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## Contextual Influences on Eating Behaviors: Heuristic Processing and Dietary Choices

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### Abstract

This paper reviews some of the evidence that dietary behaviors are, in large part, the consequence of automatic responses to contextual food cues, many of which lead to increased caloric consumption and poor dietary choices. We describe studies that illustrate how these automatic mechanisms underlie eating behaviors, as well as evidence that individuals are subject to inherent cognitive limitations, and mostly lack the capacity to consistently recognize, ignore or resist contextual cues that encourage eating.

Restaurants and grocery stores are the primary settings from which people obtain food. These settings are often designed to maximize sales of food by strategically placing and promoting items to encourage impulse purchases. Although a great deal of marketing research is proprietary, this paper describes some of the published studies that indicate that changes in superficial characteristics of food products, including packaging and portion sizes, design, salience, health claims, and labeling strongly influence food choices and consumption in ways for which people generally lack insight. We discuss whether contextual influences might be considered environmental risk factors from which individuals may need the kinds of protections that fall under the mission of public health.

### Keywords

Obesity; heuristics; restaurants; supermarkets; public health

### Introduction

The dominant American ethic that individuals should be self-sufficient and responsible for their own behaviors is the foundation of the popular belief that if people are overweight or obese, it is a direct consequence of their own conscious choices. The traditional economic view is that humans are rational beings who make deliberate decisions in their own best interests. However, over the past few decades, three areas of research--behavioral economics, social psychology, and neuroscience-- have suggested that people are often irrational and their choices are frequently the consequence of automatic, hardwired, instinctual processes made without conscious awareness. Because people cannot fully control their visual, auditory or olfactory senses, they cannot ignore contextual factors. Even

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though people are aware of many contextual factors, they often do not realize how the factors influence food choices and the amount of food consumed.

This paper reviews some of the evidence that dietary behaviors are, in large part, the consequence of automatic responses to contextual food cues, many of which lead to increased caloric consumption and poor dietary choices. We describe studies that illustrate how these automatic mechanisms underlie eating behaviors, focusing primarily on restaurants and grocery stores. These settings play a significant role in the obesity epidemic. However, they are also potential mechanisms through which dietary behaviors can be shifted toward healthier choices. We discuss whether contextual influences might be considered environmental risk factors from which individuals may need the kinds of protections that fall under the mission of public health.

## **Decision-making: Automaticity, dual process theory, and neuroscience**

A growing body of research suggests that people respond to contextual cues without conscious thought or decision-making. The human brain is designed to process contextual stimuli automatically: the neurons that transmit signals from our senses to the brain are directly connected to motor neurons, so people can respond reflexively, without having to make a conscious decision (1). For example, if people touch something very hot, they will withdraw their hands before they have the time to make a conscious decision to do so. The ability to act automatically, which is often a protective measure, also extends to eating and food choices.

A recent study measured how quickly consumers can make a decision to choose a preferred candy or snack food (2). After ranking their favorites among 50 candies and snacks, subjects were presented with a series of random images of two of the snacks lasting 20 milliseconds. Participants were able to indicate which of the two snacks they preferred in less than 1/3 of one second (313 milliseconds) with an accuracy conforming to previous rankings better than chance (> 50%). In a replication of the study, participants were asked to make sure they were certain about their choice before choosing. Accuracy improved to 73%, with the average decision taking less than half a second (404 milliseconds) (2).

Although this decision-making study was conducted in a laboratory, other researchers studying decision-making in more natural settings have also found that people make food choices very quickly, without thoroughly weighing the consequences. When people make rapid decisions they rely on heuristic devices, such as the appearance of objects, familiar pictures, shapes, sizes, logos, brands and prices. Heuristics are simple procedures that help individuals find adequate, though often imperfect, answers to difficult questions (3). Although relying on heuristic cues to guide eating usually results in selections that are larger and have more calories, this automatic decision-making mechanism allows people to function efficiently, and frees up limited attention and cognitive capacity to address a myriad of other demands.

However, relying on heuristic cues can also lead to systematic errors and inferior choices, especially because today, salient heuristic food cues favor the selection of foods high in calories, fat, and sugar (4, 5). Furthermore, food cues may purposely mislead or confuse consumers for marketing purposes; for example, many food products use signs and symbols in their packaging that suggest a product is healthier than it really is in order to promote sales (6).

Classical economic theory posits that when people make decisions, they weigh many different criteria. Applied to food choices, people have the opportunity to attributes like price, sensory appeal, convenience, familiarity, etc. and concerns about health. In a

modeling exercise, researchers examined actual meal choices, comparing two ways that decisions can be made. One method accounted for trade-offs among 38 attributes while the other was a lexographic decision heuristic that used only one distinguishing characteristic on which to make a choice (7). The predictive value of the two models was exactly the same, suggesting that a heuristic process relying on a single characteristic has, on average, the same outcome as a complex process that attempts to weigh and measure multiple attributes. Thus, heuristic cues allow people to make decisions with a minimum amount of cognitive effort.

Automaticity and heuristic-based decision-making characterize a great deal of human behavior. Automaticity refers to processes that occur without conscious direction, without effort, without control, and without intent (8). Indeed, much of human behavior is determined not by conscious intentions, but by features of the environment that operate outside of conscious awareness (9). Our senses operate automatically: if we see or hear a stimulus, we first automatically orient to that stimulus, and our perceptions can then alert the part of our brain that is responsible for conscious awareness. Nevertheless, we can respond to contextual cues without our conscious awareness ever being involved (10, 11). Habits exemplify this phenomenon; they are specific behaviors initiated automatically by contextual cues that were previously congruent with the performance of the behavior (12).

Research findings on automaticity and habit are consistent with dual processing theory. Dual processing theory hypothesizes that people utilize one of two distinct systems of processing information--cognitive and non-cognitive. Cognitive processing implies careful, thoughtful decision-making in which an individual consciously weighs the costs and benefits of a particular decision, makes comparisons, and arrives at what seems to be the best option given the circumstances. Non-cognitive processing implies a quick automatic response that uses heuristics to guide decisions. Decision occurs without any thoughtful or conscious deliberation. It has been estimated that the majority of decisions and behaviors occur on a non-cognitive, automatic basis (11, 13-15). Eating, in particular, tends to be more automatic and heuristically cued than other behaviors, because eating is a behavior that is necessary for survival (16).

While non-cognitive processing is relatively effortless, cognitively based decision-making is an effortful and potentially depleting activity that interferes with subsequent performance and self-control (17). Baumeister and colleagues have developed a strength model of decision-making (18, 19) and found that self-control can fatigue just like a muscle. There are many ways that demands on the cognitive system can deplete self-control. For example, cognitive loads that temporarily occupy limited cognitive resources lead to more heuristic-based choices. Self-control can also be depleted by the very act of making a decision, leaving cognitive resources subsequently unavailable to make thoughtful choices (17). Notably, the presence of food cues can deplete self-control in both dieting and non-dieting individuals, causing them to eat larger quantities of food (20-22).

The impact of cognitive depletion on eating and food choices may be quite significant, particularly when people have to make decisions about what to eat frequently and routinely. Shopping requires decision-making, which is cognitively depleting. Spears showed that on days when people shop, they are more likely to engage in eating as a secondary behavior, defined as eating while doing another activity, such as driving or watching TV (23). Because people can only concentrate on one thing at a time, when they multi-task, they can attend to just one primary task, while the others occur automatically. Therefore, eating as a secondary behavior reflects automaticity, rather than a thoughtful or controlled behavior.

Being faced with racial and gender discrimination is also cognitively depleting. One study showed that participants who recalled more frequent episodes of discrimination and women who were given non-merit based negative feedback were more likely to choose an “unhealthy” candy bar rather than a healthier granola bar than those who suffered less discrimination or were given feedback by a fair individual, respectively (24). Shiv and Fedorikhin showed that cognitive loads have a similar biasing impact on food choice: participants who had to memorize a 7-digit number were 50% more likely to choose chocolate cake over fruit salad compared to participants who had to memorize a 2-digit number (4). Although there are a multitude of mechanisms that work to maintain energy balance, including physiological signals of satiety, cognitive factors can override metabolic adaptations. Cognitive depletion is considered a prime reason why dieters fail to maintain their diets and weight loss over the long term (17, 19).

Although there is some variation across individuals in a population in their capacity for self-control, the concept that everybody has a limited capacity to make wise choices is common to both psychology and behavioral economics. In economics, the idea of “bounded rationality” explains less than optimal decision-making; people settle for decisions that appear to be satisfactory (25). Even when people have all the information necessary to make good decisions, they are often subject to biases that lead to inferior choices. In his recent book, *Thinking, Fast and Slow*, Daniel Kahneman has outlined multiple ways in which contextual cues lead to poor decisions. These include biases related to mood (affect bias), which is influenced by the setting, biases related to availability or saliency, biases related to order of presentation, and biases related to framing and comparisons (anchoring). Even when people know that biases exist, they often cannot protect themselves from such biases (3).

In addition to empirical evidence for limited cognitive capacity, there is a physiological basis that supports the concept of limited cognitive capacity. During tests of executive control, (a term used to describe one's capacity for making wise decisions), brain imaging studies showed that those who performed better on a variety of cognitive challenges used different neural pathways than those with lower levels of executive control (26). Other researchers have found that differences in executive capacity are primarily genetic, since performance on challenging cognitive tasks is more similar among monozygotic twins than dizygotic twins (27). Moreover, differences in cognitive capacity across individuals appear to be stable and persist over time (28, 29).

While the capacity of individuals has not changed in recent decades, the presence of contextual cues that influence decision-making has. Over the past few decades, the amount of information individuals need to process has been dramatically increasing. When people are overwhelmed with too much information, they often resort to non-cognitive processing. Moreover, non-cognitive processing comprises a multitude of mechanisms that influence behaviors and decision-making. The mechanisms are essentially the means by which people learn about, adapt to, and interact with their environments. These mechanisms include priming, conditioning, and mere exposure conditioning.

*Priming* occurs when a salient cue or stimulus influences people by sensitizing someone to activate specific memories or associations so that it influences a subsequent behavior. Priming works only when people are unaware of the intention or existence of the prime. If an individual were aware that the prime is trying to influence a behavior, then he or she would have the opportunity to compensate (30). For example, several studies have shown that when both children and adults are exposed to low-nutrient food advertising, they consume more food not only while watching the ads but also during subsequent taste tests, compared with individuals not exposed to the low-nutrient food advertising (31, 32).

*Conditioning* is the pairing of two stimuli so that they become associated, resulting in the quality and characteristics of one stimulus being transferred to the other (33, 34). The preference people may show for branded products, even when the same product is available in a different package, is an example of conditioning influencing food choice (35). *Mere exposure conditioning* is seeing or perceiving something without it being paired with any other stimulus. Seeing something repeatedly increases our preferences for that object compared to objects not seen previously, even if the object is neutral. The effect is stronger when those exposed do not remember that they saw it. The object becomes part of the familiar background evaluated as safe (36, 37). Mere exposure conditioning is the theoretical mechanism behind the effectiveness of “product placement.” For example, when a product is shown in a movie, people are more likely to choose it at a subsequent time (36, 38, 39).

In summary, eating behaviors tend to be automatic and rely heavily on heuristic, non-cognitive processing. As a consequence, they are subject to priming and conditioning processes. These processes are ingrained in human nature. It is generally believed that heuristic processing tends to favor the selection of foods high in calories, sugar, and fat because these foods have more energy and are helpful to augment stores of energy in the face of uncertainty with regard to future food availability (40). However, modern conditioning and previous cultural exposures make it difficult to know the extent to which such preferences are hard-wired, learned, or preferentially cued by the design of the current food environment.

## Contextual Influences in Away-from-Home Food Settings

Since very few people produce the majority of their own food through farming, ranching or hunting, they rely on commercial sources such as supermarkets, grocery stores and restaurants. These settings are often designed to promote purchases that will maximize retailer profits, rather than individual well-being. The following sections describe a variety of on-site characteristics and strategies that operate through heuristic processes and that influence choice and food consumption in these settings.

### Restaurants

Food consumed in away-from-home settings currently comprises 1/3 of all calories consumed. It is also generally nutritionally inferior to food consumed at home (41). Away-from-home foods tend to have more calories, fat, sugar, and salt, and less fruits, vegetables, fiber, and nutrients like calcium and iron than foods consumed in the home. In part this is due to the limitations of what is available (42); however, in away-from-home situations, eating decisions tend to be spontaneous, rapid, and influenced by heuristic cues.

A 1994 Roper poll found that for 51 percent of Americans, the most recent decision to eat out was made at the last minute. Young adults were the most likely to decide to eat out on the spur of the moment (64 percent), while those aged 60 and older were the most likely to plan (52 percent). Only 25 percent of trips to fast-food places are planned vs. 58% to full-service restaurants. Forty-two percent of Roper respondents explained their choice with “just felt like going out” (43).

Multiple sensory elements in restaurants influence not only the choices of foods, but the quantities consumed. Below we discuss the role of menus and menu-labeling, portion sizes, variety, music, visual displays, waitress behavior, and health rating systems.

**Menus and signboards**—How items are presented on the menu influences what items consumers pick. This idea that order matters has been noted by behavioral economists (3),

and two recent controlled studies support the claim. In one study, when unhealthy items were placed on the back of a menu, customers were less likely to choose them (44). In a second study in which items were rotated within categories such as appetizers, drinks, and desserts, foods that were presented as either the first or last versus in the middle, were more likely to be chosen. One explanation is that customers may only cursorily scan menus, so the items at the beginning or end of a category become more salient (45). Experts in menu design claim that menus contain a “sweet spot” on the upper right hand side, and anything placed there will be chosen with greater frequency than if it were placed at the bottom of the menu (46). Placing expensive items next to lower priced items is said to increase the sale of the lower priced items (47).

**Menu calorie labeling**—Menu calorie labeling is mandated for restaurants with 20 or more outlets because it was assumed that the information would help people make better choices. A 1984 menu calorie labeling study showed that added calorie information did not impact purchases (48). Recent studies have reported mixed results. Some have confirmed the limited impact of menu calorie labeling, showing no significant changes in total calories per person ordered before and after the labeling was implemented (49-52). However, one field study showed that in a subset of restaurants, people who noticed the calorie labels ordered 100 fewer calories (53). Holdsworth and Haslam, reviewing twenty different point-of-choice labeling schemes, most of which focused on calories, found some modest short-term benefits. However, they could not conclude that there were long term benefits, given a lack of follow-up studies (54).

Part of the reason calorie labeling is not more successful may be due to widespread limitation in numeracy—many people have trouble interpreting numbers and may be more influenced by emotional factors and moods (55). Moreover, eye-tracking studies of nutritional labeling indicate that people focus more on images than on numbers (56).

**Other Nutritional Labeling Schemes**—Other labeling schemes have used symbols instead of numbers. Traffic light symbols have used red to indicate high calories, yellow for moderate calories, and green for low calorie items. In one laboratory study, the traffic light labels increased consumption of “green” foods and decreased consumption of “red” foods, while nutrition labels with numbers only decreased energy intake in lean females (57). Another laboratory study compared the response of children to calorie labeling on menus vs. indicating healthy items with a picture of a heart. In this case, children were more likely to be influenced by the heart pictogram than by the calorie labels (58). However a field study that placed traffic light labels on healthier menus showed that the labeling was acceptable to consumers, but when consumers ordered these healthy meals they were significantly more likely to order a dessert, which negated any reduction in calories from choosing the healthy meal (59)

**Labeling food as “healthy”**—Healthy labels have been perceived as synonymous with a food that is less palatable (60). Researchers have compared the relative impact of a health message on food to a price reduction, and found that the price reduction alone had a larger or equal impact than a combined approach did. The healthy message alone did not increase selection of healthy products (61).

**Portion sizes**—Many studies have shown that when people are served larger portions, they eat more compared to the quantity consumed when offered smaller portions (62-68). A common finding across the studies is that individuals seldom notice changes in portion sizes. Individuals consuming different amounts of food tend to report similar subjective levels of

satiety, indicating that people lack an internal mechanism to recognize the quantity of energy consumed.

**Variety**—Several laboratory studies show that small changes in variety increase the quantity of foods consumed. Merely providing 3 different shapes of pasta increases calorie consumption by 14% (69, 70). In another study of children, simply changing an elbow macaroni to a spiral shape increased total food consumption (71).

**Pricing**—Discounts on healthy items have been shown to increase their purchase and consumption (72-75), but there are no studies that have looked at the long-term impact on total diet. One study implemented a proportional pricing scheme, such that customers would not get more calories for less money per calorie. Among the general public, proportional pricing did not reduce consumers' size choices, but overweight and obese consumers were more likely to select smaller portions of soft drinks and high caloric snacks (76).

**Accessibility**—Multiple studies have shown that making food items more accessible increases their consumption, and reducing accessibility decreases consumption. In a cafeteria setting, ice cream consumption was reduced when the ice cream was placed in the back compared to the front and when the lid was on the ice cream cooler (77). Similarly, in another cafeteria study candy and potato chip consumption was decreased when they were placed away from the serving line, rather than on it (78). In a hospital cafeteria, when low-calorie desserts were less accessible by being placed in the back of an array of desserts, customers chose them less often; people who were overweight or obese were no more likely to select them than normal weight individuals (79). A recent study manipulated the location of salad bar items between the edge and the middle of the display. Items in the middle were chosen less often than those on the edge. In another manipulation the researcher examined the amount of food selected using different utensils, either tongs or spoons. Smaller amounts of foods were taken with tongs. Taken together, the manipulations had the potential to reduce the average calorie value of servings by 8-16% (77).

**Music**—In a review of how music influenced eating, Spence and Shankar (80) found that music affected both food selections and the rate at which food is consumed. For example, customers ordered more drinks in a bar when music related to drinking was played (Drunk Sailor song) versus when Top 40 music was played. The loudness of music has also been associated with customers ordering more drinks. In some studies, the speed or the beats per minute have been correlated with the speed of eating and drinking as well, with faster music leading to more rapid eating. However, in other studies tempo had no effect (81, 82). The tastiness and perception of freshness or staleness of potato chips can be manipulated by amplifying the volume of sounds made when biting into them. Furthermore, background auditory cues have been shown to influence how people rate the flavor of foods. Oysters served with a “sound of the sea” soundtrack playing were rated as tastier than when farmyard noises were played. Overall, Spence and Shankar found that music can affect people's sense of the passage of time, can be arousing or distracting, enhance one's mood, or bias or prime their behaviors by making certain choices or sensations more salient.

**Waitress behavior**—The behaviors of wait staff can also affect what people order and how much they consume. Herman and Polivy compared how 338 obese and normal individuals responded to dessert in a high-class French restaurant when offered cake or pie using four different methods. First, the waitress simply handed out a dessert menu, saying nothing. The second method allowed the diners simply to see the dessert. The third method used social influence, and the waitress stated, “I recommend the cake (pie). That's what I'd

have.” The last condition combined seeing the dessert with the social influence condition. Here, the waitress showed two desserts and recommended one.

The obese diners were no more likely than normal weight persons to order dessert when they got the dessert menu, but were 67% more likely than normal weight persons to order when they saw the dessert or when the waitress personally recommended one. It was hypothesized that obese individuals may be more compliant (i.e., responded more to the pressing request of the waitress)(83).

In another study that varied waitress's body size, non-dieters ate more snacks when the server was thin, dieters ate more when the server was heavy. Dieters were also more persuaded by a heavy (vs. a thin) server, choosing either a healthy and unhealthy snack, depending upon what the waitress recommended (84).

**Health rating systems**—Local jurisdictions have developed nutrition rating systems and healthy eating programs, such as the “Por vida” program in San Antonio, TX and the Smart Meal program in Colorado (85). Neither of these programs has been evaluated. However, a rating program based upon hygiene has. The rating system not only influenced consumer choices of restaurants, but was also associated with a reduction in food borne diseases. In 1998, Los Angeles introduced a restaurant rating system in which the results of kitchen inspections intended to prevent the spread of infectious diseases began to be posted outside restaurants within 5 feet of an entrance. In addition to the ratings, a certification program was developed for food handlers, and over 30,000 were certified.

This rating system changed both restaurant and consumer behavior. Within one year of program initiation, restaurants improved their preparation standards, and inspection scores increased from about 25% to over 50% performing at an “A” level (score of 90-100). Improved scores were generally maintained on subsequent inspections. Restaurants with low grades reported a loss in revenue and customer patronage (86). Sales at restaurants receiving an A grade rose 5.7 percent, or about \$15,000 a year, whereas B-level restaurant sales increased 0.7 percent, and sales at C-level establishments decreased 1 percent.

The system also focused efforts on restaurants with lower ratings, which were inspected more frequently than establishments with higher scores. The rate of closures (resulting from 2 or more sequential ratings of C or lower) decreased (87). In the year after the introduction of the restaurant rating system, the number of patients admitted to hospitals for food-related illnesses dropped by 13% (88). In addition, the quality of restaurants across the county became more equitable, with the average score increasing in areas with income below the median to equal those in areas with income above the median.

### **Supermarkets and Grocery Stores**

Although supermarkets and groceries have been losing customer share to big box stores like Wal-Mart and Costco, they are still the source of most food consumed in the United States (89). Fewer than 5% of the US population lack easy access to supermarkets: they live in areas called “food deserts,” where they are more than ½ mile from a supermarket and lack access to a car (90).

Store design and in-store factors are very important in determining sales, and thus consumption patterns of shoppers. Over time, as the supermarket industry has discovered which store factors are most closely associated with sales, the designs and practices have been modified to maximize profits. Over the past few decades, supermarkets have increasingly expanded their inventory with new food products, and the number of unique items has grown from about 7000 products in 1970(91) to over 40,000 today (92). The



increase in items is primarily due to processed foods, since their development is potentially unlimited. Unprocessed foods are limited to edible animal products, fruits, vegetables and grains under cultivation. Many supermarkets have more than 50,000 different items on the shelves. The plethora of different foods, brands, products, and formulations creates a highly stimulating environment that requires multiple decisions. As previously discussed, these will be cognitively depleting for many shoppers.

The expansion in availability of processed foods means that most food stores have many more processed food products available relative to unprocessed foods. For example, a study of food stores in Los Angeles and Southern Louisiana found generally low ratios of the total shelf space for fruits and vegetables to the total shelf space for unhealthy snack items (carbonated beverages, salty snacks, cookies and pastries, and candy). The ratios were lowest in convenience stores, drug stores, and liquor stores (0.10 or below), slightly higher in small food stores (0.18 to 0.30), and highest in medium-sized food stores (0.40 to 0.61) and supermarkets (0.55 to 0.72). Nowhere did the shelf space for fruits and vegetables exceed the shelf space devoted to snack foods that should be consumed in moderation (93).

The following sections describe how store features and the type and variety of products available influence consumer choice in food store settings. Features of supermarkets that influence purchases include the location and placement of foods in the store, their packaging, promotions, and point of sale information.

## Consumer Behavior in a Supermarket

Shoppers can only buy products that they are exposed to during their trip to the store, so supermarkets tend to arrange products to increase the chance that consumers will travel through as much of the store as possible. For example, popular perishable products like milk are placed at the back of the store to encourage shoppers to travel around the entire store (94). In a typical shopping trip, 60-80% of the time is spent in ineffective wandering, as customers deviate from a path that would be the shortest route to obtain the goods they purchase. Those who deviate more buy more than twice the number of product categories as those who deviate least (95, 96).

People typically make two types of visits to a supermarket-- one for a large quantity of purchases when people stock up for an extended period and more frequent "fill-in" trips when they buy a few items that they need immediately (89). The vulnerability of people to contextual cues varies considerably depending on the type of trip. For example, people appear to make more unplanned purchases on fill-in trips than during other trips (97). Research suggests that about 2/3 of purchase decisions are made in the store, so decision-making is susceptible to in-store advertising (98). In addition, most consumers make their choices quickly with little search or price comparison efforts (99).

Studies of consumer choices are typically conducted to determine how advertising, prices, and other promotions affect branded products, given that a great deal of money and effort is spent on developing brands with a specific look and logo. Consumer choice is influenced by two major factors: attention that a product display attracts, and the inferences a consumer makes about the quality of the product itself (100). Eye-tracking studies have tried to disentangle the effects of displays and the pre-existing goals and expectations of consumers. Display effects have been characterized as "bottom up" while individual preferences have been called "top-down effects." Displays account for 2/3 of the attention paid to a brand, while only 1/3 of attention can be attributed to customer preferences and goals (101-103). Studies that have objectively quantified attention using eye tracking have found that self-reports of attention are not valid proxies for actual visual attention, and that self-reported information and recall are probably misleading (100). In a typical 20 minute shopping trip, a

shopper reads only 8 to 10 lines of text, so communication is accomplished primarily through iconic images, shapes, and colors (92).

### **Placement**

Multiple studies indicate that where an item is placed in a supermarket influences whether it is noticed, and therefore how well it sells. Today manufacturers pay retailers “slotting allowances,” which are payments to obtain specific retail shelf space; higher payments are demanded for more salient spaces (e.g., those at eye level or at the ends of aisles) (104). Items that are at eye-level or just below eye level sell better than items on top and bottom shelves (99). Two studies showed that items placed in high positions are evaluated more positively than when placed in lower positions (105, 106). Items that are at the displays at the end of the aisle with facings in three directions-- sell between 2-5 times more than items located elsewhere (92, 107). End-aisle displays now account for 30-40% of all supermarket sales (92, 108). Items that are positioned in the middle of an array of similar items are noticed more frequently, but this increased attention does not always translate into increased sales (100). Doubling the number of facings for a branded product has been shown to increase its selection by 67% (100). Free standing product display racks rank second in their ability to attract attention given their large size and novelty. Such displays account for 36% of all product exposures in the store (92).

Many items are placed at the checkout register, especially items that are considered impulse-buy items, like magazines, candy, gum, soft drinks, and a variety of confections. Within these product categories, checkout sales represent 46% of all supermarket sales. In one study, when customers were asked why they bought the items from the checkout, 81% reported that they had forgotten to pick up the items from the aisles (98). However, this study did not ask shoppers whether purchases of these items had been previously planned before they entered the store.

Surprisingly, for products in the center aisles, within food categories, making products harder to find may result in increased sales. For example if ready to eat cereals are organized by type, sales decrease by 5%. Alphabetizing soups reduce sales by 6%. It's possible that while having to focus their attention on a display to find a specific product, people are exposed to novel products of which they were previously unaware, leading to more purchases (94).

### **Packaging of products**

Items in the center aisles attract attention through their packaging(92). Many features of packaging can attract the consumer's attention and affect their evaluation. For example, factors like package shape, color, graphics, pictures, and logos influence choice. Products packaged in containers that appear larger, (regardless of actual volume of contents) are generally favored over smaller ones; in the same vein, people pay more attention to text in larger rather than smaller fonts (109).

### **Use of packaging to attract children**

Many packages attract children with promotions, competitions, collectors' items and premiums, cartoon characters and celebrities. One study of 1,551 parents of children ages 5-12 showed that parents perceived high calorie, low nutrient foods to be healthier if the packages had a sports celebrity endorsement. They were also more likely to choose a low-nutrient product if it had a health claim or sports celebrity endorsement (110). Another study showed that pre-school children preferred a chocolate wafer bar with a cartoon character over the same type of product that had just been advertised on a television commercial, but had no cartoon character on the package (111). Studies examining the impact of cartoon

characters and brand names on taste have shown that labeled, branded products are preferred to the same products with different packaging (112, 113). When branded characters were placed on fruits, preschoolers also liked them and requested them at a level similar to candy (114).

### **Nutrition labeling**

How a product's nutrients are framed influences consumer evaluations. For example customers had more favorable opinions of beef labeled 75% lean rather than 25% fat, but the difference in opinions diminished once consumers had the opportunity to taste the beef. The study illustrates that framing creates expectations, but that once a person has an objective experience with a product, the framing has less influence on decisions (115).

To investigate how people respond to a variety of nutrient labels, researchers manipulated different nutrient labels on microwave popcorn. They found that “no trans fats” and ‘low calorie’ labels were associated with an increase in purchases, while “low fat” labels were associated with a decrease in sales on microwave popcorn, indicating that the label may trigger concerns about taste. If the package had multiple claims, sales were lower compared to displaying only a single nutrient claim (116, 117).

### **Sales promotions**

In a review of the impact of sales promotions, Hawkes found that promotions affect consumption patterns by influencing purchases, but there are insufficient data to determine how much promotions influence actual overall diet (118). However, limited studies exist that help us understand some of the mechanisms through which a variety of marketing strategies operate. For example, discounts and bonus packs in which people get an extra quantity of a product for the same price are marketing strategies to increase product sales. In comparing which people prefer, Mishra and Mishra found that for less healthy “vice products” (chocolates), people were more likely to increase purchases if there was a discount, but for utilitarian healthy products (raisins) they were most likely to increase purchases if there was a bonus pack (119).

### **Purchase quantity**

Multiple-unit pricing (e.g., 4 for \$2.00) has been shown to increase sales by up to 32%, compared to single unit price (e.g., 50 cents each), even when the unit cost is the same. This effect was shown across a wide variety of food categories (120). Even messages like “Buy 18 for your freezer” influence quantity purchased when no discounts are offered. Moreover, when the quantity that could be purchased at a discount is limited, consumers tended to purchase more than when no limits were set. For example, limiting the sale to 12 cans of soup at discounted rate vs. 4 cans, versus no limit, resulted in an average sale of 7, 3.5 and 3.3 cans respectively (120).

### **Sampling**

Product sampling can stimulate uptake of an unfamiliar food product (121), and supermarkets often use sampling as a way to increase attention to new products and to promote sales (89). One survey found that 70% of consumers said they would shop at a specific store if they knew it would offer samples, and 86% said they were more likely to purchase a new brand if they were able to try a sample first. However, one study showed that while in-store sampling resulted in short term increases in the sales of the products being sampled, it was at the expense of other products in the same category. In the long term, when the sampling period was over, sales fell to baseline levels (122).

## Variety

In a series of studies on choice in the face of variety, Sela et al. found that with more available healthy choices, selection of healthy items increased (123). Given 10 choices of ice cream, 5 high- and 5 low-fat, people were more likely to choose a lower fat version than when there was only one high and one low fat option. When people had to choose an item from either a tray with two candies or a tray with 6 fruits, they were more likely to choose fruit. Similarly, when more cookies than fruit were available among potential choices 45% chose cookies compared to 33% choosing cookies when more fruit was available.

These findings suggest that the relative availability across different categories of foods determines which is chosen—if the ratio of low-nutrient food to fruits and vegetables is higher, low-nutrient food will be chosen at a higher frequency than if the ratio were lower, and vice versa. As shown earlier, in most stores the ratio of unhealthy processed foods exceeds the volume of foods like fruits and vegetables.

Other studies examining the impact of multiple choices within one product category show that having too many choices may result in people not choosing at all or being less satisfied with what they did choose (124). For example, giving consumers choices among 30 flavors of jam resulted in fewer purchases and less satisfaction than when only 6 choices were available (125).

## In-store media

A new trend in point-of-purchase messaging is the use of in-store media including ads on shopping carts, talking shelves, floor signage, interactive flat panels, and in-store audio and video. This type of media can also influence consumer choices. For example, sales of desserts and drinks increased 68% when they were featured on a digital display system installed next to the cash register (126).

## Atmospherics--Music and Scent

Review articles have identified many studies suggesting that ambient scents and music can influence how much people eat as well as what they choose to purchase (80, 127). Because people cannot turn off their senses, ambient scent and music cannot be blocked. Both scents and music stimuli as well as other contextual factors (128) can influence mood and attentiveness, whether or not the stimuli are consciously perceived. The presence of pleasant smells has been shown to increase the time spent in shopping environments as well as increase purchases. Bradford and Desrochers claim that the use of covert objective ambient scent is a potentially deceptive and manipulative practice that can persuade people without their awareness that they are being persuaded (127).

## Disparities in Contextual Influence and Response to Contextual Factors

Individuals of lower socio-economic status and of racial/ethnic minority backgrounds frequently reside in neighborhoods where they have a higher exposure to contextual cues that promote eating lower quality diets, including exposure to more billboard advertising (129), and more convenience stores (130). Furthermore, even where there are large chain supermarkets in low-income neighborhoods, they are sometimes designed differently than markets in higher income neighborhoods owned by the same franchise. The authors have noted that the Kroger-owned “Food for Less” in low-income neighborhoods uses more extensive impulse marketing strategies and more aggressively promotes low nutrient and energy dense foods and beverages than the Kroger owned “Ralph’s” markets in higher-income neighborhoods in the same city. For example, entering Food for Less one has to pass through a gauntlet of sugar-sweetened beverages, cookies, donuts, and salty snacks that

always appear to be on sale; fruits and vegetables are in the back. In contrast, in Ralphps, fruits and vegetables are placed towards the front of the store.

Exacerbating aggressive marketing is the evidence that persons with fewer financial resources are more vulnerable to impulse marketing techniques that foster heuristic processing and/or are cognitively depleting. In the study by Spears, the percentage of individuals engaging in secondary eating on shopping days was significantly higher for those of lower income than for higher income individuals. A randomized experiment in which individuals were either assigned to be “rich” by having two choices versus assigned to be “poor,” because they could only make one choice, showed that those in the poor conditions demonstrated lower levels of self-control than those in the rich condition (23). The findings imply that the poorer choices associated with poverty are situational, and not an inherent characteristic of the individual.

Other evidence of disparities in vulnerability to spontaneous, rapid choices comes from the 1994 Roper Poll, which showed that planning to eat dinner away from home, compared with just spontaneously going out, increases with income. Only 35 percent of adults with household incomes of less than \$15,000 planned their last dinner outing, compared with 49 percent of those with incomes of \$50,000 or more(43).

### **Insight into Contextual Cues**

In most studies when subjects are debriefed, few recognize that environmental factors had any impact on their own behaviors and food consumption. Indeed, many people vehemently deny that factors other than their own internal preferences influence their decisions, even when the evidence is made explicit (9). In general people lack insight into the causes of their behaviors or decisions. The mental work behind choices made rapidly is hidden from conscious awareness (3, 131). Instead, when people make quick decisions, they often manufacture a plausible reason, which is sometimes, but not always, correct (131).

Given the habitual nature of eating, the rapidity with which people must make eating decisions, and the cognitive depletion associated with decision-making, the current evidence suggests that most people lack the capacity to consistently make wise food choices, without sacrificing executive control in other areas of their lives (132, 133). Several studies have shown that dieters have developed deficits in executive functioning. The preoccupying nature of having to pay close attentions to dietary choices has been considered the primary cause of this phenomenon (134-136).

### **Limitations**

The studies cited are drawn from multiple fields and sources, and for the most part represent short term laboratory or field-based studies. As a result, the findings only represent short term results. However, because eating is a routine behavior, and eating choices are freshly made and are inherently subject to contextual influence, it is plausible that the same results would be repeatedly seen over time. Longer term studies of food intake suggest that people do not naturally compensate when they consume too much at one meal, by eating less at subsequent meals (63, 137).

### **Conclusion: Contextual Cues as Risk Factors**

Until now, factors like impulse marketing and placement of low-nutrient food, menu design, and the atmospherics of restaurants and supermarkets have not been considered overt risk factors for obesity. Instead, individual, conscious choice has been deemed the source of obesity. The automatic behaviors of individuals in response to contextual food cues have not

been widely recognized. Yet understanding the true nature of how people make choices about food is critical to developing solutions to the obesity epidemic.

There are a myriad of contextual factors that influence eating and food purchasing behaviors in ways that people cannot recognize or resist. While contextual influences can be helpful or harmful, it is clear that contextual influences promoting low nutrient foods have increased over the past few decades (138, 139). Because contextual influences moderate food consumption, they could fully explain the obesity epidemic. Even if individuals could be aware of all the subtle ways in which the environment cues behaviors, few individuals have the capacity to ignore or resist these cues on an ongoing, routine basis. In addition, many individuals would deny that these contextual factors even influence their behavior in the first place. The ubiquity of less healthful choices can overwhelm and undermine cognitive, deliberate decision-making.

The current debate about society's role in promoting better choices, including healthier diets, has been shifted to the concept of "libertarian paternalism," which advocates making a worse choice more effortful and deliberative than making a better choice (140). A public health approach would be to directly reduce, limit, or mitigate environmental factors leading to choices that increase the risk of chronic diseases. Risk reduction for environmental risk factors is typically accomplished by regulation and enforcement (141).

Since food outlets like restaurants and supermarkets are already regulated by local governments, there is a strong potential for further interventions to regulate factors that increase an individual's risk for diet-related chronic diseases. In both settings, attempts to help people make better choices by pointing out healthful characteristics do not seem to be sufficient to overcome the automatic responses to the promotion of less healthful items. In restaurants, the strongest factors appear to be the presentation of food choices and the quantity served. In supermarkets, saliency and presentation are key factors that influence choice.

Heuristic reasoning and eating behaviors are bound together because eating is a routine habitual behavior, occurring several times every day. Therefore, the kinds of interventions to help people make better choices should employ heuristic processing. Regulating contextual risk factors is a potentially powerful vehicle for obesity control, because it can facilitate the meeting of public health recommendations on a population level. For example, developing standards like portion control that require a default serving size consistent with national dietary guidelines could prevent inadvertent overconsumption, but still allow individuals to order more than one portion if they wanted. Regulations that govern the nutrient profile of foods placed in salient locations, for example, prohibiting the placement of candy on end aisle or cash register displays could protect people who want to avoid these foods from an impulse purchase.

Given that there are multiple strategies that have been effective in encouraging people to eat more than they need, the same strategies might be employed to curtail overconsumption and influence retailer and manufacturer practices and policies. Establishing consumer laboratories in working restaurants and supermarkets dedicated to promoting healthy choices could monitor the impact of manipulating contextual factors, including placement, pricing, labeling, promotions, atmospherics, and incentives. Empirical research to test the efficacy of heuristic based interventions that would transform retail food settings is needed. Research is necessary to avoid unintended consequences, for example, if the presence of healthy items results in greater indulgence in foods associated with chronic diseases (142, 143). Once malleable risk factors and protective factors are identified, these can be the targets of future regulation.

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