Chapter 23

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Mindless Eating: Environmental Contributors to Obesity

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Everyone—every single one of us—eats how much we eat partially because of what is around us. We overeat not only because of hunger, but also because of family and friends, packages and plates, names and numbers, labels and lights, colors and candles, shapes and smells, distractions and distances, cupboards and containers. This list is almost as endless as it is invisible to us.

Most of us are largely unaware of what influences how much we eat. This is one of the ironies of food consumption research. Dozens of studies involving thousands of people show that people wrongly think that how much they eat is mainly determined by how hungry they are, how much they like the food, and what mood they are in (Wansink, Payne, and Chandon 2007). We all think we are too smart to be tricked by packages, lighting, or plates. This suggests that people may be influenced at a basic level of which they are not aware or which they do not monitor. Understanding these drivers of consumption volume has immediate implications for research, nutrition education, and consumer welfare (Meiselman 1992; Rozin and Tuorila 1993). This review aims to explain what environmental factors unknowingly influence consumption intake and why they do so.

When we examine how much one eats in the ecological context of the food environment, there are two common levels of analysis: macro-level and micro-level. At the macro-level, the focus is on government regulation, food industry incentives, school lunch programs, and advertising campaigns (Brownell and Horgren 2003). <<AU: 2004 in References>> At the micro-level, the focus is on making a choice, such as between fresh fruit or a sweet snack.

Within this broad ecological context, there is an intermediate level that is often overlooked because it lies between the policy arena and personal choice. This intermediate level is the environment in which we live and work. It is a level that can influence food intake without involving the taste, texture, or quality of the food itself. That is, regardless of whether one is eating an apple or an apple pie, these environmental factors can often unknowingly drive intake. To avoid having to continually make caveats about different food categories, it is useful to differentiate those drivers that are independent of the food being examined from those that are more dependent.

We will use the term "eating environment" to refer to the ambient factors that are independent of food, such as atmosphere, the effort of obtaining food, the time of day, the social interactions that occur, and the distractions that may be taking place (Birch and Fisher 2000; Birch et al. 1987; Clendenen, Herman, and Polivy 1994; Pliner 1973). In contrast to the eating environment, the "food environment" refers to those factors that directly relate to the way that food is provided or presented, such as its salience, structure, package or portion size, whether it is stockpiled, and how it is served (Chandon and Wansink 2002; Rolls, Engell, and Birch 2000; Kahn and Wansink 2004). The specific features of a food, such as its taste, texture, nutritional value, and so forth, will not be directly examined here since they relate to the characteristics of a food category and not to the environment where they are eaten (eating environment) or presented (food environment).

Although many of the influences of the eating environment and the food environment have been identified and listed by some scholars (Stroebele and de Castro 2004), others have focused on identifying the domain of their influence, such as the kitchenscape, tablescape, platescape, and foodscape (Sobal and Wansink 2007). Perhaps a richer way to view the influence of these environments is by referring to *how* they influence our consumption. While the quantity of a food a person serves and eats is partly determined by personal norms (what they usually serve and eat), they can also be altered on any given occasion by the environmental cues around them. These cues can suggest an altered consumption norm, and can also interfere with our ability to monitor how much we have eaten. As figure 23.1 indicates, two of the principal ways in which these environments influence how much we consume is through (1) the consumption norms they suggest, and (2) the way they disrupt our intake monitoring ability.

<Insert Figure 23.1 about here>

Although the environmental factors outlined in figure 23.1 will be discussed individually, it is important to realize that they operate simultaneously. Consider the end-of-the-year weight gain that many experience over the holidays (Yanovski et al. 2000; Rosenthal et al. 1987). For most, this weight gain is a combined result of both the eating environment and the food environment. The holiday *eating environment* directly encourages overconsumption because it involves long parties (long eating durations), convenient leftovers (low eating effort), friends and relatives (eating with others), and a multitude of distractions. At the same time, the *food environment*—the salience, structure, size, shape, and stockpiles of food—simultaneously facilitates overconsumption.

After underscoring the ubiquitous impact that consumption norms and consumption monitoring have on behavior, this review describes the systematic influences of the eating environment and the food environment. For researchers, this review shows that redirecting our focus to the "whys" or to the processes behind consumption will raise the profile and impact of our research. For health professionals, this review underscores how small structural changes in personal environments can help reduce the unknowing overconsumption of food.

Why Do Environmental Cues Make Us Overeat?

It has often been suggested that we overeat from larger portions because we have a tendency to "clean our plate" (Birch et al. 1987). While this may appear to *describe* why many people eat what they are served, it does not *explain* why they do so or why they may overserve themselves to begin with. Figure 23.1 suggests two reasons that portion size may have a ubiquitous, almost automatic influence on how much we eat: First, portion sizes create our consumption norms; second, we underestimate the calories in large portion sizes.

Environmental Cues Bias Consumption Norms

People can be very impressionable when it comes to how much they eat. There is a flexible range as to how much food an individual can eat (Herman and Polivy 1984), and one can often "make room for more" (Berry, Beatty, and Klesges 1985). For this reason, a person may be quite content eating 6–10 ounces of pasta for dinner without feeling overly hungry or overly full.

A key part of figure 23.1 is the role of *consumption norms* (Wansink 2004). For many individuals, determining how many ounces of pasta to serve themselves for dinner is a relatively low-involvement behavior which is a difficult nuisance to continually and accurately monitor. Sometimes people rely on consumption norms to help them determine how much they should consume. Food-related estimation and consumption behavior can be based on how much one normally buys or normally consumes. Yet consumption can also be unknowingly influenced by other norms or cues that are present in the environment. An important theme of this commentary is that larger packages in grocery stores, larger portions in restaurants, and larger kitchenware in homes all suggest a consumption norm that very subtly influences how much people believe is appropriate to eat.

In one series of studies that we are currently conducting, we ask people to serve the amount of four different foods (ice cream, popcorn, soup, and M&Ms) they thought would be appropriate, typical, reasonable, and normal to consume. However, we vary the size of the bowls (medium vs. large) we give them. Regardless of the food and regardless of the person, the larger the bowl people are given, the larger the consumption norm they believe is appropriate.

Large-size packages, large-size restaurant portions, and large-size dinnerware all have one thing in common—they suggest that it is appropriate, typical, reasonable, and normal to serve larger servings. These all implicitly influence our personal consumption norm for that situation.

Such norms suggest a consumption quantity (or a range) that is acceptable to consume. Large plates or packages may implicitly or at least perceptually suggest that it is more appropriate to eat more food than smaller plates or smaller packages would suggest. The use of consumption norms, as with normative benchmarks in other situations, may be relatively automatic and may often occur outside of conscious awareness (Schwarz 1996).

This is what makes these norms so powerful. Even when made aware of them, most people are unwilling to acknowledge they could be influenced by anything as seemingly harmless as the size of a package or plate. Even when shown that larger packages and plates lead them to serve an average of 31 percent more food than matched control groups, 98 percent of the diners in these field

studies resolutely maintained that they were not influenced the size of package or plate they were given (Wansink and Sobal 2007); see table 23.1.

<Insert Table 23.1 about here>

We Underestimate the Calories in Large Portions

The second key part of figure 23.1 is the role of *consumption monitoring*. When people pay close attention to what they eat, they tend to eat less. Unfortunately, large portion sizes can either bias people or confuse their estimate of how much they have eaten (Van Ittersum and Wansink 2007).

Our ability to monitor our consumption can help reduce discrepancies between how much we eat and how much we *believe* we eat. Our environment can have an exaggerated influence on consumption because it can bias or confuse estimates of how much one has eaten, or even the number of times one thinks one is actively making a decision about starting or stopping an eating episode.

Not surprisingly, a major determinant of how much one eats is often whether one deliberately monitors or even pays attention to how much one eats (Polivy et al. 1986; Polivy and Herman 2002). In lieu of monitoring how much one is eating, people can use cues or rules of thumb (such as eating until a bowl is empty) to gauge the amount of food consumed.

Unfortunately, using such cues and rules of thumb can yield inaccurate estimates. In one study, unknowing diners were served tomato soup in bowls that were refilled through concealed tubing that ran through the table and into the bottom of the bowls. People eating from these "bottomless" bowls consumed 73 percent more soup than those eating from normal bowls, but estimated that they ate only 4.8 calories more (Wansink, Painter, and North 2005).

Our inability to monitor or estimate how many calories we eat becomes less accurate as portion sizes increase. It used to be believed that obese people were worse at underestimating the calories in their meals than people of normal weight (Lichtman, Pisarska, and Berman 1992). This was even believed to be a contributing cause of their obesity (Livingstone and Black 2003). Recent studies in the *Annals of Internal Medicine* have instead shown that this apparent bias is due to the size of the meals, not the size of people (Wansink and Chandon 2006). All people of all sizes—even registered

nurses and dieticians—are equally inaccurate in their estimations of calories from large portions (Chandon and Wansink 2007). While it initially appears that heavier people are worse estimators of what they eat, a person of normal weight is just as inaccurate at estimating a 2,000-calorie lunch as a heavy-set person. It is just that obese people eat a lot more 2,000-calorie lunches.

With any large-sized portion of food, a lot of calories can be eaten before there is any noticeable sign that the supply has decreased. It does not matter how accurate or how diligent a person is at estimating calories; larger portions obscure any such changes until it is almost too late.

Are We Aware of the Consumption Norms That Have Led Us to Overeat?

People can be very impressionable when it comes to how much they eat (Herman and Polivy 1984). Someone can often "make room for more" (Berry, Beatty, and Klesges 1985; Lowe 1993) and be influenced by consumption norms around them (see figure 23.1). For many individuals, determining how much to eat or drink is a mundane and relatively low-involvement behavior that is a nuisance to continually monitor, so they instead rely on consumption norms to help them determine how much they should consume (Wansink and Cheney 2005). Many seemingly isolated influences on consumption—such as package size, variety, plate size, or the presence of others—may suggest how much is typical, appropriate, or reasonable to eat or drink.

As with normative benchmarks in other situations, they may often be relatively automatic and occur outside of conscious awareness. Indeed, when asked how many food-related decisions he or she makes in a particular day, the average person estimates between 15 and 30. In reality, a number of different studies have shown that the typical person makes between 200–300 food-related decisions a day (Wansink and Sobal 2007) (See figure 23.2.) Moreover, this appears to vary by BMI. Those who are obese (BMI > 30) make the most decisions, but estimate themselves as making the fewest.

<Insert Figure 23.2 about here>

Even when consumption norms do influence us, there is anecdotal evidence that people are generally either unware of their influence or that they are unwilling to acknowledge it (Vartanian and Herman 2005). Past evidence of the presence or absence of this awareness has sometimes been suggested in the context of lab experiments (Nisbett and Wilson 1977). The problem with trying to

generalize from such artificial contexts is that people are generally aware that some manipulation has occurred, and they may be reluctant to acknowledge any influence, primarily because of reactance. This phenomenon can best be observed in the context of controlled field studies conducted in natural environments (Meiselman 1992).

The basic organizing framework is that both the food environment and the eating environment directly contribute to consumption volume. Importantly, however, they also contribute to consumption volume *indirectly* through the mediated impact they have on consumption norms and on perceived consumption volume. For instance, while having dinner with a friend can have a direct impact on consumption (because of the longer duration of the meal), it can also have an indirect influence. This can be due to an individual following the consumption norms set by his friend or because his enjoyment distracts him from monitoring how much he consumes. Although these factors will be discussed individually, they often operate simultaneously. For instance, the holiday weight gain of .37 kg (Yanovski et al. 2000) is probably a combined result of consumption norms, food salience and availability, group sizes, and other factors.

How the Food Environment Encourages Mindless Eating

The allure of ice cream in the freezer is much stronger for most than the allure of broccoli in the refrigerator. Food intake can often be related to the perceived taste or cravings associated with foods (Polivy, Coleman, and Herman 2005; Wansink, Cheney, and Chan 2003), and such cravings can be different across gender and across age groups (Wansink, Cheney, and Chan 2003). One's liking for a food might increase chewing and swallowing rates (Bellisle and LeMagnen 1981) and is generally correlated with greater consumption (Bobroff and Kissileff 1986; Meiselman, King, and Weber 2003).

Despite this link between palatability and consumption, the availability of tasty, highly palatable foods is neither a necessary nor a sufficient cause for overconsumption (Mela and Rogers 1993). People can unknowingly overeat unfavorable foods as much as they do their favorites. This section examines the food-related environmental factors that influence consumption volume but which are unrelated to palatability. They can be characterized as the Five S's of the food environment because

they refer to a food's (1) salience, (2) structure, and (3) size, and also (4) whether it is stockpiled and 5) how it is served.

Salient Food Promotes Salient Hunger

Simply seeing (or smelling) a food can stimulate unplanned consumption (Boon et al. 1998; Cornell, Rodin, and Weingarten 1989). For instance, when 30 chocolate kisses were placed on the desks of secretaries, those candies placed in clear jars were consumed 46 percent more quickly than those placed in opaque jars (Wansink, Painter, and Lee 2005). Similarly, people given sandwich quarters wrapped in transparent wrap were found to eat more than those who were given sandwiches in nontransparent wrap (Johnson 1974).

It had been believed that such increased intake of visible foods occurred because their salience served as a constant consumption reminder. While part of this may be cognitively based, part of it is also psychologically based. Simply seeing or smelling a favorable food can increase reported hunger (Bossert-Zaudig et al. 1991; Jansen and Van den Hout 1991; Klajner et al. 1981; Staiger, Dawe, and McCarthy 2000) and can stimulate salivation (Hill, Magson, and Blundell 1984; Rogers and Hill 1989), which can be correlated with greater consumption (Nederkoorn and Jansen 2002). Recent physiological evidence suggests that the visibility of a tempting food can enhance actual hunger by increasing the release of dopamine, a neurotransmitter associated with pleasure and reward (Volkow et al. 2002). The impact of these cues can be particularly strong with unrestrained eaters (Jansen, Broekmate, and Heijmans 1992).

Although seeing or smelling a food can make it salient, salience can also be internally generated (Schachter 1971). For instance, one food-recall study suggested that eating bouts associated with internally generated salience may involve greater consumption volume than those associated with externally generated salience, such as the sight or smell of a food (Wansink 1994). Another study manipulated the salience of canned soup by asking people to write a detailed description of the last time they ate soup. Those who increased their consumption salience of soup in this way intended to consume 2.4 times as much canned soup over the next two weeks as did their counterparts in the control condition (Wansink and Deshpande 1994).

Structure and Perceived Variety Can Drive Consumption

Rolls and her colleagues have shown that if consumers are offered a plate with three different flavors of yogurt, they are likely to consume an average of 23 percent more yogurt than if offered only one flavor (Rolls et al. 1981). This basic notion that increasing the variety of a food can increase the consumption volume of that food (Miller et al. 2000; Rolls 1986) has been found across a wide range of ages (Rolls and McDermott 1991) and for both genders (Rolls et al. 1992; Rolls et al. 1998).

Recently, however, Kahn and Wansink (2004) have shown that simply increasing the *perceived variety* of an assortment can increase consumption. In one study they gave people an assortment of 300 chocolate-covered M&M candies that were presented in either seven or ten different colors. Although they were identically-tasting candies, people who had each been given a bowl with ten different colors ate 43 percent more (91 vs. 64 candies) over the course of hour than those who were given bowls with seven different colors. Further evidence of how perceived variety (versus actual variety) can influence consumption was shown when people were offered either organized or disorganized assortments of six flavors of jelly beans. Those offered the disorganized assortment rated the assortment as having more variety, and they ate 69 percent more jellybeans (22 vs. 13) than those offered the organized assortment (Kahn and Wansink 2004).

Even if the actual variety of the assortment is not increased, these studies suggest that simply changing the structure of an assortment (such as the organization, duplication, and symmetry) can increase how much is consumed. One reason this occurs is because increases in perceived variety make a person believe he or she will enjoy the assortment more. A second reason this occurs is because increasing the perceived variety can concurrently suggest an appropriate amount to consume (the consumption norm) in a particular situation (Kahn and Wansink 2004).

For researchers, it is important to know that perceptions of variety (Hoch, Bradlow, and Wansink 1999; Hoch, Bradlow, and Wansink 2002; van Herpen and Pieters 2002)–and not just actual variety–can influence consumption. For consumers, it is more important to know that they can physically adjust or design their immediate food environment in order to better control their intake.

The Size of Packages and Portions Suggest Consumption Norms

There is overwhelming evidence that the size of food packaging and portions has steadily increased over the past 30 years (Rolls 2003; Young and Nestle 2002). While this is a trend in much of the developed world, it is particularly prevalent in the United States and may help explain the greater obesity rate in the United States (Brownell and Horgen 2003; <<AU: OR 2004?>>Hannum et al. 2004; Nestle 2002). Rozin and his colleagues have shown that the size of packages and portions in restaurants, supermarkets, and even in recipes is much larger in the United States than in France, which is often considered to be a more food-centric country (Rozin et al. 2003).

In relating this to consumption, it is a well-supported fact that the size of a package can increase consumption (Wansink 1996), as can the size of portion servings in kitchens (Nisbett 1968; Rolls, Morris, and Roe 2002) and in restaurants (Edelman et al. 1986). What is notable is that package and portion size can even increase the consumption of unfavorable foods. For instance, when moviegoers in a Philadelphia suburb were given either medium-sized or large-sized containers of stale, 14-day-old popcorn, they still ate 38 percent more, despite the poor taste of the popcorn (Wansink and Kim 2005). It would appear that environmental cues may sometimes be as powerful—within limits—as the taste of food itself.

The impact of packages and portions on consumption is sizable. People will consume 18–25 percent more of meal-related foods (such as spaghetti) and 30–45 percent more of snack-related foods when the package sizes are twice as big as they would normally be (Wansink 1996). Such predictable increases in consumption occur even when the energy density of a food is altered, as Rolls and her colleagues demonstrated (Ello-Martin et al. 2004; Rolls et al. 2004). Something else clearly drives intake other than satiation; something is driving people to consume these foods past the point of satiation. In effect, the volume of food eaten tends to be a better indicator of how "full" one considers oneself than does the calorie density of the food (Rolls, Bell, and Waugh 2000; Rolls et al. 1998; Rolls, Morris, and Roe 2002.).

An important program of child development research by Birch and Fisher has shown that portion size first begins to influence children between three and five years of age (Birch et al. 1987; Rolls, Engell, and Birch 2000; Fisher, Rolls, and Birch 2003). This tendency to let portion size influence their consumption volume has been referred to as the "clean-your-plate" phenomenon or the completion principle (Siegel 1957) because of its possible developmental implications.

Unfortunately, neither of these suggested mechanisms explains why large packages also increase the pouring of less-edible 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 portions were too large to eat in one sitting (Folkes, Martin, and Gupta 1993; Wansink 1996). In both situations, people poured or consumed more even though there was no possibility of "cleaning one's plate."

The more general explanation of why large packages and portions increase consumption may be because they suggest larger consumption norms (recall figure 23.1). They implicitly suggest what might be construed as a "normal" or "appropriate" amount to consume. Even if one does not clean her plate or finish the contents of a package, the size of the food presented gives her liberty to consume past the point at which she might have stopped with a smaller, but still unconstrained, supply.

Stockpiled Food is Quickly Consumed

Having large stockpiles of food products at home (such as multi-unit packages purchased at wholesale club stores) can make those products more visible and salient than less plentiful ones. Not only do stockpiled products take up a great deal of pantry space, but they are often stored in salient locations until they are depleted to more manageable levels (Chandon and Wansink 2002). Because visibility and salience can stimulate consumption frequency, it is often alleged that bulk-buying or stockpiling causes overconsumption and may promote obesity.

To investigate this, Chandon and Wansink directly stockpiled peoples' homes with either large or moderate quantities of eight different foods. They then monitored each family's consumption of these foods for two weeks. It was found that when convenient, ready-to-eat foods were initially stockpiled, they were eaten at slightly twice the rate as non-stockpiled foods (an average of 112 percent faster) (Chandon and Wansink 2002). After the eighth day, however, the consumption of these stockpiled foods was similar to that of the less-stockpiled foods, even though plenty of both remained in stock. Part of this eventual decrease was due to "burn-out" or taste satiation (Inman 2001), but another factor was that the inventory level of these foods dropped to the point where they became much less visually salient (Wansink and Deshpande 1994).

To investigate the link between the visibility of stockpiled food and obesity, Terry and Beck (1985) compared food storage habits in homes of obese and non-obese families. Curiously, while their first study showed that stockpiled food tended to be visible in the homes of obese families, their second study showed the opposite. In general, however, recently stockpiled products tend to be visually salient, and this is one important reason that they are frequently consumed.

Serving Containers That are Wide or Large Create Consumption Illusions

Nearly 72 percent of a person's caloric intake is consumed using serving aids such as bowls, plates, glasses, or utensils (Wansink 2005). If a person decides to eat half a bowl of cereal, the size of the bowl can act as a perceptual cue that may influence how much they serve and subsequently consume. Even if these perceptual cues are inaccurate, they offer cognitive shortcuts that can allow serving behaviors to be made with minimal cognitive effort.

Consider drinking glasses and the vertical-horizontal illusion. Piaget and others have shown that when people observe a cylindrical object (such as a drinking glass), they tend to focus on its vertical dimension at the expense of its horizontal dimension (Krider, Raghubir, and Krishna 2001; Piaget 1969; Raghubir and Krishna 1999.). Even if the vertical dimension is identical to that of the horizontal dimension, people still tend to overestimate the height by 18–21 percent. This general principle explains why many people marvel at the height of the St. Louis Arch but not at its identical-size width.

In the context of drinking glasses, when people examine how much soda they have poured in their glass, there is a fundamental tendency to focus on the height of the liquid that has been poured and to downplay its width. To prove this, Wansink and van Ittersum conducted a study with teenagers at weight-loss camps (as well as a subsequent study with non-dieting adults) and showed that this basic visual bias caused teenagers to pour 88 percent more juice or soda into short, wide glasses than into tall, narrow glasses that held the same volume (and to subsequently consume more) (Wansink and Van Ittersum 2003). These teenagers believed, however, that they poured half as much as much as they actually did. Similar support was found with veteran Philadelphia bartenders. When asked to pour 1.5 ounces of gin, whiskey, rum, and vodka into short, wide

(tumbler) glasses, these bartenders poured 26 percent more than when pouring into tall, narrow (highball) glasses (Wansink and Van Ittersum 2003).

What about the size of plates and bowls? The size-contrast illusion suggests that if we spoon 4 ounces of mashed potatoes onto a 12-inch plate and 4 ounces onto an 8-inch plate, we will underestimate the total amount spooned onto the larger plate because of its greater negative space, even though they contain the exact same amount (Wansink and Van Ittersum 2010). That is, the size contrast between the potatoes and the plate is greater when the plate is 12 inches than when it is 8 inches. A study at an ice cream social showed similar results. People who were randomly given 24-ounce bowls dished out and consumed 15–38 percent more ice cream than those who were given 16-ounce bowls (Wansink, Van Ittersum, and Painter 2006). The same appears to be true with spoon sizes. When cough medicine was given to health center patients, the size of the spoon they were given increased the dosage they poured by 41 percent over the recommended dosage level (Wansink and Van Ittersum 2004). With plates and bowls and spoons, there is a basic tendency to use their size as an indication of how much should be served and consumed.

How the Eating Environment Stimulates Consumption

What causes the initiation and the cessation of eating? One study asked restrained dieters to maintain a consumption diary and to indicate what caused them to start and to stop eating (Tuomisto et al. 1998). Aside from hunger, people claimed they started eating because of the salience of food ("I saw the food"), the social aspects of eating ("I wanted to be with other people"), or simply because eating provided them with something to do ("I wanted something to do while watching TV or reading"). When asked why they stopped eating, some of them pointed to environmental cues (such as the time or the completion of the meal by others), which served as external signals that the meal should be over (Schacter and Gross 1968). <<AU: Not in References; also, s/b Schachter?>>Others stopped eating when they ran out of food, and still others stopped because their television program was finished or because they were at a stopping point in their reading.

These findings are consistent with other research (Rozin et al. 1998) that suggests people may have continued to eat had they been given more food, more time to eat, or more television to watch.

These responses relating to consumption start and stop times illustrate four important consumption drivers in the eating environment: (1) eating atmospherics, (2) eating effort, (3) eating with others, and (4) eating distractions. These will each be investigated in turn.

Atmospherics Influence Eating Duration

Atmospherics refer to ambient characteristics—such as temperature, lighting, odor, and noise—that influence the immediate eating environment. Consider the direct physiological influence that temperature has on consumption. Ambient temperature leads people to consume more during prolonged cold temperatures than hot temperatures (Brobeck 1948). The basic process is a result of the body's need to regulate its core temperature by using food and liquid to either warm it or cool it. In prolonged cold temperatures, the body needs more energy to warm and maintain its core temperature (Westerterp-Platenga 1999), therefore more food is eaten. In prolonged hot temperatures, the body needs more liquid to cool and maintain its core temperature (Murray 1987), therefore more liquids are drunk.

While temperature has direct physiological influences on consumption, other atmospherics—such as lighting, odor, and noise—are similar to each other in that they have a much more indirect or mediated impact on consumption. These atmospherics are thought to influence consumption volume partly because they make it comfortable for a person to spend more time eating (see figure 23.3). The longer one eats, the more one consumes.

<Insert Figure 23.3 About Here>

<H3>Lighting</H3>

Dimmed or soft lighting appears to influence consumption in two different ways: (1) by increasing eating duration, and (2) by increasing comfort and disinhibition. It has been widely reported that harsh or bright illumination decreases the amount of time consumers spend in a restaurant (Sommer 1969), while soft or warm lighting (including candlelight) generally causes people to linger and to enjoy an unplanned dessert or an extra drink (Lyman 1989; Ragneskog et al. 1996). Because people are less inhibited and less self-conscious when the lights are low, they are therefore likely to consume more than they otherwise would (Lavin and Lawless 1998).

<H3>Odor</H3>

Odor can influence food consumption through taste enhancement or through suppression (Rozin 1982; Stevenson, Prescott, and Boakes 1999). Unpleasant ambient odors are likely to shorten a meal and suppress food consumption. Yet the reverse is not necessarily true; it is not known whether favorable odors necessarily increase consumption volume. It has been found, for instance, that regardless of whether a person tastes a food or simply smells it, sensory-specific satiety can occur within a reasonably short period of time (Rolls and Rolls 1997). This suggests that while odors can have a depressing impact on consumption, they might not necessarily increase consumption other than by simply influencing one's choice of the food in the first place.

<H3>Noise and the Sound of Music</H3>

Soft music generally encourages a slower rate of eating, a longer meal duration, and a higher consumption of both food and drinks (Caldwell and Hibbert 2002). The more one enjoys the music, the more comfortable and disinhibited they feel, and the more likely they are to order a dessert or another drink (Milliman 1986). In contrast, when music (or ambient noise) is loud, fast, or discomforting, people tend to spend less time in a restaurant (North and Hargreaves 1996). In some cases, however, such an abbreviated meal can also lead people to quickly clean their plates and overeat without taking time to monitor the extent to which they are full (Lindman et al. 1986; Roballey, McGreevy, and Rongo 1985). Although more controlled fieldwork needs to be done in this area, it appears that both extremes (soft, comforting music as well as loud, irritating noise) increase consumption, but in different ways.

Increased Effort Decreases Consumption

Effort is related to the ease, access, or convenience with which a food can be consumed. It is one of the strongest influences on consumption (Levitsky 2002; Wansink 2004). The effort it takes to obtain food often explains which foods people prefer and how much they will consume (Wing and Jeffery 2001). Cafeteria studies showed that people ate more ice cream when the lid of an ice cream cooler was left open instead of closed (Meyers, Stunkard, and Coll 1980), that they consumed more milk when the milk machine was closer to the dining area (Lieux and Manning 1992), and that they imbibed more water when a water pitcher was sitting on their table than when it was farther away (Engell et al. 1996).

Scores of studies have investigated effort and animal feeding (such as pressing bars for food pellets), but surprisingly few have been conducted with people (Levitsky 2002). Notable exceptions showed that obese people were much more likely to eat almonds if they were shelled versus unshelled (Schachter and Friedman 1974), and they were more likely to use silverware instead of chopsticks (which require more effort) when compared to normal-weight patrons in Chinese restaurants (Schachter, Friedman, and Handler 1974). This same impact of effort has also been found with non-obese secretaries who were given chocolate candies that were either placed on their desks or two meters away from their desk. When they had to only reach for them on their desk, secretaries ate 5.6 more chocolates a day then when they had to stand up and walk two meters for them (Painter, Wansink, and Hieggelke 2002). These results help corroborate the initial findings regarding effort (Hearn et al. 1989), particularly when the foods are ready to eat (Chandon and Wansink 2002).

While these studies focused on physical effort, psychological effort may also play a role in consumption. Recent plate waste studies among U.S. soldiers indicate that once any component of a field ration is opened, it is generally completely consumed. Although the physical effort to open the small component packages in a field ration is minimal, there may be a psychological barrier that prevents a person from opening another individual item. Follow-up lab studies suggest that people tend to eat less when offered multiple small packages than when offered a large package of the same volume. Part of the reason is because these smaller packages provide discrete stopping points for consumption (Wansink 2004).

Socializing Influences Meal Duration and Consumption Norms

It has been well established that the presence of other people influences not only what is eaten, but also how much is eaten (see figure 23.4). Eating with familiar people can lead to an extended meal (Bell and Pliner 2003). In other cases, simply observing another's eating behavior—such as a role model (Birch and Fisher 2000), parent, friend, or stranger (de Castro 1994)—can provide a consumption norm that can also influence how much the observer eats. These effects can be dramatic. De Castro has shown that meals eaten with one other person were 33 percent larger than those eaten alone (de Castro 2000), and increases of 47 percent, 58 percent, 69 percent 70 percent,

72 percent and 96 percent have been associated with the presence of two, three, four, five, six, and seven or more people, respectively (de Castro and Brewer 1992).

<Insert Figure 23.4 About Here>

Eating with familiar and friendly people also increase how much is eaten because they can help make a meal relaxing, enjoyable, and prolonged. These relaxing, enjoyable meals can reduce one's ability or motivation to monitor how much they consume. In contrast, eating with unfamiliar people can suppress food intake in situations where self-monitoring and self-awareness is high, such as during job interviews or first dates (Pliner and Chaiken 1990; Mori, Chaiken, and Pliner 1987; Stroebele and de Castro 2004).

Interestingly, as the number of eating companions increases, the average variability of how much is eaten may actually decrease (Clendennen, Herman and, Polivy 1994). Pliner et al. (2003) <<AU: Please add to References.>>found that people eating alone ate less than those eating in groups of two or four, but that this was driven by the amount of time they spent dining. What is most interesting about this study is that as the number of people in the group increased, the variance in how much they ate appears to have decreased. That is, a person eating alone was likely to eat either much more or much less (on average) than when eating with a larger group.

Indeed, simply viewing the behavior of others has been shown to have an implicit impact on consumption (Herman, Olmsted, and Polivy 1983; Polivy et al. 1979). Studies have shown that individuals will vary the amount of cookies they eat (Roth 2000) <<AU: Pls add to References.>>and the amount of water they drink (Engell et al. 1996) depending on how much others are consuming (Polivy et al. 1979). The impact of these external social cues can be particularly strong on obese individuals (Herman, Olmsted, and Polivy 1983).

Distractions Can Initiate, Obscure, and Extend Consumption

Distractions such as reading or watching television can initiate script-related food consumption that is uncorrelated with hunger, can obscure one's ability to monitor consumption, and can extend the duration of a meal.

It was noted earlier that a diary survey of obese people indicated that some had stopped eating simply because a television program was over or because they had finished reading a magazine

(Tuomisto et al. 1998). Just as the completion of a television show or of a magazine article can lead one to terminate his dinner, a longer television show or a longer magazine article may prolong the duration of a meal past the point of satiation.

While part of the overconsumption associated with distractions such as television and magazines can be related to longer meals, another part of it is that distractions can obscure one's ability to accurately monitor how much has been eaten. One controlled study showed that people who ate lunch while listening to a detective story ate 15 percent more than those who ate their lunch in silence (Bellisle and Dalix 2001). Distractions such as television, reading, movies, and sporting events may simply redirect attention to the point where orosensory signals of satiation are ignored (Poothullil 2002). Consistent with this, another study showed that the key correlate of how much popcorn people ate in a Chicago movie theater was whether they claimed that they paid more attention to the movie or to how much they ate (Wansink and Park 2001). The more attention they paid to the movie, the more popcorn they ate.

In addition to the influence that these distractions have on meal duration and on monitoring consumption, they can also evoke consumption scripts which can initiate consumption because they lead people to associate the distraction with food. In fact, one's consumption during these events—be it a hot dog at a ballgame or popcorn during a movie—might simply be influenced by behaviorally ingrained eating scripts. That is, eating in these situations might be related more to habit than to hunger. Indeed, people in a two-week panel study were asked to indicate how hungry they were each time they ate a meal or snack. People who watched television while eating meals or snacks reported being less hungry than those who were not watching television when they ate (Stroebele and de Castro 2004).

All of these findings are consistent with the basic notion that people may elect to snack in these distracting environments because such eating is part of a habitual consumption script and not because they are necessarily hungry. Rozin showed that amnesiac patients who were told it was dinner time ate a second complete meal only 10 to 30 minutes after having eating a prior meal (Rozin et al. 1998). Even if they are not physically hungry, simply thinking it is time to have a meal or a snack is enough to cause some people to eat (Schacter and Gross 1968; <<AU: Pls verify name

and add to Refs>>Weingarten 1984). Both children (Del Toro and Greenberg 1989; Dietz and Gortmaker 1985) and adults (Jeffery and French 1998; Tucker and Bagwell 1991; Tucker and Friedman 1989) tend to snack more when watching television, and they may do so even if they are not physically hungry. Although it is frequently found that television viewing, food intake, and obesity are related (Gortmaker, Dietz, and Cheung 1990; Klesges, Shelton, and Klesges 1993), these correlational studies are often confounded with factors such as a general lack of physical inactivity. Nevertheless, they do suggest an important relationship between distracted inactivity and consumption intake (Taras et al. 1989).

Yet this basic connection between distractibility and food intake may have an even more fundamental connection to obesity. Past work has indicated that obese people have a greater tendency to be distracted than non-obese people (Rodin 1974). In a media-rich, food-rich environment, people who are distraction-prone will not be able to accurately monitor their consumption and thus are likely to overeat. If obese people are more distraction-prone, they should tend to eat even more than normal weight people in identical, distracting circumstances, whether it involves a television program, a magazine, a newspaper, or a conversation.

Conclusion

In the past 30 years, reasonable advances have been made in "outcome-based" research regarding the environmental factors that influence intake. These studies have provided a convergent understanding along with important investigations into boundary conditions. The field of food consumption and intake is at a point, however, where the next evolutionary step needs to be in the direction of understanding the "whys" behind food intake. The focus needs to move beyond showing what we do to explain why we do what we do. This will entail more of a focus on developing and testing process-models and theories of consumption. Doing so will allow more productive integration across studies and an attempt to identify the more fundamental low-involvement drivers of consumption.

Two general mediators that appear to be promising starting points are the notions of consumption norms and consumption monitoring. As noted in figure 23.1, both of these are likely

to be factors that at least partially mediate the impact of seemingly disparate concepts on consumption (such as package size, variety, and social influences).

The environment influences food-related decisions consistently throughout the day. There are two problems with this. First, we are not aware of how many decisions we make that are influenced by the environment. Second, we are not aware or we are unwilling to acknowledge that the environment has any impact on us at all. Although we make over 200 more food-related decisions a day than we think, many of these are "automatic" food choices wherein we unconsciously eat without considering what or how much food we select and consume (Rodin 1974). This is consistent with other psychological work that shows that people tend to have flawed self-assessments, leading to overconfidence (Dunning 2005). With food intake decisions, their overconfidence may lead to overconsumption and weight gain.

An important new area for environment and behavior research is to examine why environmental cues are so often discounted, and how the environment could better be altered to work for us rather than against us. Keeping a focus on the mechanisms or processes behind consumption—the "whys" behind it and the "hows" to influence it—will help the interdisciplinary topic of food consumption progress in ways that can raise its profile and its impact on academia, on health practitioners, and ultimately on consumer welfare. Table 23.2, adapted from Wansink (2004), lists environmental influences on food consumption, and how the environment can be altered to reduce food consumption.

<INSERT Table 23.2 about here>

Consumption occurs within a context wherein understanding fundamental behavior has immediate implications for consumer welfare. Yet simply knowing the relationship between environmental factors and consumption will not eliminate its biasing effects on consumers. People are often surprised at how much they consume, and this indicates that they may be influenced at a basic level of which they are not aware or which they do not monitor.

Our environment can unknowingly entice and contribute to our overconsumption of food. On the other hand, altering one's immediate environment to make it less conducive to overeating can help

us lose weight in a way that does not require the discipline of dieting or the governance of another person.

We are at a point of economic and technological development when much of the incremental improvement in our life span—and especially in our quality of life—is likely to come from behavioral changes in our lifestyle. When it comes to contributing to the life span and quality of life in the next generations, well-intentioned marketers may be in a prime position to help lead the movement toward behavior change. Obesity is a good place to start.

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Figure 23.1. Environmental Influences on Overserving and Overeating (Modified from Wansink 2004, *Annual Review of Nutrition*)

Figure 23.2. Number of Daily Food- and Beverage-related Decisions

Figure 23.3. How Atmospherics Influence Food Consumption Volume

Figure 23.4. How Social Interactions Influence Food Consumption Volume

Table 23.1. Field Study Participants Deny the Influence Interventions Have on their Intake Behavior[1]

Sample and Context of Study	Intervention and Findings	"How much did you eat compared to what is typical for you?"				"In this stu larger cont average of do you thir
		Less	About the Same	More	Chi-Square	"I didn't eat more"
40 MBA students at a Super Bowl party in a bar in Champaign, IL (Wansink & Cheney 2005)	Those serving themselves Chex Mix from 4-liter bowls (n=19) served 53 percent more than those serving from 2-liter bowls	23 percent	57 percent	20 percent	10.55 (p<.01)	63 percent
98 adults preparing a spaghetti dinner for two in Hanover, NH (Wansink 1996)	Those given half-full 32-oz. boxes of spaghetti (n=51) prepared 29 percent more than those given full 16-oz. boxes.[3]	18 percent	73 percent	9 percent	70.36 (p<.001)	71 percent
161 afternoon moviegoers in a Chicago suburb (Wansink & Park 2001)	Those given 240-gm buckets (n=82) ate 53 percent more than those given 120-gm buckets	19 percent	75 percent	6 percent	128.77 (p<.001)	15 percent
158 evening moviegoers in Feasterville, PA (Wansink & Kim 2005)	Even when given stale, 14-day-old popcorn, those given 240-gm popcorn buckets (n=40) ate 34 percent more than those given 120-gm	14 percent	78 percent	8 percent	141.65 (p<.001)	12 percent

	buckets of the same popcorn					
Average across all studies (Weighted by the number of subjects per study)		**19** percent	**73** percent	**8** percent	**331.26 (p<.001)**	**52** percent

[1] Answers are from those in the treatment group who received the intervention that resulted in greater consumption

[2] The specific intervention in the study was noted at this point. Here, the example of larger bowls was used.

[3] In this study, people poured spaghetti but did not actually consume it. Questions were modified to reflect pouring instead of eating

[4] The Chi-Square test was conservatively conducted excluding the "Other" response from the analysis. Including this resulting in all *P*s<.001.

Table 23.2. How the Environmental Influences and Can Help Reduce Consumption (Adapted from Wansink 2004)

How Environmental Factors Influence Consumption	**How Environmental Changes Can Help Reduce Consumption**
The Eating Environment	
Eating Atmospherics: Atmospherics Influence Eating Duration	• By having bread plates and entrees removed prior to compl one can finish eating and still socially remain at the table • While soft music and candlelight can improve one's enjoyme a meal, they have calorie intake consequences, and they ca enjoyed in lieu of a dessert.
Eating Effort: Increased Effort Decreases Consumption	• Repackaging foods in smaller containers increases subse opening effort and gives a person pause to reconsider • Tempting foods that are stored in less convenient locations (su in the basement or in a top cupboard) can be "too much troub obtain and unnecessarily consume

	• Leaving serving bowls and platters off the dinner table decrease the amount consumed.
Eating with Others: Socializing Influences Meal Duration and Consumption Norms	• Pre-regulate consumption by deciding how much to eat prior meal instead of during the meal. • Ordering smaller quantities or having portions packaged "t before the meal is completed.
Eating Distractions: Distractions Initiate, Obscure, and Extend Consumption	• Let food regulate the activity, not vice versa. • Pre-allocating how much will be eaten prior to a distraction-re meal or snack (such as a television program) can help avoid "e until it's over."
The Food Environment	•
Salience of Food: Salient Food Promotes Salient Hunger	• Out of sight is out of mind. Tempting, less healthy foods shou stored out of sight. • Increase the consumption of healthy, low-energy-dense foo making them more visible. Recall the popularity of fruit bowl less obese era.
Structure and Variety of Food Assortments: Perceived Variety Drives Consumption	• Decrease consumption in high variety environments (suc buffets, potlucks, or large dinners by putting the food into organized patterns. Conversely, arranging food in less orga patterns may stimulate consumption of healthy foods i cafeterias of retirement homes and hospitals. • Avoid multiple bowls of the same food (such as at parties, dinners, or buffets) because they increase perceptions of v and stimulate consumption
Size of Food Packages and Portions: Packages and Portion Size Suggest Consumption Norms	• Repackaging foods into smaller containers decreases consum by suggesting smaller consumption norms • Pre-plating smaller portions onto plates and leaving the se bowl off the dinner table will decrease consumption.

Stockpiling of Food: Stockpiled Food is Quickly Consumed	• Reducing the visibility of stockpiled foods will re consumption frequency (out of sight out of mind) • Storing stockpiled foods out in a less accessible place or box up will reduce its convenience and thus how frequently consumed.
Serving Containers: Serving Containers that are Wide or Large Create Consumption Illusions	• Replace short wide glasses with tall narrow ones • Use smaller bowls and plates to help reduce serving sizes consumption