The role of simulations in consumer experiences and behavior: Insights from the grounded cognition theory of desire

Esther K. Papies[1, 2]

Maisy Best[1]

Elena Gelibter[1]

Lawrence W. Barsalou[1]

[1]Institute of Neuroscience and Psychology, University of Glasgow, UK

[2]Dept. of Psychology, Utrecht University, NL

Please address correspondence to Esther K. Papies or Lawrence W. Barsalou, Institute of Neuroscience and Psychology, University of Glasgow, 58 Hillhead Street, Glasgow G12 8QB, UK; Esther.Papies@glasgow.ac.uk; Lawrence.Barsalou@glasgow.ac.uk.

Acknowledgement: We would like to thank Aart van Stekelenburg for useful comments on an earlier version of this manuscript.

Abstract

What are the mechanisms by which extrinsic and environmental cues affect consumer experiences, desires, and choices? Based on the recent grounded cognition theory of desire, we argue that consumption and reward simulations constitute a central mechanism in these phenomena. Specifically, we argue that appetitive stimuli, such as specific product cues, can activate simulations of consuming and enjoying the respective products, based on previous learning experiences. These consumption and reward simulations can lead to motivated behavior, and can be modulated by state and trait individual differences, situational factors, and product-extrinsic cues. We outline the role of simulations within the grounded theory of desire, offering a theoretical framework for understanding motivational processes in consumer behavior. Then, we illustrate the theory with behavioral, physiological, and neuroimaging findings on simulations in appetitive behavior and sensory marketing. Finally, we outline important issues for further research and applications for stimulating healthy, prosocial, and sustainable consumer choices.

Introduction

How do consumers develop preferences and desires for certain products or behaviors? What are the mechanisms by which both extrinsic and environmental cues affect consumer choices and experiences? Why does a glass of wine taste better when it is labeled as more expensive? Why does a piece of cake look more attractive with a fork presented on the right-hand side? Why do we like the same dish more in an Italian restaurant than in a hospital? In this paper, we answer these questions from a novel, grounded cognition perspective, focusing on the role of simulations for understanding how external cues trigger and modulate consumer choices and experiences.

In brief, our theory suggests that consumer choices and experiences are heavily influenced by simulations, or re-enactments, of previous experiences that have been stored in memory and that can be retrieved by relevant cues in specific situations (for an overview of the core propositions of the theory, see Table 1). Thus, when perceiving the expensive price label for a glass of wine, a consumer may simulate the pleasant experience of tasting an excellent wine, using the same sensory and reward processing areas in the brain that were involved in previous experiences. Actually drinking wine then leads to a more rewarding experience than when an inexpensive wine has been simulated. Similarly, rewarding consumption simulations are more likely to be triggered when external cues match those cues that were encoded in previous rewarding experiences, for example, a fork used for eating a cake, or an eating environment associated with good cooking. This way, simulations of previous experiences triggered by external cues can affect consumers' expectations of a certain product, and therefore affect decision making as well as experiences and evaluations.

Overview

In this article, we discuss how the grounded theory of desire and motivated behavior can explain various motivational processes involved in consumer behavior within a single theoretical framework. To this end, we first introduce the constructs of situated conceptualization, pattern completion inference, and simulation, and discuss how these constructs can account for the cognitive mechanisms through which experiences can be stored in memory and later retrieved to guide motivated behavior. In the following section, we apply this theory to consumer behavior and review relevant empirical research, addressing behavioral, physiological, and neuroimaging findings on appetitive consumer behaviors. Finally, we discuss implications for future research, including important outstanding research questions, testable predictions, and implications for applications with a particular focus on increasing healthy, prosocial, and sustainable consumer behavior.

The grounded cognition theory of desire and motivated behavior

Here we introduce the theoretical perspective to be adopted in exploring the roles of simulation in consumer behavior. This perspective is not meant to replace existing accounts, such as dual process theories, theories of conditioning, or theories of habit formation. Instead we view our approach as complementary to these others, adding dimensions associated with situations, inference, and simulation.

Situated conceptualization

We assume that the brain is organized around a situation processing architecture (Barsalou, 2003, 2009, 2016a, 2016b; Barsalou, Niedenthal, Barbey, & Ruppert, 2003; Wilson-Mendenhall, Barrett, Simmons, & Barsalou, 2011; Yeh & Barsalou, 2006). As a person perceives, cognizes, feels, and acts in a situation, multiple neural systems process different situational elements in parallel, generating complementary streams of information. Different neural systems process the current setting (parietal lobe, parahippocampal gyrus, retrosplenial cortex), objects in the setting (the ventral stream in occipital and temporal cortices), other agents who are present (temporal poles, FFA, mPFC, PCC, STG, EBA), self conceptions and self relevance (mPFC, PCC), physical actions in the environment (motor and somatosensory cortices, cerebellum, basal ganglia), and a wide variety of cognitive, affective, and interoceptive responses to the situation (lPFC, ACC, mPFC, PCC, OFC, amygdala, insula).

Over time, each of these neural systems produces a continuous stream of perceptual experiences (qualia) for its respective situational content, along with corresponding conceptual interpretations. If you are reading this article in a café, for example, some of these neural systems may be producing streams of perceptual and conceptual information about the space you are in, its furniture, and the other agents present. Other neural systems may continually establish the self-relevance of events as they unfold, reflecting your identity, values, goals, and norms. Other neural systems may control actions related to reading, drinking coffee, and interacting with others, also providing somatosensory and visual feedback. And yet other neural systems may be producing continual thoughts about the article and your café experience, along with affective responses, mentalizing, and associated bodily states.

As each of these systems processes its respective situational information, other systems integrate these streams of "local" information "globally" (Barsalou, 2016b; Wilson-Mendenhall et al., 2011). Coherent perceptual experiences of the situation result from this integration, along with coherent conceptual interpretations of the events occurring. At the level of global interpretation, for example, you might experience finishing your coffee and feel ready to begin reading your article, while realizing that a friend across the room just recognized you. The combined local and global conceptualizations of a situation are referred to as a *situated conceptualization.* At a given point in time, a situated conceptualization can be used to interpret what is occurring in the current situation at multiple levels of analysis, while simultaneously controlling relevant actions and producing related cognition, affect, and bodily states.

As a situated conceptualization is constructed, associative mechanisms establish a statistical trace of it in long-term memory (Barsalou, 2003, 2009, 2016b; Barsalou et al., 2003; Yeh & Barsalou, 2006). When a specific situation, or type of situations, occurs repeatedly, the situated conceptualizations that result could become integrated into a category of *exemplars* that represents this situation (cf. Medin & Schaffer, 1978; Nosofsky, 2011). Alternatively, similar situated conceptualizations could be superimposed on a common network, such that their aggregate effects on network weights represent the category of similar exemplars. If the network contains hidden units that capture correlations between local situation elements, it can statistically maintain information from specific exemplars while not representing them exactly (e.g., Barsalou, 1990; Love, Medin, & Gureckis, 2004; McClelland & Rumelhart, 1985). An individual who routinely meets in a café with a co-worker, for example, may develop a category of situated conceptualizations for this repeated situational experience.

While we typically learn situated conceptualizations through our own experiences, we suggest that situated conceptualizations can also become established vicariously (for similar suggestions, see also Best & Papies, 2017; Papies, 2017). In consumer behavior, this could happen, for example through observing other consumers' interactions with specific products, or by being exposed to advertisements. While future research has yet to establish this (as we address in the Discussion), we assume that once learned, situated conceptualizations established vicariously will function to guide motivated behavior through pattern completion inferences and simulations as if they had been learned directly, as we will describe now.

Pattern completion inferences

When a local or global element of an earlier situation is reencountered on a later occasion, a situated conceptualization stored in memory may become re-activated in a Bayesian manner (e.g., Barsalou, 2011; Clark, 2013). Encountering the facade of a café in one's neighborhood, for example, may re-activate situated conceptualizations of previous visits to the café. As the reencountered element is processed in the relevant processing stream(s), it projects onto all situated conceptualizations in memory that share similar perceptual and conceptual content. Essentially, the brain is attempting to categorize the type of situation currently being experienced. The best matching situated conceptualization becomes active and categorizes the current situation as a similar type of situation.

From a Bayesian perspective, the best matching situated conceptualization is one that has occurred frequently in the past (a prior), along with a good fit to current situational cues (a likelihood). On many occasions, the best-matching situated conceptualization may come from a category for a familiar repeated situation or from a specific memory of a relatively unique situation. On rare occasions, no matching situated conceptualization may be available, such that the situated conceptualization constructed to represent the current situation largely functions on its own.

When a stored situated conceptualization becomes active, it produces inferences about what is likely to happen in the current situation via the process of *pattern completion*. Content in the activated situated conceptualization that has not yet been perceived is inferred as being likely to occur. We further assume that emotion and other internal states also often result from pattern completion inferences, such that experiencing an object or event previously associated with emotion begins to produce a similar emotion again (Barrett, 2006; Barsalou, 2016a; Barsalou & Wiemer-Hastings, 2005; Wilson-Mendenhall et al., 2011; Wilson-Mendenhall, Simmons, Martin, & Barsalou, 2013). In general, pattern completion inferences appear to play central roles across diverse perceptual, cognitive, affective, and appetitive phenomena. In every situation, the best-matching situational memories become active to guide goal-directed behavior, offering a form of expertise based on previous experience. As described later, we similarly believe that pattern completion inferences often underlie the perception and decision making central to consumer experiences and behavior.

Finally, the grounded theory of desire and motivated behaviour assumes that the best fitting situated conceptualization that becomes active in memory is adapted to the current situation. Rather than rigidly fitting the situated conceptualization to the situation, working memory processes it dynamically, fitting the situated conceptualization that is retrieved to constraints of the current situation.

Simulation

From the grounded cognition perspective, the local and global elements represented within situated conceptualizations are grounded in the neural and peripheral bodily systems that produce perception, action, and internal states (Barsalou, 1999, 2008b, 2009, 2016a). When representing an object in its absence, such as a strawberry, neural systems associated with perceiving the object's shape, color, and motion become active to represent this information conceptually (e.g., Kiefer & Barsalou, 2013; Martin, 2001, 2007). When representing potential physical interactions with the object, brain areas associated with executing the associated actions become active (e.g., Pulvermüller, 2005). When representing the abstract qualities of the object, such as its reward value and associated mental states, brain areas associated with these qualities become active (e.g., Chen, Papies, & Barsalou, 2016; Simmons, Martin, & Barsalou, 2005; Wilson-Mendenhall et al., 2013). Importantly, representing an object in its absence across these systems could occur unconsciously in a highly conditioned manner, not just consciously and deliberately. Indeed, conditioned unconscious simulations are likely to dominate cognition, relative to conscious imagery.

In general, the grounded cognition perspective assumes, first, that when an *actual* object, event, or abstract quality is processed in the current situation, activity in relevant neural systems is stored and integrated into evolving conceptual knowledge. When consuming strawberries, for example, memories of their red color, sweet taste, and juicy texture are stored in the visual, gustatory, and somatosensory systems used to process these perceptions. Analogously, memories of the actions used to grasp, chew, and swallow strawberries are stored in the motor system, and memories of the subsequent pleasure and reward in motivational systems. Over time, multimodal memories of strawberries on different occasions become increasingly entrenched in the neural systems that perceive, control, and evaluate experiences of consuming them, integrated in higher-order association areas.

Entrenched knowledge about strawberries becomes active on later occasions when conceptual inferences about them are required (e.g., reading the word "strawberry" and establishing its meaning; seeing pictured strawberries in an advertisement and imagining what it would be like to eat them). From the grounded cognition perspective, the process of simulation underlies these conceptual inferences. Specifically, conceptualizing what a strawberry is (in response to a word or picture) involves reactivating the relevant neural systems for interacting with it, such that the color system simulates the strawberry's red color, the gustatory system simulates its sweet taste, the motor system simulates appropriate eating behaviors, and motivational systems simulate pleasure and reward. In other words, conceptual knowledge about the strawberry results from re-experiencing, or simulating, it in the relevant neural systems used to actually experience real strawberries.

We further assume that multimodal simulation underlies the process of pattern completion inference. When something in the current situation reactivates a situated conceptualization stored in memory, the pattern completion inferences that result are expressed as multimodal simulations. When entering a familiar café and expecting to drink coffee, read an article, and converse with friends, these pattern completion inferences are produced as simulated events in the respective modalities. Anticipating the coffee, for example, produces relevant simulations of drinking, tasting, and reward. We further assume that these neural simulations often produce associated embodiments, such as anticipated feelings of arousal on consuming caffeine, and smiling on possibly seeing a friend. We suggest that such simulations can explain a variety of processes in consumer behavior, as we will demonstrate below.

The role of state and trait individual differences

Across diverse phenomena, the situated conceptualization framework offers a natural account of individual differences (Barsalou, 2016a; Papies & Barsalou, 2015; Papies, Pronk, Keesman, & Barsalou, 2015; Wilson-Mendenhall et al., 2011). As different individuals experience different kinds of situations related to a specific phenomenon, different populations of situated conceptualizations accrue in their respective long-term memory systems. As different individuals consume different kinds of foods in different kinds of situations, for example, they accumulate different populations of situated conceptualizations for eating. As a consequence, these different populations of eating memories produce different pattern completion inferences to the same food cues in later situations. On seeing a burger, for example, people who often consume burgers would generate pattern completion inferences that anticipate the taste, reward, actions associated with consuming them. Dieters and vegetarians who rarely or never eat burgers, however, would activate different pattern completion inferences, including the inhibition of taste and reward simulations, perhaps accompanied with the activation of long-term weight loss, sustainability, and healthy eating goals, thus leading to different behavioral outcomes.

Thus, the situated conceptualization perspective offers a natural account of how individual differences in states and traits affect motivation and behavior (Papies & Barsalou, 2015; Papies et al., 2015). As we shall see later, individual differences in motivation play potentially important roles in how simulations affect consumer processing. In general, both can be viewed as reflecting pattern completion inferences that originate in situational experience. From this perspective, an individual's current state reflects the pattern completion inferences currently active across perceptual, cognitive, affective, and bodily systems. If, for example, an individual is motivated to consume coffee, this motivational state is likely to reflect pattern completion inferences that have resulted from situated conceptualizations active in the current situation.

Whereas a person's current state reflects the aggregate set of pattern completion inferences active in the current situation, a person's traits reflect populations of situated conceptualizations in long-term memory. If, for example, a person frequently practices restrained eating (dieting), then many situated conceptualizations associated with restraint reside in memory waiting to become active (e.g., Papies, 2016a). As a consequence, future situations are likely to activate these memories, such that they restrain eating via multimodal pattern completion inferences. In this way, the population of situated conceptualizations associated with restraint function as a trait in the brain and body. Alongside other factors, such as genetics (cf. Epstein, 1979; Mischel, 1968), a wide variety of cognitive, affective, motivational, and behavioral traits can be viewed as reflecting a person's idiosyncratic populations of situated conceptualizations in memory.

Applying the grounded cognition theory of desire to consumer behavior

We suggest that the grounded cognition theory of motivated behavior can explain previous findings in consumer behaviour within one comprehensive framework. To illustrate this, we next discuss behavioural, physiological, and neuroimaging research on motivational processes in consumer behavior. Specifically, we will focus on the role of simulations in motivating behaviour, and in modulating the effect of external cues on behavior.

First, we review research findings showing that cues of appetitive stimuli can trigger consumption simulations which in turn are associated with the motivation to consume and can affect consumer behavior. We propose that simulations that result from learned situated conceptualizations may underlie the findings showing that external or internal cues can trigger desire and motivated behaviour even in the absence of physiological need. Next, we discuss how these effects are moderated by individual and situational differences, such as hunger or dieting motivation, or contextual features. Finally, we turn to findings showing how external, product-extrinsic cues can modulate simulations in response to appetitive stimuli and therefore affect motivation and behavior through, for example, labels on food products or sensory marketing techniques. Across these sections, our literature review mainly serves to illustrate how this theoretical framework can explain a variety of existing findings, and is by no means designed to be exhaustive.

The role of consumption simulations in desire

In the domains of food and drink, appetitive cues have been shown to trigger approach responses, motor impulses, salivation, increased visual attention, and positive affect (Brunyé et al., 2013; Keesman, Aarts, Vermeent, Häfner, & Papies, 2016; Van Dillen, Papies, & Hofmann, 2013; Veling, Aarts, & Papies, 2011). These responses likely result from spontaneous simulations of consuming and enjoying the cued products. Focusing first on behavioral and then on neuroimaging studies, we will now review findings on simulations triggered by appetitive cues in more detail, and we will discuss how they can help to understand the powerful motivational effects of appetitive cues on behavior.

Behavioral and physiological research. A variety of findings suggest that appetitive cues trigger consumption simulations, and that these may contribute to the desire to consume. Behavioral studies show that when presented with images of food items, for example, people spontaneously simulate picking them up and consuming them in their habitual way given the constraints of the situation, and that this contributes to their motivation to consume them (Eelen, Dewitte, & Warlop, 2013; Elder & Krishna, 2012). Similarly, when choosing between consumer products, people tend to prefer those that are easier to interact with (e.g., tools with the handle oriented rightwards if right handed), a phenomenon referred to as the motor fluency effect (Ping, Dhillon, & Beilock, 2009). These findings extend previous work that showed people spontaneously simulate interacting with objects they are presented with in their habitual way, for example picking up a teapot with one’s dominant hand (Tucker & Ellis, 1998).

A related series of behavioral studies shows that these simulations not only include motor actions, but also sensory experiences, rich contextual information, and reward information. When categorizing food words, for example, people spontaneously use so-called “script” categories that describe how you interact with the food, such as “dinner foods” or “foods you eat with a spoon” (Blake, Bisogni, Sobal, Devine, & Jastran, 2007; Ross & Murphy, 1999). Similarly, when asked to list the features that are typically true of a number of food or drink items (Keesman et al., 2017; Papies, 2013), participants not only list sensory features of the products themselves ("salty", "crunchy", "cold"), but also detailed information about the situations in which they are typically consumed ("TV", "with beer", "Friday night") and hedonic words describing the pleasure of consumption ("tasty", "delicious", "satisfying"). In addition, these situated reward simulations have been found to correlate with desire for the presented foods or alcoholic drinks (Keesman et al., 2017; Papies, 2013). Conversely, focusing participants on the attractiveness of food items by instructing them to list those features that would motivate them to eat the foods, increased the number of features associated with situated consumption and reward simulations (Lindner, Papies, Zandstra, Dijksterhuis, & Smeets, 2017). These findings suggest that aspects of the context play an important role in the motivation to consume food or drinks, and that simulating them in response to appetitive cues affects motivational processes.

A series of experiments on the role of mental simulation in the desire for consumer products further supports a causal role for simulations in the motivation to consume (Elder & Krishna, 2012). When, for example, product images facilitated the simulation of eating the product, with the spoon in a bowl of yoghurt facing the participant's dominant hand, participants reported more spontaneous eating simulations and higher purchase intentions for desirable products. As we address below, such simulations may be especially likely if they are motivationally and contextually relevant, for example when the perceiver is evaluating a potentially attractive food (see also Eelen et al., 2013; Pecher & van Dantzig, 2016). Importantly, and demonstrating that simulations play a crucial, causal role in motivation, these effects are eliminated when participants press a clamp in their dominant hand, which interferes with the motor simulation triggered by a product image (Elder & Krishna, 2012). Similarly, preventing the simulation of holding or interacting with a food or drink by occupying one's dominant hand has been shown to reduce the perceived attractiveness of the objects (Shen & Sengupta, 2012; for a review of similar findings in other domains, see Ping et al., 2009). Conversely, when simulating a previous rewarding interaction with an object is facilitated by one's own motor behavior (e.g., selecting a food object by touching it on a touch screen rather than by clicking on it with a mouse), or by holding an object that facilitates interacting with the object (e.g., holding a fork to eat noodles presented on a picture), desire for an attractive food is enhanced (Shen & Sengupta, 2012; Shen, Zhang, & Krishna, 2016). Again, these findings show that simulations based on one's previous experiences, using the same bodily systems used in the behaviour initially, shape motivational processes.

Additional evidence for the role of embodied consumption simulations in motivation comes from recent work on salivation in response to food cues. Previous research has shown that being exposed to food items can trigger spontaneous salivation in participants, especially if the food is highly liked (e.g., Rogers & Hill, 1989). While these findings have typically been understood as simple conditioning effects, it has been suggested that salivation is especially likely to occur if participants expect to be later eating the food, making preparatory physiological responses particularly relevant (Spence, 2011). In addition, salivation effects have been found to be moderated by individual differences in mental imagery abilities and eating motivation (Nederkoorn & Jansen, 2002; White, 1978). This suggests that the anticipatory simulation of consuming the food, especially if it is attractive, may play a role in salivation responses. In a recent set of experiments (Keesman et al., 2016), this hypothesis was tested directly by exposing participants to a neutral, an attractive, or a sour food and either asking them to merely look at the food, or to imagine eating it. Subsequently, salivation, self-reported spontaneous eating simulations, and desire to eat the food were assessed. Participants indicated that they simulated eating the attractive food more than the neutral food, even in the absence of explicit simulation instructions. Salivation was increased by the instruction to simulate eating the food, especially if the food was attractive. In addition, salivation was associated with desire to eat, but only for the attractive food. These findings suggest that attractive food spontaneously triggers embodied simulations of eating it resulting from pattern completion inferences on situated conceptualizations, which support goal-directed behaviour.

Similar findings have been reported in the domain of alcohol. Here, research has shown that alcohol cues, as well as situational cues associated with drinking, trigger alcohol-related thoughts, approach impulses, and the desire to drink (for reviews, see Field, Schoenmakers, & Wiers, 2008; Wiers & Stacy, 2006). Such effects are especially pronounced in habitual drinkers, as Sheeran and colleagues have shown (2005). We suggest that alcohol-related cues activate situated conceptualizations of drinking experiences, which trigger simulations and desire as pattern completion inferences.

Further research indeed suggests that alcohol cues activate simulations of consuming alcohol, or in other words, (partial) re-enactments of previous drinking experiences. Priming social drinkers with alcohol-related words, for example, has been shown to induce cognitive effects that resemble being intoxicated, such as performing worse on cognitive tasks (Fillmore, Carscadden, & Vogel-Sprott, 1998), aggressive thoughts (Bartholow & Heinz, 2006), and judging women as more attractive (Friedman, McCarthy, Förster, & Denzler, 2005). Similarly, exposure to drug cues, including alcohol cues, can trigger physiological responses similar to actual consumption (see Carter & Tiffany, 1999, for a meta-analysis). Finally, consuming an alcohol placebo drink (i.e., a drink that is falsely presented as containing alcohol) leads to similar bodily changes as actually drinking, including impaired motor performance and increased sexual arousal in men (Mckay & Schare, 1999; Terence & Lawson, 1976; Vuchinich & Sobell, 1978). These findings suggest that alcohol cues trigger consumption and reward simulations as pattern completion inferences on situated conceptualizations, established during observed or experienced previous drinking episodes, which manifest on both a behavioural and a physiological level.

Neuroimaging evidence. Neuroimaging studies provide further evidence for consumption and reward simulations in response to food and drink cues. Specifically, this evidence demonstrates that similar neural systems are involved in processing such cues as during actual consumption behavior, which directly illustrates the activation of simulations, or re-enactments of previous states on the neural level. Again, we suggest that such simulations result from pattern completion inferences on situated conceptualizations that have been established during previous consumer experiences. Although this hypothesis has mostly been tested with regard to appetitive consumer behaviors, we suggest that it can potentially increase our understanding of relatively automatic neural responses in other domains of consumer behavior as well.

Numerous experiments have shown that presenting either images or words of attractive foods activates areas in the brain that are involved in gustatory and reward processing, such as the insula, frontal operculum, orbitofrontal cortex, and ventral striatum (Barros-Loscertales et al., 2012; Simmons et al., 2005; van der Laan, de Ridder, Viergever, & Smeets, 2011). Similarly, neuroimaging studies in the domain of alcohol have shown activations in reward areas in response to alcohol cues in problem drinkers (Myrick et al., 2004; Schacht et al., 2011). Some studies show similar effects in response to food or sugary drinks cues compared with non-food control objects (e.g., Beaver et al., 2006; Burger & Stice, 2014), while other work shows that the activations in gustatory and reward areas are stronger for attractive, high-calorie food compared to neutral, low-calorie food (e.g., Goldstone et al., 2009). In addition, studies including special populations of individuals who try to regulate their food intake, such as chronic dieters or individuals with anorexia nervosa, show that food cues also lead to activations in regions typically involved in conflict monitoring, exerting cognitive control, and representing body image (e.g., Coletta et al., 2009; Sanders et al., 2015).

Synthesizing this area of research, we recently suggested that food cues activate a core eating network (Chen, Papies, & Barsalou, 2016), which consists of both a ventral reward pathway, including among others the insula, orbitofrontal cortex, and ventral striatum, and a dorsal control pathway, including among others the parietal cortex, dorsolateral prefrontal cortex, and the dorsal striatum. These pathways are involved in actual eating (Kaye, Fudge, & Paulus, 2009) as well as in processing food cues, such as words or images of food. The differential activation of both pathways in response to a food cue depends on features of both the stimulus and of the perceiver, such as the food's attractiveness and the individual's state of hunger or dieting motivation. Our review shows, for example, that the reward pathway is more likely to be activated in response to high-calorie food cues and in hungry perceivers (see also van der Laan et al., 2011), and that the control pathway is more likely to be activated in individuals who try to restrict their intake. This suggests that when encountering a food cue, a simulation of eating (or not eating) the food becomes active as pattern completion inferences on situated conceptualizations and predicts the food's taste and reward value, given the perceiver's current state and eating motivation. In other words, food cues trigger a re-enactment of an individual's response to food cues in a similar previous situation that is modulated by chronic and current eating goals. These simulations prepare for effective, goal-directed action, for example, grabbing the food in order to eat and enjoy it, or rejecting it in order to protect one's body weight.

Further studies indeed show that these neural responses to food cues predict consumption behaviour and long-term outcomes associated with consumption. Activations in part of the reward pathway in response to food pictures, for example, have been shown to correlate with desire for food (Wang et al., 2004), predict snack intake after the fMRI session independent of hunger (Lawrence, Hinton, Parkinson, & Lawrence, 2012), and predict giving in to daily-life temptations to eat (Lopez, Hofmann, Wagner, Kelley, & Heatherton, 2014). Similarly, reward activations in response to food cues can prospectively predict body weight increases over several months, as well as lower success rates during weight loss treatment for obese individuals (Demos, Heatherton, & Kelley, 2012; Murdaugh, Cox, Cook III, & Weller, 2012; Stice, Burger, & Yokum, 2015; Yokum, Ng, & Stice, 2011). These findings confirm that the consumption and reward simulations triggered by appetitive stimuli may have motivational potential and affect consumption behavior.

In sum, the research using behavioural, physiological, and neuroimaging measures that we have reviewed so far provides evidence that people spontaneously simulate consumption and reward when exposed to appetitive cues. Resulting from pattern completion inferences on situated conceptualizations established during previous instances of motivated behavior, these simulations contribute to the experience of desire as well as to conscious and nonconscious motivational processes in the pursuit of goals.

The role of individual and situational differences

The consumption and reward simulations in response to appetitive cues described above can explain why external cues can lead to motivated consumption behaviour even in the absence of physiological needs. Research shows, for example, that food cues can trigger desire and lead to overeating even in the absence of hunger (Lowe & Butryn, 2007). Similarly, smoking cues can trigger nicotine cravings in smokers trying to quit even when they are using nicotine replacements (Tiffany, Cox, & Elash, 2000). The grounded theory of desire and motivated behaviour suggests that physiological states are an important feature of the situated conceptualizations stored during consumption episodes. As a result, physiological needs, and motivational states more generally, modulate the simulations that are triggered by appetitive cues as a result of pattern completion inferences, and thus modulate the effects of appetitive cues on consumer experiences and behavior. To illustrate this, we review research findings on the effects of individual differences in motivation on consumption and reward simulations and their impact on motivated processes and discuss similar effects of situational differences.

Effects of individual differences in motivation. Much research demonstrates that trait and state individual differences in motivation affect consumer experiences and behaviour. We suggest that these effects can be understood through differences in consumption and reward simulations that result from pattern completion inferences on situated conceptualizations established in earlier, similar situations. Being hungry, for example, has been shown to enhance perceived attractiveness, desire, and spontaneous approach motivation toward high-calorie food in particular (e.g., Papies et al., 2015; Seibt, Häfner, & Deutsch, 2007). We suggest that this may be the case because during earlier eating episodes in similar states of hunger, situated conceptualizations of highly rewarding experiences were encoded that are then simulated as pattern completion inferences in response to encountering high-calorie food cues in hungry states (see Papies et al., 2015). Indeed, neuroimaging studies show that eating when food-deprived is associated with stronger activations in parts of the reward pathway of the core eating network (Stice, Burger, & Yokum, 2013; Uher, Treasure, Heining, Brammer, & Campbell, 2006). Furthermore, being hungry during the exposure to food cues enhances responses in taste and reward areas

(Siep et al., 2009; van der Laan et al., 2011). Administering a high dose of ghrelin, and therefore experimentally inducing a physiological state of hunger, has been shown to increase activations in taste and reward areas in the brain in response to food pictures (Malik, McGlone, Bedrossian, & Dagher, 2008). These findings suggest that a stronger reward response is encoded in a consumer's situated conceptualizations of eating when hungry, and that this stronger reward response is later simulated when a food cue is encountered in a hungry state. Consistent with this idea, administering ghrelin also enhances appetite, and leads participants to vividly imagine eating a preferred meal, suggesting again that cues of hunger stimulate eating and reward simulations (Schmid et al., 2005).

Just like the motivation to eat has been shown to enhance eating and reward simulations, the motivation to restrict one's food intake has been found to be associated with a dampening of these responses. In a property generation task assessing participants self-reported representations of food concepts, dietary restraint has been found to correlate with slightly reduced eating and reward simulations in response to food words (Papies, 2013). Across studies, chronic dieters have been found to experience difficulties in consistently maintaining eating restraint, which may be reflected in this group showing both stronger reward and stronger control responses to food cues (Chen et al., 2016). Using subtle primes to remind dieters of their long-term dieting motivation, however, helps them make healthier food choices and restrain their intake of high-calorie food (for a review, see Papies, 2016b). In line with this, focusing individuals on health-related aspects of food increases activity in control regions of the brain (Hare, Malmaud, & Rangel, 2011; Hollmann et al., 2012; Yokum & Stice, 2013). Again, we suggest that such priming and mind-set manipulations activate situated conceptualizations of successfully restraining one's intake in the pursuit of long-term goals, which may help to override the effects of eating and reward simulations and facilitate healthy behaviour (Papies, 2016b). Indeed, individuals high in trait self-control have been found to experience lower levels of desire in potentially tempting situations (Haynes, Kemps, & Moffitt, 2016a; Hofmann, Baumeister, Förster, & Vohs, 2012), potentially because their long-term goals help them activate memories of overriding consumption and reward simulations, which then control current behavior. Conversely, individuals with a higher body mass index, and thus most likely a history of overeating, show enhanced reward responses to cues of attractive foods (see Chen et al., 2016), and individuals with alcohol dependency show stronger neural reward responses to alcohol cues (Tapert, Brown, Baratta, & Brown, 2004). These findings suggest that consumers' motivational states with regard to appetitive stimuli modulate the consumption and reward simulations that these stimuli trigger, which in turn affect consumption behavior.

Effects of situations. Similar to individual differences in motivation, we suggest that situational factors also modulate the simulations triggered by appetitive cues, and thus modulate the effects of appetitive cues on consumer experiences and behavior. As reviewed above, situations feature prominently in consumers' representations of appetitive products, such that consumption situations are listed as typical features of food and drink items, and consumer products are organized in memory around eating situations (e.g., Blake et al., 2007; Keesman et al., 2017; Papies, 2013). Consistent with this, we suggest that situational cues play an important role in retrieving situated conceptualizations of consumption experiences, which in turn determine the consumption and reward simulations that appetitive cues activate.

Demonstrating the effects of situational cues, recent research has shown that attractive, unhealthy snack foods are more strongly associated with positive affect when this is examined in the afternoon compared to the morning (Haynes, Kemps, & Moffitt, 2016b). Possibly, this happens because such foods are more likely to be consumed and enjoyed at that time of day, affecting the situated conceptualizations that are established during consumption and later re-activated. In a similar way, cuing a restaurant or a hospital environment can make food seem more or less attractive in relatively automatic ways (Roefs et al., 2006), again suggesting that situational cues modulate the consumption and reward simulations triggered by food cues. In the domain of alcohol, research has suggested that situational cues can modulate the effect of alcohol cues on feeling and behaving as if intoxicated, such that alcohol placebo effects are stronger in bar labs or naturalistic settings than in standard laboratory settings (Mckay & Schare, 1999). These findings suggest that situational factors modulate the effects of product cues on motivational processes, which we suggest results from different simulations being triggered via the pattern completion process described earlier.

The role of product-extrinsic cues

In this final empirical section, we review research findings that illustrate how product-extrinsic cues can affect consumer experiences and behaviour. Specifically, we suggest that product-extrinsic cues can affect which situated conceptualizations are mapped onto a current situation, and thus modulate the simulations that are triggered as pattern completion inferences on these situated conceptualizations. In this manner, food labels, packaging colors, and even utensils used for consumption can affect the expectancies consumers have about products, implemented as consumption simulations.

Effects of labels. A variety of experiments show that linguistic labels affect expectations as well as neural and behavioural responses to food and drink products. One important set of studies demonstrating this phenomenon presented smoked salmon ice-cream to consumers that was labelled as either a “frozen savory mousse”, “ice-cream”, or “Food 386”. When the food was labelled as ice-cream, participants expected a sweet and fruity flavour and liked the food much less than if they expected a savory mousse or an unknown, novel food (Yeomans, Chambers, Blumenthal, & Blake, 2008). Studies on the use of health labels have shown that labels indicating a lowered salt or fat content of a product can affect expectations of sensory qualities, and reduce expected and actual liking (e.g., Kahkonen & Tuorila, 1998; Liem, Miremadi, Zandstra, & Keast, 2012). Linguistic labels have also been found to affect physiological responses to consumption. It has been shown, for example, that when participants anticipated the consumption of a milkshake that was labelled as “indulgent”, and therefore perceived as high in calories, this triggered a stronger anticipatory rise in the gut peptide ghrelin compared with when the identical milkshake is labelled “sensible”, reflecting increased appetite and readiness to eat (Crum, Corbin, Brownell, & Salovey, 2011). After consumption of the “indulgent” milkshake, ghrelin levels declined more sharply compared to the “sensible” milkshake. Thus, although the actual product consumed was the same, simulations of ingesting a high-calorie milkshake based on the label affected participants’ automatic physiological responses to the food.

These findings are in line with alcohol placebo studies (see above), which have shown that labelling a non-alcoholic drink as alcoholic can lead to a variety of physiological and behavioural effects of consumption that are similar to actually consuming alcohol. Again, this suggests that linguistic labels can trigger simulations based on previously learned situated conceptualizations, which then affect what consumers expect and experience upon consumption.

Neuroimaging studies further support our hypothesis that these effects are driven by actual simulations, or re-enactments in the relevant brain areas. In one experiment, tasting a food that was labelled as “rich and delicious” in the fMRI scanner led to increased activation in reward areas of the brain as well as to higher liking, compared to tasting the same food with the label “boiled vegetable water” (Grabenhorst, Rolls, & Bilderbeck, 2008). Extending these findings, a later study showed that tasting an orange juice that was labelled as “extra sweet” compared to “less sweet” changed activations in primary taste areas in the brain as well as sweetness ratings (Woods et al., 2011). Similarly, tasting the same wine with a label suggesting a higher price compared to a lower one increased activations in reward areas, as well as liking of the wine when consuming it (Plassmann, O'Doherty, Shiv, & Rangel, 2008). We suggest that linguistic labels activate specific simulations in sensory and reward regions in the brain, partially re-enacting previous experiences in response to similar cues, which are then superimposed on the actual taste perception and thus affect consumer experience (cf. Hansen, Olkkonen, Walter, & Gegenfurtner, 2006). Such a mechanism has important implications for the marketing of healthy consumer products, which we will briefly address in the Discussion.

Effects of multimodal cues. Research in sensory marketing shows that cues presented in other modalities, for example, haptic, olfactory, or auditory cues, can affect expectations and experiences in a similar way and most likely through similar mechanisms as linguistic labels, as they modulate the simulations that are activated in response to appetitive cues.

Research on the "direct touch effect," for example, has shown that choosing a food product through a touch screen leads to more affect-driven, pleasure-oriented choices compared to clicking on it with a computer mouse (Shen et al., 2016). We suggest that re-enacting a previously performed motor behavior may make it easier to simulate a previous rewarding interaction with the object, which makes its reward value more salient and increases desire. In line with this, tasting a food with the cutlery that has been used previously enhances a central taste dimension of the food (i.e., making cheese taste saltier; Harrar & Spence, 2013). Similar findings emerge from research on olfactory imagery, which shows that adding imagery of the smell to an imagined or actual picture of a food can enhance desire and consumption (Krishna, Morrin, & Sayin, 2014). Furthermore, appealing to more senses in advertising increases perceived taste when consuming the advertised product (Elder & Krishna, 2010). Again, we suggest that providing more cues that map onto a previous rewarding experience help to more strongly simulate consumption and reward, which affects consumer expectations and experiences.

Other research provides evidence that effects of external cues indeed depend on an individual's learning experience. In one experiment, consumers were offered potato chips in one of two packaging designs (i.e., in a light blue vs. green package). Depending on which brand participants habitually consumed and the color scheme that this brand uses for packaging chips (light blue = cheese & onion, green = salt & vinegar, or vice versa), participants perceived the flavor of the chips to be the flavor that is associated with that color

(Piqueras-Fiszman & Spence, 2011). Together, these findings suggest that extrinsic cues can modulate the simulations triggered by consumer products, by affecting the specific situated conceptualization that become active for interpreting a consumption situation.

Discussion

In this article, we have used the construct of simulation within the grounded cognition theory of desire and motivated behavior to interpret a variety of phenomena in consumer behavior. We argued that consumers continuously establish and update situated conceptualizations of consumption experiences in memory. Specifically, situated conceptualizations include information about diverse qualities of consumer experience, including sensory input, affect experienced, actions performed, goals pursued, and various aspects of the consumption context such as objects and people present. Encountering appetitive stimuli on subsequent occasions re-activates the best-matching situated conceptualization in memory, and non-present aspects of this representation are then simulated as pattern completion inferences. These simulations can motivate behavior, and they can be modulated by state and trait individual differences, by the consumption context, and by product-extrinsic cues. The research we have reviewed supports this theoretical framework with findings from behavioural, physiological, and neuroimaging experiments.

We suggest that our theory has a number of potentially useful applications for consumer behavior, particularly in domains of appetitive behavior. At the same time, however, a number of important issues for further research emerge from applying this theoretical framework to consumer research.

Implications for influencing consumer behavior

We suggest that attempts to influence consumer behavior will benefit from systematic attempts to activate "beneficial" consumption and reward simulations in critical situations. First of all, behavior can be influenced by removing specific situational cues, and thus reducing the likelihood that consumption and reward simulations for unhealthy or unsustainable behaviors are activated (for a review, see Best & Papies, 2017). This could mean, for example, removing brand logos and images from cigarette packaging, moving tempting foods from kitchen counters to kitchen cupboards, or placing meat dishes in the middle of the menu where they are less likely to be ordered.

Secondly, attempts to influence consumer behavior could focus on developing product cues or situational cues that stimulate reward simulations for healthy, prosocial, or sustainable options. Such an approach could be implemented, for example, by providing social rewards for eating fruits and vegetables as in the food dudes programme for children (Horne et al., 2008), by cueing rewards from cooperative behavior through posters that activate social norms (Ernest-Jones, Nettle, & Bateson, 2011), or increasing the salience of immediate rewards that can be associated with an activity that is typically construed mostly in terms of delayed rewards, such as exercising (Woolley & Fishbach, 2016). Importantly, product cues should not emphasize the healthful qualities of a product per se (e.g., “reduced salt”) if these are not highly rewarding, since research has shown that this may negatively affect the consumption simulations – typically assessed as expectancies – triggered by a product.

In a related but slightly different approach, behavior can be influenced by adding product or situational cues that enhance the salience of long-term rewards of healthy, prosocial, or sustainable options. This priming approach is especially likely to work if the consumer indeed values the rewards of the alternative behavior, for example, by being motivated to eat healthily to protect health or body weight, and if the consumer knows which means are available to pursue the alternative behavior (Papies, 2016b, 2016a). Research has shown that goal priming can affect appetitive as well as other consumer behaviors (Papies, 2016a), and we suggest that it may work through activating rewarding simulations of pursuing long-term rewards, based on previous experiences.

Finally, applying the grounded cognition theory of desire to consumer behavior suggests that behavior can be influenced by creating situated conceptualizations of engaging in healthy, prosocial, or sustainable behaviors that can be retrieved easily in response to environmental cues, and that lead to consumption and reward simulations that then motivate the desired behaviors. As this approach aims to lay down novel situated conceptualizations in response to external cues in order to influence behaviour, this can be seen as a type of training intervention (see Papies, 2016b). In consumer behaviour, this is most likely to take the form of advertising. How this can be done most effectively in order to create the most vivid and compelling simulations to influence behavior is an important issue for future research, as we also discuss below.

Future research

A number of important questions remain to be addressed before we fully understand the role of simulations in consumer experiences and behaviour. Although many more questions have probably been triggered in the reader already, we would like to focus here on questions relating to two main issues, namely the automaticity of the effects described here, particularly with regard to conscious awareness, and the novel theoretical contributions of our theory for understanding consumer behaviour.

Automaticity and conscious awareness. One important issue to be addressed in future research is the question to which degree the effects of simulations described here are automatic, and the related question of when simulations become conscious and whether and how they are amenable to conscious control. We suggest that in most cases, simulations that are triggered by external cues are a feature of relatively involuntary conceptual processing and therefore do not require intentions, conscious awareness, or a high amount of cognitive resources (see Barsalou, 2008a). At the same time, research suggests that simulations are more likely to occur if they are task- or goal-relevant, and thus require some depth of processing (Lebois, Wilson-Mendenhall, & Barsalou, 2015; Santos, Chaigneau, Simmons, & Barsalou, 2011). In addition, research suggests that consumption and reward simulations may require some cognitive resources, as research has shown that the hedonic value of attractive foods is not fully activated if a perceiver is under high cognitive load (Van Dillen et al., 2013), possibly because rewarding eating simulations are then less likely to be activated. In a similar way, the effect of advertising slogans that refer to multiple senses has been found to be limited by cognitive load (Elder & Krishna, 2010), again suggesting that sensory-based consumption simulations require cognitive resources. At the same time, other work has shown that eating simulations and the associated salivary response, particularly in response to high-calorie foods, were activated even without instructions to simulate eating the food (Keesman et al., 2016), suggesting that features of the stimulus that make the stimulus more action-relevant can also make consumption and reward simulations in response to the stimulus more likely. These findings suggest that it might be worthwhile to examine the conditions under which consumption and reward simulations occur for different types of stimuli and as a function of different states and traits of the perceiver.

The idea that simulations are more likely to occur if they are task- or goal-relevant may also help to predict under which circumstances product cues that trigger simulations can be expected to affect behavior. One recent series of experiments (Pecher & van Dantzig, 2016), for example, did not replicate the findings that presenting consumer products oriented to facilitate motor simulations with the dominant hand increases the intention to purchase them (Elder & Krishna, 2012). This might be due to the lack of specific task instructions in the replication studies, compared to the Elder and Krishna studies, where participants were instructed to evaluate and rate household or consumer products. An evaluation mindset might induce deeper processing of the product images and thus induce action simulations, in line with the notion that such simulations are context-dependent and support goal-directed action in a given situation (see also Eelen et al., 2013). More generally, our theory suggests that consumer behavior phenomena involving simulations are more likely to occur, and thus to replicate, if the relevant simulations have been stored as part of an individual's situated conceptualizations, and if they are re-activated in the later context, for example, because they are motivationally relevant to the individual, or task-relevant in the research context (see also Barsalou, 2016b).

Related to the issues of automaticity and motivational relevance is the question of when consumption and reward simulations reach conscious awareness, and are experienced as cravings. In their elaborated intrusion theory of desire, Kavanagh, Andrade and May (2005) suggested that initial intrusive thoughts, for example, about how rewarding it would be to have a sweet snack, can trigger conscious elaborations if they elicit a strong affective reaction or "a keen sense of deficit" (p. 448). It is not quite clear, however, which factors would contribute to such a response, and there are likely strong individual and situational differences that affect whether a simulation reaches conscious awareness. In line with the discussion of automaticity above, we suggest that the action-relevance of a simulation, given features of the stimulus and the perceiver, might be one crucial factor to examine in future research, such that simulations with high action relevance are particularly likely to reach conscious awareness. As an example, consumption and reward simulations in response to an attractive, high-calorie food item are more likely to occur and more likely to reach consciousness when the perceiver is hungry and the expected reward is therefore especially strong, compared to the consumption and reward simulations triggered by a healthier food item.

The issue of conscious awareness also points to another important question, namely, the potential to consciously control one's consumption and reward simulations and their effects on behavior. In instances where conscious awareness is a necessary condition for exerting control, strong salient simulations might be most amenable to control, as they act as a cue to engage control processes, for example, by applying mindfulness-based strategies to deconstruct their compelling nature and high subjective realism (e.g., Jenkins & Tapper, 2014; Lacaille et al., 2014; Papies, Barsalou, & Custers, 2012; Papies et al., 2015). Indeed, recent findings suggest that such mindfulness strategies, which rely on the individual introspecting and observing their own consumption and reward simulations, are particularly effective if the presented stimuli are of particular motivational relevance, for example, due to the perceiver's chronic or current motivation (Papies et al., 2015). Future research could study more systematically how awareness of those simulations that would most benefit from regulation can be increased (see also Papies, 2017a, for a discussion of mindfulness in this context), and which strategies are most effective in different circumstances.

Novel theoretical contributions. While we argue that our grounded cognition approach should be seen to complement, rather than replace, existing theories of motivational processes in consumer behavior (e.g., dual-process theories, such as Hofmann, Strack, & Deutsch, 2008; theories of affective vs. cognitive processes, such as Shiv & Fedorikhin, 1999; theories of consumer habits, e.g., Wood & Neal, 2009), we do suggest that it makes certain unique contributions that could be enhanced further by future research. One important feature of our theory is that it allows us to understand a variety of motivational processes within one comprehensive theoretical framework. Specifically, and as described elsewhere, our theory can account for effects of habits, impulses, social norms, and nonconscious goals (Best & Papies, 2017; Papies, 2016b, 2017b), as well as for effects of influence and regulation strategies such as goal priming, implementation intentions, and mindfulness (Barsalou, 2016b; Papies, 2016b; Papies et al., 2015). This parsimonious approach may enable a more integrated consideration of various phenomena in self-regulation that have previously been considered only separately, and may also enable the study of behavior change strategies that cut across phenomena.

In addition, the grounded theory of desire and motivated behaviour naturally interfaces with the brain and body, and is supported by a wide variety of behavioural, physiological, and neuroimaging research findings. Importantly, this suggests that our approach is consistent with current understandings of the brain's architecture, which is ultimately required to implement the processes that are being discussed here. Furthermore, grounding our theory explicitly in neural processes allows for the further study of the phenomena described here by converging methods. It might be useful, for example, to examine the experiential, behavioural, and neural signatures of consumption and reward simulations together, and to study the effects of conscious awareness on these processes. We suggest that this may lead to novel insights that could not be obtained by focusing on behavioural or on neuroimaging approaches alone.

The grounded cognition theory laid out here also leads to a number of testable predictions that could be considered in future research. One of these relates to the effect of motivational relevance that was already briefly addressed above. Specifically, we predict that high motivational relevance for a stimulus should increase the likelihood and intensity of consumption and reward simulations, and increase conscious access to these simulations. While some research already suggests that this is the case for food products, it should be studied more systematically and across domains. Our theory also predicts that an individual's learning experiences with particular consumer products should shape the simulations that become active during later encounters with product cues, with this being testable in both behavioural and neuroimaging experiments. Here, one could further systematically manipulate the degree of overlap between the learning and the testing situation in order to examine the hypothesis that the best matching situated conceptualization becomes active on a later encounter to produce situated, goal-directed action.

Finally, we suggest that situated conceptualizations can also become established vicariously, as well as becoming established via direct experience (for similar suggestions, see also Best & Papies, 2017; Papies, 2017). When hearing about a non-present situation being described, or when watching an advertisement that displays a person engaging in a particular consumer behavior, it is plausible that the perceiver simulates the situation. We assume that the processing of these simulations is much like the processing of actual situations. As a vicarious situation is comprehended, the situation processing architecture simulates its multimodal components across perceptual, cognitive, affective, and motor systems in the brain, producing a coherent perceptual experience via imagery, together with a coherent conceptual interpretation. Once a situated conceptualization of the described situation has been constructed, it then becomes stored in memory as described earlier, and can later be activated via the pattern completion inferences, producing multimodal inferences via simulation. We assume that humans acquire a tremendous amount of situational experience in this manner, which is central to diverse social and cultural activities. Clearly, this mechanism could play a central role in marketing via advertising and through the sharing of consumer experience. Future research could therefore directly test this mechanism and its implications for influencing consumer behavior.

Table 1

Core propositions of the grounded cognition theory of desire and motivated behavior, providing an account of how simulations can affect consumer experience and behavior

Core proposition	***Description***
Establishing situated conceptualizations	Consumers continuously establish and update comprehensive representations of consumption experiences in memory, so-called situated conceptualizations.
Features of situated conceptualizations	Situated conceptualizations can contain information about, for example, sensory input, affective experience, actions performed, bodily states, goals pursued, and various aspects of the consumption context such as objects and people present.
Re-activating situated conceptualizations	Encountering relevant stimuli on subsequent occasions re-activates the best-matching situated conceptualization in memory, which is then adapted to fit the current situation.
Simulations within situated conceptualizations	Non-present aspects of this situated conceptualization are simulated (i.e., re-enacted) as pattern completion inferences, using the same neural systems as during the original consumption experience.
Effects of simulations	Once active, simulations affect consumer experience, motivation, and behavior. In turn, they can be modulated by state and trait individual differences, by the consumption context, and by product-extrinsic cues.

Note. The above processes are assumed to be statistical and could be affected by both random error and systematic bias. For example, memory error and bias could occur during the storage of situated conceptualizations; a current situational cue could fail to activate the most appropriate situated conceptualization; or a simulated pattern completion inference could be incorrect in the current situation.

References

Barrett, L. F. (2006). Solving the emotion paradox: Categorization and the experience of emotion. *Personality and Social Psychology Review*, *10*, 20–46. https://doi.org/10.1207/s15327957pspr1001_2

Barros-Loscertales, A., Gonzalez, J., Pulvermuller, F., Ventura-Campos, N., Bustamante, J. C., Costumero, V., … Avila, C. (2012). Reading salt activates gustatory brain regions: fMRI evidence for semantic grounding in a novel sensory modality. *Cerebral Cortex*, *22*, 2554–2563. https://doi.org/10.1093/cercor/bhr324

Barsalou, L. W. (1990). On the indistinguishability of exemplar memory and abstraction in category representation. In T. K. Srull & R. S. W. Jr, *Content and process specificity in the effects of prior experiences: Advances in social cognition* (Vol. 3, pp. 61–88). Hillsdale, NJ: Erlbaum.

Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral and Brain Sciences*, *22*, 577–660.

Barsalou, L. W. (2003). Situated simulation in the human conceptual system. *Language and Cognitive Processes*, *18*, 513–562. https://doi.org/10.1080/01690960344000026

Barsalou, L. W. (2008a). Grounded Cognition. *Annual Review of Psychology*, *59*(1), 617–645.

Barsalou, L. W. (2008b). Grounding symbolic operations in the brain's modal systems. In G. R. Semin & E. R. Smith, *Embodied grounding: Social, cognitive, affective, and neuroscientific approaches* (pp. 9–42). New York: Cambridge University Press.

Barsalou, L. W. (2009). Simulation, situated conceptualization, and prediction. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *364*(1521), 1281–1289. https://doi.org/10.1098/rstb.2008.0319

Barsalou, L. W. (2011). Integrating Bayesian analysis and mechanistic theories in grounded cognition. *Behavioral and Brain Sciences*, *34*, 191–192. https://doi.org/10.1017/S0140525X11000197

Barsalou, L. W. (2016a). On Staying Grounded and Avoiding Quixotic Dead Ends. *Psychonomic Bulletin & Review*, *23*(4), 1122–1142. https://doi.org/10.3758/s13423-016-1028-3

Barsalou, L. W. (2016b). Situated conceptualization offers a theoretical account of social priming. *Current Opinion in Psychology*, *12*, 6–11. https://doi.org/10.1016/j.copsyc.2016.04.009

Barsalou, L. W. (2016c). Situated conceptualization: Theory and applications. In Y. Coello & M. H. Fischer, *Foundations of embodied cognition: Volume 1. Perceptual and emotional embodiment* (pp. 11–37). East Sussex: Psychology Press.

Barsalou, L. W., Niedenthal, P. M., Barbey, A. K., & Ruppert, J. A. (2003). Social embodiment. In B. H. Ross, *Psychology of Learning and Motivation* (Vol. 43, pp. 43–92). New York: Academic Press.

Barsalou, L. W., & Wiemer-Hastings, K. (2005). Situating abstract concepts. In D. Pecher & R. A. Zwaan, *Grounding cognition: The role of perception and action in memory, language, and thinking* (pp. 129–163). New York: Cambridge University Press.

Bartholow, B. D., & Heinz, A. (2006). Alcohol and Aggression Without Consumption Alcohol Cues, Aggressive Thoughts, and Hostile Perception Bias. *Psychological Science*, *17*(1), 30–37. https://doi.org/10.1111/j.1467-9280.2005.01661.x

Beaver, J. D., Lawrence, A. D., van Ditzhuijzen, J., Davis, M. H., Woods, A., & Calder, A. J. (2006). Individual differences in reward drive predict neural responses to images of food. *The Journal of Neuroscience*, *26*(19), 5160–5166.

Best, M., & Papies, E. K. (2017). Right here, right now: situated interventions to change consumer habits. *Under Review*.

Blake, C. E., Bisogni, C. A., Sobal, J., Devine, C. M., & Jastran, M. (2007). Classifying foods in contexts: How adults categorize foods for different eating settings. *Appetite*, *49*(2), 500–510. https://doi.org/10.1016/j.appet.2007.03.009

Brunyé, T. T., Hayes, J. F., Mahoney, C. R., Gardony, A. L., Taylor, H. A., & Kanarek, R. B. (2013). Get in My Belly: Food Preferences Trigger Approach and Avoidant Postural Asymmetries. *PLoS ONE*, *8*(8), e72432. https://doi.org/10.1371/journal.pone.0072432

Burger, K. S., & Stice, E. (2014). Neural responsivity during soft drink intake, anticipation, and advertisement exposure in habitually consuming youth. *Obesity*, *22*(2), 441–450. https://doi.org/10.1002/oby.20563

Carter, B. L., & Tiffany, S. T. (1999). Meta-analysis of cue-reactivity in addiction research. *Addiction*, *94*(3), 327–340. https://doi.org/10.1080/09652149933829

Chen, J., Papies, E. K., & Barsalou, L. W. (2016). A core eating network and its modulations underlie diverse eating phenomena. *Brain and Cognition*, *110*, 20–42. https://doi.org/10.1016/j.bandc.2016.04.004

Clark, A. (2013). Whatever next? Predictive brains, situated agents, and the future of cognitive science. *Behavioral and Brain Sciences*, *36*, 1–73.

Coletta, M., Platek, S., Mohamed, F. B., van Steenburgh, J. J., Green, D., & Lowe, M. R. (2009). Brain activation in restrained and unrestrained eaters: An fMRI study. *Journal of Abnormal Psychology*, *118*(3), 598–609. https://doi.org/10.1037/a0016201

Crum, A. J., Corbin, W. R., Brownell, K. D., & Salovey, P. (2011). Mind over milkshakes: Mindsets, not just nutrients, determine ghrelin response. *Health Psychology*, *30*(4), 424–429. https://doi.org/10.1037/a0023467

Demos, K. E., Heatherton, T. F., & Kelley, W. M. (2012). Individual Differences in Nucleus Accumbens Activity to Food and Sexual Images Predict Weight Gain and Sexual Behavior. *The Journal of Neuroscience*, *32*(16), 5549–5552. https://doi.org/10.1523/JNEUROSCI.5958-11.2012

Eelen, J., Dewitte, S., & Warlop, L. (2013). Situated embodied cognition: Monitoring orientation cues affects product evaluation and choice. *Journal of Consumer Psychology*, *23*(4), 424–433. https://doi.org/10.1016/j.jcps.2013.04.004

Elder, R. S., & Krishna, A. (2010). The Effects of Advertising Copy on Sensory Thoughts and Perceived Taste. *Journal of Consumer Research*, *36*(5), 748–756. https://doi.org/10.1086/603546

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. https://doi.org/10.1086/661531

Epstein, S. (1979). The stability of behavior: I. On predicting most of the people much of the time. *Journal of Personality and Social Psychology*, *37*(7), 1097–1126. https://doi.org/10.1037/0022-3514.37.7.1097

Ernest-Jones, M., Nettle, D., & Bateson, M. (2011). Effects of eye images on everyday cooperative behavior: a field experiment. *Evolution and Human Behavior*, *32*(3), 172–178. https://doi.org/10.1016/j.evolhumbehav.2010.10.006

Field, M., Schoenmakers, T., & Wiers, R. W. (2008). Cognitive Processes in Alcohol Binges: A Review and Research Agenda. *Current Drug Abuse Reviews*, *1*(3), 263–279.

Fillmore, M. T., Carscadden, J. L., & Vogel-Sprott, M. (1998). Alcohol, cognitive impairment and expectancies. *Journal of Studies on Alcohol*, *59*(2), 174–179.

Friedman, R. S., McCarthy, D. M., Förster, J., & Denzler, M. (2005). Automatic effects of alcohol cues on sexual attraction. *Addiction*, *100*(5), 672–681. https://doi.org/10.1111/j.1360-0443.2005.01056.x

Goldstone, A. P., Prechtl de Hernandez, C. G., Beaver, J. D., Muhammed, K., Croese, C., Bell, G., … Bell, J. D. (2009). Fasting biases brain reward systems towards high-calorie foods. *European Journal of Neuroscience*, *30*(8), 1625–1635. https://doi.org/10.1111/j.1460-9568.2009.06949.x

Grabenhorst, F., Rolls, E. T., & Bilderbeck, A. (2008). How Cognition Modulates Affective Responses to Taste and Flavor: Top-down Influences on the Orbitofrontal and Pregenual Cingulate Cortices. *Cerebral Cortex*, *18*(7), 1549–1559. https://doi.org/10.1093/cercor/bhm185

Hansen, T., Olkkonen, M., Walter, S., & Gegenfurtner, K. R. (2006). Memory modulates color appearance. *Nature Neuroscience*, *9*(11), 1367–1368. https://doi.org/10.1038/nn1794

Hare, T. A., Malmaud, J., & Rangel, A. (2011). Focusing Attention on the Health Aspects of Foods Changes Value Signals in vmPFC and Improves Dietary Choice. *The Journal of Neuroscience*, *31*(30), 11077–11087. https://doi.org/10.1523/JNEUROSCI.6383-10.2011

Harrar, V., & Spence, C. (2013). The taste of cutlery: how the taste of food is affected by the weight, size, shape, and colour of the cutlery used to eat it. *Flavour*, *2*, 21. https://doi.org/10.1186/2044-7248-2-21

Haynes, A., Kemps, E., & Moffitt, R. (2016a). Does trait self-control predict weaker desire for unhealthy stimuli? A lab-based study of unhealthy snack intake. *Personality and Individual Differences*, *89*, 69–74. https://doi.org/10.1016/j.paid.2015.09.049

Haynes, A., Kemps, E., & Moffitt, R. (2016b). Is cake more appealing in the afternoon? Time of day is associated with control over automatic positive responses to unhealthy food. *Food Quality and Preference*, *54*, 67–74. https://doi.org/10.1016/j.foodqual.2016.07.004

Hofmann, W., Baumeister, R. F., Förster, G., & Vohs, K. D. (2012). Everyday temptations: an experience sampling study of desire, conflict, and self-control. *Journal of Personality and Social Psychology*, *102*(6), 1318–1335. https://doi.org/10.1037/a0026545

Hofmann, W., Strack, F., & Deutsch, R. (2008). Free to buy? Explaining self-control and impulse in consumer behavior. *Journal of Consumer Psychology*, *18*(1), 22–26. https://doi.org/10.1016/j.jcps.2007.10.005

Hollmann, M., Hellrung, L., Pleger, B., Schlögl, H., Kabisch, S., Stumvoll, M., … Horstmann, A. (2012). Neural correlates of the volitional regulation of the desire for food. *International Journal of Obesity*, *36*(5), 648–655. https://doi.org/10.1038/ijo.2011.125

Horne, P. J., Hardman, C. A., Lowe, C. F., Tapper, K., Le Noury, J., Madden, P., … Doody, M. (2008). Increasing parental provision and children’s consumption of lunchbox fruit and vegetables in Ireland: the Food Dudes intervention. *European Journal of Clinical Nutrition*, *63*(5), 613–618. https://doi.org/10.1038/ejcn.2008.34

Jenkins, K. T., & Tapper, K. (2014). Resisting chocolate temptation using a brief mindfulness strategy. *British Journal of Health Psychology*, *19*(3), 509–522. https://doi.org/10.1111/bjhp.12050

Kahkonen, P., & Tuorila, H. (1998). Effect of Reduced-fat Information on Expected and Actual Hedonic and Sensory Ratings of Sausage. *Appetite*, *30*(1), 13–23. https://doi.org/10.1006/appe.1997.0104

Kavanagh, D. J., Andrade, J., & May, J. (2005). Imaginary relish and exquisite torture: The elaborated intrusion theory of desire. *Psychological Review*, *112*(2), 446–467.

Kaye, W. H., Fudge, J. L., & Paulus, M. (2009). New insights into symptoms and neurocircuit function of anorexia nervosa. *Nature Reviews Neuroscience*, *10*, 573–584. https://doi.org/10.1038/nrn2682

Keesman, M., Aarts, H., Vermeent, S., Häfner, M., & Papies, E. K. (2016). Consumption Simulations Induce Salivation to Food Cues. *PLOS ONE*, *11*(11), e0165449. https://doi.org/10.1371/journal.pone.0165449

Keesman, M., Papies, E. K., Ostafin, B. D., Verwei, S., Häfner, M., & Aarts, H. (2017). Situated representations of alcohol predict drinking behavior.

Kiefer, M., & Barsalou, L. W. (2013). Grounding the human conceptual system in perception, action, and internal states. In W. Prinz, M. Beisert, & A. Herwig, *Action science: Foundations of an emerging d iscipline* (pp. 381–407). Cambridge, MA: MIT Press.

Krishna, A., Morrin, M., & Sayin, E. (2014). Smellizing Cookies and Salivating: A Focus on Olfactory Imagery. *Journal of Consumer Research*, *41*(1), 18–34. https://doi.org/10.1086/674664

Lacaille, J., Ly, J., Zacchia, N., Bourkas, S., Glaser, E., & Knäuper, B. (2014). The effects of three mindfulness skills on chocolate cravings. *Appetite*. https://doi.org/10.1016/j.appet.2014.01.072

Lawrence, N. S., Hinton, E. C., Parkinson, J. A., & Lawrence, A. D. (2012). Nucleus accumbens response to food cues predicts subsequent snack consumption in women and increased body mass index in those with reduced self-control. *NeuroImage*, *63*(1), 415–422. https://doi.org/10.1016/j.neuroimage.2012.06.070

Lebois, L. A. M., Wilson-Mendenhall, C. D., & Barsalou, L. W. (2015). Are Automatic Conceptual Cores the Gold Standard of Semantic Processing? The Context-Dependence of Spatial Meaning in Grounded Congruency Effects. *Cognitive Science*, *39*(8), 1764–1801. https://doi.org/10.1111/cogs.12174

Liem, D. G., Miremadi, F., Zandstra, E. H., & Keast, R. S. (2012). Health labelling can influence taste perception and use of table salt for reduced-sodium products. *Public Health Nutrition*, *15*(12), 2340–2347. https://doi.org/10.1017/S136898001200064X

Lindner, K., Papies, E. K., Zandstra, E. H., Dijksterhuis, G., & Smeets, M. A. M. (2017). Simulations of consumption situations make food attractive.

Lopez, R. B., Hofmann, W., Wagner, D. D., Kelley, W. M., & Heatherton, T. F. (2014). Neural Predictors of Giving in to Temptation in Daily Life. *Psychological Science*, *25*(7), 1337–1344. https://doi.org/10.1177/0956797614531492

Love, B. C., Medin, D. L., & Gureckis, T. M. (2004). SUSTAIN: A Network Model of Category Learning. *Psychological Review*, *111*(2), 309–332. https://doi.org/10.1037/0033-295X.111.2.309

Lowe, M. R., & Butryn, M. L. (2007). Hedonic hunger: A new dimension of appetite? *Physiology & Behavior*, *91*(4), 432–439.

Malik, S., McGlone, F., Bedrossian, D., & Dagher, A. (2008). Ghrelin Modulates Brain Activity in Areas that Control Appetitive Behavior. *Cell Metabolism*, *7*(5), 400–409. https://doi.org/10.1016/j.cmet.2008.03.007

Martin, A. (2001). Functional neuroimaging of semantic memory. In R. Cabeza & A. Kingston, *Handbook of functional neuroimaging of cognition* (pp. 153–186). Cambridge, MA: MIT Press.

Martin, A. (2007). The representation of object concepts in the brain. *Annual Review of Psychology*, *58*, 25–45. https://doi.org/10.1146/annurev.psych.57.102904.190143

McClelland, J. L., & Rumelhart, D. E. (1985). Distributed memory and the representation of general and specific information. *Journal of Experimental Psychology: General*, *114*(2), 159–188. https://doi.org/10.1037/0096-3445.114.2.159

Mckay, D., & Schare, M. L. (1999). The effects of alcohol and alcohol expectancies on subjective reports and physiological reactivity: A meta-analysis. *Addictive Behaviors*, *24*(5), 633–647. https://doi.org/10.1016/S0306-4603(99)00021-0

Medin, D. L., & Schaffer, M. M. (1978). Context theory of classification learning. *Psychological Review*, *85*, 207–238. https://doi.org/10.1037/0033-295X.85.3.207

Mischel, W. (1968). *Personality and assessment*. New York: Wiley.

Murdaugh, D. L., Cox, J. E., Cook III, E. W., & Weller, R. E. (2012). fMRI reactivity to high-calorie food pictures predicts short- and long-term outcome in a weight-loss program. *NeuroImage*, *59*(3), 2709–2721. https://doi.org/10.1016/j.neuroimage.2011.10.071

Myrick, H., Anton, R. F., Li, X., Henderson, S., Drobes, D., Voronin, K., & George, M. S. (2004). Differential brain activity in alcoholics and social drinkers to alcohol cues: relationship to craving. *Neuropsychopharmacology: Official Publication of the American College of Neuropsychopharmacology*, *29*(2), 393–402. https://doi.org/10.1038/sj.npp.1300295

Nederkoorn, C., & Jansen, A. (2002). Cue reactivity and regulation of food intake. *Eating Behaviors*, *3*(1), 61–72.

Nosofsky, R. M. (2011). The generalized context model: An exemplar model of classification. In E. M. Pothos & A. J. Willis, *Formal approaches in categorization* (pp. 18–39). Cambridge: Cambridge University Press.

Papies, E. K. (2013). Tempting food words activate eating simulations. *Frontiers in Psychology*, *4:*, 838. https://doi.org/10.3389/fpsyg.2013.00838

Papies, E. K. (2016a). Goal priming as a situated intervention tool. *Current Opinion in Psychology*, *12*, 12–16. https://doi.org/10.1016/j.copsyc.2016.04.008

Papies, E. K. (2016b). Health goal priming as a situated intervention tool: how to benefit from nonconscious motivational routes to health behaviour. *Health Psychology Review*, *10*(4), 408–424. https://doi.org/10.1080/17437199.2016.1183506

Papies, E. K. (2017a). Mindfulness and health behavior: Examing the roles of attention regulation and decentering. In *Mindfulness in Social Psychology* (pp. 94–108). Routledge.

Papies, E. K. (2017b). Situating interventions to bridge the intention-behaviour gap: A framework for recruiting nonconscious processes for behaviour change. *Social and Personality Psychology Compass, in press.*

Papies, E. K., & Barsalou, L. W. (2015). Grounding Desire and Motivated Behavior: A theoretical framework and review of empirical evidence. In *The Psychology of Desire* (pp. 36–60). New York, NY, US: Guilford Press.

Papies, E. K., Barsalou, L. W., & Custers, R. (2012). Mindful Attention Prevents Mindless Impulses. *Social Psychological and Personality Science*, *3*(3), 291–299. https://doi.org/10.1177/1948550611419031

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. https://doi.org/10.1037/a0038032

Pecher, D., & van Dantzig, S. (2016). The role of action simulation on intentions to purchase products. *International Journal of Research in Marketing*, *33*(4), 971–974. https://doi.org/10.1016/j.ijresmar.2016.03.006

Ping, R. M., Dhillon, S., & Beilock, S. L. (2009). Reach For What You Like: The Body’s Role in Shaping Preferences. *Emotion Review*, *1*(2), 140–150. https://doi.org/10.1177/1754073908100439

Piqueras-Fiszman, B., & Spence, C. (2011). Crossmodal correspondences in product packaging. Assessing color–flavor correspondences for potato chips (crisps). *Appetite*, *57*(3), 753–757. https://doi.org/10.1016/j.appet.2011.07.012

Plassmann, H., O’Doherty, J., Shiv, B., & Rangel, A. (2008). Marketing actions can modulate neural representations of experienced pleasantness. *Proceedings of the National Academy of Sciences*, *105*(3), 1050–1054. https://doi.org/10.1073/pnas.0706929105

Pulvermüller, F. (2005). Brain mechanisms linking language and action. *Nature Reviews Neuroscience*, *6*(7), 576–582.

Roefs, A., Quaedackers, L., Werrij, M. Q., Wolters, G., Havermans, R., Nederkoorn, C., … Jansen, A. (2006). The environment influences whether high-fat foods are associated with palatable or with unhealthy. *Behaviour Research and Therapy*, *44*(5), 715–736. https://doi.org/16/j.brat.2005.05.007

Rogers, P. J., & Hill, A. J. (1989). Breakdown of dietary restraint following mere exposure to food stimuli: Interrelationships between restraint, hunger, salivation, and food intake. *Addictive Behaviors*, *14*(4), 387–397. https://doi.org/10.1016/0306-4603(89)90026-9

Ross, B. H., & Murphy, G. L. (1999). Food for Thought: Cross-Classification and Category Organization in a Complex Real-World Domain. *Cognitive Psychology*, *38*(4), 495–553. https://doi.org/10.1006/cogp.1998.0712

Sanders, N., Smeets, P. A. M., van Elburg, A. A., Danner, U. N., van Meer, F., Hoek, H. W., & Adan, R. A. H. (2015). Altered Food-Cue Processing in Chronically Ill and Recovered Women with Anorexia Nervosa. *Frontiers in Behavioral Neuroscience*, *9*. https://doi.org/10.3389/fnbeh.2015.00046

Santos, A., Chaigneau, S. E., Simmons, W. K., & Barsalou, L. W. (2011). Property generation reflects word association and situated simulation. *Language and Cognition*, *3*, 83–119. https://doi.org/10.1515/LANGCOG.2011.004

Schacht, J. P., Anton, R. F., Randall, P. K., Li, X., Henderson, S., & Myrick, H. (2011). Stability of fMRI striatal response to alcohol cues: A hierarchical linear modeling approach. *NeuroImage*, *56*(1), 61–68. https://doi.org/10.1016/j.neuroimage.2011.02.004

Schmid, D. A., Held, K., Ising, M., Uhr, M., Weikel, J. C., & Steiger, A. (2005). Ghrelin Stimulates Appetite, Imagination of Food, GH, ACTH, and Cortisol, but does not Affect Leptin in Normal Controls. *Neuropsychopharmacology*, *30*(6), 1187–1192. https://doi.org/10.1038/sj.npp.1300670

Seibt, B., Häfner, M., & Deutsch, R. (2007). Prepared to eat: how immediate affective and motivational responses to food cues are influenced by food deprivation. *European Journal of Social Psychology*, *37*(2), 359–379.

Sheeran, P., Aarts, H., Custers, R., Rivis, A., Webb, T. L., & Cooke, R. (2005). The goal-dependent automaticity of drinking habits. *British Journal of Social Psychology*, *44*(1), 47–63. https://doi.org/10.1348/014466604X23446

Shen, H., & Sengupta, J. (2012). If you can't grab it, it won't grab you: The effect of restricting the dominant hand on target evaluations. *Journal of Experimental Social Psychology*, *48*(2), 525–529. https://doi.org/10.1016/j.jesp.2011.11.003

Shen, H., Zhang, M., & Krishna, A. (2016). Computer Interfaces and the "Direct-Touch" Effect: Can iPads Increase the Choice of Hedonic Food? *Journal of Marketing Research*, *53*(5), 745–758. https://doi.org/10.1509/jmr.14.0563

Shiv, B., & Fedorikhin, A. (1999). Heart and mind in conflict: The interplay of affect and cognition in consumer decision making. *Journal of Consumer Research*, *26*(3), 278–292.

Siep, N., Roefs, A., Roebroeck, A., Havermans, R., Bonte, M. L., & Jansen, A. (2009). Hunger is the best spice: an fMRI study of the effects of attention, hunger and calorie content on food reward processing in the amygdala and orbitofrontal cortex. *Behavioural Brain Research*, *198*(1), 149–158. https://doi.org/10.1016/j.bbr.2008.10.035

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.

Spence, C. (2011). Mouth-Watering: The Influence of Environmental and Cognitive Factors on Salivation and Gustatory/Flavor Perception. *Journal of Texture Studies*, *42*(2), 157–171. https://doi.org/10.1111/j.1745-4603.2011.00299.x

Stice, E., Burger, K. S., & Yokum, S. (2015). Reward Region Responsivity Predicts Future Weight Gain and Moderating Effects of the TaqIA Allele. *Journal of Neuroscience*, *35*(28), 10316–10324. https://doi.org/10.1523/JNEUROSCI.3607-14.2015

Stice, E., Burger, K., & Yokum, S. (2013). Caloric Deprivation Increases Responsivity of Attention and Reward Brain Regions to Intake, Anticipated Intake, and Images of Palatable Foods. *NeuroImage*. https://doi.org/10.1016/j.neuroimage.2012.11.028

Tapert, S. F., Brown, G. G., Baratta, M. V., & Brown, S. A. (2004). fMRI BOLD response to alcohol stimuli in alcohol dependent young women. *Addictive Behaviors*, *29*(1), 33–50. https://doi.org/10.1016/j.addbeh.2003.07.003

Terence, G., & Lawson, D. M. (1976). Expectancies, alcohol, and sexual arousal in male social drinkers. *Journal of Abnormal Psychology*, *85*(6), 587–594. https://doi.org/10.1037/0021-843X.85.6.587

Tiffany, S. T., Cox, L. S., & Elash, C. A. (2000). Effects of transdermal nicotine patches on abstinence-induced and cue-elicited craving in cigarette smokers. *Journal of Consulting and Clinical Psychology*, *68*(2), 233–240. https://doi.org/10.1037/0022-006X.68.2.233

Tucker, M., & Ellis, R. (1998). On the relations between seen objects and components of potential actions. *Journal of Experimental Psychology: Human Perception and Performance*, *24*(3), 830–846. https://doi.org/10.1037/0096-1523.24.3.830

Uher, R., Treasure, J., Heining, M., Brammer, M. J., & Campbell, I. C. (2006). Cerebral processing of food-related stimuli: Effects of fasting and gender. *Behavioural Brain Research*, *169*(1), 111–119. https://doi.org/10.1016/j.bbr.2005.12.008

van der Laan, L. N., de Ridder, D. T. D., Viergever, M. A., & Smeets, P. A. M. (2011). The first taste is always with the eyes: A meta-analysis on the neural correlates of processing visual food cues. *NeuroImage*, *55*(1), 296–303. https://doi.org/10.1016/j.neuroimage.2010.11.055

Van Dillen, L. F., Papies, E. K., & Hofmann, W. (2013). Turning a blind eye to temptation: How task load can facilitate self-regulation. *Journal of Personality and Social Psychology*, *104*(3), 427–443.

Veling, H., Aarts, H., & Papies, E. K. (2011). Using stop signals to inhibit chronic dieters' responses toward palatable foods. *Behaviour Research and Therapy*, *49*(11), 771–780. https://doi.org/10.1016/j.brat.2011.08.005

Vuchinich, R. E., & Sobell, M. B. (1978). Empirical separation of physiologic and expected effects of alcohol on complex perceptual motor performance. *Psychopharmacology*, *60*(1), 81–85. https://doi.org/10.1007/BF00429183

Wang, G.-J., Volkow, N. D., Telang, F., Jayne, M., Ma, J., Rao, M., … Fowler, J. S. (2004). Exposure to appetitive food stimuli markedly activates the human brain. *NeuroImage*, *21*(4), 1790–1797. https://doi.org/10.1016/j.neuroimage.2003.11.026

White, K. D. (1978). Salivation: the significance of imagery in its voluntary control. *Psychophysiology*, *15*(3), 196–203.

Wiers, R. W., & Stacy, A. W. (2006). Implicit Cognition and Addiction. *Current Directions in Psychological Science*, *15*(6), 292–296. https://doi.org/10.1111/j.1467-8721.2006.00455.x

Wilson-Mendenhall, C. D., Barrett, L. F., Simmons, W. K., & Barsalou, L. W. (2011). Grounding emotion in situated conceptualization. *Neuropsychologia*, *49*, 1105–1127. https://doi.org/10.1016/j.neuropsychologia.2010.12.032

Wilson-Mendenhall, C. D., Simmons, W. K., Martin, A., & Barsalou, L. W. (2013). Contextual Processing of Abstract Concepts Reveals Neural Representations of Nonlinguistic Semantic Content. *Journal of Cognitive Neuroscience*, *25*(6), 920–935. https://doi.org/10.1162/jocn_a_00361

Wood, W., & Neal, D. T. (2009). The habitual consumer. *Journal of Consumer Psychology*, *19*(4), 579–592. https://doi.org/10.1016/j.jcps.2009.08.003

Woods, A. T., Lloyd, D. M., Kuenzel, J., Poliakoff, E., Dijksterhuis, G. B., & Thomas, A. (2011). Expected taste intensity affects response to sweet drinks in primary taste cortex: *NeuroReport*, *22*(8), 365–369. https://doi.org/10.1097/WNR.0b013e3283469581

Woolley, K., & Fishbach, A. (2016). For the Fun of It: Harnessing Immediate Rewards to Increase Persistence in Long-Term Goals. *Journal of Consumer Research*, *42*(6), 952–966. https://doi.org/10.1093/jcr/ucv098

Yeh, W., & Barsalou, L. W. (2006). The situated nature of concepts. *The American Journal of Psychology*, *119*, 349–384. https://doi.org/10.2307/20445349

Yeomans, M. R., Chambers, L., Blumenthal, H., & Blake, A. (2008). The role of expectancy in sensory and hedonic evaluation: The case of smoked salmon ice-cream. *Food Quality and Preference*, *19*(6), 565–573. https://doi.org/10.1016/j.foodqual.2008.02.009

Yokum, S., Ng, J., & Stice, E. (2011). Attentional Bias to Food Images Associated With Elevated Weight and Future Weight Gain: An fMRI Study. *Obesity*, *19*(9), 1775–1783. https://doi.org/10.1038/oby.2011.168

Yokum, S., & Stice, E. (2013). Cognitive regulation of food craving: effects of three cognitive reappraisal strategies on neural response to palatable foods. *International Journal of Obesity*, *37*, 1565–1570. https://doi.org/10.1038/ijo.2013.39