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**Slim by Design:
Redirecting the Accidental Drivers
of Mindless Overeating**

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Abstract

We first choose what to eat and then we choose how much to eat. Yet as consumer psychologists, we understand food choice much better than food consumption quantity. This review focuses on three powerful drivers of food consumption quantity: 1) Sensory cues (how your senses react), 2) emotional cues (how you feel), and 3) normative cues (how you believe you are supposed to eat). These drivers influence consumption quantities partly because they bias our consumption monitoring – how much attention we pay to how much we eat. To date, consumption quantity research has comfortably focused on the first two drivers and on using education to combat overeating. In contrast, new research on consumption norms can uncover small changes in the eating environment (such as package downsizing, smaller dinnerware, and reduced visibility and convenience) that can be easily implemented in kitchens, restaurants, schools, and public policies to improve our monitoring of how much we eat and to help solve mindless overeating. It is easier to change our food environment than to change our mind.

Food choice decisions are different than food consumption quantity decisions. The former determine *what* we eat (salad or pasta); the latter determine *how much* we eat (half of it or all). Consumer psychologists and health psychologists have often focused on understanding the mechanisms that influence food choice more than on understanding what influences food consumption quantity. Yet at a time of increasing obesity, understanding what influences how much we eat is as relevant as understanding what we eat (Hall, et al. 2011; Hill 2009; Nestle & Nesheim 2012; Rozin, Ashmore & Markwith 1996; Young & Nestle 2002).

Unfortunately, what we have so far discovered about consumption quantities has been largely been ignored by public health, nutrition, and medicine. Part of this is due to our process-focus and their outcome-focus. As consumer psychologists, we typically focus on causal antecedents, process mediators, statistical significance, psychological individual traits as moderators, and counter-intuitive short-term effects on food choice. In contrast, public health and community nutrition research largely focuses on outcomes, effect sizes, point estimates, actionable interventions, demographic moderators, and long-term effects on weight gain and health. This outcome-focus is really a solution-focus. It ultimately places a premium on potentially effective even if theoretically unsurprising interventions, such as raising prices and nutrition education (e.g., Block, Chandra, McManus & Willett 2010; Ni Mhurchu, Blakely, Jiang, Eyles & Rodgers 2010).

A framework that organizes the drivers to overeating (defined as eating more than one realizes) could help spotlight and stimulate overlooked, creative, prescriptive solutions. As seen in Figure 1, we build on the important distinction between sensory and normative influences first made by Peter Herman and Janet Polivy (2005, 2008) and suggest that 1) sensory, 2) emotional, and 3) normative drivers influence consumption quantity partly because they either facilitate or interfere with consumption monitoring. Although some consumption quantity research has focused on sensory drivers and emotional drivers, these are sometimes either individually specific or otherwise difficult to change in a way that is scalable and cost-effective for public health. Instead, increased attention

needs to be given to consumption norms and to the environmental interventions that can influence them and improve the monitoring of how much we eat (Chandon & Wansink 2011; Wansink 2004).

[Insert Figure 1]

CONSUMPTION MONITORING

We eat more than 1,000 meals a year. We should expertly know how much food we have eaten and it should be easy to know when we are eating past the point when it is no longer pleasurable. Yet when Americans are asked to recall the last time they overate to the point of regret, 83% had done it within the past 10 days (Wansink 2014). Even after eating 1,000 meals year after year, we are remarkably bad estimators of how much we eat, but the errors are not random – they are biased in a systematic way. Herein lie the seeds of a solution: While these errors or biases often lead us to overeat, they can also be leveraged to help us eat less.

Consumption Estimation Inaccuracies

When we eat standard-sized foods in small quantities – such as two eggs for breakfast – it is relatively easy to monitor how much we have eaten. It becomes much more difficult, however, when we have eaten multiple foods or when the portion sizes are not standard, such as a pasta entrée, a home-made cookie, or a large, two-handed fountain drink with no size information.

Prior research describes a consumption range – a *mindless margin* – in which people can either slightly overeat or slightly under-eat without being aware of it (Wansink 2006). Over the course of a meal, studies have suggested that a person can appear to eat up to 15-20% more or less than they typically do without realizing they have relatively over- or under-eaten.

That is, if a person needs 2000 calories to stay in energy balance, they could eat within the 1700-2300 calories without feeling they had eaten less or more than typical. Yet over the course of one year, even 100 fewer or extra calories per day (equivalent to a tablespoon of peanut butter, 8 oz. of soda, or 1 small glass of wine) will make the difference between being six pounds lighter or six pounds heavier (Hall, et al. 2011).¹

This inability to detect small differences partly explains why people are generally unaware of their inability to monitor their consumption and why so much of our consumption—19.9% according to a meta-analysis (Trabulsi & Schoeller 2001)—is under-reported. It also explains why people are generally unaware of the influence of the accidental drivers of mindless eating, whose effects tend to be within that 15-20% range. Importantly, this bias repeatedly occurs regardless of one's nutrition knowledge (Bellisle, Dalix & Slama 2004; Tooze, et al. 2004) and it is exacerbated by the way food is packaged, displayed, and poured (Chandon 2013). When a person either selects or serves a food (before they eat), these biases are perceptual. After a person has already eaten, these biases are memory-related.

Perceptual Biases of Portion Size (Pre-Intake)

The visual biases that lead to overeating begin as soon as people pick up a package or plate. Even though volume and weight information are mandatory on most packages, most people visually infer the volume from the size of the package or the size (medium versus large) mentioned on its label (Lennard, Mitchell, McGoldrick & Betts 2001; Viswanathan, Rosa & Harris 2005). In the case of restaurant portions or convenience store cups, size information is not mandatory and consumers have little choice but to estimate it visually.

Unfortunately, visual cues linked to sizes and shapes can lead to dramatic estimation inaccuracies (Chandon & Wansink 2007b; Folkes & Matta 2004; Krider, Raghubir & Krishna

¹ Forecast obtained from the NIH body weight simulator <http://bwsimulator.niddk.nih.gov>.

2001; Krishna 2007). First, although people are relatively accurate at estimating small quantities of a food, they underestimate large quantities of food by a surprising large margin (Chandon & Wansink 2007b). Just as we all underestimate magnitude changes in volume, weight, or brightness, the subjective estimate of an increasing meal or portion size appears much smaller than it really is. As a rule of thumb, doubling the size of a fast-food portion or product packages only makes it appear to be 50-70% bigger (Chandon & Ordabayeva 2009). This helps explain why obese people so dramatically underestimate their consumption – they simply tend to choose larger meals and portions sizes. In other words, meal size, not body size drives errors when estimating the size of meals (Wansink & Chandon 2006).

These biased perceptions are not a result of people underestimating differences in the height, width, or length of packages or portions. Instead, they are a result of people intuitively believing that these changes in size are additive instead of multiplicative (Ordabayeva & Chandon 2013). This mistaken use of an additive heuristic to solve a multiplicative size estimation problem explains why elongated packages appear bigger than packages with a lower height to width ratio (Krishna 2006; Raghubir & Krishna 1999; Wansink & Van Ittersum 2003). For example, Ordabayeva and Chandon (2013) showed that an object downsized by 24% appears to have been downsized by only 2% when it has been elongated. Because of the primacy of vision over other senses, elongation strongly biases size perceptions even when people are asked to weigh the product by hand. It even leads people to over-pour wine when holding a glass (versus having it set on a table) or when pouring into a wider red wine glass than a more narrow white wine glass of the same capacity (Walker, Smarandescu & Wansink 2014).

Recall Biases of Consumption Quantity (Post-Intake)

Estimating consumption becomes even more difficult once the food has been eaten. Drawing attention to how much food is eaten by leaving residual evidence of consumption in view (such as discarded candy wrappers) facilitates monitoring and decreases consumption quantity (Polivy, Herman, Hackett & Kuleshnyk 1986). In one study, people ate a third fewer stackable potato chips out of tube cans when every seventh chip was colored red (Geier, Wansink & Rozin 2012). In another setting, Super Bowl fans ate 27% fewer chicken wings when waitresses did not remove the bones from the table compared to when they did bus the tables (Wansink & Payne 2007). Adding unobtrusive partitions (such as colored cellophane in between the cookies inside the package, or having every seventh stacked potato chip colored red) can reduce intake because it facilitates consumption monitoring and because it offers an interruption or a “pause point” for a person to ask themselves if they are really that hungry (Cheema & Soman 2008; Geier, et al. 2012).

Impairing the ability to gauge consumption from visual cues increases consumption quantity. In a “dark restaurant” (Dunkelbühne) in Berlin, diners were served regular or larger dinner portions when either eating in total darkness or when eating in a regularly-lit restaurant. Larger portions led to consumption underestimation and to a 36% increase in food consumption in the dark (versus only 22% in the light) yet their subjective satiety were largely unaffected by how much they had consumed (Scheibehenne, Todd & Wansink 2010).

Distractions that Disrupt Consumption Monitoring

Given how difficult it is to accurately monitor our consumption, it is unsurprising that consumers are as easily distracted from how much they are consuming and this generally leads to overeating. With the few exceptions discussed below, consumer research has generally examined the effects of distraction on food choice, not on consumption quantity (Shiv & Fedorikhin 1999; Shiv & Nowlis 2004). For instance, when people are asked to

watch television during lunch, they eat 12% more without it having any corresponding impact on their hunger, satiety, or palatability (Bellisle, et al. 2004). Another study found that people ate 18% more when asked to eat lunch in front of the television and ate 14% more when assigned to eat with a friend (Hetherington, Anderson, Norton & Newson 2006). By videotaping these lunches, it was found that these increases were caused by reduced consumption monitoring. Whereas people who were asked to eat alone spent 85% of the time looking at their meal, this proportion went down to 33% (eating with a friend) and 28% (watching TV).

Distraction also has carryover effects, leading one to forget what they have eaten and to again eat more *after* watching TV (Higgs & Woodward 2009). Conversely, enhancing memory of one's last meal decreases later snack intake, which may be one reason why keeping a food diary has been so effective in weight loss. Not remembering what one has eaten is a major reason why distractions promote overeating. It does not matter whether they are in the form of television, video games, friends, or a book. In a characteristically clever study, Rozin and colleagues even found that amnesiac patients would repeatedly eat the same meal every hour if they were told it was dinner time again (Rozin, Dow, Moscovitch & Rajaram 1998).

Interestingly, there may even be an additional sensory explanation for the pronounced impact distractions have on diets. Recent studies suggest that distractions interferes with the monitoring of specific food attributes, such as flavor, variety, and calorie density (Higgs 2008), and it also delays the onset of taste monotony or sensory specific satiety, which helps determine when a person will stop eating a particular food (Remick, Polivy & Pliner 2009). Its effects can be measured at the physiological level of salivation rate (Epstein, Rodefer, Wisniewski & Caggiula 1992).

Although it is clear that distractions can lead us to overeat, they can also promisingly be used to distract us away from food and to therefore eat less. In one snacking study, people were given an average of one-quarter as much of an afternoon snack as they typically ate and were then given a distracting task to do (return a phone call or deliver an envelope to an office down the hall). Fifteen minutes following their snack, they rated themselves equally sated and equally satisfied as a control group who had eaten four times as much of the snacks (van Kleef, Shimizu & Wansink 2013).

Summary

In the absence of external stopping points, consumption monitoring largely determines consumption quantity decisions. To date, however, consumer psychology research has merely focused on a) documenting the inaccuracies and systematic biases of our consumption estimates, b) showing how they can be explained by perceptual quantity estimation biases, and c) showing that everyday distracting tasks like watching television strongly interfere with monitoring. So while we know a lot about a narrow slice of consumption monitoring, there are many more promising opportunities. For instance, we have typically focused on the negative consequences of distractions, instead of thinking more creatively about how we can harness these distractions to distract ourselves away from the temptation of food before we overeat.

The next sections examine research on the sensory, emotional, and normative drivers of overeating and highlight how they influence consumption quantities by either directly or indirectly interfering with—or facilitating—accurate consumption monitoring.

SENSORY DRIVERS OF CONSUMPTION QUANTITY

Most people wrongly believe that hunger is the biggest determinate of consumption quantity (Glanz, Basil, Maibach, Goldberg & Snyder 1998; Vartanian, Herman & Wansink 2008). In reality—except in the cases of extreme hunger or extreme satiation—physiological cues (hunger, satiation, and gastric distension) play a surprisingly limited role in how much we eat. Instead of reviewing the physiology of hunger itself, we focus on internal sensory cues (such as palatability) and on ambient sensory cues (such as sounds, scents, lighting, and temperature).

Hunger and Satiation Cues

A homeostatic model of eating assumes that people eat to balance their energy inputs and output: They are driven to eat because of declining energy resources (they feel hungry) and they stop eating once they have replenished these resources (they feel full). As a result, hunger and satiation (the opposite of hunger) would naively appear to be the most obvious drivers of consumption quantity (Herman & Polivy 1983). This model seems logically correct at the extremes—such as after a 24-hour fast on one extreme, or after a Thanksgiving dinner on the other extreme. Yet in between, these extremes, the main impact of being hungry seems to have less of an influence on *how much* we eat than on *what* we eat. For instance, buffet goers who had been deprived of food for 18-hours (which is not uncommon when a person skips breakfast) consumed no more food than those who had eaten breakfast three hours earlier. Instead, they ate more starches (French fries and bread) than vegetables or fruit (Wansink, Tal & Shimizu 2012). The same is true when grocery shoppers are hungry. They do not buy greater quantities of food when they are hungry, they simply buy a greater

proportion of less healthy, ready-to-eat foods, including breakfast cereals, cookies, crackers, and potato chips (Tal & Wansink 2013).

To underscore this disconnect between one's hunger and how much we eat, one seven-day study had people keep a food diary and to also rate how hungry they were at various times during the day (Mattes 1990). There was no correlation between how hungry people were and how much they decided to eat. Their eating episodes often occurred when hunger ratings were low or were constant, and very few people displayed any correlation between hunger ratings and number of eating occurrences. Most people eat even when they are not hungry and when eating has stopped becoming pleasurable, and they only stop eating when they reach the point of feeling physically full but short of feeling physically uncomfortable (Poothullil 2002).²

There is a growing body of research suggesting that hunger and satiety are mostly psychological constructs determined by memory and mental simulation (Morewedge, Huh & Vosgerau 2010; Redden 2008). For example, people satiate less when they remember the variety of foods that they have consumed in the past (Redden & Kruger 2009). The worse one's memory of what they just ate, or the perceived ease of recalling past consumption, the less sated one feels and the more desire they have to continue eating (Redden & Galak 2013).

Palatability

² In a large part, this gap between when we feel full and when we stop eating exists because these sensations of fullness or satiety are the outcome of a complex integration of physiological, sensory, and contextual inputs influenced by memory and expectations (Epstein, Temple, Roemmich & Bouton 2009). The effects of the physical and chemical qualities of the ingested food and of oral and gastric signals such as gastric distention on satiation are complex, vary across people, and are highly interactive depending, for example, on the actual location of the food is in the gastrointestinal tract (Cecil 2001; Ritter 2004). For example, the formerly well-established result that liquid foods are less satiating than solid foods has been shown to depend on characteristics such as pre-load volume, the time lag between the pre-load and the next meal, and the quantity and quality of sensory inputs (Almiron-Roig, Chen & Drewnowski 2003; de Graaf & Kok 2010).

Palatability – the anticipated and the experienced pleasure of eating or smelling tasty food – is one major reason why hunger and satiation do not fully explain how much we eat. Palatability is the result of complex multisensory interactions between the smell, oral texture, temperature, viscosity, and the sound made by food when they are being shown, served, or eaten (Auvray & Spence 2008; Rozin 2009; Zampini & Spence 2010).

Never before has a wider variety of tasty, affordable food been more easily available to consume. These sensory cues of palatability increase our subjective feelings of hunger and decrease feelings of satiety (Rozin, et al. 1998). Multiple studies have also shown that they prime the goal of hedonic eating while disrupting consumption monitoring (Stroebe, Mensink, Aarts, Schut & Kruglanski 2008; Stroebe, van Koningsbruggen, Papies & Aarts 2013). The mere sight or smell of palatable food makes people simulate consumption, with its pleasure and rewards, eroding a dieter's willpower and lead to overeating (Papies, Barsalou & Custers 2012; Rogers & Hill 1989). Placing candies in clear (vs. opaque) dishes and close (vs. six feet away) from people's desk was found to double actual consumption quantity but not perceived consumption (Wansink, Painter & Lee 2006).

Ambient Sound, Scent, Lighting, and Temperature

Consider four relevant ambient sensory cues of an eating environment: Sounds, scents, lighting, and temperature. These external (hence non-physiological) sensory cues can have a large impact on consumption quantity because people typically cannot block out, control, or avoid them (Krishna 2012, 2009; Zampini & Spence 2010). With sound, for instance, loud background music has been shown to increase the consumption speed of food and drink (McCarron & Tierney 1989; McElrea & Standing 1992; Stroebele & de Castro 2006) and lead to up to 18% increase in food consumption in a fast food restaurant (Wansink & Van Ittersum 2012). Beyond loudness, in nicer, table-service restaurants, it has been shown that appealing

music leads to longer meals and higher calorie consumption because people are more likely to order a dessert or another drink (Caldwell & Hibbert 2002; Milliman 1986). At least part of music's influence on overconsumption comes from consumption monitoring failures. Pleasant and familiar background music reduces the perception of time duration (Garlin & Owen 2006; Morrin, Chebat & Gelinias-Chebat 2009) and music distracts from the sensations coming from eating the food itself, which further impairs monitoring (Woods, et al. 2011).

Moving on to the other three features of eating environment, the main effects are these: First, pleasant ambient odors that complement a food can increase consumption quantity (Fedoroff, Polivy & Herman 1997, 2003) and offensive or inconsistent odors decrease consumption quantity (Wadhwa, Shiv & Nowlis 2008). Second, similar to loud sounds, harsh lighting makes people eat faster and reduces the time they stay in a restaurant whereas soft or warm lighting (including candlelight) generally causes people to linger and likely enjoy an unplanned dessert or an extra drink (Lyman 1989; Stroebele & De Castro 2004). Third, people eat more when the ambient temperature is below the thermo-neutral zone (Westerterp-Plantenga, van Marken Lichtenbelt, Cilissen & Top 2002). Unlike for sound however, it is not clear whether scents, lighting, and temperature impact consumption quantities because they interfere with monitoring or because they make food less attractive or less of a priority compared with physical comfort (Scheibehenne, et al. 2010; Wansink, Shimizu, Cardello & Wright 2012).

Individual Differences and Eating Restraint

In the 1960's, Stanley Schachter cleverly demonstrated that obese people (compared with normal-weight people) are less influenced by internal physiological cues like hunger and are more influenced by external cues (Herman & Polivy 2008). In one classic study, obese people ate more food after Schachter and Gross (1968) manipulated a clock to make them

believe that it was meal time. They repeatedly ate each time the clock (an external cue) indicated it was the time they usually ate (such as 12:00 and 5:00 PM), and still ate the full consumption quantity eaten by the non-obese (Nisbett & Storm 1974).

Later work has contended that these individual differences have less to do with obesity and more to do with restrained eating, which is often colloquially referred to as “dieting” but more precisely defined as repeated restraint attempts and failures (Fedoroff, et al. 1997; Fishbach, Friedman & Kruglanski 2003; Herman & Deborah 1975). That is, instead of determining when to start and stop eating based on hunger and satiety, restrained eaters use cognitive “dieting” rules to govern what, how much, or how often they should eat. These dieting rules can easily be disrupted by one’s mood, by cognitive load, or by dietary violations such as accidentally eating a “forbidden” hedonic food. These “shocks” demotivate restrained eaters from monitoring how much they eat, and make them more likely than normal eaters to be influenced by external sensory, emotional, and normative cues.

After a 40-year lull, researchers are again studying the relative impact of internal versus external cues. For example, Wansink, Payne, and Chandon (2007) found that when Americans (vs. French) report what led them to stop eating dinner the previous night, they are more likely to report using external cues such as whether their plate was empty or whether the television show they were watching was over. In contrast, the French reported using internal cues such as “I was no longer hungry” or “The food no longer tasted as good.” The same results were found when contrasting normal weight people with obese people regardless of their nationality. Recent research on self-control now distinguishes between successful and unsuccessful restrained eaters or dieters (Fishbach, et al. 2003). For successful dieters, being exposed to palatable food cues actually primed the *opposite* goal of restraint, enabling them to successfully lose or maintain their weight when faced with temptation. Repeated exposure to

temptation actually inoculates them from future self-regulation failures (Dewitte, Bruyneel & Geyskens 2009; Geyskens, Dewitte, Pandelaere & Warlop 2008).

What is recently becoming of interest is how one's surroundings can help facilitate self-regulation – even in the face of temptation. Environments that are devoid of food-related cues (such as the workplace or church) help people better monitor their consumption (Hofmann, Friese & Roefs 2009; Stroebe, et al. 2013). These environments are particularly helpful for people with low-working memory capacity, again underscoring the critical importance of consumption monitoring (Hofmann, Gschwendner, Friese, Wiers & Schmitt 2008).

A new frontier is the one that shows how the impact of different types of cues would change across different levels of hunger. For example, among normal weight people, moderate hunger actually increases reliance on some external cues (such as social imitation) as well as a reliance on sensory and emotional cues (Jansen & van den Hout 1991; Kaufmann 1995; Spiegel, Shrager & Stellar 1989). In contrast, normative cues such as the size of the portion, the size of the container, or the perception of the amount of food, tend to influence most people more similarly (Herman & Polivy 2008; Rolls, Morris & Roe 2002; Wansink & van Ittersum 2007), but may have a slightly exaggerated impact on extroverts compared to introverts (Van Ittersum and Wansink 2013).

Summary

In the past, physiological cues have been the natural starting point to study eating. Recently, however, researchers have shown how seemingly straightforward physiological drivers like hunger and satiation only account for a small percentage of how much we eat. In their review paper, even Herman and Polivy (2008) admit that their path-breaking boundary model – which assumes that hungry individuals eat no matter what – may only be true only in

extreme cases and that other cues (like palatability and external sensory cues) actually influence consumption quantity to a much larger extent than previously believed. Furthermore, palatability and sensory cues have been shown to influence consumption quantities partially because they short-circuit physiological signals.

Finally, these sensory cues appear to drive consumption quantity more for restrained eaters or dieters than other people. For over 30 years, this has been an unexplained paradox. People who watch what and how much they eat – and therefore should be better monitors of their consumption – are repeatedly more impressionable than people who just eat what they feel like eating. Once palatable food or ambient scents (for example) throw them off balance, their cognitive restraint and dieting rules are no longer effective; their consumption becomes disinhibited, and they lose the motivation to monitor their consumption. This suggests that strict consumption monitoring can actually backfire. On the other hand, because another subset of dieters has found a way to make these temptations actually increase their resolve (Geyskens, et al. 2008), there is a rich opportunity to better understand what causes these dramatically different responses, and how new framing, rules-of-thumb, or in-home interventions might be designed to better help restrained eaters stay restrained.

EMOTIONAL DRIVERS OF CONSUMPTION QUANTITY

“Emotional eating” is a term often used to describe the interest that some researchers and most of the popular press appears to have with these eating bouts associated with mood or stress. Such eating bouts are typically defined as involving three or more times the amount of food a person would typically eat in this type of situation (Wansink 1994). Part of this interest with emotional eating and eating bouts may have to do with the episodes being memorable, definable, and dramatic. People can remember the last time they binged on a pint of ice cream

by the light of the freezer door better than they can remember the slightly larger portion of cereal they served themselves a couple days earlier.

It may be, however, that emotional eating is less common than its media mentions would lead one to believe. In one self-reported study, when asked to identify the last time they ate to the point of regret, only 12% attributed this overeating episode to stress, mood, or other emotional cues (Wansink & Chandon 2014), whereas 49% attributed it to hunger and 39% to the palatability of the food. In this section, we review the role of affect valence (positive vs. negative emotions) and the impact of stress and ego depletion.

Affect Valence

For many years, the key insight regarding mood and food was that the worse you felt, the worse you ate. Nowhere was this clearer than in one's choice of comfort foods. One study found that people were 4.2 times more likely to eat a less healthy food (mainly snack foods) when in a negative mood but were 2.5 times more likely to eat a healthier food, such as a meal-related food, when in a positive mood (Wansink, Cheney & Chan 2003). People eat more popcorn and M&M's when they are in a sad mood because they are watching a sad movie but eat more raisins when they are watching a happy movie (Garg, Wansink, and Inman (2007).

Recently, however, it appears this tendency is most common with restrained and stress eaters (Sproesser, Schupp & Renner 2014). With unrestrained eaters, there is less of an impact of mood on food (Macht 1999; 2008). Importantly, this helps explain why most food and mood studies show much smaller effect sizes if they look at a general population and must use an eating restraint measure as a covariate in their analyses (Gardner, Wansink, Kim & Park 2014).

More recent studies have looked beyond valence to examine more specific aspects of emotions such as their temporal orientation and function. Winterich and Haws (2011) found that people experiencing hopefulness (a future-focused positive emotion) consumed less of an unhealthy food than those experiencing a past- (pride) or present-focused emotional state (happiness). Finally, recent studies demonstrate the goal-dependence of emotions (Andrade 2005). In general, sadness increases indulgent eating because it functions as a signal to regulate negative emotions (Gardner, et al. 2014). When the eating enjoyment goal is salient however, sadness functions as a signal to be more vigilant about future losses and makes people less likely to indulge (Salerno, Laran & Janiszewski 2014).

Stress

Overeating research is dominated by studies of stress. Animal studies have examined the effects of physical stressors – such as extended immersion in ice water – and focused on identifying its physiological pathways to subsequent behaviors (Adam & Epel 2007). These studies suggest that stress increases the reward value of palatable food because it stimulates opioid release which decreases the stress response. Still, these theories assume that stress uniformly leads to overeating.

Human studies have focused on why some people respond differently to stress than others. These studies – which mostly focus on restrained eaters – use a variety of creative manipulations to induce feelings of stress, including threats of shock, watching unpleasant videos, task failures, anticipated public speaking, interpersonal rejection, and remembering negative personal events. One consistent finding has been that restrained (but not unrestrained) female students eat more when stressed, regardless of the particular stressor used. Studies have also found more stress-induced eating among women than men—although this could be explained by the higher prevalence of restrained eating among women (Greeno

& Wing 1994). As an analog, consider the increasing levels of stress college students face throughout the semester. One recent study showed the sales of unhealthy foods sold on a university campus increases across each semester but then drops dramatically back down at the beginning of the next semester (Wansink et al 2012). The opposite pattern was found for healthier foods.

Some studies have examined the link between consumption quantity and depression, which has been linked by some to an extreme form of stress. Because of their strong link with depression, lack of appetite and weight loss have long been considered among the major symptoms of depression (Beck 1972). Still, more recent studies have shown that between one third and half of depressed people gain weight during depression, showing that weight loss is not the useful diagnostic symptom of depression that it was once thought to be (Greeno & Wing 1994).

Depletion

Consistent with stress, one of the more engaging and novel streams related to consumption quantity is one showing that threats to a person's identity and ego increase consumption of indulgent, unhealthy foods (Baumeister, Heatherton & Tice 1993; Lambird & Mann 2006). For example, Baumeister, DeWall, Ciarocco, and Twenge (2005) found that people who were told that no one wanted to work with them ate more cookies, and Inzlicht and Kang (2010) found that the experience of stereotype threat – taking a math test – led women who are highly stigma conscious to eat significantly more ice-cream. In a nationwide quasi-experiment, Cornil and Chandon (2013) showed that people eat more, and less healthily, after a narrow unexpected defeat of their favorite football team, but they tend to eat less and better after a victory.

Fortunately, recent insights suggest self-affirmation can help counter the negative impact of vicarious losses to one's ego as well as to their favorite football team (Cornil & Chandon 2013). Logel and Cohen (2012) even found that, after two and half months, women who had been asked to self-affirm their core values had a lower BMI than those who did not. Now that the impact of depletion has been shown to be robust across people and places, what would be most promising is to discover what advice could be given to people to lessen such an impact.

Summary

Despite its popular press presence, negative affect and stress only reliably appear to increase consumption quantity among restrained eaters. Moreover, despite its past clinical use, under-eating is not the consistent indicator of depression that it was once thought to be. In contrast to these two misperceptions, depletion appears to influence consumption quantity reliably among both restrained and normal eaters.

While the relationship between depletion and overeating is robust, its explanations are not. Whereas some argue that ego threats deplete people's self-regulation resources or motivate them to escape self-awareness (Mandel & Smeesters 2008), others have argued it instead merely skirts attention away from goal conflict and toward reward and gratification (Inzlicht & Schmeichel 2012; Stroebe, et al. 2013). Supporting the idea that depletion impacts attention, studies have found that goal conflict influences the perceived size of food portions (Cornil, Ordabayeva, Kaiser, Weber & Chandon 2014). All these studies point to the role of attention, and hence of consumption monitoring, to how emotional cues lead to overeating.

NORMATIVE DRIVERS OF CONSUMPTION QUANTITY

Whether it is Thanksgiving dinner or a tailgate party, there is a flexible range as to how much food a person can eat and still “make room for more” (Berry, Beatty & Klesges 1985; Ferber & Cabanac 1987; Herman & Polivy 1984). To complicate this, serving sizes are ambiguous. To many, the correct self-serving size appears to be whatever a person thinks is appropriate, normal, typical, and reasonable for them (Wansink 2006). Consumption norm theory (Herman & Polivy 2005; Herman, Roth & Polivy 2003) suggests that the amount a person serves oneself is determined by serving norms that can be internally established, such as how much they usually serve, how much they normally buy, or how much product they think they have left in their pantry (Chandon & Wansink 2006). These norms can also be externally established by the eating behavior of dinner companions (McDowell 1988), by the size of food packaging (such as the one bag of chips, or 20-oz of soft drinks), or the size of dinnerware (Wansink 2010).

Social Facilitation and Social Matching

We eat 30-60% more if we eat with others, according to lab studies and food diary studies in free-living conditions (Herman & Polivy 2005; 2003), and this can increase as much as 75% when eating with friends or family (de Castro & Brewer 1992). These social facilitation effects do not impact self-reported hunger, arousal, or emotionality (de Castro 1990; Patel & Schlundt 2001) and influence consumption quantities partly by extending how long people eat (Bell & Pliner 2003; de Castro 1990; Feunekes, de Graaf & van Staveren 1995; Hetherington, et al. 2006) and partly by priming impression management goals (Mori, Chaiken & Pliner 1987; Pliner, Chaiken & Flett 1990). Eating with others also impairs consumption monitoring. Hetherington, et al. (2006) showed that eating with familiar others

increases consumption quantity by 18% and that this is partly because, when people eat with friends, they only spend 33% of their time looking at their food vs. 85% when they eat alone.

In general, people eat more when their eating companions eat more and less when their eating companions eat less (Brunner 2012; 2003; Romero, Epstein & Salvy 2009). Social matching of food intake is consistent with studies showing that obesity spreads across social networks (Christakis & Fowler 2007). One explanation is that the amount eaten by others provides a social cue as to how much is an appropriate amount to eat (Herman, et al. 2003). Mimicry also contributes to social matching. Real-time observations of dyads of young females showed that they tend to take a bite of their meal at the similar times (Hermans, et al. 2012). People imitate others also in the belief that they will be more liked and accepted. Ingratiation explains why matching is stronger when people want to be socially accepted (Robinson, Tobias, Shaw, Freeman & Higgs 2011) and when the eating companion is similar to them. For example, people with a normal weight are more likely to imitate the serving size of thin than obese people (McFerran, Dahl, Fitzsimons & Morales 2010a) and dieters are more persuaded by a heavy than thin server (McFerran, Dahl, Fitzsimons & Morales 2010b).

Categorization Cues and Health Halos

“Food is either healthy or unhealthy.” People spontaneously categorize food as intrinsically good or bad, healthy or unhealthy, regardless of how much is eaten (Rozin, et al. 1996). This is why people often determine their serving size based partly on whether they categorized the food as healthy or unhealthy. This categorization, in turn, is influenced by the type of food, its health or nutrition claims, its brand, packaging, price, promotion, and distribution. If any of these marketing actions imply or lead one to believe the food is healthier than they would otherwise think, it can lead to a “health halo” (Chandon & Wansink 2007a), whereby people generalize that the food scores favorably on all health and nutrition aspects

(including it being lower in calories), leading them to underestimate its calorie content and to eat more than they think (Andrews, Netemeyer & Burton 1998; Carels, Konrad & Harper 2007). When a food has such a health halo, choosing it can lead a person to also choose more indulgent side dishes in the same meal or more indulgent food in following consumption occasions (Chandon & Wansink 2007a; Finkelstein & Fishbach 2010; Wilcox, Vallen, Block & Fitzsimons 2009). Of course, as shown in Figure 1 in (Chandon 2013), health inferences can also be more negative than they should, an effect referred to as “health horn” by Burton, Cook, Howlett, and Newman (2014). Furthermore, consumers – especially dieters – estimate that a combination of healthy and unhealthy food (such as having a side salad with a hamburger) has fewer calories than the unhealthy food (hamburger) alone. Fortunately, this bias can be eliminated if a consumer can be reminded or primed to think about food quantity (not just quality) and when they estimate calories sequentially (Chernev 2011; Chernev & Gal 2010).

Health halo effects happen for at least three reasons: 1) health halos make people think that they can eat more without breaking their dietary goals, 2) health halos make people hungrier, and 3) health halos reduce guilt (for a review, see Chandon 2013). Health halos robustly operate independently of a person’s BMI, gender, or whether they are a restrained or normal eater (Bowen, et al. 2003; Provencher, Polivy & Herman 2008). Neurological and behavioral responses show that health halos influence the consumption experience itself (and its neural and hormonal effects) and not just its interpretation (Crum, Corbin, Brownell & Salovey 2011; Lee, Frederick & Ariely 2006; Plassmann, O’Doherty, Shiv & Rangel 2008).

Portion Size Cues

People can infer how much is appropriate to eat from the portion size of the food they are served (Rolls, et al. 2002), from the size of the package it comes from (Wansink 1996), from how much they have left in their pantry (Chandon & Wansink 2006), and from the size of the dinnerware that is being used – the plates, bowls, glasses, serving containers, and

serving spoons (van Ittersum & Wansink 2012). Smaller packages, smaller restaurant portions, and smaller dinnerware all have one thing in common. They perceptually suggest to us that it is more appropriate, typical, reasonable, and normal to serve and to eat less food than larger versions would instead suggest.

There is considerable evidence that—with perhaps the exception of children under three—larger packages (Wansink 1996) and serving sizes significantly increases consumption (Chandon & Wansink 2002; Devitt & Mattes 2004; Fisher & Kral 2008; Geier, Rozin & Doros 2006; Marchiori, Corneille & Klein 2012; Rolls, Engell & Birch 2000). These studies have shown that the decrease in calorie intake due to downsizing can often be 30% less (Steenhuis & Vermeer 2009). For instance, it was recently found that the 104 calorie decrease in the newly revised McDonald's Happy Meals did not result in any corresponding within-meal increases in the selection of more caloric options or in additional purchases (Wansink & Hanks 2014). Experimentally, Rolls, Roe, and Meengs (2006) found no differences in hunger when people were served 50% or 100% more food than usual, although their consumption had increased by 16% and 26%, respectively. Indeed, a recent meta-analysis of 104 studies estimates that consumption quantity increases by 35% when serving size is doubled (Zlatevska, Dubelaar & Holden 2014). Importantly, these changes in consumption due to serving size increases or decreases are typically not followed by caloric compensation for up to 10 days (Levitsky & Pacanowski 2011; Rolls, Roe & Meengs 2007; Steenhuis & Vermeer 2009).

Recall earlier that when people were asked to consider the last time they overate and to indicate why they did so, 49% claimed to overeat because they were hungry and 38% said it was because the food tasted really good (Wansink 2014). When it comes to portion sizes, package sizes, and serving sizes, people overeat even when the food does not taste good and when they are not hungry. Supersized servings can even increase the consumption of bad-tasting foods, such as stale 14-day-old popcorn (Wansink & Kim 2005). Consumption increases

of 30% are reported frequently, even for foods with low palatability and even when the calorie count of the food is also increased, suggesting that it is the perception of volume that drives consumption – not eating enjoyment or actual calorie content (Steenhuis & Vermeer 2009; Wansink & Park 2001).

Manipulating the perceived size of the portion, not just its actual size, also leads people to eat more. Labeling products as “small” makes people eat more but think they are eating less (Aydinoğlu & Krishna 2011; Aydınoğlu, Krishna & Wansink 2009). In one study, when restaurant pasta servings were labeled as “Regular” instead of “Double-size,” intake increased from 305 to 463 calories (Just & Wansink 2013).

Even if the total amount of available food is the same, changing the size of the food “unit” itself greatly influences how much one takes. For instance, people served themselves 127% more candies and 69% more pretzels when the candies and pretzels were in large units than when they were available in small (e.g., half a pretzel) units (Geier, et al. 2006). Even “virtual” partitions such as placing a red potato chip every 7 or 14 regular chips, can serve as a cue for appropriate serving size and influence consumption quantities (Cheema & Soman 2008; Geier, et al. 2012). Size perceptions and preferences can also be manipulated simply by adding or removing extremely large or small sizes even if nobody chooses either of them. By virtue of the compromise effect, adding an extremely small or large size alternative makes the middle size more attractive and more frequently selected. Conversely, about two-thirds of the people who chose a medium size beverage chose a larger size when the small size was eliminated, thereby making their previous “medium” size become the new “small” size of the range (Sharpe, Staelin & Huber 2008).

People consume most of their food using serving aids such as bowls, plates, glasses, or utensils (Wansink & Sobal 2007) . Since people seem to serve in rough proportion to the size of their bowl or plate, larger dinnerware leads to larger serving sizes and larger calorie intake

for at least the 54% of Americans who say eat until they “clean their plate” (Collins 2006). For instance, even leading nutritional science professors who were given 24 oz. bowls of ice cream, served and consumed about 39% more ice cream than those given 16 oz. bowls (Wansink, van Ittersum & Painter 2006).

Both packaging and dinnerware can serve as consumption norms because most people, not just “plate-cleaners,” rely on visual cues to stop eating. If a person decides to eat half a bowl of cereal, the size of the bowl acts as a visual cue that influences how much they serve, consume, and waste (van Ittersum & Wansink 2012). To illustrate this, when diners were served tomato soup in bowls that were unknowingly being refilled from tubing that ran through the table and into the bottom of the bowls, they unknowingly ate 73% more soup (Wansink, Painter & North 2005). The effects of perceived consumption become stronger with delay. Another study manipulated both actual and perceived intake by using refillable bowls and showed that actual intake predicts hunger more strongly than perceived intake immediately after consumption, but the opposite occurs two hours after consumption (Brunstrom, et al. 2012).

Glass sizes and shapes also lead nearly all people – even professional bartenders – to over-pour everything from milk to juice to whiskey. Because elongated glasses appear to fill up faster than short, fat glasses with the same volume (Krishna 2006; Raghubir & Krishna 1999), people pour less volume into them and drink less from elongated glasses (Wansink & Van Ittersum 2003). This elongation bias caused summer campers to unknowingly pour and drink 88% more juice or soft drinks into a short, wide glass than into a tall, narrow one of the same volume. Even Philadelphia bartenders poured an average of 32% more gin, vodka, and whiskey into tumblers than highball glasses holding the same volume (Wansink and van Ittersum 2005). Even when shown their bias and asked to pour again two minutes later, they still exhibited an average 21% bias. Volume perception biases also explains why cylindrical

glasses (whose volume increase with both the height and width poured) appear to fill up faster than conical glasses, leading people to over-pour when given “Martini”-shaped conical glasses (Chandon & Ordabayeva 2009). Visual illusions also operate for plates. Because of the Delboeuf illusion, the same amount of food seems smaller on larger plates or on plates with thin rims (McClain, et al. 2013) and this leads people to overserve on larger plates and underserve on smaller ones (van Ittersum & Wansink 2012).

Although decreasing the size of packaging, portions, and plates can appear to robustly decrease same-meal or within-meal food intake without other forms of calorie compensation, there were initially some questions about whether this would persist long enough to have a measureable impact on weight loss (Caine-Bish, Feiber, Gordon & Scheule 2007; Rolls, Roe, Halverson & Meengs 2007). Pedersen, Kang, and Kline (2007) conducted a six-month trial with Type 2 diabetics who were given portion-controlling dinner plates and cereal bowls. Although people were aware of the manipulation, they still lost 4.4 lbs. more than the control condition. A study for an NIH trial (Robinson & Matheson 2014) showed that decreasing plate sizes decreased average meat intake by 34% for adults and 5% for children over a three month period. A second NIH study investigated 216 households in Syracuse, New York, who had been randomly given either 25 or 30.5-cm plates (Hanks, Kaipainen & Wansink 2013). Those who used these plates 10 or more times each week lost 3 lbs. or 1.4% of their BMI over the four month study.

Summary

To understand the extent to which consumption monitoring mediates the effects of normative cues on consumption quantity, it is important to distinguish between visual and social cues. Visual cues operate at an almost unknowing level, influencing expert dieticians and novices alike (Chandon & Wansink 2007b). Even when pointed out, people generally deny they were influenced by such cues. For instance, when 1,214 people in six studies were

told how they were biased by a manipulated consumption norm (a package size, plate size, etc.), 94% persistently and wrongly maintained that they were unaffected (Wansink & Sobal 2007). Moreover, even when they can be convinced, the bartender data reported earlier show that people are still biased the next time serve themselves. With misleading visual cues, it would appear that consumption monitoring is almost hopeless. The easiest solution would simply be to discreetly switch to smaller portions or to use taller glasses or smaller plates which mislead people in the direction of healthier, smaller portions.

In contrast, social cues – such as social facilitation and social matching – provide people with a reference of how much to consume. Eating with others appears to primarily influence our consumption by impairing consumption monitoring by drawing attention away from the food, outside our awareness. However, because drawing attention to social influences generally reduces their effects (Cialdini & Goldstein 2004; Hammond 2010), alerting people that they are being influenced by what others are eating should reduce these normative effects.

NEW DIRECTIONS FOR PROMISING SOLUTIONS

Nowhere in consumer psychology could a researcher have a more immediate, measurable impact on a mother tomorrow morning than when discovering solutions to eating problems. Yet publishing our research results is not the same as solving useful problems. Sometimes we solve interesting theoretical problems that are not practical. Sometimes we solve practical problems with non-scalable answers.

What we seldom do is to ask what implications our research has for consumers who want to change a target behavior. Consider many of the findings reviewed in this paper. One group who would find these – or the derivation of their principles – potentially useful are

dieters who want to lose weight or parents who want their family to eat better. Being very specific about the changes they should make would be a useful way to translate our discoveries into action. When we think in terms of specific advice – how it could be used – it can change how we design studies, discuss results, and disseminate the related implications to consumers, companies, or policy makers (Wansink 2011).

As example, consider the main finding that when chocolate candy dishes were moved off of desks of secretaries and put in opaque containers, they ate half as many (Painter, Wansink & Hieggelke 2002). Although the theoretical point of the research was that food convenience and salience interferes with consumption monitoring, the main relevance to a dieter is the main effect: the closer the candy dish, the more you eat. As a main effect, this basic principle can be extrapolated to provide advice to these people in other areas of their life. For instance, dieters could be advised to:

- Place snacks in the TV room on a table 6 feet farther than where you sit.
- Eliminate the cookie bowl from the kitchen.
- Move cereal boxes off of the kitchen counter.
- Pre-plate entrées and starches in kitchen (don't serve them family style).
- Place a fruit bowl within a three-foot of your most traveled kitchen pathway.
- Serve salad and vegetables family style.

As an illustration, we took the evidence-based findings reported in this paper – and relevant extrapolations of their principles – and developed a Self-Assessment Scorecard with 100 simple tips for dieters (see Table 1-- Wansink 2014). The goal of this scorecard is to be both diagnostic and prescriptive. The recommended changes are unambiguous, binary, and objectively measurable. This self-assessment would give a person a score between 0 and 100 that shows whether they control their eating environment to facilitate healthy eating or whether their environment and habits negatively controls their eating. The lower the score, the

more they are negatively influenced by their eating environment; the higher their score, the more they are using their environment to help them eat healthier. But in addition to being diagnostic, this scorecard also points out exactly what immediate changes they can make to turn their immediate environment around, so that it works for them rather than against them.

[Insert Table 1]

What prevents consumer psychologists from providing clear, objective, simple advice to consumers based on their research? Part of it may be that we cannot often imagine how our research could be used. Because of our interest in theoretical explanations, interactions, and mediations, we often overlook the power that main effects can have in the lives of consumers. Whereas our reputations benefit and our papers are published because of their theoretical contributions, their value to consumers could be because of these simple, basic main effect findings that we typically disregard as "uninteresting."

Table 1 offers one possible take on what we consumer psychologists have discovered and how it might easily fit into people's lives as solutions. To move toward more refined solutions, we will need to 1) view our research as a potential solution to people's problems, but also to 2) conduct our research in a theoretically rigorous way that yields general principles. While the Self-Assessment Scorecard in Table 1 offers a first approximation at such solutions, it also suggests dozens of follow-up opportunities for theoretical rigor that would investigate boundary conditions and mediating mechanisms. Knowing mediating mechanisms will be useful in generating entirely new sets of interventions or new. Knowing the boundary conditions of various interventions will be useful in developing different assessment tools for different people and situations.

Although Table 1 suggests basic changes that might work for most people, some of these changes will work better for some people than for others. For example, as noted earlier, smaller portion sizes do not influence consumption for children under three and do not reduce

consumption when the sizes are so small that restrained eaters view the food as healthy. Similarly, although health halos generally increase consumption quantities, their effectiveness is lower when health claims negatively influence flavor expectations (Kiesel, McCluskey & Villas-Boas 2011; Kozup, Creyer & Burton 2003), for people who care more about taste than nutrition (Irmak, Vallen & Robinson 2011; Vadiveloo, Morwitz & Chandon 2013), for men (Bowen, Tomoyasu, Anderson, Carney & Kristal 1992), and for familiar brands or expert consumers (Hoegg & Alba 2007). Future research needs to examine the robustness of health halos for diverse socio-economic groups and outside the US, where the negative association between health and taste is less pronounced because people associate “healthy” with “fresh” and “high quality” (Fischler, Masson & Barlösius 2008; Werle, Trendel & Ardito 2013).

More generally, research is needed to integrate food choice and consumption decisions. Most of the studies on food choices examine what to eat and not how much is eaten. Conversely, most of the studies reviewed here examined how much to eat *after* the decision of what to eat had already been made. Future research must examine the effects of proposed interventions on both what and how much to eat. For example, downsizing a package – say a soft drink bottle – by elongating it can hide the true extent of the size reduction and thus increase purchasing, yet it could backfire if people finish it earlier than anticipated and decide to consume a second.

Ultimately, learning how to change consumption norms – particularly those resulting from visual cues – hold tremendous promise for researchers for three reasons: 1) Their impact is magnified because of repeated actions, 2) they can be found in an endless number of forms, and 3) their perceptual nature makes consumers more vulnerable to them than they believe. From an intervention standpoint, changing the size of a cafeteria tray or the size label on a restaurant menu can change consumption in an automatic way that does not necessitate willpower or an expensive public health education campaign.

IMPLICATIONS FOR POLICY MAKERS, COMPANIES, AND CONSUMERS

Giving people objective nutrition knowledge about the health costs of overconsumption is necessary but unlikely to be sufficient to change behavior. Exhorting people to change their dietary habits through moralizing and guilt-inducing appeals is not a credible alternative solution. Both ideas fall short because we cannot expect that most people will adopt a cognitively-costly mindful eating approach for the over 200 automatic food decisions that they make every day (Wansink & Sobal 2007). Even though mindful consumption strategies can be learned (Papies, et al. 2012; Peter & Brinberg 2012), it is not clear that most people will be willing to sustain this over the three years that are usually required to lose weight and establish a new equilibrium (Hall, et al. 2011).

This suggests another complementary approach: focusing on changing the choice environment at both the time of purchase and the time of consumption (Thaler & Sunstein 2003). This relies less on persuasion and more on environmental interventions that lead consumers into making slightly better but repeated food choices without thinking about each of them. This is done mostly by altering the eating environment in the ways suggested in Table 1 for one's home environment and in similar ways in the four other places where people purchase or consume food: their most frequented restaurants, their favorite grocery store, where they work, and where their children go to school (Wansink 2014). This small-steps approach is not designed to achieve major weight loss among the obese, but rather to prevent obesity among the 90% of the population that is gradually becoming fat by consuming an excess of less than 100 calories per day (Hill, Wyatt, Reed & Peters 2003).

Leveraging Our Research in Medicine, Nutrition, and Public Health

Although consumer psychologists have been uncovering an increasing number of insights about food consumption behavior, many of these insights have not had their deserving impact on the field of public health, nutrition, or medicine. In addition to what has already been noted, consumer psychology research is often overlooked because of our general lack of interest in consumer heterogeneity. Public health researchers are keenly interested in the differences between men and women, educated and less educated people, old and young, rich and poor, both in the US and abroad. These same researchers—and reviewers—are often disconcerted when we acknowledge that we did not find these distinctions theoretically interesting enough to analyze or even collect. What we see as a conceptually uninteresting null effect (such as the lack of differences between genders) or a confounded or over-determined strong effect (such as strong differences between income levels or ethnicities) can inform key interventions they may be considering.

To have an impact beyond our field, we need to examine how our short-term, cross-sectional results hold across time. Longer time-horizons are particularly important because habituation and compensation can offset short-term effects. Just as the link between behavioral intentions and actual behavior is not perfect, neither is the link between how much a person decides to serve and how much they decide to subsequently eat. Most of our studies measure what someone takes or how much they take, but seldom how much they eat. While there is early evidence that a large percentage of what a person self-serves is eaten – perhaps as much as an average of 92% (Wansink & Johnson 2014), this is not precise enough for the standards of medicine, nutrition, and public health and may vary across people and situations (such as school cafeterias vs. lab studies). Our results might make strong cases, but they do not make precise cases. Because medicine, nutrition, and public health are focused on measurable, tangible behaviors, they consider many of these studies to be the equivalent of behavioral intention studies with no clear proof of impact.

Ideally, new studies would combine the best characteristics of consumer research (including rich psychological insights and multi-method testing), nutrition (including longitudinal designs, representative participants, biomarkers of calorie intake and expenditures), and economics (including population-level interventions and analyses, and policy implications).

To summarize these concerns and the way forward, we can go back to Michel Pham's (2013) presidential address about the seven sins of consumer psychology. We must expand the scope of our research from buyer behavior to actual (repeated) consumption behavior (Sin 1). We need to adopt multiple theoretical lenses (Sin 2). We must go beyond theory testing and do more phenomenon-based and descriptive research and empirical generalization (sin 3). We must go beyond research by convenience and do more grounded field work (Sin 6). And, more generally, we need to do research that is more externally relevant (Sin 7). As noted throughout this review – this requires moving our focus from statistical significance to effect size, from theory testing to prediction models, and from tests of associations to point estimates. Policy makers are not interested in counter-intuitive findings that demonstrate consumer irrationality – these findings are typically small and often occur under narrow, stylized, "hot house" conditions.

Of all academics, consumer psychologists are perhaps in the best position to have a real impact on how people, companies, and legislators think about healthy eating. First, we understand people's full motivations and choices better than nutritionists. Second, we do not demonize the food industry in the same way that many public health and medical researchers do (therefore we have the ability to partner with the players with the biggest impact on consumption). Third, thanks to the multidisciplinary nature of most marketing departments, we can easily collaborate with colleagues across the hall who know how to sophisticatedly model supply—and not just demand—effects, who know how to analyze archival data and estimate

policy effects, who understand the importance of consumer heterogeneity and who, most importantly, understand and generally appreciate the contribution of experimental research. Table 2 outlines the areas in which we—as consumer psychologists—have a key methodological, theoretical, or dispositional edge to powerfully change this domain.

[Insert Table 2]

Helping Companies Make Healthy Profits

A wide range of people and institutions would like to better control a person's consumption of food for a wide range of reasons. Those in the hospitality industry want to decrease food costs (via serving size) without decreasing satisfaction. Those in public policy want to decrease waste, health expenditures, and lost productivity which influence wellbeing. Those in health and nutrition want to decrease obesity and its associated diseases. Those in strenuous field situations, such as combat military and deployed rescue workers, want to decrease *under*-consumption. Those on restricted diets want to decrease calories, fat, or sugar intake.

It is important to realize that food companies are not focused on making people fat; they are focused on making money. Take the notion of single-serving packaging. Although such packaging can increase production costs, the \$43 billion spent in 2013 on diet-related products is evidence that there is a portion-predisposed segment that would be willing to pay a premium for packaging that enabled them to eat less of a food in a single serving and to enjoy it more. For instance, results from a survey of 770 North Americans indicated that 57% of them would be willing to pay up to 15% more for these portion-controlled items (Wansink & Huckabee 2005). Although targeting this "portion-prone" segment will not initially address the immediate needs of all consumers, it can provide the critical impetus that companies need to develop profitable win-win solutions.

There are many more of these win-win solutions that can profitably benefit both companies and consumers; many of which can offer a wide range of profitable segmentation opportunities for companies. One answer to the obesity issue lies in market-based changes that help consumers develop a new appetite for healthy foods. Innovative solutions for de-marketing obesity will be solutions that leverage the basic reasons why we eat the way we eat. In this context, consumer psychology can help companies develop a wide range of solutions, just as has been done with the decrease of portion sizes in Unilever's Seductive Nutrition program, or the reformulation and relaunch of McDonald's Happy Meals (Wansink & Hanks 2014). In a previous article, we outlined dozens of innovative actions taken by food producers, grocers, and restaurants to continue to grow without contributing to the obesity epidemic (Chandon & Wansink 2012).

Bringing Research Home . . . to Consumers

Consumption is a context where understanding fundamental behavior has immediate implications for consumer welfare (Cutler, Glaeser & Shapiro 2003). People are often surprised at how much they consume, and this indicates they may be influenced at a basic level of which they are not aware or do not monitor. Similar to the fundamental attribution error, this explains why simply knowing these environmental traps does not typically help one avoid them (Baranowski, Cullen, Nicklas, Thompson & Baranowski 2003). Moreover, relying only on cognitive control and on willpower is often disappointing (Boon, Stroebe, Schut & Jansen 1998). Yet, consistently reminding people to vigilantly monitor their actions around food is unrealistic. Continued cognitive oversight is already difficult for people who are focused, disciplined, and concentrated. It is nearly impossible for those of us who are not. The studies reviewed here – and their Scorecard manifestation in Table 1 – illustrate how an individual can alter his or her personal environment to help make their family slim by design.

CONCLUSION

As our consumer psychology studies show, our senses, affect, and norms can all entice and contribute to our mindless over-consumption of food. Yet, these studies also show that a personally altered environment can help people more effortlessly control their consumption in a way that does not necessitate the discipline of dieting or the governance by someone else.

If changing the behavior of consumers, food marketers, opinion leaders, and policy makers, is one objective of our research, it is important to realize that it may not happen naturally. Unfortunately, this has been the approach of consumer psychologists over the last decades, and it has led to a disappointing impact outside our field – especially as it relates to changing consumers, companies, and policy. Instead it is important to more actively visualize who will use our research and how they will use it *before* we begin conducting our studies (Mick 2011). Consider the following example discussed by Parmar (2007). Suppose researchers have a working hypothesis that consumers pour more liquid into short, wide glasses than tall, narrow glasses of the same volume. Before conducting that research, the researchers might ask themselves following questions: 1) Who should use this? Managers for bar and restaurant chains and the beverage companies that provide glassware to them. 2) What change could they make? Replace short, wide bar glasses with tall, thin ones to reduce beverage consumption while improving margins. 3) What independent variables are realistic? Barware in sizes and shapes most commonly used by the largest casual dining chains 4) What would make this compelling? Real bartenders in real bars in a real city who pour the four most commonly-poured drinks into the most common glass sizes. Mapping out possible answers to these questions – even though the results of the study are not yet known – will direct the research design to be most potentially impactful. Referred to as “activism research”

(Wansink 2011), these answers can suggest a new context, a different population, or overlooked independent variables that can ignite unanticipated, but rewarding change. It is easier to change our food environment than to change our mind.

Table 1. Slim by Design In-Home 100 Self-Assessment Scorecard

(Reprinted, with permission from Slim by Design, Wansink 2014)

Read each of the 100 statements below. Visualize your home. Indicate whether the statement is true for your home by checking the box to the left. If you believe that your home does not reflect the statement 100% do not check the bubble on the left. After you have completed the checklist, tally all boxes with check marks and write this number in the designated area at the end of the scorecard. This number represents your home's baseline score. A low score indicates your environment is working against you. A high score indicates that your environment is working for you. The boxes which are not checked are areas of opportunity for you to consider implementing in the future.

Dishware

- Plates are between 9-10-inches in diameter
- Plates have a colored rim
- Plates are sectioned
- Cereal bowls are smaller than 20-oz
- Juice glasses are 8-oz
- Glasses are tall and narrow
- Water glasses are 16-oz or larger

Dining Table

- Children under 12 have smaller plates than parents
- Children under 12 have smaller bowls than parents
- Children under 12 have smaller glasses than parents
- Serving bowls are small enough to have to be refilled
- Salad and vegetables are served first
- Salad and vegetables are served family-style (on the table)
- The serving bowls for starches and entrées are not setting on the table
- The serving bowls for starches and entrées are located on the kitchen stove
- Serving spoons Tablespoon-sized or smaller
- Serving tongs are not used
- At least one person at the table is drinking milk
- Everyone has a glass of water
- No wine is being drunk or it is being drunk from tall narrow wine glasses
- No soft drinks are being drunk
- No food packages (other than condiments) are on the table
- Lights are dimmed
- Soft music is being played
- Everyone stays seated until everybody is through eating
- The family eats together at the same time

Kitchen

- No television
- No comfortable chairs
- Earth-tone painted walls (neither too bright or too dark)
- Blender is on the counter
- Toaster is not on the counter

- Breakfast cereal is not visible
- Cookies are not visible
- Snacks are not visible
- A full fruit bowl is visible
- Fruit bowl contains 2 or more types of fruit
- Fruit bowl is within 3 feet of the most common kitchen pathway
- Kitchen has a floral scent
- Kitchen is the major room you enter upon entering home

Refrigerator

- Fruit and vegetables are on the center shelf
- Cut fruit and vegetables are bagged or in a container
- Healthiest left-overs are in transparent containers
- Healthiest left-overs are wrapped in transparent wrap
- Less healthy leftovers are stored in opaque containers
- Less healthy leftovers are wrapped in aluminum foil
- Refrigerator has at least 6 non-fat yogurts in it
- A second low-calorie, high protein snack is available (e.g., string cheese)
- Healthiest snacks are in the front middle
- Less healthy snacks are in the back or the lower sides
- Low-fat milk is in the refrigerator
- Less healthy leftovers are stored in the produce drawers
- No more than 2 cans of soft drinks
- A full pitcher of cold water is always available

Freezer

- Healthiest leftovers are in transparent containers
- Less healthy leftovers are stored in opaque containers
- Less healthy leftovers are wrapped in aluminum foil

Cupboards

- Healthiest foods are in the front middle
- Healthiest foods are eye level
- Less healthy foods are in the back or the lower sides
- Less healthy foods are stored on the bottom or the top
- There is a designated snack cupboard that is inconvenient
- Snack cupboard has a child-proof lock on it (even if no children)

Pantries

- Healthiest foods are in the front middle
- Healthiest foods are eye level
- Less healthy foods are in the back or the lower sides
- Less healthy foods are stored on the bottom or the top
- Pantry is not located in the kitchen

Counters

- Cookies are not visible
- Snacks are not visible
- Candy is not visible
- Regular soft drinks are not visible

- Diet soft drinks are not visible
- Nuts are not visible
- Breakfast cereal is not visible

TV Room

- Full glass or water or water bottle is always next to the chair
- Snacks are located at least 6 feet from seating area
- All snacks are eaten out of bowls, not bags or original containers
- Snacks are eaten from small bowls, 8-oz or less
- Candy wrappers are left on coffee table
- Beverage containers – cans or bottles – are left on coffee table

Home Office

- Full glass or water or water bottle is always on the desk
- Snacks are located at least 6 feet from seating area
- All snacks are eaten out of bowls, not bags or original containers
- Snacks are eaten from small bowls, 8-oz or less
- Candy wrappers are left on coffee table
- Beverage containers – cans or bottles – are left on coffee table

Car

- Never take breakfast, lunch, or dinner in the car.
- No candy.
- No cookies.
- No high-calorie snack.
- Bag of nuts or other healthy snacks available for adults and children.
- Always carry water bottle.
- No soft drink.
- Choose concentrated energy shots over energy drinks to avoid high calorie intake.

Night stand

- No candy.
- No cookies.
- No high-calorie snack.
- Glass or bottle of water handy.

Purse

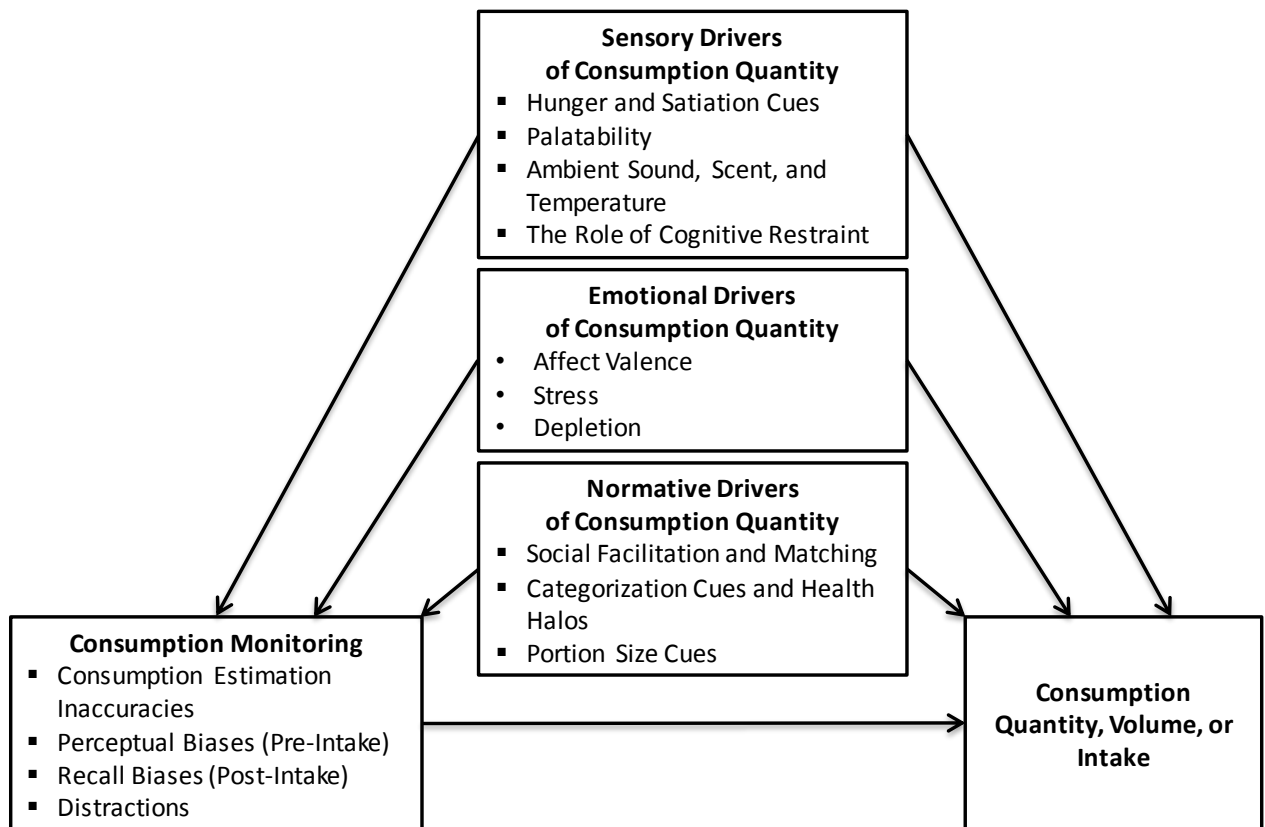
- No high-calorie snack.
- Bag of nuts or other healthy snacks available for adults and children.
- Water bottle.

Table 2. Value-added Research Opportunities of Consumer Psychologists Studying Consumption Behavior

	Competitive Advantages for Consumer Psychology Researchers	Competitive Disadvantages for Consumer Psychology Researchers	Where are some of the Greatest Opportunities?
Consumption Monitoring	<ul style="list-style-type: none"> • Fits well into existing and comfortable research paradigms • Numerous theories and methods are available to determine the source of cognitive and perceptual biases 	<ul style="list-style-type: none"> • Necessitates studies that involve actual eating behavior (versus choice studies or computer studies) • To be most influential, studies will need to involve realistic field situations and validation 	<ul style="list-style-type: none"> • While most research has focused on bias, it has not focused on the reasons behind why such cognitive or perceptual biases exist. • Generating rules of thumb and monitoring short-cuts would be useful to legions of dieters and clinicians.
Sensory Drivers of Consumption Quantity	<ul style="list-style-type: none"> • We are well suited to conceive and test psychological mechanisms that could interact with physiological factors 	<ul style="list-style-type: none"> • Tools and facilities for physiological research are often costly and more accessible in medical schools • IRB delays • High subject costs 	<ul style="list-style-type: none"> • Isolating common or more general psychological states that mediate and environmental stimuli and eating • Articulating a greater range of environmental conditions that could influence behavior (such as crowding, type of noise level, lighting variation, and so on).
Affective Drivers of Consumption Quantity	<ul style="list-style-type: none"> • Wide range of theories are available • Sophisticated tools/skills for investigating relevance of theories to a behavior 	<ul style="list-style-type: none"> • Too much focus on isolating a single mechanism often makes the research question too narrow and the research context too stylized and unrealistic • Often results in studies with little apparent field validity 	<ul style="list-style-type: none"> • Determining how thought processes or feelings interact with physiology to alter eating behavior • Explaining general findings in the field and showing how the interventions could be modified or targeted to be more effective.

<p>Normative Drivers of Consumption Quantity</p>	<ul style="list-style-type: none"> • Strong conceptual training in both the perceptual, behavioral, and social drivers of consumption norms • Tools and emphasis on internal validity enable an ability to disclose subtle effects 	<ul style="list-style-type: none"> • An overemphasis on research precedent limits the creativity of interventions • An overemphasis on internal validity can generate interventions that are not scalable or generalizable 	<ul style="list-style-type: none"> • Determine how internal norms are established and when these are dominated by external norms • Developing a new taxonomy for consumption norms would aid in identifying a wider range of norms that could useful intervention points in personal life and in public health.
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Figure 1. Drivers of Consumption Quantity



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