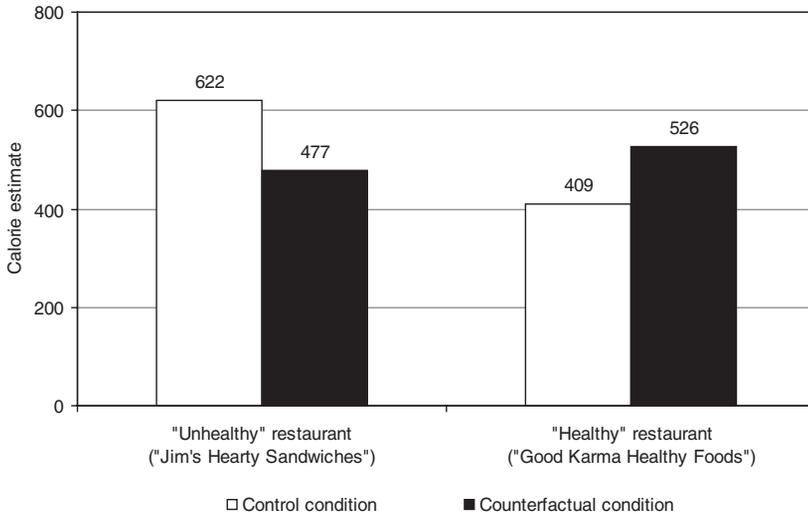
Mandatory Calorie Disclosure

One obvious solution to reduce health halos would be to mandate the disclosure of calorie information not just for packaged goods but also in away-from-home consumption situations. Although opposed by the restaurant industry on the grounds that it is impractical and anticommercial, legislation to that effect is being put in place.³ The question of whether this legislation will prove effective, however, is still open. Thus, one study (Howlett et al. 2009) showed that providing calorie information about a sandwich unexpectedly high in calories reduced consumers' intention to purchase it and reduced their subsequent intake of cookies and candies. On the other hand, prior research conducted for packaged goods suggests that mandatory calorie disclosure alone is unlikely to be sufficient to eliminate health halos simply because not enough consumers pay attention to nutrition information. For example, although some studies found that the Nutrition Labeling and Education Act increased consumer search for and comprehension of nutrition information for packaged goods (Moorman 1996), other studies found no effect on search, recall, or choice (Balasubramanian and Cole 2002).

Counterfactual Thinking

If health halos are caused by priming and selective activation, one solution is to encourage consumers to question the validity of the health claims. The effectiveness of this debiasing strategy is enhanced if people are asked to consider evidence inconsistent with the prime because it increases the accessibility of claim-inconsistent knowledge (Mussweiler, Strack, and Pfeiffer 2000). In one study, Chandon and Wansink (2007a) asked people to estimate the number of calories in a meal consisting of a ham sandwich and a soda (660 calories). They asked another group of people whether they would like to have chips with this meal. They manipulated health halos by way of the restaurant name ("Good Karma Healthy Foods" vs. "Jim's Hearty Sandwiches") and the food available on its menu (e.g., carrot soup vs. a sausage sandwich). Participants in the "consider the opposite" condition were also asked to find arguments supporting the idea that the ham sandwich was a generic meal and not typical of the restaurant serving it. Participants in the control condi-

Figure 4.5 **Counterfactual Thinking Reduces the Effects of Health Halos on Calorie Estimations**

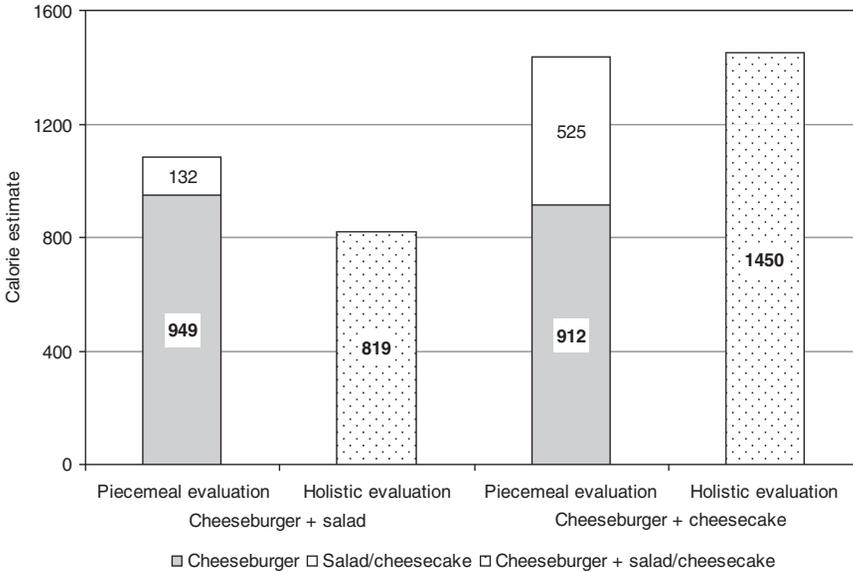


Note: Prompting people to question the health claims of the restaurant eliminates the effects of health halos on calorie estimation.

tion more deeply underestimated the calorie content of the target meal and were more likely to order chips with this meal when it came from the supposedly healthy restaurant than when it came from the supposedly unhealthy restaurant (see Figure 4.5). However, the effects of health halos disappeared in the “consider the opposite” condition in which calorie estimations and side-order consumption intentions were essentially the same regardless of the health claims. Prompting people to question the validity of health primes therefore eliminated halo-based biases.

Piecemeal Evaluation

Prior research indicates that piecemeal estimation tends to improve people’s calorie estimations of a meal (Chandon and Wansink 2007b). Piecemeal evaluation is especially effective in attenuating the averaging bias. Indeed, because the averaging bias is caused by individuals forming an overall evaluation of the healthiness of a meal comprising both healthy and unhealthy items, this bias is less pronounced, or even eliminated, in cases when individuals form separate evaluations of the items. To illustrate, in one experiment (Chernev and Gal 2010) one group of respondents was shown a meal comprising a cheeseburger and a green salad, and another group was shown a meal comprising the same cheeseburger and a piece of cheesecake instead of a salad. In addition, some of the respondents in each group were asked to estimate the calorie content of the entire meal, whereas others were asked to

Figure 4.6 **Piecemeal Evaluations Tend to Reduce the Averaging Bias**

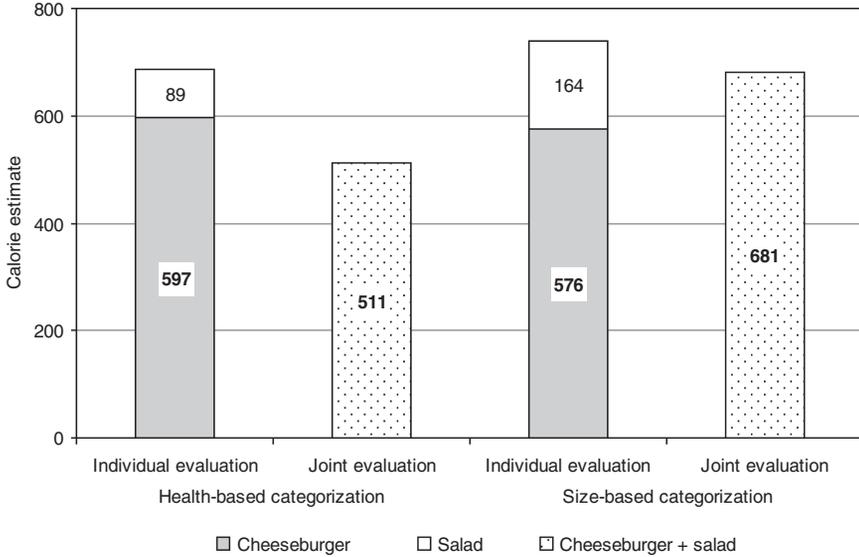
Note: The averaging bias is greater for a meal combining a healthy and an unhealthy item when consumers form an overall evaluation of the items than when the items are evaluated in a piecemeal fashion.

estimate the calorie content of the individual components. In both cases, the meal viewed by respondents was exactly the same; only the manner of estimating (overall vs. piecemeal) differed. The data summarized in Figure 4.6 show that respondents asked to evaluate the calorie content of the cheeseburger-and-salad combination perceived it to have fewer calories than respondents asked to estimate the calorie content of the meal's individual components (819 vs. 1082). In contrast, respondents asked to evaluate the calorie content of the cheeseburger-and-cake combination perceived it to have virtually the same amount of calories, regardless of whether they estimated its calorie content in an overall or a piecemeal fashion (1450 vs. 1437). Thus, when evaluated in a piecemeal fashion, the calorie content of the cheeseburger was essentially the same regardless of whether it was paired with a healthy or unhealthy option (949 vs. 912 calories); however, when evaluated in a holistic fashion, adding a healthy option was perceived to detract calories from the indulgent option.⁴ Piecemeal evaluation therefore improved the accuracy of calorie estimation and attenuated the averaging bias (see also Chernev 2011).

Size-Based Evaluation

Because the averaging bias is a function of individuals' categorical beliefs about a meal's overall healthiness, eliminating this bias might be accomplished by de-

Figure 4.7 **Focusing on Meal Size Tends to Reduce the Averaging Bias**



Note: The averaging bias is greater when consumers focus on the healthiness of a meal rather than its size.

emphasizing people’s attention on the healthiness of the available food items. One approach to shifting people’s attention away from healthiness-based categorization is to emphasize other aspects of the available meals such as meal size. Because larger meals are perceived to have more calories (Chandon and Wansink 2007b; Scott et al. 2008), size-based inferences are likely to work in a direction opposite to health-based inferences, leading to an increase, rather than a decrease, in the perceived calorie content of the combined meal vis-à-vis its individual components. Therefore, when people use alternative means, such as size, to infer a meal’s calorie content, the underestimation effect associated with people’s evaluations of a meal’s healthiness should be attenuated or even disappear.

The impact of evaluating a meal’s size is illustrated by the following experiment (Chernev and Gal 2010). Respondents were divided into three groups: some were shown a meal comprising a cheeseburger, others were shown a meal comprising a carrot-and-celery salad, and the rest were shown a meal comprising the cheeseburger and the carrot-and-celery salad. In addition, all respondents were initially presented with three pairs of items: a cake and an apple, a tomato and a burger, and a chocolate chip cookie and a kiwi. To manipulate consumers’ focus on either the health-related or the size-related aspect of the meal, some of the respondents were asked to indicate which item in each of the three pairs was healthier, while the others were asked to indicate which item in each pair was bigger. The data summarized in Figure 4.7 show that the latter type of categorization led to a reversal

of the averaging bias. Respondents asked to compare the initially presented items according to their healthiness perceived the cheeseburger/salad meal to have fewer calories than the cheeseburger alone (511 vs. 597). In contrast, respondents asked to compare the initially presented meals by size did not display an averaging bias, and their estimates of the cheeseburger/salad combination were essentially the same as the sum of the individual components (681 vs. [576 + 164]). Thus, whereas health-based evaluations were more likely to promote the use of an averaging rule and an underestimation of the calorie content of healthy/unhealthy combinations, size-based evaluations were likely to promote the use of an additive rather than an averaging rule, thus attenuating calorie underestimation.

CONCLUSION

The research outlined in this chapter has important managerial and public policy implications. The finding that adding healthy options to the menu leads consumers to underestimate the calorie content of all foods on the menu (health halo), particularly of meals combining healthy and unhealthy foods (averaging bias), casts a shadow on the potential of healthy options to significantly reduce overeating. While providing an alternative for individuals interested in a healthier lifestyle, the introduction of healthier options ironically can lead to overconsumption stemming from underestimation of the calorie content of the considered meals. Therefore, an important implication of the findings reported in this research is that providing calorie information in a user-friendly format at the time of food selection could help minimize the overconsumption resulting from the reported averaging bias.

Our findings also raise important questions regarding the implications of people's reliance on a healthy/unhealthy classification to make their food consumption decisions. Categorizing foods according to their healthiness is rooted in the actions of many government and private institutions, which use such categorizations to help consumers regulate their food intake. Yet our findings suggest that this approach can sometimes yield exactly the opposite results when it comes to monitoring calorie intake since health-based categorization can lead to underestimating the calorie content of healthy foods and of combinations of healthy and indulgent items. This, in turn, can lead to counterproductive behaviors because people think they are eating a healthier and less caloric meal when they actually are consuming more calories.

NOTES

1. Prior research has shown that errors of calorie estimation partly stem from psychophysical biases in quantity estimation, which lead people to slightly overestimate the calorie content of small portions, to strongly underestimate the calorie content of large portions, and to underestimate the magnitude of portion size changes. For a review of this research, see Chandon (2009).

2. Foods can claim to be low-fat as long as they contain less than three grams of fat per serving, regardless of their caloric content. On average, foods labeled as low-fat do

not contain significantly fewer calories per serving than foods without this label (National Institutes of Health 2004).

3. In 2008, California was the first U.S. state to pass a law stating that restaurant chains with twenty or more locations will be required to post caloric information on menus and indoor menu boards and to provide brochures with nutritional content upon request by January 1, 2011.

4. In addition to providing a remedy for the averaging bias, this experiment illustrates the conceptual distinction between the averaging and halo biases. Indeed, if the observed underestimation was a result of a healthiness “spillover” from the healthy to the unhealthy item, then the underestimation effect should have persisted regardless of the nature of the decision task (overall vs. piecemeal), since respondents in both conditions saw the healthy and unhealthy items next to each other. In contrast, the data show that the observed underestimation effect has its own antecedents that go beyond the halo effect.

REFERENCES

- Allison, David B., Kevin R. Fontaine, JoAnn E. Manson, June Stevens, and Theodore B. VanItallie. 1999. “Annual Deaths Attributable to Obesity in the United States.” *Journal of American Medical Association*, 282 (16), 1530–1538.
- Andrews, J. Craig, Richard G. Netemeyer, and Scot Burton. 1996. “Consumer Generalization of Nutrient Content Claims in Advertising.” *Journal of Marketing*, 62 (4), 62–75.
- Balasubramanian, Siva K., and Catherine Cole. 2002. “Consumers’ Search and Use of Nutrition Information: The Challenge and Promise of the Nutrition Labeling and Education Act.” *Journal of Marketing*, 66 (3), 112–127.
- Burton, Scot, Elizabeth H. Creyer, Jeremy Kees, and Kyle Huggins. 2006. “Attacking the Obesity Epidemic: The Potential Health Benefits of Providing Nutrition Information in Restaurants.” *American Journal of Public Health*, 96 (9), 1669–1675.
- CDC. 2006. *Overweight and Obesity: Contributing Factors*. Washington, DC: Center for Disease Control and Prevention Online.
- Chandon, Pierre. 2009. “Estimating Food Quantity: Biases and Remedies.” In *Sensory Marketing: Psychological Research for Consumers*, ed. Aradhna Krishna, 323–342. New York: Taylor and Francis.
- Chandon, Pierre, and Brian Wansink. 2007a. “The Biasing Health Halos of Fast-Food Restaurant Health Claims: Lower Calorie Estimates and Higher Side-Dish Consumption Intentions.” *Journal of Consumer Research*, 34 (3), 301–314.
- . 2007b. “Is Obesity Caused by Calorie Underestimation? A Psychophysical Model of Meal Size Estimation.” *Journal of Marketing Research*, 44 (1), 84–99.
- Chernev, Alexander. 2009. “The Dieter’s Paradox.” Working paper, Kellogg School of Management, Northwestern University.
- Chernev, Alexander. 2011. “Semantic Anchoring in Sequential Evaluations of Vices and Virtues.” *Journal of Consumer Research*, forthcoming. <<AU: Update?>>
- Chernev, Alexander, and David Gal. 2010. “Categorization Effects in Value Judgments: Averaging Bias in Evaluating Combinations of Vices and Virtues.” *Journal of Marketing Research*, 47 (August).
- Goodhart, Robert S., and Maurice E. Shils. 1980. *Modern Nutrition in Health and Disease*. 6th ed. Philadelphia: Lea and Febiger.
- Heini, Adrian F., and Roland L. Weinsier. 1997. “Divergent Trends in Obesity and Fat Intake Patterns: The American Paradox.” *American Journal of Medicine*, 102 (3), 259–264.
- Howlett, Elizabeth A., Scot Burton, Kenneth Bates, and Kyle Huggins. 2009. “Coming to a Restaurant Near You? Potential Consumer Responses to Nutrition Information Disclosure on Menus.” *Journal of Consumer Research*, 36 (3), 494–503.

- Kardes, Frank R., Steven S. Posavac, and Maria L. Cronley. 2004. "Consumer Inference: A Review of Processes, Bases, and Judgment Contexts." *Journal of Consumer Psychology*, 14 (3), 230–256.
- Keys, Ancel. 1997. "Coronary Heart Disease in Seven Countries." *Nutrition*, 13 (3), 249.
- Krider, Robert E., Priya Raghurir, and Aradhna Krishna. 2001. "Pizzas: Pi or Square? Psychophysical Biases in Area Comparisons." *Marketing Science*, 20 (4), 405–425.
- Lansky, David, and Kelly D. Brownell. 1982. "Estimates of Food Quantity and Calories: Errors in Self-Report Among Obese Patients." *American Journal of Clinical Nutrition*, 35 (4), 727–732.
- Lichtman, Steven W., Krystyna Pisarska, Ellen Raynes Berman, Michele Pestone, Hillary Dowling, Esther Offenbacher, Hope Weisel, Stanley Heshka, Dwight E. Matthews, and Steven B. Heymsfield. 1992. "Discrepancy Between Self-Reported and Actual Caloric Intake and Exercise in Obese Subjects." *New England Journal of Medicine*, 327 (27), 1893–1898.
- Livingstone, M. Barbara, and Alison E. Black. 2003. "Markers of the Validity of Reported Energy Intake." *Journal of Nutrition*, 133 (3), 895S–920S.
- Moorman, Christine. 1996. "A Quasi Experiment to Assess the Consumer and Informational Determinants of Nutrition Information." *Journal of Public Policy and Marketing*, 15 (1), 28–44.
- Mussweiler, Thomas. 2003. "Comparison Processes in Social Judgment: Mechanisms and Consequences." *Psychological Review*, 110 (3), 472–489.
- Mussweiler, Thomas, Fritz Strack, and Tim Pfeiffer. 2000. "Overcoming the Inevitable Anchoring Effect: Considering the Opposite Compensates for Selective Accessibility." *Personality and Social Psychology Bulletin*, 26 (9), 1142–1150.
- Must, Aviva, Jennifer Spadano, Eugenie H. Coakley, Alison E. Field, Graham Colditz, and William H. Dietz. 1999. "The Disease Burden Associated with Overweight and Obesity." *Journal of American Medical Association*, 282 (16), 1523–1529.
- National Institutes of Health. 2004. Diet Myths. Bethesda, MD: NIH Publication No. 04–4561. <http://win.niddk.nih.gov/publications/myths.htm>.
- Oakes, Michael E. 2005. "Stereotypical Thinking About Foods and Perceived Capacity to Promote Weight Gain." *Appetite*, 44 (3), 317–324.
- Oakes, Michael E., and Carole S. Slotterback. 2001. "What's in a Name? A Comparison of Men's and Women's Judgments About Food Names and Their Nutrient Contents." *Appetite*, 36 (1), 29–40.
- Olshansky, S. Jay, Douglas J. Passaro, Ronald C. Hershow, Jennifer Layden, Bruce A. Carnes, Jacob Brody, Leonard Hayflick, Robert N. Butler, David B. Allison, and David S. Ludwig. 2005. "A Potential Decline in Life Expectancy in the United States in the 21st Century." *New England Journal of Medicine*, 352 (11), 1138–1145.
- Provencher, Veronique, Janet Polivy, and C. Peter Herman. 2008. "Perceived Healthiness of Food: If It's Healthy, You Can Eat More!" *Appetite*, 52 (2), 340–344.
- Raghunathan, Rajagopal, Rebecca W. Naylor, and Wayne D. Hoyer. 2006. "The Unhealthy = Tasty Intuition and Its Effects on Taste Inferences, Enjoyment, and Choice of Food Products." *Journal of Marketing*, 70 (4), 170–184.
- Rozin, Paul, Michele Ashmore, and Maureen Markwith. 1996. "Lay American Conceptions of Nutrition: Dose Insensitivity, Categorical Thinking, Contagion, and the Monotonic Mind." *Health Psychology*, 15 (6), 438–447.
- Sacks, Frank M., George A. Bray, Vincent J. Carey, Steven R. Smith, Donna H. Ryan, Stephen D. Anton, Katherine McManus, Catherine M. Champagne, Louise M. Bishop, Nancy Laranjo, Meryl S. Leboff, Jennifer C. Rood, Lilian de Jonge, Frank L. Greenway, Catherine M. Loria, Eva Obarzanek, and Donald A. Williamson. 2009. "Comparison of Weight-Loss Diets with Different Compositions of Fat, Protein, and Carbohydrates." *New England Journal of Medicine*, 360 (9), 859–873.

- Scott, Maura L., Stephen M. Nowlis, Naomi Mandel, and Andrea C. Morales. 2008. "The Effects of Reduced Food Size and Package Size on the Consumption Behavior of Restrained and Unrestrained Eaters." *Journal of Consumer Research*, 35 (3), 391–405.
- Thompson, Tommy G., and Ann M. Veneman. 2005. *Dietary Guidelines for Americans*. 6th ed. Washington, DC: U.S. Government Printing Office.
- USDA. 2008. MyPyramid.gov: Steps to a Healthier You.
- Wansink, Brian. 2006. *Mindless Eating: Why We Eat More Than We Think*. New York: Bantam Books.
- Wansink, Brian, and Pierre Chandon. 2006. "Can 'Low-Fat' Nutrition Labels Lead to Obesity?" *Journal of Marketing Research*, 43 (4), 605–617.
- Werthenbroch, Klaus. 1998. "Consumption Self Control by Rationing Purchase Quantities of Virtue and Vice." *Marketing Science*, 17 (4), 317–337.