

**Pleasure and the Control of Food Intake:
An Embodied Cognition Approach to Consumer Self-Regulation**

Olivia Petit

Imagineering Institute/City University London

Frédéric Basso

London School of Economics and Political Science

Dwight Merunka

Aix-Marseille University/ Kedge Business School

Charles Spence

University of Oxford

Adrian David Cheok

Imagineering Institute/City University London

Olivier Oullier

Aix-Marseille University

Olivia Petit, Imagineering Institute, Malaysia, and City University London, United Kingdom; Frédéric Basso, Department of Social Psychology, London School of Economics and Political Science, United Kingdom; Dwight Merunka, CERGAM EA 4225, Aix-Marseille Graduate School of management – IAE, Aix-Marseille University, France, and Kedge Business School, Marseille, France; Charles Spence, Department of Experimental Psychology, University of Oxford, United Kingdom; Adrian David Cheok, , Imagineering Institute, Malaysia, and City University London, United Kingdom; Olivier Oullier, LPC, UMR 7290, FED 3C, FR 3512, Aix-Marseille University & CNRS, France.

Correspondence concerning this article should be addressed to Olivia Petit, Imagineering Institute, Anchor 5, Mall of Medini, No. 4 Lebuuh Medini Utara, Medini Iskandar, 79200 Iskandar Puteri, Johor, Malaysia, oliviapetit@imagineeringinstitute.org.

Pleasure and the Control of Food Intake: An Embodied Cognition Approach to Consumer Self-Regulation

ABSTRACT

Consumers try to avoid temptation when exposed to appetizing foods by diverting their attention away from their senses (e.g., sight, smell, mouthfeel) and bodily states (e.g., state of arousal, salivation) in order to focus on their longer-term goals (e.g., eating healthily, achieving an ideal body weight). However, when not including sensations in their decision-making processes, consumers risk depleting their self-regulatory resources, potentially leading to unhealthy food choices. Conversely, based on the concept of ‘embodied self-regulation’, it is suggested that considering bodily states may help consumers regulate their food choices more effectively. A new model is proposed that facilitates understanding observed consumer behavior and the success or failure of self-control in food intake. It is argued that bodily states and sensory information should be considered when modeling consumer behavior and developing health-related advocacy and communication campaigns. The model proposed here leads to new perspectives on consumer consumption behavior and health policy research and strategies.

Keywords: embodiment, self-control, consumer behavior, metaphor, food, advertising

Imagine a hungry consumer standing in front of a vending machine deciding on what snack to buy. This consumer will likely begin narrowing down alternatives and hesitate between say a rich chocolate bar and a healthy natural grain bar. Choosing the latter may be driven by health goals. However, this decision, just as the alternative of a chocolate bar, engages the senses that influence perception, judgment and eventually food choice and consumption (Krishna, 2012). According to the theory of embodied cognition, “*simulations of perceptual, motor, and introspective experience underlie the representation and processing of knowledge*” (Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005, p. 94). This theory highlights the importance of exteroceptive senses and interoceptive bodily states, such as muscle activity, hunger, thirst and emotions, in the judgment formation process. According to this theory, all cognitive processes are “*fundamentally grounded in their physical context*” (Niedenthal et al., 2005, p. 186).

The importance of bodily states in cognition is already integrated in sensory marketing practices to drive consumer perceptions and simulations (e.g., Elder & Krishna, 2012; Spence, 2015; for a review, see Krishna, 2012; Krishna, Cian, & Sokolov, 2016). For example, food marketing and advertising lead consumers to making taste inferences. These can be thought of as embodied mental simulations (or reenactments) of what would occur if the food item under consideration were to be consumed (Barsalou, Simmons, Barbey, & Wilson, 2003). These inferences then facilitate product recall and willingness to consume the product (Krishna, Lwin, & Morrin, 2010). For instance, Jif (lemon juice) and Orangina (orange soft drink) utilize packaging shapes and product textures that resemble and evoke the fruit in order to appeal to consumers’ sense of touch (Krishna, 2012; for a review, see Spence & Gallace, 2011) and hence the gustatory inferences associated with this. However, in spite of this knowledge and managerial practice, sensory marketing is rarely used to promote healthy food choices.

Bodily states and sensory simulation are mainly perceived as disrupting self-regulation (Strack, Werth, & Deutsch, 2006). For instance, the sight of a chocolate cake may activate positive associations with sensory information (e.g., taste, mouthfeel) and behavioral patterns linked to this sensory information (e.g., eating the cake). The ensuing mental sensorimotor imagery prepares the body to initiate a behavioral response (Hofmann, Friese, & Strack, 2009). It is generally believed that health-related goals conflict with these bodily states as illustrated by a hot-cold decision triangle that opposes colder state reasoning with hotter visceral reactions, such as hunger, thirst, pain and sexual desire (Yang et al., 2012) (see Figure 1 in the next section). According to this model, bodily states must be inhibited for consumers to make healthier food choices. However, self-regulation is effortful and requires cognitive resources that are only available for short periods of time and are therefore difficult to engage continuously (Baumeister, 2002). The depletion of these resources may then lead to the failure of self-regulation. It follows that the inhibition of bodily states consumes self-regulatory cognitive resources, which in turn leads to succumbing to temptation and unhealthy food choices (Vohs & Faber, 2007).

This article revisits the hot-cold decision triangle model and proposes a new model that explicitly incorporates the concept of embodied self-regulation. In particular, it is contended that consumers' consideration of bodily states and sensory information may very well lead to healthy decisions with a reduced use of self-regulatory resources. Past empirical research demonstrates that in order not to use self-control, healthy behaviors may be implicitly promoted simply by changing the consumption environment, for example, package downsizing, smaller dinnerware and reduced visibility and convenience (Marteau, Hollands, & Fletcher, 2012, Wansink & Chandon, 2014). However, this low profile strategy does not necessarily encourage people to pursue their long-term goals.

By contrast, this article proposes that bodily states may be directly integrated into the self-regulation process to promote healthy habits over the long term. It is argued that whenever the consideration of bodily states associated with healthy consumption is enhanced, those states associated with unhealthy consumption will play a lesser role in decision-making and thereby lead to using fewer self-regulatory resources. This article relies on the theory of embodied cognition to demonstrate how bodily states contribute to self-regulation and could potentially be used to promote healthy eating behaviors (e.g., Niedenthal et al., 2005). This leads to **our** proposition concerning “*embodied self-regulation*”. It is argued that from the standpoint of embodied cognition, all consumer decision-making is grounded in sensorimotor activity, including the decision not to consume unhealthy food. A better understanding of the sensorimotor aspects of self-regulation provides new insights in the field of consumer psychology. A novel explanation of healthy food choice may also help policy makers and the food industry deliver more effective health communication campaigns.

In the first section of this article, the concept of embodied self-regulation is introduced and defined. This leads to proposing a new type of (non-exclusive) relationship between “cognition” and “bodily states” as applied to healthy food choices. In the second section, individual differences in eating behaviors are described from the perspective of embodied self-regulation. Finally, it is discussed how embodied healthy food communication campaigns could help consumers control themselves and change their eating habits.

EMBODIED SELF-REGULATION: BEYOND THE HOT-COLD DICHOTOMY

Maintaining a healthy diet and engaging in regular physical activity requires pursuing long-term goals that involve self-regulatory processes. According to MacInnis and Patrick (2006, p. 225), self-regulation entails: “*the process of controlling thoughts, behavior, attentions, and emotions to achieve a self-corrective action that helps one attain a*

normatively appropriate or personally desirable goal”. As many of these responses (i.e., thoughts, behaviors and emotions) have motivational power, engaging self-regulatory processes requires strength to overcome them, as demonstrated by a significant decrease in activity in the brain areas involved in self-control during a choice task after having performed an attention task (Muraven, Tice, & Baumeister, 1998; Hedgcock, Vohs, & Rao, 2012).

Therefore, self-regulation may be perceived as a “cold reflective system” that controls the “hot impulsive system” according to the hot-cold decision triangle model (Yang et al., 2012). Individuals are able to maintain their long-term goals whenever their self-regulatory resources are high. The idea underlying this dual system model is that visceral urges lead to impulsive decisions and exhaust self-regulatory resources. To limit visceral reactions and facilitate “cold reasoning”, one suggestion is reducing the physical and temporal proximity of the individual to the stimuli (Loewenstein, 1996; Yang et al., 2012). However, physiological processes associated with cognition are experienced with different degrees of intensity and do not necessarily take the form of visceral urges. Indeed, some physiological processes actually help consumers make healthier decisions. Thus, after presenting the hot-cold decision triangle model, it is proposed revising it and integrating the concept of embodied self-regulation.

The Hot-Cold Decision Triangle

Yang et al. (2012) model cognitive systems and visceral states in a triangle to represent the likelihood of consumers making healthy food choices. The hot-cold decision triangle is based on the dual system model of behavioral determination whereby a first emotional, perceptive and intuitive system (System 1) operates automatically, quickly and effortlessly. A second logical and reflective system (System 2) operates more slowly, effortfully and deliberately (Kahneman & Frederick, 2002; Metcalfe & Mischel, 1999; Shiv, Fedorikhin, & Nowlis, 2005; Strack et al., 2006). To this dual system model, Yang et al. (2012) add a hot/cold dimension representing the visceral urges illustrated with a triangle (Figure 1).

Insert Figure 1

The lower right part of the triangle reflects the situation where consumers are able to ‘engage’ (i.e., deliberately, using System 2) in cold reasoning unperturbed by visceral urges. In this situation, people have sufficient cognitive resources and carefully consider their long-term goals. The likelihood of consumers selecting healthy options depends on maintaining their cognitive resources.

In the lower left corner of the triangle, visceral urges and cognitive resources are limited. People tend to minimize cognitive efforts and their decisions are ‘dominated’ (i.e., with only few deliberations) by heuristics and automaticity (System 1). They mostly follow consumption norms unconsciously when regulating their behavior. The likelihood of making healthy food choices is essentially determined by these norms, for instance, how much other people eat, how large the food portion is (Herman, Roth, & Polivy, 2003; Wansink & van Ittersum, 2013; Yang et al., 2012). To facilitate healthy consumption, the food environment can be modified to ‘nudge’ people towards healthier choices (Marteau, Hollands, & Fletcher, 2012; Wansink & Chandon, 2014; Yang et al., 2012). Nudging is a cognitive strategy used to help people make better choices by inducing behavioral changes and redesigning the social and/or physical environment to influence their choices, thus improving individual and/or collective health and wellbeing (Sunstein, 2016; Thaler & Sunstein, 2008). Reducing food portions or inserting a colored chip at regular intervals in a tube of potato chips enables inducing smaller consumption norms and decreasing food intake (Geier, Wansink, & Rozin, 2012; Wansink, 2010).

The upper left corner of the triangle illustrates the visceral urges that ‘drive’ consumers (i.e., without deliberation) to unhealthy options to satisfy immediate needs. In this situation, it is difficult to help consumers make healthier food choices. However, Yang et al. (2012)

propose the use of visceral urges to help consumers behave more healthily, for example, generating negative visceral reactions to cigarettes or unhealthy food by associating them with disgusting pictures of what could happen if consumed (e.g., Gallopel-Morvan, Gabriel, Le Gall-Ely, Rieunier, & Urien, 2011; Leshner, Bolls, & Thomas, 2009; Puhl, Luedicke, & Peterson, 2013a).

The hot-cold decision triangle model provides a useful structure to understand healthy behaviors and the failure of self-regulation. However, according to this model, hunger, pain and pleasure are considered disruptive influences on self-regulation. Automatic and heuristic solutions are therefore suggested (e.g., smaller food portions) to compensate for such influence (Wansink & Chandon, 2014; Yang et al., 2012). Reducing the size of food portions may help consumers decrease the quantity of high calorie food they consume, but does not necessarily help them make healthier food choices. Therefore, the hot-cold decision triangle is revisited and expanded by introducing an additional dimension (upper-right, see Figure 2) that accounts for situations in which bodily states support the cognitive system.

The High-Low Embodied Decision Matrix

According to embodied cognition, bodily states and cognitive appraisals jointly contribute to judgments and choices (Niedenthal et al., 2005; Oullier & Basso, 2010). However, a more embodied decision does not necessarily imply a less cognitive decision and, conversely, a more cognitive decision does not necessarily imply a less embodied decision (Reimann et al., 2012). Controlling food intake or eating food that does not belong to the preferred options are decisions that stimulate the senses and bodily states, such as the reduction of pleasure during consumption or the simulation of pleasure resulting from consumption of less appreciated food items. Self-regulation from an embodied cognition perspective implies not only that individuals seek to control their bodily states, but also that they consider and integrate their bodily states in the context of reaching long-term goals.

Thus, “embodied self-regulation” can be defined as the process by which bodily states may be used to reveal and facilitate behavioral self-regulation in achieving long-term goals. In this article, the hot-cold decision triangle is revisited to propose the high-low embodied decision matrix (Figure 2).

Insert Figure 2

Given that bodily states are no longer solely associated with System 1, the ordinal axis now corresponds to the level of embodiment. The upper-left corner of the matrix illustrates visceral urges and the lower right part corresponds to reasoning with minimal consideration of bodily states. The lower-left part considers automatic and heuristic decisions not based on visceral urges. Finally, the upper-right corner corresponds to an embodied form of reasoning. If, by definition, all reasoning involves physiological processes (Barsalou, 2008; Niedenthal et al., 2005), a high level of embodiment indicates that bodily states have a higher weight in consumer reasoning processes in considering and achieving long-term goals.

In summary, an embodied decision is not necessarily more automatic or uncontrolled. The consideration of bodily states helps consumers control themselves. To support this idea, it is now presented ways in which self-regulation is likely to improve through various considerations of bodily states.

Embodied Self-Regulation

Interoception is the sense of the physiological state of the body and includes sensual touch, muscular and visceral sensations, hunger and thirst (Craig, 2002). By comparing bodily states at the present time with those of the past and the future, people create a coherent representation of their feelings about an object that helps in making decisions (Craig, 2009).

For this reason, bodily states trigger cognitive states and facilitate specific thoughts. They change perceptions of objects and affect attitudes, price evaluations and even moderate purchasing intent (Barone, Lyle, & Winterich, 2015; Hung & Labroo, 2011).

From the perspective of embodied self-regulation, bodily states facilitate and reveal behavioral self-regulation. For example, when people enter a store to buy food, they are shown to choose healthier snacks if they weave a pen between their stretched fingers rather than loosely between their index and middle fingers (Hung & Labroo, 2011). Thus, exercising self-regulation is facilitated by the concomitant occurrence of physical muscle contraction and willpower to control food consumption.

Self-regulation may also be facilitated by creating an association between sensory information provided by an unhealthy but appetizing food item and the choice not to consume it. Sensory information provided by the sight and smell of a chocolate cake in a bakery storefront reminds passersby of the pleasure of previous consumption episodes. However, this may also elicit thoughts linked to weight gain and current diet (Fishbach, Friedman, & Kruglanski, 2003; Spence, Okajima, Cheok, Petit, & Michel, in press). Repeated attempts at self-control favor the formation of a link between the representation of perceptions associated with momentary temptation (e.g., the chocolate cake) and the cognitive representation of the goal that these perceptions disrupt (e.g., achieving a healthy weight). The simple presentation of temptation-related information (e.g., junk food items) favors processes that alert people that their long-term interests are threatened. With such information, people tend to yield less to temptation compared to when presented with a neutral stimulus (Fishbach et al., 2003). From the standpoint of embodied self-regulation, when faced with the temptation to eat a piece of cake and evoking multisensory information, making a healthy food choice is easier when consumers have previously associated this information with acts of self-control.

McCrickerd and Forde (2016) highlight that all senses play an important role in food consumption and that enhancing sensory stimulation while eating affects food intake. For instance, food texture (e.g., creaminess, crunchiness, firmness and thickness) is a major determinant of eating rate. To reach the same degree of satiation, people consume 47% more of a chocolate-flavored dairy liquid than a chocolate-flavored dairy semi-solid with an equal energy density (de Wijk, Zijlstra, Mars, De Graaf, & Prinz, 2008). Liquids are consumed much faster than solids due to a decrease in orosensory exposure time, which increases the eating rate (de Wijk et al., 2008).

The sense of taste works as a sensor and informs the brain on the inflow of nutrients to produce a satiety signal (de Graaf, 2012). Consequently, doubling the orosensory exposure time while drinking orangeade reduces intake by as much as 30-35% (Weijzen, Smeets, & de Graaf, 2009). Similarly, increasing retronasal aroma exposure and concentration produced by the release of volatile molecules during swallowing has been shown to lead to a 9% reduction in food consumption (Ramaekers et al., 2014). Enhancing the duration and physical intensity of sensory stimulation can therefore exert a positive influence on self-regulation.

In addition to bodily states and sensory information, embodied mental simulation also helps individuals control themselves. Visual exposure to food pictures may in certain cases increase satiety and exert a beneficial effect over people's food behavior (Spence et al., in press). According to the embodied cognition perspective, initial perceptions of an object are stored in memory and when new perceptions of the object are later experienced, the initial perceptions are mentally simulated (see Barsalou, 2008). Empirical results show that simulation of consumption is at least partially represented in the same brain systems (Simmons, Martin, & Barsalou, 2005). For this reason, similar to perception, mental simulation could also reduce the attractiveness of the product. For example, similar to the effects of orosensory exposure, which gradually reduce expectations of pleasure during

eating (de Graaf, 2012; Redden & Haws, 2013), simulating food consumption can also decrease hunger (Morewedge, Huh, & Vosgerau, 2010).

Morewedge et al. (2010) demonstrate that the mere fact of imagining eating many (vs. few) M&M's candies significantly reduces subsequent consumption. Meanwhile, Cornil and Chandon (2014) show that merely imagining the taste and smell of appetizing food increases the hedonic appeal and willingness to pay for smaller, but not larger, food portions. Papies, Pronk, Keesman and Barsalou (2015, p. 149) suggest that mindful attention (i.e., "*becoming aware of one's thoughts and experiences*") moderates how bodily states translate into appetitive behavior. They show that directing this sort of attention to simulations of unhealthy food reduces the effect of hunger on food craving and choice of unhealthy snacks. From the perspective of embodied self-regulation, being more conscious of one's bodily states (and their simulation) in response to appetitive stimuli may be beneficial to pursuing healthy goals.

To summarize, several routes connecting senses, bodily states and cognition to successful self-control have been outlined, confirming the potential of the high-low embodied decision matrix to represent the likelihood of choosing healthy options. Senses and bodily states may be muscular, visual, olfactory and introspective. Consumers should thus be able to adopt embodied self-regulation in making food choices in grocery stores, restaurants and also in online environments where sensory information is limited.

INDIVIDUAL DIFFERENCES IN EMBODIED SELF-REGULATION

According to the high-low embodied decision matrix, bodily states facilitate self-regulation without necessarily depleting cognitive resources. In other words, a consumer who takes into account his/her senses and bodily states should be able to maintain his/her long-

term goals. In relation to consumer heterogeneity, it will now discuss the self-regulatory ability of different types of eaters linked to their bodily states.

Dieters and Unrestrained Eaters

The difference between dieters and unrestrained eaters is their reasons for not choosing an unhealthy food option. For dieters, this choice results from the conflict between their immediate pleasure and the expected long-term health consequences. By contrast, unrestrained eaters make this choice because they do not like eating unhealthy food (Bublitz, Peracchio, & Block, 2010). To determine consumption, dieters rely on self-generated rules (e.g., food not to eat when on a diet) instead of the physiological signals of hunger and satiety their bodies provide (Bublitz et al., 2010). However, because satiety is key to halting consumption through lowering the desire to eat (Redden & Haws, 2013), failing to consider bodily states may lead to the failure of self-regulation and therefore dieting. Dieters try to focus more on health goals than on their physical sensations in order not to succumb to temptation. This leads to a poor estimation of caloric content and food intake. For instance, Chernev and Gal (2010) report that those trying to control their weight are more likely to estimate that a hamburger with salad is less calorific than the same hamburger when presented by itself (compared to consumers who do not care about weight management). Instead, relying on the level of satiety rather than on external signals would provide a better estimation of nutrient intake. This is key to halting consumption in that it lowers the desire to eat (Redden & Haws, 2013).

A further disadvantage of not considering bodily states is that self-control resources are required to regulate consumption. Unrestrained eaters will choose healthy food because they like it. Therefore, even when their control resources are low, they will continue to choose healthy food since this is not considered a constraint (Hofmann, Rauch, & Gawronski, 2007). By contrast, dieters need to make perpetual cognitive mediation efforts to fight their urges to

consume unhealthy food. For instance, Vohs and Heatherton (2000) show that when dieters are close to appealing food but cannot touch it, they use self-regulatory resources to not eat it. This situation exhausts their ability to resist when they are subsequently offered another snack. A better understanding of the origin of this urge to eat is thus desirable.

Overweight and Normal Weight Eaters

Being overweight is associated with a failure to maintain health goals. For instance, there is a negative association between disposition to self-control and body mass index (BMI) (Keller & Siegrist, 2014). Ouwehand and Papies (2010) demonstrate that dieters who successfully maintain low body weight report less desire to eat high-calorie food after being exposed to attractive food than overweight dieters. This distinction in disposition of self-control between those who are and are not overweight may be linked to the consideration of bodily states during food consumption (Berridge, Ho, Richard, & DiFeliceantonio, 2010).

Berridge et al. (2010) distinguish two systems involved in food consumption: liking and wanting. The liking system initiates with the immediate assessment of food products related to gustatory pleasure and implies an important role of taste in food choice. The wanting system is more sensitive to the eating environment and entails a willingness to engage in behaviors designed to obtain the desired food. Liking and wanting co-vary; changes in taste lead to proportional adjustments in the willingness to eat while changes in the willingness to eat lead to adjustments in hedonic responses during consumption (Finlayson, King, & Blundell, 2007). An energy deficit can elicit hunger, but the gradual reduction of pleasure through consumption then serves as an indicator to halt consumption. However, liking and wanting can also be distinct. Anticipated pleasure motivates people to increase their consumption regardless of satiety. By activating representations of food experiences in memory, environmental signals modulate the will to eat and increase energy intake by reducing attention to homeostatic regulation.

This separation between the wanting and liking systems appears clearer for those who are obese (Berridge et al., 2010). While non-obese individuals tend to be more attentive to food pictures when they are hungry (Goldstone et al., 2009), obese people look at high-calorie food pictures quicker and for longer, regardless of their level of satiety (Castellanos et al., 2009). Thus, the motivations underlying food choice for obese individuals appear to be more related to anticipated pleasure than to physiological need (Petit, Basso, Huguet, Plassmann, & Oullier, 2011). In parallel, the level of pleasure during consumption is less important for obese people than for lean individuals (Berridge et al., 2010). Pleasure does not constitute an indicator of replenishment and thus obese eaters are less able to self-regulate because they experience less pleasure during consumption. For these individuals, increased brain activity in the gustatory and somatosensory cortices during exposure to food pictures prior to consumption is accompanied by decreased brain activity associated with reward during consumption (Stice, Spoor, Bohon, Veldhuizen, & Small, 2008). Hence, expectation of the pleasure of consumption appears to be disconnected from bodily states and leads to an extreme focus on the eating environment.

In summary, consumers taking into account bodily states and particularly their pleasure during consumption, do not use many self-regulatory resources. They are less influenced by external cues and expected pleasure of consumption than consumers who do not take their senses and bodily states into account. For this reason, health marketing campaigns should be crafted to help people consider their bodily states to potentially make healthy food choices.

PERSPECTIVES ON HEALTH MARKETING FROM THE EMBODIED COGNITION STANDPOINT

Bodily states are essential for self-regulation, and as such, policy makers and the food industry should develop communication strategies to take these into account. In particular,

promoting mental sensory motor imagery of healthy food in advertising will likely encourage self-regulation (Petit, Cheok, & Oullier, in press; Spence et al., in press).

Simulating the Taste of Healthy Food

Unsuccessful dieters, and more generally unhealthy eaters, often tend to create oppositions between products that are “healthy”, “nourishing” or “good for you” and those that are “enjoyable”, “fun” or “exciting” (Schuldt & Hannahan, 2013). Thus, products labeled as healthy tend not to be popular among such consumers (Raghunathan, Naylor, & Hoyer, 2006; see also Werle, Trendel, & Ardito, 2013). When dieting, individuals are likely to base their food choices solely on health aspects as they do not perceive healthy food as pleasant. Advertising campaigns may help people control their food intake more easily by questioning the presumed negative relationship between healthy versus tasty food (Raghunathan et al., 2006). For instance, the Swedish grocery retail chain ICA Sverige AB adopted sensory labels (e.g., juicy oranges rather than Florida oranges) to try to entice consumers into eating more fruit and vegetables (Krishna, 2012).

By highlighting the pleasure of eating healthy food, properly designed advertising could induce tasty food inferences that facilitate the selection of healthy food items. Petit et al. (2014b) demonstrate that the sensory simulation of the taste of healthy food increases healthy food choices, especially amongst those with a high BMI. For these individuals, the sensory simulation of the taste of healthy food leads to greater activity in the brain areas involved in taste inference, the valuation of choices and self-regulation. By contrast, the simulation of health benefits leads to less activity in these brain areas. Similarly, Petit, Merunka and Oullier (2014a) report that people with unhealthy eating habits are motivated more by messages that highlight the pleasure of eating fruit and vegetables than by messages highlighting positive health consequences. Therefore, feeling pleasure renders healthy goals more acceptable. By contrast, highlighting health consequences devalues healthy food choice. These findings are

in line with Werle and Cuny (2012) who show that the choice of a healthy snack doubles in the absence of health messages.

Food advertising that facilitates embodied mental simulation through sensorimotor fluency increases purchasing intentions (Elder & Krishna, 2012). Therefore, promoting mental sensorimotor imagery of healthy food consumption may increase healthy product purchasing intentions. For instance, metaphors may elicit sensorimotor inferences from a hedonic experience domain (e.g., junk food consumption) to focus consumers on the hedonic experience in the target domain of healthy food consumption. Ways of using metaphors in healthy food advertisements are described next.

Metaphors and Food Perception

Sensory metaphors, i.e., metaphors that relate more to the senses and with greater associative cues than their semantic equivalents (Akpınar & Berger, 2015), constitute an important means of encouraging embodied mental simulation amongst consumers (Forceville, 2008; Hirschman, 2007; Zaltman & Zaltman, 2008). Using metaphors helps communicate embodied concepts, since metaphors transfer experientially remote manipulations of bodily states (Landau, Meier, & Keefer, 2010).

Theoretically, *“an embodied concept is a neural structure that is actually part of, or makes use of, the sensorimotor system of the brain. Much of conceptual inference is, therefore, sensorimotor inference”* (Lakoff & Johnson, 1999, p. 20).

A metaphor inherently involves an inference by mapping from a source to a target domain to explain an experience domain (Lakoff & Johnson, 2003). For instance, in a food metaphor advertisement, such as “hair-silk is ice cream” (Forceville, 2008), the source domain of the metaphor (food) leads to taste inferences as perceptual (gustatory) reenactments, which focuses the consumer on nourishment in the target domain (hair silk).

Similarly, a Food Imitating Product (FIP, i.e., a household cleaning or personal care product that incorporates food attributes to improve the consumption experience) constitutes a food product metaphor (Basso et al., 2014). Metaphors such as “hygiene products are food” draw consumer attention to the product’s sensory and hedonic aspects (e.g., shape, color and odor) while masking their more negative and sometimes hazardous features (e.g., cleaning, toxicity). This may help explain why some FIPs are accidentally ingested (Basso et al., 2014). Consumer behavior can also have metaphoric effects. For instance, the act of hand washing before and/or after food consumption is a hygienic practice that also symbolically cleanses individuals of their transgressions (e.g., hedonic food choice) (Martins, Block, & Dahl, 2015). For this reason, such practice increases the likelihood that consumers will choose hedonic food before consumption and decreases the perceived guilt after hedonic food consumption (Martins et al., 2015).

In public health communication, food is often the target domain of metaphors to efficiently simulate the experience of satiety or disgust and help reduce food cravings. Consider an obesity-related health message such as: “*Are you pouring on the pounds?*” (Puhl, Luedicke, & Peterson, 2013a). Here, the “pounds are drinks” metaphor encourages consumers to experience drinks in terms of pounds. In the message, “*You wouldn’t inject your children with junk. So why are you feeding it to them?*” (Puhl, Peterson, & Luedicke, 2013b), the “junk food is a drug” metaphor suggests junk food could be experienced as drugs. These metaphors also rely on the reenactment of the experience of fullness (“pouring”, “inject”, “feeding”), which may have a parallel and powerful effect on food perceptions.

When individuals are fed (and feel full), they find low- rather than high-calorie food appealing (Goldstone et al., 2009). If people can reenact an experience of fullness by means of a metaphor, they may find low-calorie food more appealing (Levontin, Ein-Gar, & Lee, 2015). Therefore, marketing campaigns using metaphors may help simulate pleasant healthy

food and unpleasant junk food perceptions, potentially leading to improved perceptions of satiety signals and better food intake regulation.

Metaphors and Bodily Perspectives

The problem with the use of metaphors to target bodily states in campaigns against obesity is that this may lead to the stigmatization of those who are overweight (Puhl et al., 2013b). Hoyt, Burnette and Auster-Gussman (2014) demonstrate that although the “obesity is a disease” suggestion reduces the body dissatisfaction of obese people, it also weakens the importance they place on health-focused dieting and their weight concerns. Accordingly, representing obesity as a disease may render self-regulatory efforts futile, which inevitably leads to failure and disengagement. In a similar vein, the “obesity is suicide” campaign of the Northern Bariatric Surgery Institute uses non-credible metaphors (“butter is a suicide bomb”, “candies are suicide pills”). The mere consumption of candy does not lead to weight gain or health risks. Overconsumption does. Eating 10 candies does not affect people’s health in the same way as swallowing 10 pills to commit suicide. Furthermore, as previously noted, obese people have difficulty estimating the quantities consumed due to their poor consideration of bodily states. Thus, effective metaphors could be tuned towards helping obese consumers take better account of their embodied experience.

In a 2011 fitness campaign, the X-Fit Body Trainer ads featured a metaphor of a pregnant man using a large belly as a cue of pregnancy, which is impossible for a man. It also referred to an embodied, conceptual metaphor, according to which the body is a container (Johnson, 1987; Lakoff, 1987; see also Boot & Pecher, 2015). Taking the first-person perspective of an obese man, the ad was directed at obese people and to help non-obese consumers visualize what being obese means. A 2008 Brazilian ad for the Eizens Sport Center featured a fat man unable to climb on top of a fat woman’s belly in bed. The metaphor of a fat belly as a mountain suggests that pleasure is possible by reducing the belly. Here, the

conceptual metaphor relies on orientation to indicate that “more is up” (Lakoff & Johnson, 1980) and treats obesity from a third-person perspective. Further research should explore the effects of such metaphors on self-regulation.

The metaphor examples reflect two visual perspectives: first- and third-person. From a first-person perspective, consumers see the experience through their own eyes; a third-person perspective instead encourages people to see their experience through the eyes of others. In discussing the interplay between perception, cognition and action, Macrae, Raj, Best, Christian and Miles (2013) illustrate that a first-person perspective appears more embodied than a third-person perspective (Lorey et al., 2009; see also Christian, Parkinson, Macrae, Miles, & Wheatley, 2015). Such findings may be useful in promoting embodied self-regulation. For instance, visualization (i.e., visual imagery) is only effective with a health message (e.g., “eating three extra portions of fruit tomorrow”) and the beneficial effects are more pronounced from a first-person perspective (Rennie, Uskul, Adams, & Appleton, 2014). The first-person perspective would seem to be critical in promoting healthy food consumption, perhaps because the gustatory simulation of healthy food is more intense from a first-person perspective. Further research should test this proposition.

Disruptive Perspectives in Health-Oriented Communication Campaigns

Figurative metaphors deviate artfully from expectations (Phillips & McQuarrie, 2009). However, if figurativeness is too disruptive, the metaphor may be unsuccessful, as demonstrated by some anti-smoking campaigns that led the targeted population to misunderstand the metaphor’s intended meaning (Basso & Oullier, 2011; Bremer & Lee, 1997). Therefore, it would be interesting to attempt to account for the impact of the visual perspective on highly figurative metaphors and the potential disruption of health-oriented campaigns.

In the visual metaphor “French fries are cigarettes” depicted in Figure 3a below, the concept of cigarettes is mapped onto the concept of French fries, such that they appear dangerous. Although the picture of a cigarette pack featuring the words “killer at large” aims to suggest the danger of French fries, it could also evoke the pleasure of consuming and thereby increase the craving for food. A more appropriate solution could be the comparison illustrated in Figure 3b, according to which healthy food (carrots) provides as much pleasure as junk food (French fries). This nonverbal comparison supports the simulation of pleasure derived from the consumption of healthy food. Bolthouse Farm’s slogan “eat 'em like junk food” in Figure 3c refers to the enjoyment of eating chips or candy bars and sends the message that carrots are likely to lead to the same pleasure. This advertising campaign also features metaphorical ads in which a sensual model slowly rubs a carrot on her lips, recalling, amongst other things, chocolate advertising. This metaphor reactivates the experience of chocolate consumption and transfers it to carrots (Lakoff & Johnson, 2003; Landau et al., 2010). This kind of transfer may also be useful for anti-obesity campaigns given that they challenge the negative relationship between healthy food and tasty food and render healthy food choices more acceptable (Raghunathan et al., 2006).

CONCLUSIONS

The concept of embodied self-regulation is introduced to explain the role played by bodily states in self-control. It is revisited and enhanced the hot-cold decision triangle that only considers bodily states as visceral urges in connection with an implicit system (System 1). It is then proposed a new model, the high-low embodied decision matrix, which also considers the level of embodiment of a deliberating system (System 2) (Kahneman & Frederick, 2002; Metcalfe & Mischel, 1999; Shiv et al., 2005; Strack et al., 2006; Yang et al., 2012). System 1 may still operate automatically and heuristically or be led by visceral urges.

However, viewing matters through the lens of embodied self-regulation considers that bodily states do not necessarily conflict with long-term goals. Rather, bodily states potentially contribute to the realization of long-term goals and facilitate self-regulation without necessarily depleting cognitive resources.

Consumers focused on long-term goals while taking into account their bodily states are more likely to adopt healthier behaviors (Fishbach et al., 2003; Hofmann et al., 2007; Papies et al., 2015). Eaters who cannot exert self-control, rarely consider the reduction of pleasure that occurs during consumption. Instead, they rely on external signals from the eating environment to regulate their food behavior, which requires more effort and leads to overconsumption. The lack of consideration of bodily states likely stems from the importance people assign to anticipated pleasure in determining food choices. However, consumption of healthy food can be palatable and pleasure does not necessarily need to be inhibited.

Advertising campaigns have the potential to promote the simulation of pleasant experiences for consumers and thus render the consumption of healthy food more attractive. The challenge is now to develop healthy food campaigns that use strategies that evoke embodiment to facilitate mental simulation and tackle the “*dysfunctional inferences*” of taste and reward (Simmons et al., 2005, p. 1607).

More generally, embodied self-regulation suggests that all decisions consumers make, no matter whether in relation to medical checkups, buying shoes, renting a car or negotiating a loan, are grounded in their physical context and integrate bodily states. This calls for marketing research to better understand how bodily states are involved in purchasing decisions usually thought of as requiring “cold reasoning” to facilitate self-control and lead to more embodied social marketing campaigns.

REFERENCES

- Akpinar, E., & Berger, J. (2015). Drivers of cultural success: The case of sensory metaphors. *Journal of Personality and Social Psychology*, 109(1), 20-34.
<http://doi.org/10.1037/pspa0000025>
- Barone, M. J., Lyle, K. B., & Winterich, K. P. (2015). When deal depth doesn't matter: How handedness consistency influences consumer response to horizontal versus vertical price comparisons. *Marketing Letters*, 26(2), 213-223. doi:10.1007/s11002-013-9276-8
- Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology*, 59, 617-645.
doi: 10.1146/annurev.psych.59.103006.093639
- Barsalou, L. W., Simmons, W. K., Barbey, A. K., & Wilson, C. D. (2003). Grounding conceptual knowledge in modality-specific systems. *Trends in Cognitive Sciences*, 7(2), 84-91. doi:10.1016/S1364-6613(02)00029-3
- Basso, F., & Oullier, O. (2011). Smokers are suckers: Should incongruous metaphors be used in public prevention? *American Journal of Public Health*, 101(2), 203-204.
doi:10.2105/AJPH.2010.197996
- Basso, F., Robert-Demontrond, P., Hayek, M., Anton, J. L., Nazarian, B., Roth, M., & Oullier, O. (2014). Why people drink shampoo? Food imitating products are fooling brains and endangering consumers for marketing purposes. *PLOS One*, 9(9), e100368.
doi:10.1371/journal.pone.0100368
- Baumeister, R. F. (2002). Yielding to temptation: Self-control failure, impulsive purchasing, and consumer behavior. *Journal of Consumer Research*, 28(4), 670-676.
doi:10.1086/338209
- Berridge, K. C., Ho, C. Y., Richard, J. M., & DiFeliceantonio, A. G. (2010). The tempted brain eats: Pleasure and desire circuits in obesity and eating disorders. *Brain Research*, 1350, 43-64. doi:10.1016/j.brainres.2010.04.003
- Boot, I., & Pecher, D. (2015). Representation of categories: Metaphorical use of the container schema. *Experimental Psychology*, 58(2), 162-170. doi:10.1027/1618-3169/a000082

- Bremer, K., & Lee, M. (1997). Metaphors in marketing: Review and implications for marketers. *Advances in Consumer Research*, 24, 419-424.
- Bublitz, M. G., Peracchio, L. A., & Block, L. G. (2010). Why did I eat that? Perspectives on food decision making and dietary restraint. *Journal of Consumer Psychology*, 20(3), 239-258. doi:10.1016/j.jcps.2010.06.008
- Castellanos, E. H., Charboneau, E., Dietrich, M. S., Park, S., Bradley, B. P., Mogg, K., & Cowan, R. L. (2009). Obese adults have visual attention bias for food cue images: Evidence for altered reward system function. *International Journal of Obesity*, 33(9), 1063-1073. doi:10.1038/ijo.2009.138
- Chernev, A., & Gal, D. (2010). Categorization effects in value judgments: Averaging bias in evaluating combinations of vices and virtues. *Journal of Marketing Research*, 47(4), 738-747. doi:10.1509/jmkr.47.4.738
- Christian, B. M., Parkinson, C., Macrae, C. N., Miles, L. K., & Wheatley, T. (2015). When imagining yourself in pain, visual perspective matters: The neural and behavioral correlates of simulated sensory experiences. *Journal of Cognitive Neuroscience*, 27(5), 866-875. http://doi.org/10.1162/jocn_a_00754
- Cornil, Y., & Chandon, P. (2014). Pleasure as a substitute for size: How multisensory imagery can make people happier with smaller food portions. Under review.
- Craig, A. D. (2002). How do you feel? Interoception: The sense of the physiological condition of the body. *Nature Reviews Neuroscience*, 3(8), 655-666. doi:10.1038/nrn894
- Craig, A. D. (2009). How do you feel--now? The anterior insula and human awareness. *Nature Reviews Neuroscience*, 10(1), 59-70. doi:10.1038/nrn2555
- de Graaf, C. (2012). Texture and satiation: The role of oro-sensory exposure time. *Physiology & Behavior*, 107(4), 496-501. doi:10.1016/j.physbeh.2012.05.008
- de Wijk, R. A., Zijlstra, N., Mars, M., De Graaf, C., & Prinz, J. F. (2008). The effects of food viscosity on bite size, bite effort and food intake. *Physiology & Behavior*, 95(3), 527-532. doi:10.1016/j.physbeh.2008.07.026
- Elder, R. S., & Krishna, A. (2012). The “visual depiction effect” in advertising: Facilitating embodied mental simulation through product orientation. *Journal of Consumer Research*, 38(6), 988-1003. doi:10.1086/661531
- Finlayson, G., King, N., & Blundell, J. E. (2007). Liking vs. wanting food: Importance for human appetite control and weight regulation. *Neuroscience & Biobehavioral Reviews*, 31(7), 987-1002. doi:10.1016/j.neubiorev.2007.03.004

- Fishbach, A., Friedman, R. S., & Kruglanski, A. W. (2003). Leading us not into temptation: Momentary allurements elicit overriding goal activation. *Journal of Personality and Social Psychology*, 84(2), 296-309. doi:10.1037/0022-3514.84.2.296
- Forceville, C. (2008). Metaphor in pictures and multimodal representations. In R. W. Gibbs (Ed.), *The Cambridge handbook of metaphor and thought* (pp. 462-482). New York, NY: Cambridge University Press.
- Gallopel-Morvan, K., Gabriel, P., Le Gall-Ely, M., Rieunier, S., & Urien, B. (2011). The use of visual warnings in social marketing: The case of tobacco. *Journal of Business Research*, 64(1), 7-11. doi:10.1016/j.jbusres.2009.09.012
- Geier, A., Wansink, B., & Rozin, P. (2012). Red potato chips: Segmentation cues can substantially decrease food intake. *Health Psychology*, 31(3), 398-401. doi:10.1037/a0027221
- Goldstone, A. P., Precht de Hernandez, C. G., Beaver, J. D., Muhammed, K., Croese, C., Bell, G., Durighel, G., Hughes, E., Waldman, A. D., Frost, G., & Bell, J. D. (2009). Fasting biases brain reward systems towards high-calorie foods. *European Journal of Neuroscience*, 30(8), 1625-1635. doi:10.1111/j.1460-9568.2009.06949.x
- Hedgcock, W. M., Vohs, K. D., & Rao, A. R. (2012). Reducing self-control depletion effects through enhanced sensitivity to implementation: Evidence from fMRI and behavioral studies. *Journal of Consumer Psychology*, 22(4), 486-495. doi:10.1016/j.jcps.2012.05.008
- Herman, C. P., Roth, D. A., & Polivy, J. (2003). Effects of the presence of others on food intake: A normative interpretation. *Psychological Bulletin*, 129(6), 873-886. doi:10.1037/0033-2909.129.6.873
- Hirschman, E. C. (2007). Metaphor in the marketplace. *Marketing Theory*, 7(3), 227-248. doi: 10.1177/1470593107080343
- Hofmann, W., Friese, M., & Strack, F. (2009). Impulse and self-control from a dual-systems perspective. *Perspectives on Psychological Science*, 4(2), 162-176. doi:10.1111/j.1745-6924.2009.01116.x
- Hofmann, W., Rauch, W., & Gawronski, B. (2007). And deplete us not into temptation: Automatic attitudes, dietary restraint, and self-regulatory resources as determinants of eating behavior. *Journal of Experimental Social Psychology*, 43(3), 497-504. doi:10.1016/j.jesp.2006.05.004

- Hoyt, C. L., Burnette, J. L., & Auster-Gussman, L. (2014). "Obesity is a disease": Examining the self-regulatory impact of this public-health message. *Psychological Science*, 25(4), 997-1002. doi:10.1177/0956797613516981
- Hung, I. W., & Labroo, A. A. (2011). From firm muscles to firm willpower: Understanding the role of embodied cognition in self-regulation. *Journal of Consumer Research*, 37(6), 1046-1064. doi:10.1086/657240
- Johnson, M. (1987). *The body in the mind*. Chicago, IL: University of Chicago Press.
- Kahneman, D., & Frederick, S. (2002). Representativeness revisited: Attribute substitution in intuitive judgment. In T. Gilovich, D. Griffin, & D. Kahneman (Eds.), *Heuristics and biases: The psychology of intuitive judgment* (pp. 49-81). New York, NY: Cambridge University Press.
- Keller, C., & Siegrist, M. (2014). Successful and unsuccessful restrained eating. Does dispositional self-control matter? *Appetite*, 74, 101-106. doi:10.1016/j.appet.2013.11.019
- Krishna, A. (2012). An integrative review of sensory marketing: Engaging the senses to affect perception, judgment and behavior. *Journal of Consumer Psychology*, 22(3), 332-351. doi:10.1016/j.jcps.2011.08.003
- Krishna, A., Cian, L., & Sokolov, T. (2016). The power of sensory marketing in advertising. *Current Opinion in Psychology*, 10, 142-147. doi:10.1016/j.copsyc.2016.01.007
- Krishna, A., Lwin, M. O., & Morrin, M. (2010). Product scent and memory. *Journal of Consumer Research*, 37(1), 57-67. doi:10.1086/649909
- Lakoff, G. (1987). *Women, fire and dangerous things*. Chicago, IL: University Press of Chicago.
- Lakoff, G., & Johnson, M. (1980). The metaphorical structure of the human conceptual system. *Cognitive Science*, 4(2), 195-208. doi:10.1207/s15516709cog0402_4
- Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and its challenge to western thought*. New York, NY: Basic Books.
- Lakoff, G., & Johnson, M. (2003). Afterword. In G. Lakoff, & M. Johnson (Eds.), *Metaphors we live by* (pp. 243-276). Chicago, IL: University Press of Chicago.
- Landau, M. J., Meier, B. P., & Keefer, L. A. (2010). A metaphor-enriched social cognition. *Psychological Bulletin*, 136(6), 1045-1067. doi:10.1037/a0020970
- Leshner, G., Bolls, P., & Thomas, E. (2009). Scare'em or disgust'em: The effects of graphic health promotion messages. *Health Communication*, 24(5), 447-458. doi:10.1080/10410230903023493

- Levontin, L., Ein-Gar, D., & Lee, A. Y. (2015). Acts of emptying promote self-focus: A perceived resource deficiency perspective. *Journal of Consumer Psychology*, 2(25), 257-267. doi:10.1016/j.jcps.2014.08.001
- Loewenstein, G. (1996). Out of control: Visceral influences on behavior. *Organizational Behavior and Human Decision Processes*, 65(3), 272-292. doi:10.1006/obhd.1996.0028
- Lorey, B., Bischoff, M., Pilgramm, S., Stark, R., Munzert, J., & Zentgraf, K. (2009). The embodied nature of motor imagery: The influence of posture and perspective. *Experimental Brain Research*, 194(2), 233-243. doi:10.1007/s00221-008-1693-1
- MacInnis, D. J., & Patrick, V. M. (2006). A spotlight on affect: The role of affect and affective forecasting in self-regulation and impulse control. *Journal of Consumer Psychology*, 16(3), 224-231. doi:10.1207/s15327663jcp1603_4
- Macrae, C. N., Raj, R. S., Best, S. B., Christian, B. M., & Miles, L. K. (2013). Imagined sensory experiences can shape person perception: It's a matter of visual perspective. *Journal of Experimental Social Psychology*, 49(3), 595-598. doi:10.1016/j.jesp.2012.10.002
- Marteau, T. M., Hollands, G. J., & Fletcher, P. C. (2012). Changing human behaviour to prevent disease: The importance of targeting automatic processes. *Science*, 337(6101), 1492-1495. doi:10.1126/science.1226918
- Martins, C. M., Block, L. G., & Dahl, D. W. (2015). Can hand washing influence hedonic food consumption? *Psychology & Marketing*, 32(7), 742-750. doi:10.1002/mar.20814
- McCrickerd, K., & Forde, C. G. (2016). Sensory influences on food intake control: Moving beyond palatability. *Obesity Reviews*, 17(1), 18-29. doi: 10.1111/obr.12340
- Metcalfe, J., & Mischel, W. (1999). A hot/cool-system analysis of delay of gratification: Dynamics of willpower. *Psychological Review*, 106(1), 3-19. doi: 10.1037/0033-295X.106.1.3.
- Morewedge, C. K., Huh, Y. E., & Vosgerau, J. (2010). Thought for food: Imagined consumption reduces actual consumption. *Science*, 330(6010), 1530-1533. doi:10.1126/science.1195701
- Muraven, M., Tice, D. M., & Baumeister, R. F. (1998). Self-control as a limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology*, 74(3), 774-789. doi:10.1037/0022-3514.74.3.774
- Niedenthal, P. M., Barsalou, L. W., Winkielman, P., Krauth-Gruber, S., & Ric, F. (2005). Embodiment in attitudes, social perception, and emotion. *Personality and Social Psychology Review*, 9(3), 184-211. doi:10.1207/s15327957pspr0903_1

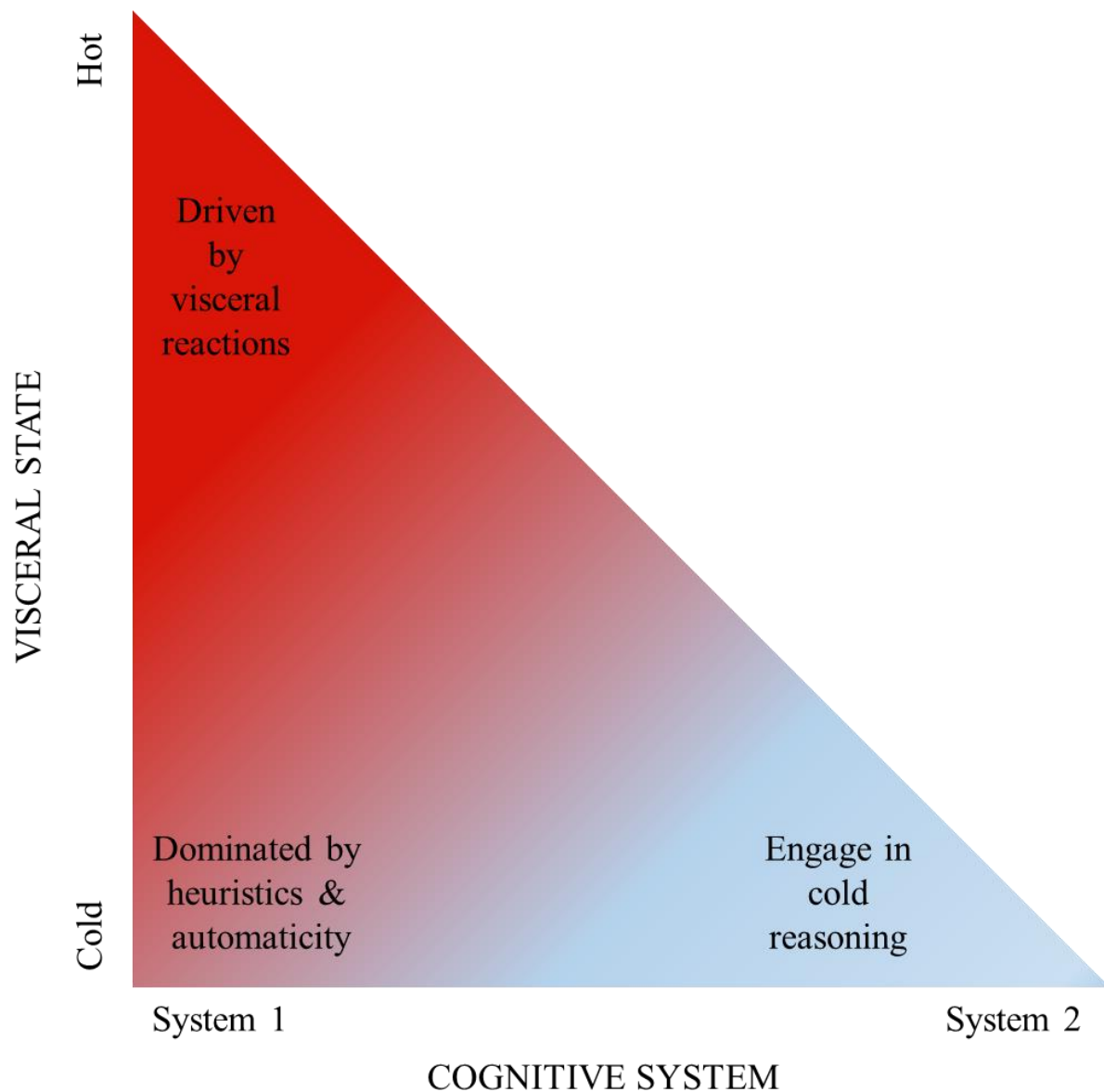
- Oullier, O., & Basso, F. (2010). Embodied economics: How bodily information shapes the social coordination dynamics of decision-making. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 365(1538), 291-301. doi: 10.1098/rstb.2009.0168
- Ouwehand, C., & Papies, E. K. (2010). Eat it or beat it. The differential effects of food temptations on overweight and normal-weight restrained eaters. *Appetite*, 55(1), 56-60. doi:10.1016/j.appet.2010.04.009
- Papies, E. K., Pronk, T. M., Keesman, M., & Barsalou, L. W. (2015). The benefits of simply observing: Mindful attention modulates the link between motivation and behavior. *Journal of Personality and Social Psychology*, 108(1), 148-170. doi:10.1037/a0038032
- Petit, O., Basso, F., Huguet, P., Plassmann, H., & Oullier, O. (2011). [Food behaviour and obesity: Insights from decision neuroscience]. *Medecine Sciences: M/S*, 27(11), 1000-1008. doi: 10.1051/medsci/201127111000
- Petit, O., Cheok A. D., & Oullier, O. (forthcoming). Can food porn make us slim? How brains of consumers react to food in digital environments. *Integrative Food, Nutrition and Metabolism*.
- Petit, O., Merunka, D., & Oullier, O. (2014a). Adapting communication messages to reward and punishment sensitivity of targeted audiences in fighting obesity. Paper presented at the 43rd Annual Conference of The Academy of Marketing Science (AMS), Indianapolis, Indiana, May.
- Petit, O., Merunka, D., Raccach, D., Anton, J. L., Nazarian, B. Cheok, A. D., & Oullier, O. (2014b). Health and pleasure in dietary food choices: Individual differences in the value system of the brain. Poster presented at the Annual Conference Consumer Neuroscience Satellite Symposium, Miami, Florida, September.
- Phillips, B. J., & McQuarrie, E. F. (2009). Impact of advertising metaphor on consumer belief: Delineating the contribution of comparison versus deviation factors. *Journal of Advertising*, 38(1), 49-62. doi:10.2753/JOA0091-3367380104
- Puhl, R., Luedicke, J., & Peterson, J. L. (2013a). Public reactions to obesity-related health campaigns: A randomized controlled trial. *American Journal of Preventive Medicine*, 45(1), 36-48. doi:10.1016/j.amepre.2013.02.010
- Puhl, R. M., Peterson, J. L., & Luedicke, J. (2013b). Fighting obesity or obese persons? Public perceptions of obesity-related health messages. *International Journal of Obesity*, 37(6), 774-782. doi:10.1038/ijo.2012.156

- Raghunathan, R., Naylor, R. W., & Hoyer, W. D. (2006). The unhealthy= tasty intuition and its effects on taste inferences, enjoyment, and choice of food products. *Journal of Marketing*, 70(4), 170-184. doi:10.1509/jmkg.70.4.170
- Ramaekers, M. G., Luning, P. A., Ruijschop, R. M., Lakemond, C. M., Bult, J. H., Gort, G., & van Boekel, M. A. (2014). Aroma exposure time and aroma concentration in relation to satiation. *British Journal of Nutrition*, 111(03), 554-562. doi:10.1017/S0007114513002729
- Redden, J. P., & Haws, K. L. (2013). Healthy satiation: The role of decreasing desire in effective self-control. *Journal of Consumer Research*, 39(5), 1100-1114. doi:10.1086/667362
- Reimann, M., Feye, W., Malter, A. J., Ackerman, J. M., Castano, R., Garg, N., Kreuzbauer, R., Labroo, A. A., Lee, A. Y., Morrin, M., Nenkov, G. Y., Nielsen, J. H., Perez, M., Pol, G., Rosa, J. A., Yoon, C., & Zhong, C. B. (2012). Embodiment in judgment and choice. *Journal of Neuroscience, Psychology, and Economics*, 5(2), 104-123. doi:10.1037/a0026855
- Rennie, L., Uskul, A. K., Adams, C., & Appleton, K. (2014). Visualisation for increasing health intentions: Enhanced effects following a health message and when using a first-person perspective. *Psychology & Health*, 29(2), 237-252. doi:10.1080/08870446.2013.843685
- Schuldt, J. P., & Hannahan, M. (2013). When good deeds leave a bad taste. Negative inferences from ethical food claims. *Appetite*, 62, 76-83. doi:10.1016/j.appet.2012.11.004
- Shiv, B., Fedorikhin, A., & Nowlis, S. M. (2005). Interplay of the heart and the mind in decision-making. In S. Ratneshwar & D. G. Mick (Eds.), *Inside consumption: Consumer motives, goals, and desires* (pp. 166-184). London, UK: Routledge.
- Simmons, W. K., Martin, A., & Barsalou, L. W. (2005). Pictures of appetizing foods activate gustatory cortices for taste and reward. *Cerebral Cortex*, 15(10), 1602-1608. doi:10.1093/cercor/bhi038
- Spence, C. (2015). Leading the consumer by the nose: On the commercialization of olfactory-design for the food & beverage sector. *Flavour*, 4:31.
- Spence, C., & Gallace, A. (2011). Multisensory design: Reaching out to touch the consumer. *Psychology & Marketing*, 28, 267-308. doi:10.1002/mar.20392

- Spence, C., Okajima, K., Cheok, A. D., Petit, O., & Michel, C. (in press). Eating with our eyes: From visual hunger to digital satiation. *Brain and Cognition*.
doi:10.1016/j.bandc.2015.08.006
- Stice, E., Spoor, S., Bohon, C., Veldhuizen, M. G., & Small, D. M. (2008). Relation of reward from food intake and anticipated food intake to obesity: A functional magnetic resonance imaging study. *Journal of Abnormal Psychology*, 117(4), 924-935.
doi:10.1037/a0013600
- Strack, F., Werth, L., & Deutsch, R. (2006). Reflective and impulsive determinants of consumer behavior. *Journal of Consumer Psychology*, 16(3), 205-216.
doi:10.1207/s15327663jcp1603_2
- Sunstein, C. R. (2016). The council of psychological advisers. *Annual Review of Psychology*, 67(1), 713–737. <http://doi.org/10.1146/annurev-psych-081914-124745>
- Thaler, R. H., & Sunstein, C. (2008). *Nudge. Improving decisions about health, wealth and happiness*, London, UK: Penguin Books.
- Vohs, K. D., & Faber, R. J. (2007). Spent resources: Self-regulatory resource availability affects impulse buying. *Journal of Consumer Research*, 33(4), 537-547.
doi:10.1086/510228
- Vohs, K. D., & Heatherton, T. F. (2000). Self-regulatory failure: A resource-depletion approach. *Psychological Science*, 11(3), 249-254. doi:10.1111/1467-9280.00250
- Wansink, B. (2010). From mindless eating to mindlessly eating better. *Physiology & Behavior*, 100(5), 454-463. doi:10.1016/j.physbeh.2010.05.003
- Wansink, B., & Chandon, P. (2014). Slim by design: Redirecting the accidental drivers of mindless overeating. *Journal of Consumer Psychology*, 24(3), 413-431.
doi:10.1016/j.jcps.2014.03.006
- Wansink, B., & van Ittersum, K. (2013). Portion size me: Plate-size induced consumption norms and win-win solutions for reducing food intake and waste. *Journal of Experimental Psychology: Applied*, 19(4), 320-332. doi:10.1037/a0035053
- Weijzen, P. L., Smeets, P. A., & de Graaf, C. (2009). Sip size of orangeade: Effects on intake and sensory-specific satiation. *British Journal of Nutrition*, 102(07), 1091-1097.
doi:10.1017/S000711450932574X
- Werle, C. O. C., & Cuny, C. (2012). The boomerang effect of mandatory sanitary messages to prevent obesity. *Marketing Letters*, 23(3), 883-891. doi:10.1007/s11002-012-9195-0

- Werle, C. O. C., Trendel, O., & Ardito, G. (2013). Unhealthy food is not tastier for everybody: The “healthy = tasty” French intuition. *Food Quality and Preference*, 28, 116-121. doi:10.1016/j.foodqual.2012.07.007
- Yang, H., Carmon, Z., Kahn, B., Malani, A., Schwartz, J., Volpp, K., & Wansink, B. (2012). The hot-cold decision triangle: A framework for healthier choices. *Marketing Letters*, 23(2), 457-472. doi:10.1007/s11002-012-9179-0
- Zaltman, G., & Zaltman, L. H. (2008). *Marketing metaphoria: What deep metaphors reveal about the minds of consumers*. Cambridge, MA: Harvard Business Press.

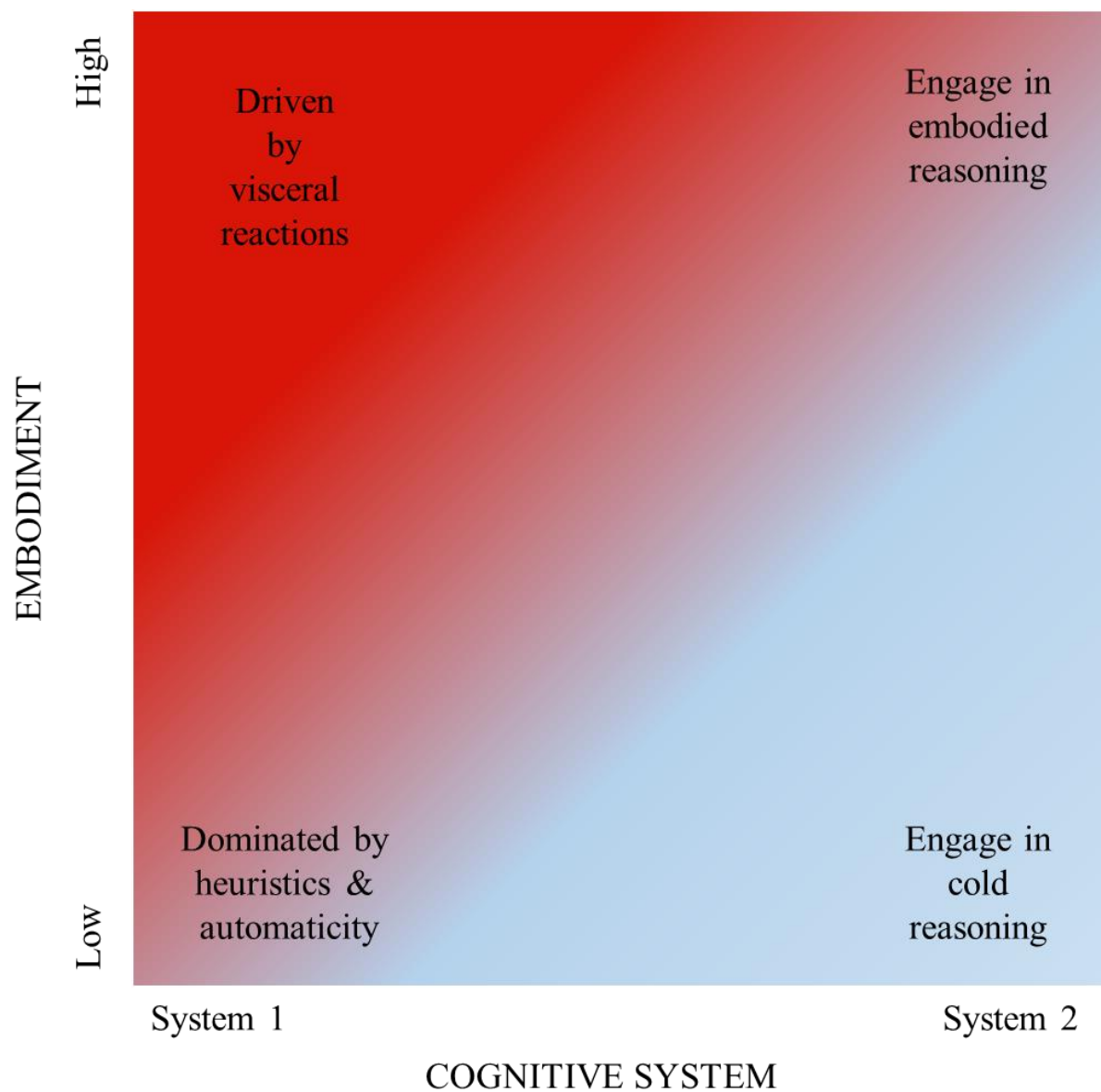
Figure 1. The hot-cold decision triangle



Source: Yang et al., 2012, Copyright (2016), with permission from Springer.

Note: "The likelihood of choosing healthier options is influenced by the extent to which the person is in a viscerally hot state and the extent to which System 1 versus 2 is utilized in the decision" (Yang et al., 2012: 258-259).

Figure 2. The high-low embodied decision matrix



Note: The likelihood of choosing healthy options is influenced by both the degree of embodiment and the extent to which System 1 versus 2 is used in the decision.

Figure 3. Visual Metaphors in the target domain of healthy food behavior



Notes: **a.** The poster for the film "Killer at Large" (with permission of Steven GreenStreet). **b.** The "Carrots are French fries" campaign to entice kids in French schools to eat healthy food (courtesy of Classe 35 agency, Marseille, France). **c.** The "Eat 'Em Like Junk Food" campaign to encourage treating baby carrots as junk food (courtesy of Bolthouse Farm)