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Review

From mindless eating to mindlessly eating better

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ABSTRACT

Plate shapes and package sizes, lighting and layout, color and convenience: these are a few of hidden persuaders that can contribute to how much food a person eats. This review first posits that these environmental factors influence eating because they increase consumption norms and decrease consumption monitoring. Second, it suggests that simply increasing awareness and offering nutrition education will be disappointingly ineffective in changing mindless eating. Third, promising pilot results from the National Mindless Eating Challenge provide insights into helping move from mindless eating to mindlessly eating better.

The paper represents an invited review by a symposium, award winner or keynote speaker at the Society for the Study of Ingestive Behavior [SSIB] Annual Meeting in Portland, July 2009.

Contents

Food choice decisions are not the same as intake volume decisions [1]. That is, the former determines *what* we eat (soup or salad); the latter determines *how much* we eat (half of the bowl or all of it). Large amounts of money, time, and intelligence have been invested into understanding the physiological mechanisms that influence food choice [2,3]. Much less has been invested in understanding how and why our environment influences food consumption volume [4–6].

For many individuals, determining how many pieces of pizza to eat for lunch is a low-involvement decision that can be based on how much one normally consumes [7]. Yet consumption can also be unknowingly influenced by environmental cues [8–10]. For instance, the number of items in an assortment or the eating behavior of a dinner companion may serve as a reference point that a person uses to gauge how much they should eat or drink. Similarly, large packages, plates, serving bowls, and even pantry arrangements can all increase how much a person serves and consumes by 15–45% [11]. The consumption norms suggested by these large sizes have been shown to influence even the experts — leading professional bartenders to

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overpour alcohol and nutritional science professors to overserve themselves ice cream.

Each day, environmental factors such as the visibility, size, and accessibility of food may be contributing to an ever-widening obesity problem in developed countries [12,13]. Yet simply knowing the relationship between environmental factors and consumption will not eliminate its biasing impact on consumers [14,15]. People are often surprised at how much they consume; perhaps they are influenced at a basic or perceptual level of which they are not aware [16,17].

Indeed, this is one of the curiosities behind the psychology of food intake. Most people cannot explain why they made one food decision over another without simply saying "I like it," "I was hungry," or "It was healthier [18]." When presented with the possibility they could be influenced by their environment, the majority of people deny it [19]. They might acknowledge these factors influence others but not themselves [20]. Even robust findings in anchoring, package size, and estimation find that many consumers believe the debriefing results yet adamantly claim they were not influenced [21].

It appears that some that some of the factors that drive eating decisions cannot be explained by the reason-based models that are often suggested. Some of these drivers may be at a perceptual or even preconscious level. It is at this level that sights, smells, and a rumble in a stomach might influence behavior more than the conscious trade-offs a person could articulate or respond to on a questionnaire.

Whereas our understanding of physiological underpinnings of food intake has solidified through the years, there may be key synergies in learning how physiology and psychology combine to determine eating behavior [22]. Yet while defining causes and mechanisms is useful for a basic academic understanding of obesity, it becomes operationally valuable when it can help individuals on a day-to-day basis. It becomes valuable when it moves from basic research to translational research. This paper focuses on identifying the causes and mechanisms that lead to mindless eating and obesity and showing how findings can be translated to changes day-to-day eating behaviors. As a result, there are three objectives to this review:

1) Illustrate the environmental cues that influence eating behavior and show that they appear to be explained by two basic processes.
2) Show that "education" and "awareness" are unlikely to be widely effective in helping individuals reverse these processes.
3) Share preliminary pilot results that suggest key principles to help people make small, but meaningful changes in their eating patterns.

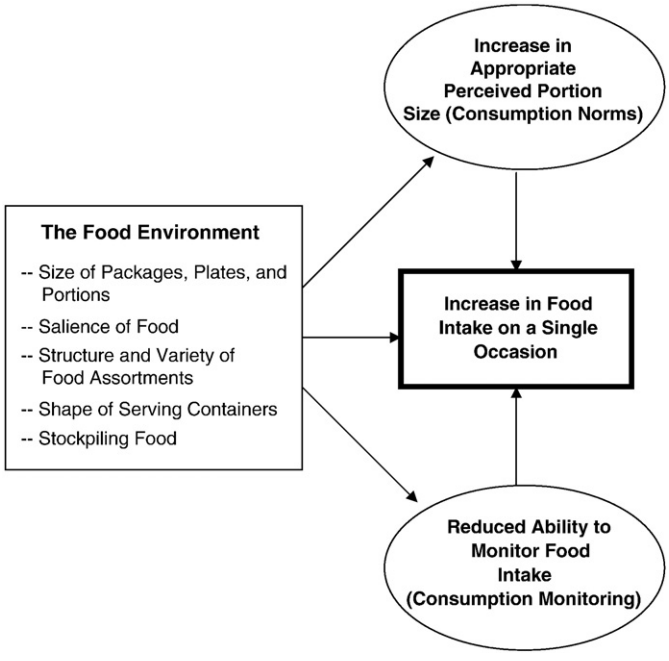

Fig. 1. Selected environmental antecedents of consumption volume.

1. Two reasons people unknowingly overeat

Whether a person over eats is not only determined by the food choices they make (which involve calorie and nutrient composition, fiber and water content), it is also determined by the portion sizes they eat and the frequency they eat [23–25]. Although eating frequency is most relevant with snacking, portion size is relevant for both meals and snacks. Because of this wider relevance, the focus on why people unknowingly overeat will be on portion size [26].

It has often been suggested that we overeat from larger portions because we have a tendency to "clean our plate [27–29]." This research presupposed that our food was served to us. But unless we are eating at a restaurant, we generally serve ourselves. If we appear to be "hardwired" to clean our plate, the solution would not be to try and short-circuit this through education. Instead, we should simply encourage people to serve themselves less in the first place.

The amount of food we eat on a single occasion is influenced by our immediate environment in two ways (see Fig. 1). First, our environment – such as the size of a package or the variety of food – can subtly suggest how much food is reasonable, normal, typical, and appropriate for us to be serving ourselves and consuming. Second, these environmental cues can lead us to mindlessly ignore internal cues of satiety because they provide external cues that we can use as rules-of-thumb as to when we should stop eating. We will examine each of these influences in turn.

1.1. Consumption norms are determined by our environment

People can be very impressionable when it comes to how much they eat. Consider a single consumption occasion — a meal. There is a flexible range as to how much food an individual can eat, and one can often "make room for more [30,31]." For this reason, if a person generally eats 8 oz of pasta for dinner, he or she may be quite content eating a little bit less or a little bit more pasta for dinner without feeling either overly hungry or overly full.

A key part of Fig. 1 is the role of consumption norms. For many individuals, determining how many ounces of pasta to serve themselves for dinner is a relatively low-involvement decision that is a difficult nuisance to repeatedly and accurately monitor [32]. As a result, people tend to rely on consumption norms to help them determine how much they should consume [33,34]. 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 [35].

Large-sized packages, large-sized restaurant portions, and large-sized dinnerware all have one thing in common. They all perceptually suggest to us that it is more appropriate, typical, reasonable, and normal to serve and to eat more food than packages or smaller plates would instead suggest [36,37]. These all implicitly influence our personal consumption norm for that situation. This use of consumption norms, as with normative bench-marks in other situations, may be relatively automatic and may often occur outside of conscious awareness [38].

This is what makes these norms so powerful. Even when made aware of them, most people are unwilling to acknowledge that they could be influenced by something as seemingly insignificant as the size of a package or plate [39]. Even when shown that larger packages and plates lead them to serve an average of 31% more food than matched control groups, 94% of the diners in four of our field studies resolutely maintained that how much food they served and ate was not influenced by the size of package or plate they had been given [40].

We find increased portion sizes in supermarkets, where the number of larger sizes has increased 10-fold between 1970 and 2000

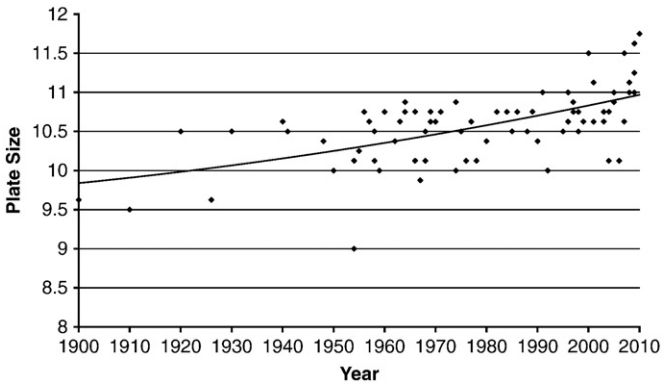

Fig. 2. The size of American-manufactured plates appears to increase from 1900 to 2010 in this sample.

[41,42]. We find increased portion sizes in restaurants, where the jumbo-sized portions are consistently 250% larger than the regular portion [43]. We even find increased portion sizes in classic home recipes. Over the past 70 years, the calories per serving of common recipes in the *Joy of Cooking* has increased an average of 35.2%, with a third of that being attributable to increased portion size [44].

Most immediately relevant to the portion distortion in our homes is that, the sizes of our plates and bowls also appear to have steadily increased. Indeed, in a preliminary investigation of this, we plotted the dates and the sizes of all the different American dinner plates being offered for sale on ebay.com – the largest bidding, resale website – on March 31, 2010. While this provides an admittedly biased sample of the available dinner plates in recent history, its results are notable. Among this sample frame of distinct American plates ($n=75$), the basic correlation between date and dinner plate was $r=0.59$ ($p<.01$). From 1900 to 2010, the average size of the dinner plates increased 22% from 9.62 in. to 11.75 in. Fig. 2 indicates how this has changed in recent history.

Yet this increasing size of plates has even been shown to be part of a larger, longer trend. That is, it might be that the size of dinnerware may generally vary with the availability and cost of food itself. While little is known about the historical size of plates in the Middle Ages, for instance, if art imitates life, the chronological depictions of dinnerware in paintings of the *Last Supper* may provide some insight. Using a CAD-CAM program, the diameter of the plates in 52 depictions of the Last Supper were indexed by the average head size in the painting [45]. As expected, the approximate date of the painting explained 22% of the variation in the size of the average plate at the table ($p=.040$) [46]. Fig. 3 shows how the size of plates has steadily increased 69% over the past millennium.

Interestingly, this increase in plate size approximately mirrors the increase in portion size and the increase in the availability and affordability of food. As the availability and affordability of food increases, so may the surrounding cues that prompt food intake or subtly suggest larger portions [47–49].

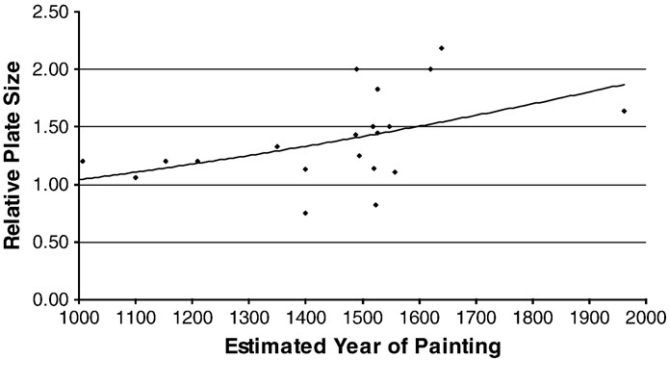

Fig. 3. The relative size of plate in depictions of the Last Supper has increased over the past millennium.

1.2. Consumption monitoring — do people really know when they are full?

One objection to studies that show people overserve themselves in response to environmental cues is that people may get tricked into overserving themselves, but they would not otherwise overeat. This presupposes that a person is more responsive to their internal cues of satiation (such as hunger or taste) than to external cues [50–54]. The extent of this predisposition varies across people [55]. One study asked a matched set of 133 Parisians and 145 Chicagoans when they knew they were through eating dinner. The Parisians said they knew they were "through eating dinner" when they "were no longer hungry" or when the "food no longer tasted good" — both internal cues of satiation. In contrast, the Chicagoans said they knew they were through eating dinner when they thought they had eaten a normal amount (e.g., "when my plate's empty") or when the TV show they were watching "was over" — external cues of satiation [56].

Yet regardless of whether a person was French or was American, overweight people relied on different cues than those who were normal weight (see Table 1). Overweight people relied more on external cues – such as whether the television show they were watching is over – to determine when to stop eating [56]. In contrast, normal-weight people had a slight tendency to rely on internal cues, such as whether the food no longer tasted as good as it did [57].

This physiological view toward satiety was further challenged in a study suggesting that people stop eating when their dish is empty. When a soup bowl was designed to automatically refill itself, those who had been given these "bottomless bowls" ate an average of 73% more than those eating from a regular bowl. When asked if they were full, a common response was, "How can I be full, I still have half a bowl left?" [58]. A similar study involving the bussing of chicken wing bones at an all you can eat restaurant showed a similar result. Those whose chicken wings had been bussed, ate 34% more, but did not believe it [59].

People may believe they know when they are full, but studies in the field suggest they eat more with their eyes than with their stomach. Indeed, a person might *think* they know when they are full, but that is their fallibility.

This problem is further complicated in an environment with large consumption norms [60]. Our inability to monitor or estimate how many calories we eat becomes increasingly less accurate as portion sizes increase. It used to be believed that obese people were worse at estimating the calories in their meals than normal-weight people [61,62]. This was even believed to be a contributing cause of their obesity [63,64].

In contrast, recent findings have instead shown that this apparent bias is caused by the size of the meals they eat, not the size of people [65]. All people of all sizes – including trained nurses and dietitians – are inaccurate at estimating the calories from large portions [66]. Although it initially seems that heavier people are worse estimators of what they eat, they are just as inaccurate at estimating a 2000-cal lunch as are their normal-weight colleagues. As Fig. 4 shows, when we control the amount of food normal-weight and overweight people are given, both groups estimate calorie content in a predictable, identical way. The answer to why there are inconsistencies in estimation ability has more to do with meal size, not people size.

Under most conditions, eating is multidimensional and difficult to precisely monitor. This can lead people to focus more on food choice than on their consumption volume of the chosen food. This can lead to unmonitored, unintended overeating [67,68]. Not only are calorie estimates biased by the size of packages and plates, they are also biased by the size of a meal. In general, all people underestimate their calorie consumption by a predictable compressive power function [69,70].

In addition to this basic tendency to underestimate one's calories as a function of the size of a meal, people are also biased by the "health halos"

Table 1
The French Paradox Redux: selected internal and external cues of meal cessation.[a]

	Nationality			BMI		
	French ($n=133$) M (SE)	America ($n=145$) M (SE)	$P \neq$	<25 ($n=232$) M (SE)	≥5 ($n=45$) M (SE)	$P \neq$
Internal cues						
I usually stop eating when I start feeling full.	7.0 (.19)	5.2 (.18)	.000	6.1 (.16)	5.6 (.37)	.167
If it doesn't taste good, I'll still eat it if I am hungry.	5.8 (.19)	4.3 (.18)	.000	5.1 (.15)	4.4 (.37)	.088
External cues						
I usually stop eating when I've eaten what most think is normal	4.0 (.20)	5.2 (.19)	.000	4.5 (.15)	5.4 (.37)	.024
I usually stop eating when the TV show I'm watching is over.	2.2 (.16)	3.7 (.16)	.000	2.9 (.13)	3.6 (.32)	.051

[a] Values are expressed as mean in a nine-point scale anchored at 1 (strongly disagree) and 9 (strongly agree) unless otherwise indicated.

that accompany labels. A series of studies where foods were falsely labeled as being "low fat" led consumers to overconsume these foods relative to control foods [71,72]. Even when taking into account the average (11%) reduction in the calorie content of low fat snack offerings, these people ate 34% more calories than the control group [73]. In fast food restaurants, a similar result was found when a person ordered and ate from a restaurant they perceived as healthier versus less healthy (such as Subway vs. McDonalds). Although consumers ate 11% fewer calories than when at McDonalds, they estimated they had eaten 37% fewer [74]. This led those at healthy restaurants to overeat (relative to their expectations) compared to those eating hamburgers and French fries.

2. From mindless eating to mindlessly eating better

In reviewing the environmental factors that are associated with overeating, two consistent explanations were identified: 1) increased consumption norms, and 2) decreased consumption monitoring. Yet simply knowing of these biases does not appear to prevent overeating.

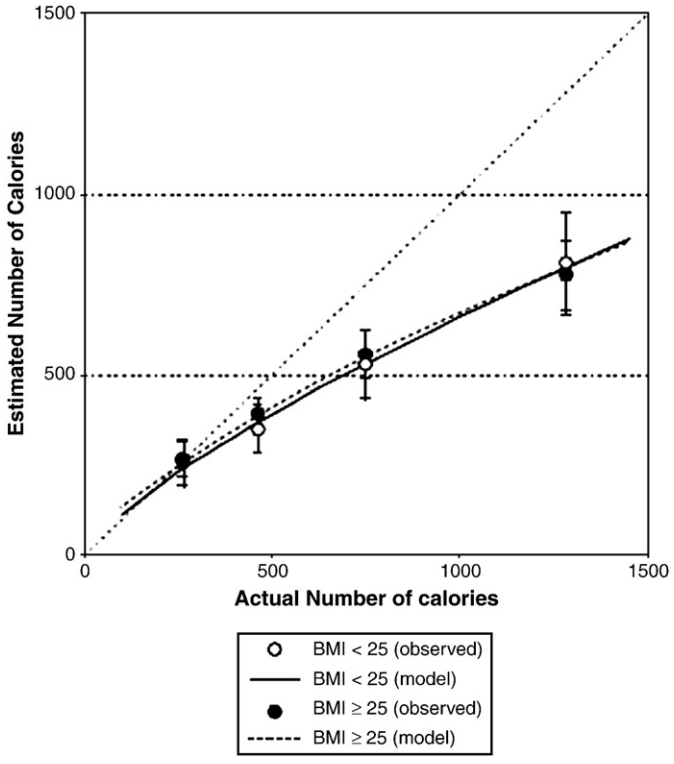

Fig. 4. Meal size, not body size influences calorie estimations (observed geometric means, 95% confidence interval, and model predictions).

People are often surprised at how much they consume, perhaps they do not fully understand calories, but it may also be that they may be influenced at a basic level of which they are not aware or do not monitor [75,76]. Indeed, studies reviewed in the prior section show this bias was common with even trained graduate students, nutrition faculty members, and with nurses and dieticians who were diabetes educators. But even the most trained, motivated individual cannot always be vigilant. One study suggested that we make 200 more food-related decisions each day than most of us realize [77]. Each of these decisions provides an opportunity for being unknowingly influenced by environmental cues. In reviewing some of these studies, it appears 1) we are not aware of over-consuming, or 2) we are not willing to acknowledge that we are impacted by these cues even *after* the cues and their general impact are made salient.

2.1. The 200 food decisions people do not know they make

Consider four controlled field studies which investigate how environmental factors such as package size, serving bowl size, and plate size influenced how much people consumed in natural environments when randomly assigned to an exaggerated treatment condition [78–81]. Participants in these studies spanned a wide range of ages and backgrounds (including graduate students, moviegoers, and Parent Teacher Association members), and in each study they were systematically assigned to different conditions and their consumption behavior was assessed. Across all of these studies, the same two questions were asked of those in the exaggerated (e.g., bigger bowl) treatment conditions:

1. "How much did you eat compared to what is typical for you?"
2. "In this study, you were in a group that was given [a larger bowl]. Those people in your group ate an average of 20–50% more than those who were instead given [a smaller bowl]. Why do you think you might have eaten more?"

The qualitative data collected during the post-experiment debriefings was coded using standard content analysis procedures [82,83]. The answers to the first question about the amount eaten were coded as either "less than," "about the same," or "more than" what was otherwise typical for them. The second question about explanations for overeating was coded as 1) they denied eating more, 2) they attributed it to hunger, 3) they attributed it to the intervention, or 4) they attributed it to a miscellaneous explanation (being in an exciting or unfamiliar situation, etc.). Individual calculations of coding reliability between the two coders were alpha = .94 (for the "how much" question) and alpha = .74 (for the "why" question). Much of the variability for the why question was due to the answers that were subsequently coded upon agreement as "Miscellaneous."

In total, 379 people were involved in these field studies with 51% (192) being in the exaggerated environmental cue condition. Brief

Table 2
Field study participants deny the influence the situational cues have on their intake behavior.[a]

Sample and context of study	Intervention (situational cues) and findings	"How much did you eat compared to what is typical for you?"				"In this study, you were in a group that was given [a larger container]. Those people in your group ate an average of 20–50% more than the others. Why do you think you might have eaten more?"[b]				
		Less (%)	About the same (%)	More (%)	Chi-square	"I didn't eat more" (%)	"I was hungry" (%)	"The (intervention) influenced me" (%)	Other (%)	Chi-square[c]
40 MBA students at a Super Bowl party in a bar in Champaign, IL [79]	Those serving themselves Chex Mix from 4-liter bowls ($n=19$) served 53% more than those serving from 2-liter bowls	23	57	20	10.55 ($p<.01$)	63	32	3	3	22.78 ($p<.001$)
98 adults preparing a spaghetti dinner for two in Hanover, NH [78]	Those given half-full 32-oz boxes of spaghetti ($n=51$) prepared 29% more than those given full 16-oz boxes.[d]	18	73	9	70.36 ($p<.001$)	71	27	4	8	67.76 ($p<.001$)
161 afternoon moviegoers in a Chicago suburb [80]	Those given 240-gm buckets ($n=82$) ate 53% more than those given 120-gm buckets	19	75	6	128.77 ($p<.001$)	15	77	5	3	152.00 ($p<.001$)
158 evening moviegoers in Feasterville, PA [81]	Even when given stale, 14-day-old popcorn, those given 240-gm popcorn buckets ($n=40$) ate 34% more than those given 120-gm buckets of the same popcorn	14	78	8	141.65 ($p<.001$)	12	79	2	7	179.42 ($p<.001$)
Average across all studies (Weighted by subjects)		19	73	8	331.26 ($p<.001$)	52	31	2	15	203.97 ($p<.001$)

[a] Answers are from those in the treatment group who received the intervention that resulted in greater consumption.
[b] The specific intervention in the study was noted at this point. Here, the example of larger bowls was used.
[c] The Chi-square test was conservatively conducted excluding the "Other" response from the analysis. Including this resulting in all $Ps<.00$.
[d] In this study, people poured spaghetti but did not actually consume it. Questions were modified to reflect pouring instead of eating.

descriptions and results for each study are shown in Table 2. Within these treatment groups, the average increase in consumption over the control was 32%. However, an average of 73% of the participants believed they ate as much as they normally ate. Of those remaining, an average of twice as many believed they had eaten less compared to those who thought they might have eaten more (19% vs. 8%).

When told of their treatment group's bias, and when asked why they might have eaten more, 52% claimed they did not eat more, and 31% said that if they did eat more, it was because they were hungry. Fifteen percent claimed they ate more for miscellaneous reasons, such as because it was a special occasion (the Super Bowl) or because it was "free."

Of those who did believe it possible that they ate more, only 2% acknowledged it was because of the environmental cue. This hesitancy to acknowledge being influenced by an external cue is common and has even been found when people are presented with tangible evidence of their bias [84]. For instance, when pouring a standard drink of alcohol, the horizontal–vertical illusion (focusing on height at the expense of width) has led professional bartenders with over five years of experience to pour an average of 29% more alcohol in short, wide glasses (tumblers) than tall, narrow glasses (highball glasses) which held the same volume [85]. When confronted with their bias and when shown that they poured at average of 1.9-oz compared to the 1.5-oz that was prescribed, the general reaction was one of disbelief and denial, despite the tangible evidence [86].

Lab studies have often found that people either do not believe they were influenced by external cues or do not want to admit this was the case [87]. These field studies show that people claim to be unaware of these factors increasing their consumption. Even when confronted with empirical data, most participants in environmental manipulations continue to disavow the findings or to look for alternative explanations.

Even when people do wish to change, something prevents them from doing so. In some cases this may be inertia or structural barriers in their life. In other cases it simply may be that we do not provide them the support structure – the choice architecture – that is needed to move from a good idea to an actual change.

The challenges of changing eating behavior are overwhelming given the approach that has often been used [88,89]. In looking toward new individual and policy solutions to mindless eating, it is worthwhile to examine new models of intervention.

2.2. The National Mindless Eating Challenge

Even when people are willing to change the troubling environmental cues around them, they may not know where to start to make the stylized changes that would be most useful for them. To help provide a solution to this dilemma, the National Mindless Eating

March	1	2	3	4	5	6	7	8	9	10	11	...	31	Total
Use the ½ Plate Rule – ½ veggies or salad.	x	x	x		x	x	x	x	x		x	...	x	27
Slow Down – start last; finish last		x			x					x	x	...	x	13
Only serve vegetables "family style"	x	x	x		x	x	x		x	x	x	...	x	24

Fig. 5. Illustration of an Accountability Checklist. The "Power of Three" checklist.

Challenge was developed. The basic goal of the web-based pilot program was to provide people with small, easy-to-implement changes to their personalized environment. From a research perspective, there were three objectives of the challenge:

1) Track the field success of lab-tested tips.
2) Develop profiles of dieter typologies to provide stylized feedback.
3) Determine what form of feedback best encourages adherence and success.

2.2.1. Method

Over 10,000 individuals who were interested in changing their eating behavior registered on a website (www.MindlessEating.org). A random sample of 2500 of these self-selected individuals were offered the opportunity to be involved in the first stages of calibration for the National Mindless Eating Challenge. Participants were asked to complete a lengthy on-line questionnaire that included self-reported measures of wellness, weight, productivity, happiness, and their recent medical history. After assessing their eating goals (eat smaller meals, snack less frequently, eat healthier, help family eat healthier, and so on), participants were randomly given three food behavior suggestions from a pool of tips that had been empirically supported by academic research. For each of nine eating goals, 8–21 lab-tested tips were identified as being potentially relevant.

After being provided with three of the tips that were most relevant for their eating goal, each participant was asked to write down 1) their biggest barrier to implementing that tip, 2) one strategy they could use to overcome that barrier, and 3) their estimate of how many days in the next 30 they would be able to successfully adhere to that behavior.

They were then provided an Accountability Checklist to track their progress. They were instructed to write their three changes for that month onto the three rows of the checklist and to check off each day they successfully made the change (see Fig. 5).

Each Friday for the next four weeks they received a reminder through the email, asking them to report the number of days of adherence for each of their three tips (over that past week). At the end of the month, they were invited back to the website, where the process repeated itself.

At the end of three months, measures of self-reported wellness, weight, and adherence were collected. A composite measure of wellness was developed based on their answers to happiness and wellness questions [90].

2.2.2. Results

Among those 2374 who completed a month or more of the program, their average weight loss was 2.3 lb (with a range of +0.8 to −12.6 lb). Preliminary analysis of those who stayed in the program for all three months showed they achieved a weight loss of 5.2 lb. As a point of comparison, the same month we started the challenge, we also monitored a traditional face-to-face "Corporate Fitness Challenge" program in Ithaca, New York with 73 individuals who were given two months of free dietary advice and free access to a health club, including a Personal Weight Loss Coach. Their combined reported weight loss over the first two months was 8.2 lb, but had dropped to 4.9 lb (a 3.3 lb weight gain) at the end of the third month.

In spite all of the advantages of the "high touch" Personal Weight Loss Coach, the trend of lost progress after the second month is troubling. In contrast, the slow-and-steady mindless changes suggested by the National Mindless Eating Challenge is more promising.

It must be underscored that these were not randomly selected groups of people. They may be different from a general population of people who do not wish to lose weight, do not have a computer, or who do not actively wish to commit to a web-based program (or to a personal trainer). Additionally, this study examined only those who stayed with the programs. There was a larger group of people who dropped out of the web-based program than from the personal trainer program. That is why it is important to condition these results by emphasizing: *among those completing three months of the program*, more consistent and steady weight loss was reported among those who had be involved in the web-based program than the personal coach program.

In a series of follow up studies, we experimented with how to most effectively present these tips to individuals in a way that would encourage the greatest adherence and satisfaction. One additional study worth noting involved 3000 people who were presented these tips in one of three ways:

1. *The "Choose Yourself" Group*: "Here are 173 lab-tested tips. Choose three to use this upcoming month."
2. *The "Five-Pick-Three" Group*: "Here are 5 tips most statistically-related to success for someone like you. Choose three to use this upcoming month."
3. *The "Here are Your Three" Group*: "Here are 3 weight loss tips most statistically-related to success for someone like you."

All participants were told they could also substitute their own tip and that they did not need to be constrained to what we suggested. Across all three groups only 4% generated their own tips.

For one month we tracked self-reported adherence (the number of adhered days/month for each tip) and satisfaction (0–100%). Unexpectedly, this preliminary study found that giving a person too much choice latitude reduced their adherence. Also unexpectedly, giving people less choice did not dramatically lower their satisfaction. As can be seen in Fig. 6, satisfaction was still rated in excess of 70%. Giving people fewer choices (3 instead of 173) but still allowing free choice ("or make your own tip"), led to greater adherence and high satisfaction [91]. It is

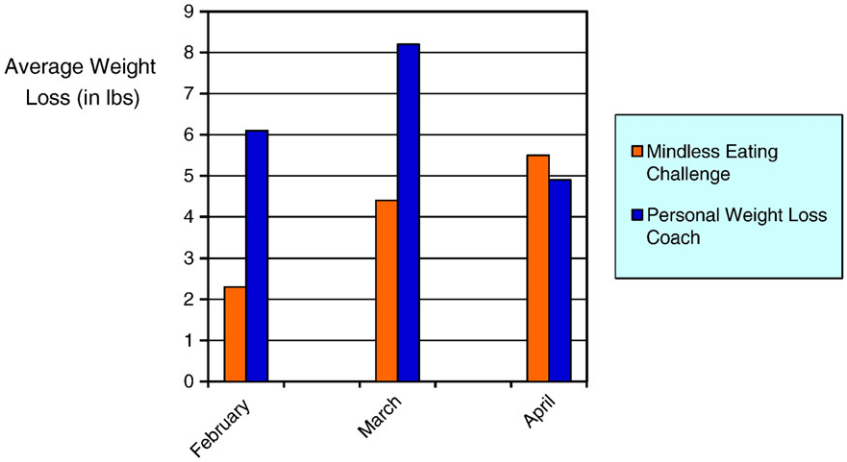

Fig. 6. A preliminary comparison of the national mindless eating challenge to a two month personal weight loss coach.

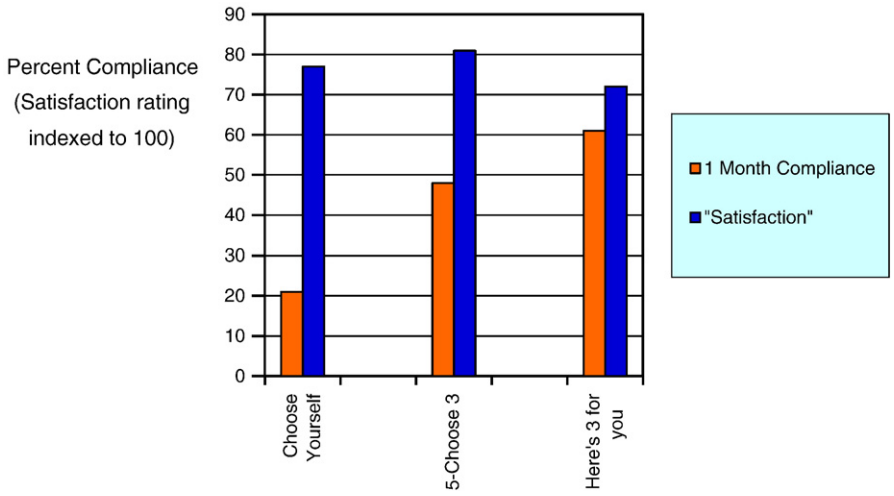

Fig. 7. When giving dietary advice, is it more effective to give less choice?

still unclear what the long-term progress would be, and further study is needed across time and across different groups of people (Fig. 7).

Portion control and calorie counting is difficult to sustain for even the most diligent [92]. It becomes even more problematic when environmental cues bias one's feeling of satiation. Given that only 1 in 20 dieters successfully maintains weight loss [93], it appears that strict, mindful regulation may not be a successful strategy for all individuals. For some, it may be easier to change their environment than to change their mind.

Most people know that an apple is healthier than a candy bar, and that one candy bar is still better for them than two candy bars. It is less clear that consumers need more nutrition information than it is that they need better heuristics to help them develop a bias toward eating less and eating healthier. Such rules could offset irrational tendencies or bad eating habits [94].

To examine this in a pilot study, 1000 visitors were recruited from a healthy eating website (www.MindlessEating.org) and asked to be involved in a three month study where they would be randomly assigned three small behavior changes they were encouraged to make. These changes were one's that had led people to eat less in controlled lab studies (such as "use 10-in. dinner plates," or "eat fruit before snacking"). Their weight and their adherence was tracked for three months.

Table 3
A pilot study of self-reported adherence and weight loss related to environmental changes.

Heuristic	Number of days of adherence per month	lb. of monthly weight loss
Use 10-in. plates for dinner.	8.14	−1.93
Don't eat with the TV on	6.71	−1.58
Eat fruit before snacking	6.10	−1.11
Eat a hot food for breakfast	12.11	−1.07
Eat vegetables and salad first.	4.23	−1.05
Use the Half-plate Rule	7.87	−0.60
Store produce on middle refrigerator shelf	7.31	−0.47
Limit snacks to three bites	6.02	−0.29
Brush teeth instead of snacking.	4.61	0.18
Eat oatmeal for breakfast.	8.68	0.83

As the abbreviated descriptions in Table 3 indicate, the effectiveness of the heuristics varied. Although they ranged from a 1.93-lb loss ("Use 10-in. plates for dinner") to a 0.83-lb weight gain ("Eat oatmeal for breakfast"), the average heuristic resulted in an average weight loss – 1.16 lb/month per person – that was statistically different from zero ($t(19) = -13.3$, $p < .001$). It is important to keep in mind that each person was given a set of three different tips. While the aggregate influences of these tips is reported for each person, they represent the combined influence of this tip along with whatever two additional tips had been assigned that person [95].

In this pilot study, there are additional findings that provide promise for more focused investigation:

(i) The most effective tips or heuristics entailed little decision making (such as "Use 10-in. plates for dinner") and little ambiguity.
(ii) Flexible heuristics ("Eat a hot food for breakfast") were easier to comply with and more effective than more restrictive heuristics ("Eat oatmeal for breakfast").
(iii) Some heuristics that reduced food intake in lab studies backfired in the field (such as "Brush teeth instead of snacking" or "Eat oatmeal for breakfast").

In general the results show the importance of weighting the effectiveness of an intervention by its adherence. Interestingly, these heuristics may help individuals make better food choices by taking their mind out of the game – turning mindless overeating into mindless *better* eating – effectively creating healthy heuristics and behavioral rules-of-thumb.

3. Four thoughts about changing eating habits

This Laboratory of Life experience – trying to change mindless eating in the real world – brings lessons of both discouragement and encouragement for those of us interested in helping change eating behaviors. On one hand, some results are discouraging because they show how some of our most robust academic findings are often not implemented by people because they do not recognize their relevance, they lack the motivation to make them work, or they lack the step-by-step encouragement and direction they might need [96]. If we fear we are often talking only to other academics, perhaps we initially are.

On the other hand, the encouragement that comes from this Laboratory of Life is that there are easy opportunities to be both academically focused and relevant. In the different studies and analyses we conducted with the National Mindless Eating Challenge, four working hypotheses emerge on how to help people translate research insights into action.

Table 4
Some examples of altering one's personal environment to help reduce food intake.

The food environment	How one's personal environment can be altered to help reduce consumption
Serving containers: serving containers that are wide or large create intake illusions	Reduce serving sizes and consumption by using smaller bowls and plates Use smaller packaging or break large packaging into sub-packages Replace short wide glasses with tall narrow ones Use smaller spoons rather than larger ones when serving oneself or when eating from a bowl
Salience of food: salient food promotes salient hunger	Eliminate the cookie jar, or replace it with a fruit bowl. Wrap tempting foods in foil to make them less visible and more forgettable. Place healthier, low-density foods in the front of the refrigerator and the less healthy foods in the back.
Structure and variety of food assortments: structure and perceived variety drives consumption	Avoid multiple bowls of the same food (such as at parties or receptions) because they increase perceptions of variety and stimulate consumption. At buffets and receptions avoid having more than two different foods on the plate at the same time. To discourage others from over-consuming at a high variety environment (such as at a reception or dinner party), arrange foods into organized patterns. Conversely, arrange foods in less-organized patterns to help stimulate consumption in the cafeterias of retirement homes and hospitals.
Size of food packages and portions: the Size of packages and portions suggest consumption norms	Repackage foods into smaller containers to suggest smaller consumption norms. Plate smaller dinner portions in advance Never eat from a package. Always transfer a food to a plate or bowl in order to make portion estimation easier.
Stockpiling of food: stockpiled food is quickly consumed	Out of sight is out of mind. Reduce the visibility of stockpiled foods by moving them to the basement or to a cupboard immediately after they are purchased. Reduce the convenience of stockpiled foods by boxing them up or freezing them. Stockpile healthy, low energy-density foods to stimulate their consumption and to leave less room for their high density counterparts.

3.1. Provide evidence the change will work

The world is filled with advice. One of our fortes as academics is our ability to prove or disprove the effectiveness of our ideas or programs. We can prove that, on average, people eat 27% more when given a 12.5-in. plate than a 9.5-in plate. If a dietician were to instruct a person to use smaller plates, it might engender reactance. If we say it with proof, we can engage reason.

All of the changes suggested in the National Mindless Eating Challenge have empirical proof they influenced single-session intake by at least 12%. While we do not always know how this would translate into a person eating at a truckstop in Barstow, Oklahoma, or eating a Thanksgiving meal in Correctionville, Iowa, they may still be more effective than not.

3.2. Give a stylized set of changes

Recall that in the National Mindless Eating Challenge one group of people was told they could choose whatever changes they wanted. Yet adherence to those changes was not high in this group. Instead, adherence was highest – exceeding 70%–when we told them *what* three changes were correlated with success for someone like them. There are two key points to understand. First, they were told *specifically* what to do. Second, they were given evidence that this was not generic advice, but it was *specifically relevant* to them. Whereas Table 4 shows different types of suggestions that had been given, it was more effective to give a person three tips instead of giving them a longer list and ask them to select which ones they wish.

Where is the freedom of choice in a situation such as this? It is the escape hatch that they can still choose any other tip they wish. Although they might appreciate the freedom of having the option, less than 4% ever take the option. These were often hold-over tips from a prior month.

3.3. Give a tool for daily personal accountability

One often-mentioned rule-of-thumb in behavioral modification is that it takes about 28 days – one month – to break an old habit and to replace it with an good one.

That leaves just one problem: what is the best way to remind a person to keep these three changes for 28 days running? One technique is what we call “The Power of Three” checklist. This is simply a piece of paper that has a month's worth of days across the top (1 to 31) and three small changes written down the side.

At the end of each day, people are asked to check off which of the three changes they accomplished that day. This small act of accountability is intended to make people more mindful of what they are doing, and it provides its own small reward of accomplishment.

If these are daily changes that would have otherwise not been made, every 35 checks could make a small but noticeable difference. Also, if one can make 28 consistent checks for one mindless behavior, it could result in swapping out mindless overeating with a new *positive* mindless behavior.

As mentally disciplined as most of us like to believe we are, nothing beats having to face facts each night and check off a little box. We have very selective memories, but the Power of Three checklist lets us know just why – or why not – we have painlessly lost two pounds on the 31st of the month.

3.4. Give regular encouragement and feedback

Habits are reinforced by days of scripted behaviors. When a change is suggested to someone – regardless of how compelling – the person may be likely to falter when they encounter the tyranny of the moment.

Providing some sort of community of encouragement can help move behavior changes from experiments to habits. With the National Mindless Eating Challenge, there are three major ways we provided encouragement and a sense of a supportive virtual community.

First, we provide weekly reminders and encouragement. Second, we re-engaged with them the end of every month to ask about their progress and to provide fresh suggestions. Third, we occasionally shared ideas or solicited their feedback on various topics we thought would be of interest to them.

4. Conclusion

The 19th Century has been called the Century of Hygiene. That is, in the 19th Century more lives were saved or extended due to an improved understanding of hygiene and public health than to any other single cause. The 20th Century was the Century of Medicine. Vaccines, antibiotics, transfusions, and chemotherapy all helped to contribute to longer, healthier lives. In 1900, the life expectancy of an American was 49 years. In 2000, it was 77 years.

The 21st century will be the Century of Behavior Change. Medicine is still making fundamental discoveries that can extend lives, but changing daily, long-term behavior is the key to adding years and quality to our lives. This will involve reducing risky behavior and making changes in exercise and nutrition. When it comes to contributing most to the life span and quality of life in the next couple generations, behavioral scientists could be well suited to effectively help us make the move. They can also motivate us to get both of these done. Our eating habits would be a good place to start.

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