11

EMBODIED COGNITION AND THE CONSTRUCTION OF ATTITUDES

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The body figures prominently in common language definitions of the term *attitude*. The Oxford Dictionary (n.d.) refers to "a position of the body indicating a particular mental state (*'the boy was standing in an attitude of despair'*)" and Merriam-Webster (n.d.) refers to "the arrangement of the parts of a body" or "a position assumed for a specific purpose (*'a threatening attitude'*)." This understanding is consistent with the use of the term by early behavioral scientists, including Herbert Spencer (1864/1909) and Charles Darwin (1872/1965), who assumed a link between evaluation and action that is apparent in bodily expression. This assumption is still detectable in Gordon Allport's (1935, p. 810) conceptualization of an attitude as "a mental and neural state of readiness, organized through experience, exerting a directive and dynamic influence upon the individual's response to all objects and situations with which it is related." Allport's approach assumed that attitudes reflect "an enduring organization of motivational, emotional, perceptual, and cognitive processes with respect to some aspect of the individual's world" as Krech and Crutchfield (1948, p. 152) put it in the leading textbook of the time. As empirical findings accumulated, it proved disappointingly difficult to find stable relationships between the assumed component processes. In response, the conceptualization of attitudes shifted to a focus on the evaluative component. The currently leading textbook defines attitude as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor" (Eagly & Chaiken, 1993, p. 1). In the succinct words of Daryl Bem (1970, p. 14), "attitudes are likes and dislikes."

   With the advent of information processing models in social psychology, these likes and dislikes were conceptualized as evaluative judgments. Paralleling general developments in cognitive psychology, the pioneering work (e.g., N.H. Anderson, 1971; McGuire, 1960; Wyer, 1974) took a decidedly "cold" approach to attitude judgments and emphasized issues that were compatible with the emerging computer metaphor of information processing models (discussed in more detail in the next section). Later research rediscovered the importance of "warm" affective and motivational processes (see the contributions in Fiedler & Forgas, 1988; Martin & Clore, 2001) and the pragmatic, goal-oriented nature of human judgment (see the contributions in Gollwitzer & Bargh, 1996). More recently, cognitive and social psychologists have turned their attention to an aspect that is as obvious as frequently overlooked: Humans do their thinking inside a body and experience the world

through their senses. This has far-reaching consequences for every aspect of mental activity, which researchers are beginning to unravel under the general rubric of "embodied cognition." These developments rekindled an interest in the role of sensory and motor processes in attitude formation and change, in ways that go far beyond the early references to bodily postures. This chapter summarizes key lessons learned from these recent developments and discusses their implications for attitude research.

Embodied Cognition

The term "embodied cognition" is an umbrella term for diverse theoretical approaches that share opposition to the "amodal" model of the mind that dominated psychology for the last four decades. The information processing models of the 1970s (for a history, see Gardner, 1987; for an authoritative contemporary treatment, see Lachman, Lachman, & Butterfield, 1979) assumed that people acquire information through their senses and that this information is translated into a common code that is independent of the sensory modality in which the information was initially acquired. The resulting amodal representations were considered the building blocks of knowledge (semantic memory) on which the mind operates with general procedures that are also independent of the modality of the original input. In this approach, amodal core cognitive processes were "sandwiched" (Hurley, 2001) between perception and action, which involve modality-specific sensory and motor processes. Once stored, knowledge representations were assumed to be context-independent, although context could influence how easily a stored representation could be accessed. These assumptions were consistent with a computer metaphor that emphasized encoding, storage, and retrieval operations and took it for granted that all operations require a common format, paralleling the operational requirements of a computer.

The emphasis on amodal knowledge representation was a sharp break with centuries of earlier theorizing in philosophy and psychology that took it for granted that visual, olfactory, or haptic inputs were stored in a form that reflected the modality of their acquisition (for a historical review, see Thomas, 2017). For the founding fathers of experimental psychology, there was little difference between a visual percept and its mental representation (e.g., Titchener, 1909; Wundt, 1911). They would have been surprised by a controversial debate over whether mental imagery involves anything resembling an image (e.g., Paivio, 1971; Pylyshyn, 1973; for the current consensus, see Kosslyn, Thompson, & Ganis, 2006). Instead, they had a heated debate about the opposite issue: Can there be anything like an "imageless" (amodal) thought? While Bühler (1907, 1908) and Külpe (1912), key scholars of the Würzburg School of psychology, assumed so, Wundt (1907) considered it impossible (for historical reviews, see Ash, 1998; Danziger, 1980).

Given social psychologists' long tradition of attending to visceral aspects of social perception and behavior, they were quick to notice the limitations of the computer metaphor. However, their attempts to integrate "hot" variables into the social cognition variants of information processing models did not fundamentally challenge the assumption of amodal representations. Instead, feelings and bodily states were themselves assumed to be stored in memory in an amodal form, for example, as nodes in a semantic network (e.g., Bower, 1981; Forgas, 2001), although they provided "online" information that competed with the amodally represented "offline" information stored in memory (e.g., Schwarz & Clore, 1983; Schwarz, 1990). Some current embodiment research (discussed below) is compatible with this tradition, which treats bodily inputs as a source of concurrent "online" information and is largely silent on issues of mental representation.

Going beyond such extensions of the information processing paradigm, the fundamental assumption of a largely decontextualized and amodal mind has been questioned more radically by several streams of research that converge in support of a metatheoretical narrative that emphasizes the situated, experiential, and embodied nature of human cognition. Following early insights by William

James (1890), situated cognition research assumes that thinking is for doing and that any mind worth having needs to be geared towards facilitating action in ways that are sensitive to the requirement of one's current situation (for a review, see Smith & Semin, 2004; for a discussion of its implications for attitude research, see Schwarz, 2007). Because people experience the world through their senses, sensorimotor information and the accompanying subjective experiences play a key role, even in domains that seem abstract and far removed from immediate sensory inputs and motor outputs. Some researchers emphasize phylogenetic processes and note that humans "evolved from creatures whose neural resources were devoted primarily to perceptual and motoric processing" (Wilson, 2002, p. 625). The skills that psychologists often refer to as "higher mental processes" developed later and presumably took advantage of these evolutionarily older programs and reused them for new purposes (for a discussion, see M. L. Anderson, 2010, 2014). Other researchers emphasize ontogenetic learning and suggest that early sensorimotor experience with the physical and social world (e.g., feeling warm and safe in the presence of a caregiver) structures later thinking about abstract concepts (e.g., security), resulting in associations between sensorimotor experience and abstract thought across content domains (e.g., Lakoff & Johnson, 1999; Williams, Huang, & Bargh, 2009).

Independent of specific assumptions about their origin, links between sensorimotor experience and abstract concepts are reflected in widely shared conceptual metaphors (for reviews, see Landau, 2017; Landau, Meier, & Keefer, 2010; S.W.S. Lee & Schwarz, 2014a; and the contributions in Landau, Robinson, & Meier, 2014). For example, a relationship may be described as "cold" or "warm"—and, indeed, experiencing physical warmth through touching a warm object increases the perception of social warmth in others (e.g., Williams & Bargh, 2008), just as the social experience of a "cold shoulder" influences perceptions of the physical temperature of the room (e.g., Zhong & Leonardelli, 2008). The bulk of social psychological embodiment research addresses influences that can be couched in metaphorical terms.

Beyond metaphors, a more radical approach to embodied cognition conceptualizes all mental acts as acts of modality-specific simulation (Barsalou, 1999, 2008, 2016a). From this perspective,

> as an experience occurs (e.g., easing into a chair), the brain captures states across the modalities and integrates them with a multimodal representation stored in memory (e.g., how a chair looks and feels, the action of sitting, introspections of comfort and relaxation).
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> (Barsalou, 2008, p. 618)

Such multimodal representations can be activated through any of the participating modalities (for a discussion, see S.W.S. Lee, 2016). For example, thinking about a chair is assumed to involve a simulation of previous sensorimotor experience with a chair, making simulations of earlier experience an essential part of any mental activity. Supporting this rationale, neuroimaging findings show that supposedly amodal "high level" processes (e.g., language comprehension, categorization, retrieval) entail activation of the brain areas involved in "low-level" sensorimotor processing (for a review, see Barsalou, 2008).

In the following sections, we elaborate on these approaches to embodied cognition and address their implications for attitude research. As will become apparent, many observations can be conceptualized in terms of more than one of the broad perspectives sketched above. From a history-of-science perspective, this is not surprising. At early stages of a research program, the focus is often on identifying challenges to the dominant paradigm in the hope that they will capture a field's attention (Root-Bernstein, 1989). Consistent with this regularity, early embodiment studies usually emphasized surprising demonstrations over the identification of the underlying processes (M. L. Anderson, 2008). As a result, there is wide consensus that we cannot understand human cognition without taking into account that humans interact with the material and social world through their bodies and

experience it through their senses. But there is much less consensus about what this implies and how it is best conceptualized. Moreover, the emerging theoretical perspectives are not necessarily mutually exclusive, and different processes may contribute to observed effects under different conditions. We return to this issue throughout this chapter.

Bodily Experience as a Source of Information

The assumption that people attend to their own bodily sensations and extract information from them has a long tradition in art, philosophy, and psychology (for discussions, see Damasio, 1994; Gibbard, 1990; Herbert & Pollatos, 2012; Niedenthal, 2007; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Solomon, 1993). From the heart that beats faster when seeing the loved one to the cold sweat of fear, perceptions of bodily states figure prominently in poems, songs, and popular images. Multiple lines of research are consistent with such intuitions. In general, (a) evaluation and bodily response (from heartbeat and pupil dilation to smiling, frowning, and approach/avoidance behaviors) are closely linked. (b) Facilitating the bodily response often intensifies the evaluative experience, whereas (c) inhibiting the bodily response attenuates it. Moreover, (d) incidental engagement of a bodily response can affect evaluation of targets that were not the cause of the apparent response, but (e) being aware of the incidental nature of the co-occurrence undermines its impact. There are likely exceptions to these generalizations, depending on the nature of the bodily experience, the extent to which it is subject to interoceptive or proprioceptive awareness, and the availability of applicable lay theories for making sense of the bodily experience. Attitude researchers are well familiar with several of the relevant research streams. Our selective review notes those traditions in passing and pays more attention to less familiar developments.

Perceived Arousal

Numerous experimental studies addressed the role of bodily arousal in attitude formation and change. A fast-beating heart indeed increases the attractiveness of erotic material (e.g., Cantor, Zillman, & Bryant, 1975; for a review, see Zillman, 1978), even when the heart rate feedback is fictitious (Valins, 1966). This influence is not observed when the arousal is attributed to an irrelevant source, such as unrelated physical exercise (Cantor et al., 1975). Similarly, the impact of physiological symptoms of fear is attenuated when the symptoms can be attributed to an allegedly arousing pill, but enhanced when the symptoms are experienced despite an allegedly tranquilizing pill (Schwarz, Servay, & Kumpf, 1985). Arousal also plays a key role in the emergence of dissonance effects (for a review, see Zanna & Cooper, 1976), which are again undermined when the arousal is attributed to an irrelevant source and enhanced when it is experienced despite the alleged presence of a counteracting force (e.g., Zanna & Cooper, 1974). Moreover, unexplained arousal induced by a drug can result in dissonance effects under conditions that are otherwise insufficient to elicit attitude change (Cooper, Zanna, & Taves, 1978). Throughout, the observed patterns of discounting and augmentation effects (Kelley, 1972) are consistent with the logic of feelings-as-information theory, which treats subjective experiences as a source of information and assumes that their influence is diminished (vs. amplified) when their perceived informational value is discounted (vs. augmented), as is the case for any other information (for reviews, see Schwarz, 2012; Schwarz & Clore, 2007).

Embodied Approach and Avoidance

Like other organisms, humans generally approach things they find pleasant, likable, and tempting and avoid things they find unpleasant, scary, or disgusting. The relationship between evaluation and approach/avoidance is bidirectional—positive (negative) stimuli are approached (avoided), and

pairing a mildly valenced stimulus with an incidental approach (avoidance) response accentuates its evaluation. Moreover, clearly valenced stimuli are processed more efficiently when paired with a compatible bodily response. We address these regularities in turn.

Evaluation Influences Movement

In the late 1950s, Andrew Solarz (1960) asked participants to familiarize themselves with a list of positive (e.g., kind, clean) and negative (e.g., cruel, dirty) words. Next, each word was presented on a card mounted on an experimental apparatus, and participants were asked to move the card to a preassigned position. The movements were initiated faster, and executed with fewer errors, when the required movement matched the valence of the word, that is, when positive words needed to be moved toward the self (approach) or negative words away from the self (avoidance). Later research, using modern response time measurement, confirmed a fast and automatic link between evaluation and compatible approach/avoidance movements (e.g., Chen & Bargh, 1999; for a review, see Neumann, Förster, & Strack, 2003).

Going beyond approach/avoidance movements, Neumann and colleagues (2005) asked participants to respond to positive or negative words by either smiling or frowning. As expected, electromyography (EMG) measures indicated a faster onset of a requested smile in response to a positive rather than negative word, and a faster onset of a requested frown in response to a negative rather than positive word. Throughout, expressing or reporting an evaluation is facilitated when the bodily activity involved in the report maps onto the link between valence and bodily approach/avoidance response.

Movement Influences Evaluation

The reverse causal relationship also holds. A given stimulus is evaluated more (less) favorably when the perceiver engages in an incidental approach (avoidance) movement. However, the emergence of this influence is constrained by the meaning of the movement in context. In a seminal series of studies, Cacioppo, Priester, and Berntson (1993) drew on the observation that the approach movement of pulling something closer involves contraction of the arm flexor, whereas the avoidance movement of pushing something away involves contraction of the arm extensor. The arm flexor can also be engaged by pressing the palm upward against the underside of a table, whereas the arm extensor can be engaged by pressing the palm downward against the top of the table. These isometric contractions have no superficial similarity with pulling or pushing, which minimizes demand characteristics. To test the influence of bodily approach/avoidance signals, Cacioppo and colleagues showed participants unknown Chinese ideographs while they engaged in an isometric flexor or extensor contraction. As expected, ideographs paired with arm flexion at the initial exposure were later preferred over ideographs paired with arm extension. This influence was only observed when the initial exposure involved evaluative processing (asking participants for a dichotomous like/ dislike judgment), but not when it involved nonevaluative processing (asking participants for a dichotomous simple/complex judgment).

Whereas the Chinese ideographs used by Cacioppo and colleagues (1993) were unknown to participants and only mildly valenced, later studies with clearly valenced stimuli showed that the movement-to-evaluation influence is context-dependent (Centerbar & Clore, 2006; Förster, 1998). Exposing participants to attractive or unattractive faces, Förster (1998) found that participants liked attractive, but not unattractive, faces more when they flexed their arm; conversely, they disliked unattractive, but not attractive, faces more when they extended their arm. In short, the bodily approach/avoidance feedback only influenced evaluation when the valence of the stimuli was compatible with the valence of the bodily feedback. Centerbar and Clore (2006) observed the

same contingency with mildly valenced Chinese ideographs taken from Cacioppo et al.'s (1993) original studies.

Just as people pull desirable things closer and push undesirable ones away, they ingest desirable substances and spit out undesirable ones. The muscles involved in producing the inward movements of ingestion and the outward movements of expectoration are also involved in speaking. Some consonants (e.g., B and P) are articulated at the front of the oral cavity; some (e.g., L and D) in the middle; and some in the back (e.g., K). As a result, the articulation of POLLOCK involves a front-to-back movement, resembling the inward muscle movements of ingestion, whereas the articulation of KOLLOP involves a back-to-front movement, resembling the outward muscle movements of expectoration. Reflecting their approach/avoidance association, words that involve an inward (front-to-back) movement are liked more than words that involve an outward (back-to-front) movement, as first observed by Topolinski, Maschmann, Pecher, and Winkielman (2014). This in-out effect is robust across languages and can influence a broad range of judgments and behaviors, from brand preferences and willingness to pay (Topolinski, Zürn, & Schneider, 2015) to food consumption (Rossi, Pantoja, Borges, & Werle, 2017; for a comprehensive review, see Topolinski, 2017).

Facilitating or Impairing Affective Response

Facilitating or impairing a person's bodily response to a stimulus also facilitates or impairs the person's affective experience of the stimulus. As Strack, Martin, and Stepper (1988) showed by varying the way in which participants held a pen in the mouth, a cartoon is perceived as funnier when the viewer's face can respond with a smile than when pursed lips inhibit a smile. This subtle manipulation proved less robust than expected in a large-scale replication effort (Wagenmakers et al., 2016) that included video recordings of participants' faces to monitor their compliance with the procedures. However, being aware that one is being recorded is a powerful manipulation by itself (see Duval and Wicklund's, 1972, work on objective self-awareness). Varying the presence versus absence of a video recording, Noah, Schul, and Mayo (2018) found that the original Strack et al. (1988) findings replicated in the absence of a camera, but not when participants knew that they were being recorded.

Independent of the robustness of Strack et al.'s (1988) pen manipulation, numerous findings provide converging evidence for the role of bodily feedback in emotional experience and information processing (for reviews, see McIntosh, 1996; Niedenthal, 2007). Particularly notable are studies that investigated the consequences of injections with botulinum toxin, commonly known as botox. Used as a cosmetic treatment, these injections reduce facial wrinkles by temporarily paralyzing the underlying muscles. They are especially popular for reducing wrinkles associated with a tensed corrugator (frowning muscle), a facial expression involved in negative emotions. What botox customers rarely anticipate are the unintended side effects of selectively impairing the response of some of their facial muscles. On the positive side, botox treatments attenuate depressive symptoms (Magid et al., 2015), presumably by reducing patients' negative affective response as predicted by facial feedback theories. On the negative side, patients' reduced facial responses also impair their understanding of others' emotional expressions, presumably by impairing the mimicry involved in "feeling" others' emotions (Neil & Chartrand, 2011).

Facial feedback is also involved in the comprehension of affect-eliciting language. EMG recordings of facial muscle response show that reading affectively positive sentences (e.g., "The water park is refreshing on the hot summer day") is accompanied by zygomaticus activation, whereas reading sad (e.g., "You slump in your chair when you realize that all of the schools rejected you") or angry (e.g., "The pushy telemarketer won't let you return to dinner") sentences is accompanied by corrugator activation (Havas, Glenberg, Gutowski, Lucarelli, & Davidson, 2010). Importantly, impairing

the corrugator response through botox injections selectively impairs the comprehension of sad and angry material, without affecting the comprehension of happy material. Such findings suggest that embodied simulation is an integral part of language comprehension, allowing concurrent bodily responses to constrain the interpretation of semantic material (for extended discussions, see Glenberg & Gallese, 2012; Havas & Matheson, 2013).

Motor Fluency

Any mental process, from perception to recall and reasoning, can be easy or difficult. Easy processing feels pleasant (Winkielman, Schwarz, Fazeneiro, & Reber, 2003), which can be captured with self-report as well as EMG measures (Winkielman & Cacioppo, 2001). This affective response informs evaluation and preference (for reviews, see Reber, Schwarz, & Winkielman, 2004; Schwarz, 2004), consistent with feelings-as-information theory (Schwarz & Clore, 1983, 2007). Going beyond the informational value of the affective response, people hold lay theories about what makes a given mental process easy or difficult, which allows perceived processing fluency to inform a wide range of other judgments (for reviews, see Alter & Oppenheimer, 2009; Schwarz, 2010). For example, difficulty of recall can imply that the event happened a long time ago, that one didn't find it interesting when it happened, or that one is currently too distracted to focus on recalling it—and which of these inferences people draw depends on the question asked (Schwarz, 2010).

Bodily contributors to fluency experiences have long been recognized. For example, contracting the corrugator during recall makes the recall feel more difficult and its influence parallels the impact of other sources of recall difficulty (e.g., Sanna, Schwarz, & Small, 2002; Stepper & Strack, 1993). Also, the disfluency associated with writing with one's nondominant hand impairs one's confidence in one's own thoughts (e.g., Briñol & Petty, 2003, Exp. 4). Whereas such manipulations are easily identified as "bodily" in nature, Topolinski (2013) identified less obvious bodily underpinnings of fluency experiences. For example, exercises that facilitate the eye movements involved in a visual perception task enhance later liking of matching visual stimuli (Topolinski, 2010). Similarly, reading involves subvocalization, which becomes easier with repetition. When the subtle muscle movements involved in subvocalization are impaired by having people chew gum (Topolinski & Strack, 2009) or popcorn (Topolinski, Lindner, & Freudenberg, 2014), the otherwise observed fluency effects are eliminated, while equally distracting motor tasks that do not impair subvocalization do not eliminate the fluency effects (Topolinski & Strack, 2009). Chewing can even eliminate the classic mere exposure effect (Zajonc, 1968) for verbal materials.

These examples illustrate how a better understanding of the bodily underpinnings of familiar phenomena can reveal novel limiting conditions, with far-reaching theoretical and applied implications (Topolinski, 2012, 2013). Future research is likely to uncover bodily contributions to other well-established psychological phenomena. In some cases, this may require a thorough reconceptualization of the phenomenon itself; in other cases, it will deepen our understanding of its component processes by adding a bodily level of analysis.

Summary

The reviewed lines of research indicate that people attend to their current sensorimotor experiences (including interoceptive and proprioceptive bodily feedback), interpret them within the constraints of the current context, and bring them to bear on the evaluative judgment at hand. The experience (e.g., arousal) provides diagnostic information when it is indeed elicited by the target of judgment, but nondiagnostic information when it is elicited by incidental influences. Because people are more sensitive to their experiences than to where those experience come from, they are likely to misread incidental experiences as part of their response to the target. Awareness of the incidental

nature of a bodily experience usually undermines its perceived informational value and attenuates its impact, consistent with principles of feelings-as-information theory (Schwarz, 2012; Schwarz & Clore, 2007). Awareness-based corrections are less likely when people lack insight into the possible influence, e.g., when proprioceptive feedback from arm flexion and extension (Cacioppo et al., 1993) or in-out articulation patterns (Topolinski et al., 2014) mirror approach/avoidance responses in nontransparent ways.

This perspective on bodily influences is largely silent on issues of mental representation and merely assumes that information provided by *concurrent* integral or incidental sensorimotor experiences is integrated with other information about the target in arriving at a judgment. In contrast, the research reviewed in the next section emphasizes the importance of *past* sensorimotor experience and its interplay with concurrent experience in mental representation.

Mental Simulation and Representation

All models of the mind agree that people perceive the world through their senses. At the next step, amodal models assume that all inputs are redescribed and stored in a common code that is independent of the sensorimotor modality in which the material was acquired, whereas modal models assume that the representation maintains its sensorimotor characteristics. A rapidly growing body of findings favors the latter account, even for pallid tasks with limited sensorimotor variation. Suppose, for example, that words are learned visually or auditorily. Under an amodal model, later recall should operate on a non-sensorimotor representation. Empirically, however, neuroimaging shows that recall involves the activation of visual areas after visual study and of auditory areas after auditory study (for a review, see Buckner & Wheeler, 2001). In general, imagining an object and thinking about it are associated with activation of the brain regions involved in interacting with the object, including vision (e.g., Kosslyn, Thompson, & Ganis, 2006); audition (e.g., Halpern et al., 2004); taste (e.g., Simmons, Martin, & Barsalou, 2005); smell (e.g., Gonzalez et al., 2006); and motor action (e.g., Grèzes & Decety, 2001; Martin, 2007). When thought pertains to complex autobiographical events, it involves a wide range of sensorimotor simulations (Rubin, 2006).

Such findings are compatible with a long history of action-based theories of perception in philosophy and psychology (for a review, see Briscoe & Grush, 2017). They also do not come as a surprise to social psychologists, who have long considered the sensory "vividness" of information (Nisbett & Ross, 1980) a crucial determinant of its impact and have used "simulation" and "imagery" instructions for many experimental purposes, from inducing moods (e.g., Schwarz & Clore, 1983) to enhancing the impact of persuasive communications (for a review, see Petrova & Cialdini, 2008). In retrospect, the intuitions that guided this work are difficult to reconcile with the assumptions of the amodal information processing paradigm within which the studies were originally couched.

Although the amodal model's key assumptions have been forcefully discredited, it has not yet been consensually replaced with a coherent alternative. One promising contender is Barsalou's (1999) theory of perceptual symbol systems and its recent development into a general theory of situated conceptualization (Barsalou, 2016a, 2016b). This approach has found considerable attention in psychology and other disciplines, including philosophy of mind (Prinz, 2002) and consumer behavior (Papies, Best, Gelibter, & Barsalou, 2017). We summarize the core propositions of this perspective and then apply it to select findings.

Simulation and Situated Conceptualization

Adopting a situated cognition perspective, Barsalou assumes that "the brain is a situated processing architecture, designed to process situations in the moment and to simulate non-present situations in thought" (Barsalou, 2016a, p. 6). Multiple neural systems process information in parallel, and the

representation retains modality-specific characteristics. "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" (Papies et al., 2017, p. 405).

Thinking about a strawberry is assumed to be based on a partial simulation of the previous experience, constrained by the current goals and context. Neuroimaging results are compatible with this assumption.

> 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., 2011).
>
> (Papies et al., 2017, p. 405)

The likelihood with which a previously formed multimodal representation becomes the basis of simulation when encountering a new stimulus depends on its overlap and frequency of past use (Barsalou, 2016a), as assumed in amodal models of concept accessibility and use (for reviews, see Higgins, 1996; Förster & Liberman, 2007; Wyer, 2008). Active representations allow for pattern completion inferences that fill current gaps with previously acquired knowledge, consistent with many other modal and amodal theories. Notwithstanding these convergences with amodal models, Barsalou's model assumes that simulation-based pattern completions are modality-specific and that motor processes participate in interacting with the target. These assumptions provide a plausible account of the subjective realism of simulations and their affective and sensory impact. To illustrate, we summarize representative findings of interest to attitude researchers.

Cognition as Simulation

As already noted, thinking about an object or situation is associated with the activation of brain areas involved in interacting with that object. On the behavioral level, this is associated with facilitation and inhibition effects. For example, Tucker and Ellis (1998) observed that participants were faster to judge the orientation of a cup (upright or inverted) when its handle was aligned with the hand needed for the response. When the handle was oriented toward the right (left) hand, a right-hand (left-hand) key press was significantly faster. Presumably, seeing the handle elicited a grasping simulation that facilitated the respective response.

Elder and Krishna (2012) explored the implications of this insight for consumers' product evaluations and purchase intentions. They showed participants food advertisements with a bowl of yogurt, a cup of soup, or a piece of cake and manipulated whether the spoon or fork was oriented toward their dominant or nondominant hand. If perceivers spontaneously engage in a consumption simulation, the simulation should be easier when the orientation of the utensil matches their dominant hand, which should make the product more appealing. Indeed, participants reported higher purchase intentions when the orientation of the utensil matched their dominant hand, making the cake more appetizing when the fork was pictured on the right (left) for right- (or left-)handed participants. The

beneficial effect of this match was eliminated when a concurrent task (pressing a clamp) interfered with the motor simulation, which confirms the causal role of concurrent motor processes. In short, the placement of a spoon can change the appeal of a soup, provided the perceiver's hands aren't busy with something else.

In related work, Shen and Sengupta (2012) reasoned that holding an object should interfere with simulating one's use of another object and hence impair its evaluation. However, this should only occur when the simulation involves the hand, that is, when the target object is something one usually grabs. Supporting these predictions, holding a ball impaired evaluations of a soft drink when participants were shown a photo of a can of the drink (which one can grab), but not when they were shown a photo of its logo. Conversely, holding something that facilitates the intended interaction with the target object should facilitate the simulation and hence improve evaluations of the target. Indeed, holding a fork in one's dominant hand improved evaluations of a bowl of pasta, but hurt evaluations of a pen.

Such findings are compatible with two explanations that are not mutually exclusive. On the one hand, easy simulations are likely to be more involving and compelling and may facilitate more confident pattern completion inferences (Elder & Krishna, 2012; Papies et al., 2017). On the other hand, easy processing itself elicits a positive affective response, which can also contribute to more positive evaluations (Shen & Sengupta, 2012; Winkielman et al., 2003). Both pathways involve ease of the sensorimotor simulation but emphasize different mediators, and the available studies offer partial support for each.

If thinking about an object involves simulation of one's previous sensorimotor experiences with it, the resulting pattern completion inferences should also guide perception of related objects. Numerous studies on placebo effects are consistent with this prediction. For example, functional magnetic resonance imaging (fMRI) studies indicate higher activation of reward areas when people taste a drink labeled as "rich and delicious" rather than as "vegetable water" (Grabenhorst, Rolls, & Bilderbeck, 2008) or taste a wine with an expensive rather than cheap label (Plassmann, O'Doherty, Shiv, & Rangel, 2008). Presumably, this reflects that the linguistic cues elicit partial simulations of previous experiences with similar products, which become part of the concurrent experience. Such simulations can also influence people's physiological responses to food. For example, Crum and colleagues (2011) observed a stronger rise in the gut peptide ghrelin when participants anticipated drinking an "indulgent" rather than a "sensible" milkshake, presumably reflecting the anticipatory simulation of previous experience.

Finally, merely imagining the repeated consumption of a food can be sufficient to elicit satiation, curbing one's interest in the imagined food, much as if one had already eaten plenty of it. Morewedge, Huh, and Vosgerau (2010) had participants imagine eating either cheese or M&M's 3 or 30 times, a task that presumably involves multimodal sensory simulation of one's previous experience of eating these foods. The more often they had imagined consumption, the less they subsequently ate the imagined food. Their consumption of the not-imagined food, on the other hand, was not affected, indicating a food-specific satiation rather than a general feeling of fullness. Whereas Morewedge and colleagues explicitly asked participants to imagine eating the food, Larson, Redden, and Elder (2014) merely asked participants to rate how appetizing they find each of a number of food photographs shown to them. Theoretically, this rating task involves taste simulation of the pictured food, which should parallel deliberate imagination. Indeed, the more pictures of salty foods participants rated, the less they subsequently enjoyed the taste of a salty food they were asked to test, suggesting that the simulation resulted in sensory-specific satiation. This satiation effect was not obtained when participants rated the brightness of the same pictures, a task that does not require taste simulation. The difference between taste and brightness ratings also illustrates that simulations are constrained by the goals at hand—thinking is for doing and which aspects of a previous experience are re-enacted is task- and context-dependent.

Summary

Findings of the type reviewed in this section challenge models that treat the core functions of cognition as operating on an amodal code, "sandwiched" (Hurley, 2001) between modality-specific sensory perception on the input side and motor action on the output side. Instead, sensorimotor information is part and parcel of mental representation, and cognition involves simulations in the form of partial re-enactments of earlier experience. These theoretical developments can accommodate familiar phenomena, shed new light on the underlying processes, and offer unique novel predictions.

From the perspective of attitude research, Barsalou's (1999, 2008, 2016a) theorizing is highly compatible with situated cognition approaches to attitude construction, which assume that any system of evaluation needs to be goal- and context-sensitive to guide behavior in adaptive ways (e.g., Schwarz, 2007; Smith & Semin, 2004). The emphasis on information gleaned from sensorimotor interaction with the attitude object and the role of simulation in representation are also compatible with many familiar phenomena, from the power of imagery to guide judgment and behavior (Markman, Klein, & Suhr, 2009; Petrova & Cialdini, 2008) to the role of prior experience in the attitude-behavior relationship (Fazio & Zanna, 1981). However, the findings also draw attention to variables that have received limited attention in attitude research. We surmise, for example, that the ease of simulating behavioral responses can play a large role in the attitude-behavior relationship, such that a busy hand may be sufficient to undermine the appeal of an otherwise desirable piece of cake, whereas a readily accessible fork may improve the appeal of an uninspiring one.

Simulation approaches highlight the role that *past* sensory experience with an object, person, or situation plays in current thought about the same object, person, or situation or their close conceptual relatives. In contrast, the metaphor approach addresses how sensory experience in one domain, say physical warmth, influences thought about a substantively different domain, say interpersonal warmth. As Landau (2017, p. 31) noted, "embodied simulation is an *intra*conceptual mechanism," whereas metaphorical reasoning is an "*inter*conceptual mechanism" that allows sensorimotor experience in one domain to affect judgment and behavior in another domain.

Embodied Metaphors

For many social psychologists, embodied cognition is probably synonymous with one particular stream of research, namely, work that illuminates how sensorimotor experience in one domain (say, touching a warm or cold cup of coffee) can influence cognition, emotion, and behavior in a different domain (say, the impression formed of another person). The recent interest in metaphors breaks with a long tradition in philosophy and linguistics that treated metaphors as a version of figurative speech that can interfere with logic and conceptual rigor and is best left to poets (for discussions of these developments, see Gibbs, 2008; Lakoff, 1998; Ortony, 1998). Metaphors are now assumed to be an indispensable part of human cognition, enabling people to think about abstract and complex targets in terms of domains with which they have more concrete experience. This shift in perspective is largely due to the seminal work of Lakoff and Johnson (1980, 1999), whose conceptual metaphor theory opened new avenues of inquiry in philosophy, linguistics, and psychology (for reviews, see Kövecses, 2010; Landau, 2017). We first summarize the core assumptions of conceptual metaphor theory and then review illustrative findings. We end this section by identifying open issues and avenues for future research.

Conceptual Metaphors

A conceptual metaphor consists of three elements: a relatively concrete and familiar *source* concept, a more abstract or complex *target* concept, and a conceptual *mapping* between the two. For example, the conceptual metaphor "Love is a journey" invites the mapping of knowledge about journeys—it

takes time, there are smooth spots and rough spots, sometimes one arrives at crossroads or dead-ends, occasionally one needs to back-track and start over—onto one's knowledge about romantic relationships. As is apparent when we compare the conceptual metaphor "Love is a journey" with its alternative, "Love is perfect unity," any conceptual metaphor highlights some aspects of the target concept and hides others. This has consequences. For example, recalling a relationship conflict has a more adverse impact on relationship satisfaction when people are induced to think about love as "unity" rather than as a "journey" (S.W.S. Lee & Schwarz, 2014b, Study 1). The journey metaphor highlights how far one has already traveled together despite complications, which are part of almost any journey and need to be overcome. In contrast, complications are difficult to reconcile with the unity metaphor, which entails a smooth fit and lack of friction.

The crucial element of the underlying process is the conceptual mapping between source and target, not its linguistic manifestation. As one would expect, the journey and unity metaphors can be activated through pertinent linguistic expressions (e.g., "on the road together" vs. "my other half"), and the prevalence of such expressions in natural language provides an indication of how widely shared the implied mapping is. However, the same metaphorical mappings can also be activated at a nonlinguistic level, e.g., by having participants assemble pieces of a circle into a whole (unity) or navigate a maze to a distant goal (journey) before they are asked any relationship questions. Empirically, both linguistic and nonlinguistic forms of metaphor activation have parallel effects on relationship judgments (S.W.S. Lee & Schwarz, 2014b, Studies 1 and 2b); that is, conflicts have a more negative impact after thinking about linguistic expressions of unity or physically forming a unit out of pieces than after thinking about linguistic expressions of journey or physically navigating the hurdles of a maze.

Theoretically, conceptual metaphor effects are only expected when people have sufficient knowledge of the source domain and the target domain to allow for the construction of a meaningful mapping. For example, political metaphors do not influence judgments of an individual politician when that target is not recognized as a politician to begin with, thus undermining the mapping (Johnson & Taylor, 1981). A lack of knowledge about the source domain would similarly thwart the process. However, a lack of source knowledge is less likely than a lack of target knowledge because most common conceptual metaphors draw on widely shared sensorimotor experiences, such as physical warmth, smell, cleanliness, movement, or perceptions of space. Because most humans share the same kinds of bodies, with similar affordances and constraints, bodily experiences of being in the world are widely shared and lend themselves to likely universal conceptual mappings with minor cultural variations. For example, in at least 18 languages studied (Soriano & Valenzuela, 2008), suspicion is embodied through smell (something does not "smell right"), although which smell exemplifies suspicion differs by language (e.g., "fishy" in English), reflecting a universal conceptual metaphor with culture-specific implementations (S.W.S. Lee & Schwarz, 2012). Similarly, thinking about time is universally grounded in the more concrete experience of locomoting through space (Boroditsky, 2000; Lakoff & Johnson, 1999), but how time flows depends on the specifics of the writing system of one's language. For people who write from left to right, the past is on the left and the future on the right, yet for those who write from right to left the past is on the right and the future on the left (e.g., Ouellet, Santiago, Funes, & Lupiáñez, 2010; Tversky, Kugelmass, & Winter, 1991). In either case, they talk about being "behind" on their deadlines and complain that the next vacation is still "far away." Moreover, inducing people to think about a future goal in terms of travel along a "path" reduces the likelihood that they get "off track" (Landau, Oyserman, Keefer, & Smith, 2014).

Other common conceptual metaphors reflect widely shared cultural knowledge rather than direct bodily experience. For example, framing crime as a "virus" invites conceptual mappings related to treating illnesses, which supports preference for reform-oriented policies that differ distinctly from the more combative policies invited by framing crime as a "beast" (Thibodeau & Boroditsky, 2011). Similarly, framing cancer as an "enemy" against whom one needs to wage "war" discourages

preventive behaviors (e.g., refraining from eating red meat) that are not part of the conceptual mapping invited by "war" (Hauser & Schwarz, 2015a). Attitude researchers are familiar with such framing effects (for a review, see Chong & Druckman, 2007), although the role of metaphors in their emergence is usually overlooked. Correcting for this oversight, Ottati, Renstrom, and Price (2014; see also Ottati & Renstrom, 2010) traced the power of many familiar framing effects in public opinion research to their metaphorical nature.

Theoretically, the impact of a metaphor's conceptual mapping is more robust (a) the more widely shared the relevant source knowledge is, which favors conceptual metaphors drawing on bodily experience; (b) the more ambiguous the target is, paralleling familiar observations from priming research in social cognition (see Higgins, 1996); and (c) the more apt the source-to-target mapping is, paralleling the familiar observation that fluent operations are more compelling than disfluent ones (see Schwarz, 2015). Note that these considerations imply that conceptual metaphor effects require at least some knowledge of the source and target domain and often some cognitive effort to link the two. Indeed, several studies found that conceptual metaphor effects increase with knowledge (e.g., Chandler, Reinhard, & Schwarz, 2012) and cognitive elaboration (e.g., Hauser & Schwarz, 2015b), in contrast to the common intuition that conceptual metaphor effects reflect shallow reasoning.

Finally, metaphorical mappings are context-sensitive. Different targets can recruit different aspects of the same source domain, just as different source domains can highlight or hide different aspects of the same target. For example, the source domain "journey" not only includes concepts of complications, but also concepts of discovery, surprise, and learning, which are not part of the source domain "unity." We would therefore expect that the "love is a journey" metaphor is not only protective when one thinks about conflicts in a relationship, but also beneficial for perceptions of mutual learning and growth. Neither of these benefits is offered by the more popular "unity" metaphor of love.

Our selective review of core findings below highlights conceptual metaphors that are grounded in bodily experiences that all or most humans share, as opposed to linguistic metaphors that reflect space- and time-specific cultural knowledge. These relatively universal conceptual metaphors can be rendered accessible through bodily experience in the absence of linguistic primes.

Physical and Social Warmth

Since Solomon Asch's (1946) pathbreaking studies on impression formation, psychologists have been aware that describing a person as "warm" rather than "cold" is associated with numerous favorable inferences. This observation inspired influential models of impression formation that consider "warmth" a central marker of a dimension that tracks whether others intend good or ill, complemented by a dimension of "competence" that tracks whether those others are able to deliver on their intentions (for reviews, see Fiske, Cuddy, & Glick, 2007; Wojciszke, 2005). The centrality of warmth has been confirmed in numerous languages across four continents (Fiske et al., 2007). What attracted less curiosity is *why* a characteristic of the physical world—warmth—might serve as a common marker for traits like trustworthy, reliable, kind, and supportive. As Asch (1946, p. 86) noted,

> for the description of persons we draw upon the entire range of sensory modalities [and] almost invariably use terms that also denote properties and processes observable in the world of nature. Terms such as warm, hard, straight refer to properties of things and of persons.

Asch (1958) offered a metaphorical account of his seminal findings, anticipating embodied cognition research half a century later.

Bargh and Shalev (2012, p. 154) suggest that the link between physical and social warmth is learned through "early childhood experiences with caretakers who provide both physical (holding

close) and psychological warmth (love, trust, help, and support)." The resulting association presumably scaffolds later thinking about the respective traits (Bargh & Shalev, 2012; Williams, Huang, & Bargh, 2009). Empirically, the link between physical and social warmth extends far beyond verbal descriptions, which were central to Asch's (1946) studies. Merely holding a warm rather than cold object (e.g., a cup of warm vs. iced coffee) can lead people to perceive another's personality as warmer (Williams & Bargh, 2008); to feel closer to the other (IJzerman & Semin, 2009); to act in socially warm and caring ways (e.g., by choosing a reward for a friend rather than for oneself; Williams & Bargh, 2008); and to be more cooperative in economic trust games (Kang, Williams, Clark, Gray, & Bargh, 2011). Conversely, people experience the physical environment as colder after having been socially rejected (Zhong & Leonardelli, 2008) or when eating alone than when eating with others (S.H.M. Lee, Rotman, & Perkins, 2014). Perceived physical warmth increases with social proximity (IJzerman & Semin, 2010), just as feelings of loneliness increase as physical temperatures drop (Bargh & Shalev, 2012, Study 2). Further illustrating the bidirectional relationship, correlational and experimental data indicate that people compensate for a lack of social warmth by increasing their experience of physical warmth (e.g., through a warm bath; Bargh & Shalev, 2012, Study 1; Shalev & Bargh, 2015) and compensate for a lack of physical warmth by increasing their exposure to social warmth (e.g., through a romance movie; Hong & Sun, 2012).

Findings of this type illustrate how an incidental sensory experience, here of physical temperature, can influence a wide range of variables that are of central interest to attitude researchers, from interpersonal attraction, trust, and cooperation to consumer preferences and consumption. Equally important, the findings also highlight the reverse influence from interpersonal attitudes to our perception of the physical world.

Smell and Suspicion

A different interpersonal orientation, social suspicion, is closely linked to another sensory experience, namely, smell. As noted earlier, linguistic analyses (Soriano & Valenzuela, 2008) indicate that suspicion is metaphorically associated with smell in many languages, such as Arabic, Chinese, English, French, German, and Spanish. When a particular smell is specified, it is the smell of rotting organic matter that may serve as food, suggesting an evolved adaptive mechanism—if it has an odd smell, better be suspicious and check before you eat. Which smell is specified differs by language, suggesting a universal conceptual metaphor with culture-specific implementations. In English, the specified odor is "fishy."

Empirically, incidental exposure to a fishy odor is sufficient to elicit suspicion as indicated by reduced cooperation in trust games, where the smell elicits concerns about the partner's reciprocity, and public goods games, where it elicits concerns about free riders (S.W.S. Lee & Schwarz, 2012, Studies 1 and 2; Sebastian, Kaufmann, & de la Piedad Garcia, 2017). The influence of fishy smells is sufficient to override individual differences in trust (Sebastian et al., 2017), and aversive smells that lack a metaphorical association with suspicion (such as the smell of flatulence, implemented through commercially available fart spray) do not undermine cooperation (S.W.S. Lee & Schwarz, 2012, Studies 1 and 2; Sebastian et al., 2017). Fishy smells also increase cognitive vigilance, as reflected in increased detection of misleading claims (D.S. Lee, Kim, & Schwarz, 2015, Study 1; Sheaffer, Gal, & Pansky, 2017) and decreased confirmation bias (D.S. Lee et al., 2015, Study 2), paralleling the impact of other manipulations of interpersonal distrust (Mayo, Alfasi, & Schwarz, 2014).

As in the case of social and physical warmth, the relationship is bidirectional. Inducing social suspicion through odd behavior of the experimenter improves the correct identification of fishy smells (S.W.S. Lee & Schwarz, 2012, Study 3) and increases sensitivity to the presence of faint fishy smells in a signal detection paradigm (Study 7). This improved smell detection and identification is limited to the smell that is metaphorically linked to suspicion and not observed for other smells.

Weight and Importance

Another pervasive conceptual metaphor links physical weight and social or intellectual importance. When "weighty matters" or the "gravity" of the situation require it, we consult experts whose opinions "carry more weight" than the "flimsy" considerations of novices; we may even describe those experts as "heavy weights" in their fields. Consistent with this metaphor, foreign currencies seem more valuable (Jostmann et al., 2009); political issues more important (Ackerman et al., 2010); diseases more severe; and medications more effective (Kaspar, 2013a) when the questionnaire in which they are described is presented on a heavy rather than a light clipboard. This relationship is again bidirectional, as books (Schneider, Rutjens, Jostmann, & Lakens, 2011) and USB memory sticks (Schneider et al., 2015) are perceived as physically heavier when their content is considered important rather than unimportant.

Research into the weight-importance metaphor also addressed a theoretical issue that is central to many persuasion studies in the dual-process tradition (e.g., Petty & Cacioppo, 1986): Are sensory inputs, like the weight of a book or clipboard, merely peripheral cues that people attend to when they either lack more diagnostic information or lack the willingness and ability to engage in more careful thought? For example, Ackerman and colleagues (2010, Study 2) asked participants by how much the government should increase or decrease funding for various social issues. When the questionnaire was presented on a heavy clipboard, participants allocated more money than when it was presented on a light clipboard. But in contrast to the plausible assumption that weight may simply serve as a peripheral cue, a weight effect was obtained only on issues that participants were likely to know about (e.g., air pollution), not on less familiar issues (e.g., regulation of the frequency bands for radio broadcast). Intrigued by this observation, Chandler, Reinhard, and Schwarz (2012) tested how the physical weight of a book influences judgments of the book's importance. Replicating Ackerman and colleagues' (2010) weight effect, the same book was considered more important when its heft was increased through a concealed weight. However, this was observed only for participants who knew something about the book, either because they had read it (Study 1) or because they could peruse a short synopsis (Study 3). Moreover, among those who had read the book, the effect of weight did not decrease with the amount of information they remembered about the book's plot. Instead, a weight effect was absent for those with very little knowledge, and pronounced for those with medium and high knowledge (Study 2). Quite clearly, the influence of the book's physical weight on perceivers' judgments of its intellectual influence did not reflect heuristic processing but seemed to require substantive elaboration that linked the sensory experience with knowledge about the book. If so, the influence of weight should be more pronounced, the more perceivers engage in elaborative reasoning. Supporting this prediction, Hauser and Schwarz (2015b) found a strong influence of weight when participants were high in need for cognition (Cacioppo & Petty, 1982) *and* had some information about the book, but no influence of weight when participants were low in need for cognition and/or lacked information about the book. Note that a heuristic processing argument would predict the exact opposite pattern, with the largest influence of weight under low need for cognition and no substantive information about the book.

These findings suggest that the book's physical weight provided an initial hypothesis ("this seems important"), which participants subsequently tested against other information. Only when they could muster supporting evidence did they endorse the book's apparent importance. From this perspective, in Ackerman et al.'s (2010) study, the clipboard's weight may have increased the allocation of funds to a social issue when participants could muster some supporting information but not otherwise, hence the weight effect on issues they knew something about. Future research may fruitfully test whether similar processes apply to other conceptual metaphor effects. For example, physical warmth (Williams & Bargh, 2008) may only render a target person socially warmer when the perceiver can find some information that is compatible with this first impression.

Physical Cleansing, Moral Judgment, and Psychological Separation

Physical and Moral Purity

Everyday language use shows a strong metaphorical link between physical and moral purity, from the Psalms' (24:4) notion of "clean hands and a pure heart" to everyday references to "dirty hands" or a "dirty mouth." In a seminal test of the behavioral consequences of the physical—moral purity metaphor, Zhong and Liljenquist (2006) found that immoral thoughts increased the appeal of cleaning products (Studies 2 and 3). Moreover, using those products to clean one's hands eliminated the impact of guilt on subsequent behavior (Study 4)—once the sins were washed off, compensatory acts were no longer needed (for an extended discussion of related work, see Zhong & House, 2014).

As in the physical domain, where contamination of the hands requires cleansing the hands, not rinsing the mouth, the metaphorical desire to cleanse is specific to the morally contaminated body part. Lying with one's mouth (by leaving a message on voice mail) increases the appeal of mouthwash over the appeal of hand sanitizer, whereas lying with one's hands (by typing an email) increases the appeal of hand sanitizer over the appeal of mouthwash (S.W.S. Lee & Schwarz, 2010a; for corresponding neuroimaging results, see Denke, Rotte, Heinze, & Schaefer, 2014; Schaefer, Rotte, Heinze, & Denke, 2015). Whereas physical cleansing is attractive after one sullied oneself with dirty acts, cleansing is unattractive after ethical acts, which suggests that the good as well as the bad leave a symbolic residue that is amenable to removal (S.W.S. Lee & Schwarz, 2010a).

A metaphorical link between physical and moral purity has been observed in many forms across numerous studies, from the desire of mock jurors to cleanse their hands after using "dirty evidence" (Bilz, 2012, Study 3) to the response of religious believers to touching texts honoring the wrong God (Ritter & Preston, 2011) to the influence of touching dirty objects on the ethicality of questionable leadership decisions (Cramwinckel, De Cremer, & van Dijke, 2013). Throughout, physical purity or impurity is found to influence people's moral judgments and behaviors, just as moral and immoral behaviors influence their attitudes towards cleansing and cleansing products (for a comprehensive review, see S.W.S. Lee & Schwarz, 2016). However, the initial focus on physical and moral purity proved too narrow and missed that physical cleansing can affect a broad range of behaviors outside the moral domain.

Beyond Moral Purity

If physical cleansing can metaphorically remove one's sins, it may also remove other traces of the past, essentially allowing people to "wipe the slate clean." Empirically, this is the case, as a few examples may illustrate (for reviews, see S.W.S. Lee & Schwarz, 2011, 2016).

As known since Brehm's (1956) seminal free-choice studies, making a difficult choice induces cognitive dissonance (Festinger, 1957), which people reduce by changing their perception of the choice alternatives: After the choice, the chosen alternative seems more attractive than before and the rejected alternative less attractive than before. This increases the perceived difference between the alternatives, thus putting doubts about one's choice to rest. Using this free-choice paradigm, S.W.S. Lee and Schwarz (2010b) tested whether cleaning one's hands would eliminate cognitive dissonance. After making a choice, all participants were asked to participate in a product test, some by merely examining a soap (Study 1) or antiseptic wipe (Study 2) and others by actually using the product to clean their hands. Subsequently, all participants re-evaluated the choice alternatives. Whereas the classic dissonance effect replicated when participants had merely examined the respective cleansing product, testing the product by cleaning one's hands fully eliminated it. Apparently, participants had wiped off their post-decisional dissonance and had no further need to justify their choice. Later research replicated this effect (De Los Reyes et al., 2012; Marotta & Bohner, 2013) and

identified a boundary condition: Washing one's hands is insufficient to reduce dissonance among people high in maladaptive thought and general anxiety (De Los Reyes et al., 2012), who find it generally more difficult to distance themselves from current concerns.

Extending this work, Xu, Zwick, and Schwarz (2012, Study 2) examined whether gamblers could wipe off the impact of a preceding streak of good or bad luck when deciding on their next move. Participants gambled for several rounds before they were asked to test an organic soap. Some participants merely examined the soap prior to evaluating it; others tested it by washing their hands. Subsequently, all participants played a final round of the gamble during which they could bet as much of their own money as they wanted. Not surprisingly, those who had been on a winning streak in previous rounds bet the most in the final round, whereas those who had been on a losing streak bet the least. However, this influence of prior good or bad luck was observed only among participants who merely examined the soap, but was eliminated among those who washed their hands. Note that these results imply that the influence of cleansing is not limited to things people may want to "wipe off," such as bad luck. Even though they may prefer not to wash after good luck, once they are induced to cleanse, the symbolic traces of earlier good luck are "removed" as well.

Similarly, Florack, Kleber, Busch, and Stöhr (2014) reported that washing one's hands is sufficient to attenuate the endowment effect (Kahneman, Knetsch, & Thaler, 1991) known from behavioral economics. People usually get attached to goods they own, even when the good is randomly assigned. However, washing one's hands reduces this attachment and increases the likelihood that the good is sold or exchanged for a different one. Finally, in the domain of academic performance, Kaspar (2013b) found that participants who washed their hands after failing a test became more optimistic about their future test performance. Unfortunately, this optimism undermined their motivation to exert effort and thus impaired their subsequent performance—wiping off a bad past is not always a good thing.

Cleansing as an Embodied Procedure of Separation

To account for the generalized nature of all these "clean-slate" effects, Dong and Lee (2017) proposed that physical cleansing serves as an embodied procedure of psychological separation. In the physical domain, cleansing separates physical traces from a physical target, for example, dirt from the hands. This familiar, and highly adaptive, procedure serves as the embodied grounding for the separation of psychological traces from a psychological target, such as dissociating a prior experience from the present self. This account predicts that cleansing reduces the accessibility of psychological traces of the past and hence their consequences for judgments and behaviors, which can accommodate the findings reviewed above.

An important implication of this rationale is that physical cleansing should also attenuate the influence of primed concepts, rendered accessible by a preceding task. Testing this prediction in the context of goal priming, Dong and Lee (2017) found that cleansing one's hands reduced the cognitive accessibility, judged importance, and behavioral impact of previously primed goals. This pattern emerged across a variety of goal contents (e.g., achievement, health, saving). In one of their studies, participants unscrambled sentences related to the goal of being healthy. Next, they examined an antiseptic wipe or tested it by cleaning their hands, before they were given a choice of snacks. Compared to those who merely examined the wipe, participants who had cleaned their hands were less likely to choose a healthy granola bar, indicating that cleansing had attenuated the impact of the primed health goal (Study 2).

Dong and Lee (2017) further proposed that the impact of cleansing should depend on its timing: When the cleansing *follows* a prime, it should attenuate the prime's impact, as observed; but when the cleansing *precedes* a prime, it should increase the prime's impact because the cleansing removed the competing influence of previously active goals. Empirically, this was the case. In one of their

studies, participants unscrambled sentences containing words related to one goal (e.g., health) and then either cleansed their hands with an antiseptic wipe or merely examined the wipe. Next, they unscrambled sentences containing words related to a second goal (e.g., saving). In this sequence, the second goal prime had a *stronger* impact on subsequent judgments when participants had used the wipe rather than merely examined it, presumably reflecting reduced goal competition (Study 3).

The rapidly growing number of cleansing studies consistently illustrates how a highly adaptive physical procedure (separating physical traces of past behavior from the body) serves as an embodied grounding for a more general psychological procedure (separating psychological traces of past behaviors and experiences from the current self) that influences judgment, emotion, and behavior across many different domains (for a review, see S.W.S. Lee & Schwarz, 2016). Physical cleansing opens potentially promising avenues for mental interventions, and people's desire for cleansing products may serve as a viable measure of their desire for psychological distancing.

Brightness and Verticality

So far, we focused on metaphors that fit the common sense notion of "bodily experience"—something is warm or cold, heavy or light, smelly, or one has freshly cleansed hands. However, humans' experience with the world includes many other sensory inputs, including some that we rarely think of as a bodily experience. For example, brightness and darkness or the placement of objects in space are attributes that we also experience through our senses. Conceptual metaphors drawing on such sensory attributes figure prominently in evaluative judgment, as our review of brightness and verticality studies will illustrate. These conceptual metaphors also illustrate that some judgments are informed by multiple sensory attributes (e.g., good is "bright" as well as "up," whereas bad is "dark" as well as "down"), known as the issue of many-to-one mapping. Conversely, some sensory attributes inform more than one judgment (e.g., being "up" can refer to valence, affect, power, or rationality, depending on task and context), known as the issue of one-to-many mapping. Consistent with familiar principles of social cognition research (Higgins, 1996; Wyer & Srull, 1989), the mapping that is most likely to be used is the one that is most accessible at the moment and most applicable to the target.

Brightness and Valence

As every child knows, good guys wear white, and characters dressed in black are probably evil. The underlying brightness-valence link has been examined in many studies using explicit and implicit measures. In a pioneering set of experiments, Meier, Robinson, and Clore (2004) showed participants valenced words (e.g., baby, spider, rude, clean) printed in white or black color on a gray background. When asked to categorize the words as good or bad, participants were faster and/or made fewer errors when the color of the print font matched the valence of the word, that is, when positive words were printed in white and negative words were printed in black. Further illustrating the valence-brightness link, the same tone of gray is perceived as darker when associated with a negative rather than positive word (Meier, Robinson, Crawford, & Ahlvers, 2007), and a happy smiley face is subsequently remembered as having had a lighter color than a sad smiley face (Song, Vonasch, Meier, & Bargh, 2012). Paralleling these observations, the skin color of hypothetical and real biracial politicians (e.g., Obama) is perceived as brighter when they share the perceiver's political position than when they oppose the perceiver's political position, even after controlling for racial prejudice (Caruso, Mead, & Balcetis, 2009; Kemmelmeier & Chavez, 2014).

As Meier and colleagues (2004, p. 82) noted, the accumulating findings suggest that "people automatically assume that bright objects are good, whereas dark objects are bad" (see also Sherman & Clore, 2009). This automatic association has potentially important implications for attitude

measurement that have so far received little attention. It suggests, for example, that brightness judgments may serve as implicit measures of attitude and that the brightness of a screen or the color background of a questionnaire may influence the evaluation of unrelated targets.

Verticality and Valence

What is good is not only bright but also up—feeling "on top of the world" is better than "feeling down" and "going to heaven" is better than "going to hell." The association is automatic and positive words are evaluated faster when presented at the top of the screen, whereas negative words are evaluated faster when presented at the bottom (Meier & Robinson, 2004, Study 1). After exposure, positive (negative) stimuli are also remembered as having been presented higher (lower) in space than was the case, indicating a spatial memory bias consistent with the underlying conceptual metaphor (Crawford, Margolies, Drake, & Murphy, 2006). Moreover, feeling good (bad) directs attention to higher (lower) areas (Meier & Robinson, 2006), as does exposure to positive (negative) words (Meier & Robinson, 2004, Study 2), resulting in differential detection of stimuli presented high or low on the screen. These and numerous similar findings reveal a robust verticality-valence conceptual metaphor. As discussed for brightness, these observations suggest the potential of inadvertent contextual influences on evaluation as well as a pathway for implicit measures.

Verticality and Status

The metaphorical meaning of verticality extends beyond valence. People "in high places" are powerful (but not always good) and their "underlings" powerless (though not necessarily bad). Looking "up" to someone may be a response to their high status or their admirable goodness, and God may be "up" there for either reason (Meier et al., 2007).

Confirming a metaphorical link between verticality and status, Schubert (2005; Giessner & Schubert, 2007) found that a given target was judged as more powerful when presented higher in space. Consistent with the relational structure of power, this influence seems robust when some targets are presented high in space and some low in space, as is the case in within-subject experiments; the influence seems weak or absent when all targets are presented in a high or a low location, as is the case in between-subject experiments (e.g., Lakens, Semin, & Foroni, 2011). This presumably reflects that the physical information (vertical placement) allows for multiple interpretations, which are context-sensitive—high status and power require that others have lower status and less power, hence, the power interpretation is more accessible, and more likely to be applied, in a relational context.

Evolutionary psychology suggests that women prefer men with status and resources (i.e., power) to men without, whereas men prefer women who are young and willing to "look up" to them (Buss & Schmitt, 1993). Consistent with these assumptions, women rate men as more attractive when their picture is presented high rather than low on the computer screen, whereas men rate women as more attractive when their picture is presented low on the screen (Meier & Dionne, 2009). The reverse relationship also holds, as people who are high in power are perceived as taller (e.g., Higham & Carment, 1992), thus occupying a higher location in vertical space, and the powerful overestimate their own height (Duguid & Goncalo, 2012).

Verticality and Rationality

Going back to Plato (5th century BC), Western societies have associated rationality with the head and emotion with the gut or heart. That the head is above the gut and heart underlies references to vertical location when we talk about "high-level intellectual discussions" that avoided the

risk of "falling to the emotional level." Indeed, implicit association tests (Greenwald, McGhee, & Schwartz, 1998) confirm an association of "up" with rational and "down" with emotional (Cian, Krishna, & Schwarz, 2015, Study 1). This association influences expectations, interpretations, and preferences. For example, ambiguous stimuli are assigned a rational meaning when presented at the top of the screen, but an emotional one when presented at the bottom (Study 2), and the top of a website is considered more appropriate for displaying rational than emotional content (Study 3). More important, a given message is more influential when presented in its proper place. For example, a candidate for a nonpartisan local election is perceived more favorably when a rational slogan ("Intelligence for the community") is displayed at the top rather than the bottom of an otherwise identical leaflet, whereas an emotional slogan ("Compassion for the community") is more influential when displayed at the bottom than at the top (Study 5). These interaction effects of the content and location of a slogan illustrate a general principle of metaphorical matching: Messages are more compelling, and people and objects perceived more favorably, when their presentation matches metaphorical expectations.

Summary

As these examples illustrate, conceptual metaphors influence judgment by structuring the representation of a target concept in terms of a source concept. A successful mapping requires (a) an apt metaphor that offers a plausible mapping and (b) some knowledge about the source and target domain that allows the person to implement that mapping. This has several implications.

First, because all humans have (almost) the same kind of body, they share a wide range of sensorimotor experiences of being in the world. Conceptual metaphors that draw on these experiences as the source domain are very influential at the population level and often universal, with minor cultural variations in their implementation. Metaphors that draw on more specific knowledge (e.g., sports metaphors or lines from Shakespeare) can be as influential for a given knowledgeable person but are less likely to be widely shared. They are therefore less influential at the population level, less likely to be universal, and their effects presumably less likely to replicate across diverse populations and settings.

Second, an influence of conceptual metaphors is not necessarily indicative of "shallow" processing. Although many metaphorical mappings are automatic, their application sometimes requires thought and increases with knowledge and elaboration. At present, which conditions amplify conceptual metaphor effects under heuristic processing, and which under elaborative processing, is not well understood.

Third, the influence of a metaphorical mapping increases with the ambiguity of the target concept and the aptness of the conceptual metaphor, paralleling observations in the social priming literature (Higgins, 1996). However, this does not imply that the influence runs only from a "concrete" source domain to an abstract and ambiguous target domain, in contrast to what some reviews initially suggested (e.g., Landau et al., 2010). Instead, the observed influence is often bidirectional (for a detailed discussion, see S.W.S. Lee & Schwarz, 2012). As seen above, a fishy smell induces suspicion, but social suspicion also improves the identification of fishy smells; physical warmth increases the perception of social warmth, but social inclusion also increases the perceived physical temperature; bright objects are evaluated more positively, but positive objects are also remembered as brighter; and so on.

Fourth, a given physical attribute can serve as a source concept in multiple conceptual metaphors. For example, physical placement along the vertical dimension of space grounds conceptual metaphors of valence, power, and rationality, among others. An applicable conceptual metaphor is recruited by the task at hand, lending different meanings to the same physical attribute. This context-sensitive selection and mapping is consistent with situated cognition's core assumption that thinking is for doing.

Fifth, different physical attributes can serve as source concepts in different conceptual metaphors bearing on the same target concept. For example, brightness as well as verticality ground conceptual metaphors of valence. This does not produce interpretational ambiguity for the perceiver when a stimulus is "bright," "up," or both but raises questions about metaphor selection when a communicator wants to convey valence and can choose between different conceptual metaphors that are similarly applicable.

Sixth, people are usually unaware of the extent to which conceptual metaphors structure their thought. For example, thinking about time in terms of locomoting through space is the dominant conceptualization natural language offers (Casasanto & Boroditsky, 2008), but people only recognize the mapping when it is explicitly pointed out. This lack of awareness makes it difficult to notice a likely influence and to correct for it, especially when the conceptual metaphor is activated through incidental sensorimotor experience rather than explicit linguistic expression. To date, conceptual metaphors have received next to no attention in mainstream discussions of mental correction procedures (Petty, Briñol, Tormala, & Wegener, 2007; Schwarz, 2015).

Implications for the Conceptualization of Attitudes

The reviewed lines of research converge on a straightforward message: The body plays a key role in affective response, evaluative judgment, and behavior. Its influence goes far beyond the historical focus on bodily posture (Darwin, 1872/1965; Spencer, 1864/1909). As Briñol and Petty (2008) noted in discussing the implications of embodied cognition for persuasion, bodily experiences can influence attitude judgments through any of the pathways of a dual-process framework, from serving as heuristic cues to serving as arguments, from facilitating or impairing the recall of associated information to facilitating or impairing systematic elaboration. When conceptualized within the context of persuasion, such influences do not pose a problem for traditional attitude theorists, who have always assumed that attitudes can be changed through sophisticated methods of persuasion. As our review indicates, however, it does not take sophisticated attempts at persuasion to change a wide variety of attitudinal responses—holding a warm rather than cold cup of coffee is enough to make a target person seem nicer (Williams & Bargh, 2008); an incidental fishy smell can undermine trust and cooperation (S.W.S. Lee & Schwarz, 2012); a heavy rather than light clipboard can make social issues on the questionnaire appear more important (Ackerman et al., 2010); a spoon that is easy rather than difficult to grasp can render a cup of soup more appealing (Elder & Krishna, 2012). Such findings have implications for different aspects of attitude research, from how to design persuasive communications to how to guard against contextual influences in attitude measurement. While these are fruitful avenues for future research, the accumulating findings also raise a broader and more fundamental concern about how we should think about attitudes to begin with: Are they things that people "have," store, and retrieve, or are they evaluations that people make in context, when needed?

From the dispositional perspective of classic attitude theories, contextual influences introduce noise that clouds the real attitude. As Eagly and Chaiken (2005, p. 747) put it, "context effects should be and are pervasive . . . because attitudinal judgments are not pure expressions of attitude but outputs that reflect both attitude and the information in the contemporaneous setting." While the contemporaneous setting gives rise to variability in attitude expression, the "inner state or latent construct that constitutes the attitude can be relatively stable. Therefore, judgments often vary around an average value that is defined by the tendency that constitutes the attitude" (Eagly & Chaiken, 2005, p. 747). From this point of view, the findings reviewed in the present chapter merely add to the long (and for many purposes, bothersome) list of variables that can produce noise. The better we understand their operation, the better we will be able to adjust for their influence, revealing the enduring role of real, latent attitudes in judgment and behavior.

In stark contrast, the attitude construction approach questions the assumption that people "have" enduring attitudes (for a more detailed discussion, see Schwarz, 2000, 2007). It starts with the premise that evaluation stands in the service of action, which requires high context sensitivity. Because action is always located in a specific context, any adaptive system of evaluation should be informed by past experience, but highly sensitive to the specifics of the present. It should overweight recent experience at the expense of more distant experience, and experience from similar situations at the expense of experience from dissimilar situations. It should take current goals and concerns into account to ensure that the assessment is relevant to what we attempt to do now, in this context. Only such context-sensitive evaluation can guide behavior in adaptive ways by alerting us to problems and opportunities when they exist; by interrupting ongoing processes when needed, but not otherwise; and by rendering information highly accessible that is relevant now, in this situation. A system that meets these needs necessarily produces the many contextual influences that attitude researchers have identified. While the dispositional approach treats these influences as deplorable noise, the construction approach treats them as signs of laudable context sensitivity and maintains that a focus on the "average value" (Eagly & Chaiken, 2005, p. 747) around which attitude judgments vary neglects the key function of evaluation: guiding behavior in specific contexts.

Attitude construction models (e.g., Ferguson & Bargh, 2007; Lord & Lepper, 1999; Schwarz, 2007; Smith & Conrey, 2007) identify the conditions under which evaluations are or are not stable across time and contexts and do or do not predict behavior. In a nutshell, an evaluation reported at time 1 will map onto an evaluation or behavioral decision at time 2 to the extent that the person draws on information with similar evaluative implications at both time points. This matching principle (Lord & Lepper, 1999) offers a parsimonious conceptualization of the conditions of stability and change in attitude reports and specifies when attitude judgments will or will not predict later behavioral decisions (for reviews, see Lord & Lepper, 1999; Schwarz, 2007). Fishbein and Ajzen's (1975) analysis of how to predict behavior from attitudes followed the same matching logic at the empirical level (by emphasizing the need to consider specifics of the future behavioral context at the time of earlier attitude measurement), while ignoring its deeper implications for the questionable status of a context-free attitude construct at the conceptual level.

Given the structure of the arguments, this debate cannot be settled by a critical experiment. The latent construct version of the dispositional perspective acknowledges that any expression of attitude—from self-report to behavior—is likely to be context-dependent but maintains that contextual influences merely reflect variations around some underlying average value that corresponds to the "real" attitude. The constructionist perspective counters that there is no need to postulate a special entity called "attitude" if general principles of judgment can account for the "real thing" as well as its methodologically bothersome but functionally adaptive variability. This is an argument of parsimony—and parsimony is not appealing when it contradicts robust lay intuitions that favor dispositional over situational explanations. Like many controversies in science, this one needs to be assessed on the basis of the heuristic fruitfulness of the theoretical perspectives and their compatibility with a broader body of knowledge: Is the way we think about attitudes compatible with what else we know about the mind?

The developments we reviewed in this chapter reveal levels of context sensitivity that far exceed what social psychologists usually subsumed under the admonition to heed the perspective of the actor (e.g., Schwarz, 2007). Thinking is for doing, and minor specifics of a real or simulated act can sway the evaluation of a target along numerous dimensions, as when the mere spatial orientation of a utensil (Elder & Krishna, 2012) or the busyness of one's hands (Shen & Sengupta, 2012) change target evaluations and behavioral intentions. Conceptual metaphors link current experience with thought about substantively different domains, allowing incidental temperatures to influence interpersonal liking (Williams & Bargh, 2008) and incidental fishy smells to undermine trust and cooperation (S.W.S. Lee & Schwarz, 2012). Throughout, thinking is profoundly influenced by the

person's sensorimotor interaction with the world. We can deplore these findings as indicative of yet another source of noise that spoils the observer's hope to predict the actor's preferences and behaviors across time and context. Or we can embrace them as indicative of how the mind adaptively incorporates situational changes into its continuous construction of the world. We find the latter a more productive perspective for understanding the dynamics of evaluation and their role in guiding behavior in context.

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