

Special issue introduction

Embodiment as a unifying perspective for psychology

THOMAS W. SCHUBERT^{1*} AND GÜN R. SEMIN²

¹*Centro de Investigação e Intervenção Social at ISCTE—Instituto
Universitário de Lisboa, Portugal*

²*Communication, Cognition, and Language (CSCL) Research
Group, Utrecht University, The Netherlands*

Abstract

Adaptive action is the function of cognition. It is constrained by the properties of evolved brains and bodies. An embodied perspective on social psychology examines how biological constraints give expression to human function in socially situated contexts. Key contributions in social psychology have highlighted the interface between the body and cognition, but theoretical development in social psychology and embodiment research remain largely disconnected. The current special issue reflects on recent developments in embodiment research. Commentaries from complementary perspectives connect them to social psychological theorizing. The contributions focus on the situatedness of social cognition in concrete interactions, and the implementation of cognitive processes in modal instead of amodal representations. The proposed perspectives are highly compatible, suggesting that embodiment can serve as a unifying perspective for psychology. Copyright © 2009 John Wiley & Sons, Ltd.

Human functioning is constrained by relatively invariant ecological, existential, material and biological conditions. Approaching human functioning from an embodied perspective means examining how biological constraints give expression to human functioning in socially situated contexts, and how that varies with ecological, material and existential conditions. This perspective contrasts with approaches in psychology that conceptualize psychological functioning in terms of a closed loop of symbols or an internal model of the world, with the meaning of each symbol defined only by other symbols. Such a conceptualization gives rise to the famous ‘symbol grounding problem’ (Harnad, 1990). If psychological functioning is treated as internal models of the world, and thus a closed loop of symbols, then there is no place for adaptive action. As a consequence, such amodal views are not perceptually grounded and have difficulties furnishing an informed answer to how adaptively successful interaction with other agents and the world emerges.

We believe that adaptive action is precisely the function of cognition (e.g., Smith & Semin, 2004), an insight that has a long history (e.g., Dewey, 1929; James, 1890; Mead, 1934; but also Barsalou, 1999; S. T. Fiske, 1992; Glenberg, 1999). As Franklin (1998) concluded from his analysis of biological and artificial minds: “The overriding task of Mind is to produce the next action. . . Minds are the control structures of autonomous agents.” (p. 412). Human functioning is constrained by the properties of our evolved brains and bodies, and therefore it is embodied.

Social psychology has had a long-standing tradition of investigating the interface between the body and cognition. This tradition precedes the current surge of interest in embodiment (Cacioppo, Priester, & Berntson, 1993; Strack, Martin, & Stepper, 1988; Valins, 1966; Wells & Petty, 1980). A substantial research literature in social psychology has revealed that the human body is more than an output device for the cognitive machinery on which most psychological theories seem to have relied. For instance, one such topic that has received considerable attention is the significance of actions as input for affective and cognitive processes, with seminal contributions showing that motor input determines evaluation and affect

*Correspondence to: Thomas W. Schubert, ISCTE/CIS, Av. das Forças Armadas, 1647-026 Lisboa, Portugal. E-mail: schubert@igroup.org

(Laird, 1984, 2007; Neumann, Förster, & Strack, 2003; Neumann & Strack, 2000; Niedenthal, 2007; Zajonc & Markus, 1984; reviewed in Adelman & Zajonc, 1989).

Surprisingly, and despite this rich research tradition, the role of the body, or, in short, ‘*embodiment*’, has never occupied central stage for theorizing and research in social psychology. Theories have mostly relied on assumptions that mental representations consist of internal models of the world or amodal networks. These theoretical approaches were imported from cognitive psychology in the 1970s and 1980s. They have led to tremendous advances and continue to be the basis for the most prominent current theories of the field on central topics such as attitudes, stereotypes, and the self (Smith, 1998).

Recent developments have signaled that the time is ripe to open a dialogue re-evaluating the role of the body for social psychological theorizing. First, there is an increasing explicit interest in social psychology addressing embodiment in perception, cognition, and affect (Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Smith & Semin, 2004). Second, considerable research outside of social psychology is driven by typically social psychological questions and a focus on the interdependence between bodily processes and the social environment. For instance, research on mirror neuron systems—specific regions in the brain that are active both when one acts oneself and observes others doing the same actions—has led to insights on imitation, empathy, and perspective taking (Rizzolatti & Craighero, 2004). These developments have contributed to novel neurally based conceptualizations of what social cognition is (e.g., Keysers & Gazzola, 2006) or to advances in our understanding of the social nature of perception and action (Knoblich & Sebanz, 2006). Surprisingly, such convergence in research questions has not led to much interdisciplinary exchange. Social psychological theorizing and findings have not had much of an impact on the research on embodiment in other fields, and *vice versa*, recent developments in cognitive science seem to have relatively little impact on social psychology.

These parallel developments led us to use this Special Issue of the European Journal of Social Psychology as a platform to initiate a dialogue in the hope of bridging this apparent divergence. The theoretical contributions to this Special Issue reflect developments outside of mainstream social psychology that are of central relevance and interest to topics within social psychology. As a further step towards enhancing a bridge-building dialogue, we also invited commentaries on the theoretical contributions. Notably, both the main contributors and the commentators come from complementary backgrounds.

The breadth of the current work on embodiment is mirrored in the various functions that the body has in shaping ‘cognition’ as exemplified by the different contributions to the current issue. Wilson (2002) identified six different formulations of the embodied cognition perspective. The target papers in the current issue focus mainly on two of those six formulations. One set consists of examinations of how social cognition is *situated* in the sense that is directly tied to and in the service of current task-relevant inputs and outputs in social interactions (Smith & Semin, 2004). The second set explores how social cognition is *modal*—or in, other words, how it is rooted in mechanisms for sensory processing and motor control even when the processed information is not relevant to the current situation (Barsalou, 2008).

Several authors emphasize the situatedness aspect. Kaschak and Maner’s (2009) formulation of embodiment focuses on overt perception–action cycles in social interaction. Accordingly, the notion of affordances is central for them. Similarly, Daum, Sommerville, and Prinz (2009) focus on “production and mutual perception of body states, body movements and their outcomes”. Marsh, Johnston, Richardson, and Smith (2009) also put bodily actions in social context in the center of their analysis—even though they arrive at very different conclusions.

For other authors of the current issue, the modality of mental representations is central. Pickering and Garrod (2009) focus on the modal qualities of representations that are involved in understanding discourse. They discuss both the embodiment of meaning in a communicated message and the grounding of language comprehension in language production codes. Similarly, Rueschemeyer, Lindemann, van Elk, and Bekkering (2009) and Zwaan (2009) focus on the role of motor representations in grounding of language comprehension. Williams, Huang, and Bargh (2009) investigate the roots of more abstract psychological concepts in concrete sensorimotor experiences made early in human development, and driven by evolved motives. In a similar way, Cohen and Leung (2009) propose that complex social representations such as norms and values are rooted in body comportments.

EMERGING THEMES

In the following, we indicate some of the trends that arise in the different discussions represented in this Special Issue. Several overlapping developments can be seen in the various contributions. For instance, a recurrent notion is that the prediction of future events, such as outcomes of one’s actions and future behavior of others, is a function that is particularly

well served by embodied processes (Pickering & Garrod, 2009; Glenberg, 2009). A further emerging theme suggests that an embodied grounding of intraindividual processes and interindividual processes can be achieved with the same conceptual tools (Marsh et al., 2009; Morsella, Lanska, Berger, & Gazzaley, 2009; Pickering & Garrod, 2009).

In the following, we would like to highlight in some more detail two topics that are shared by the majority of the current contributions, namely the issues of amodal representations and development.

On Formulating Embodiment Theories Without Amodal Representations

Let us turn first to a challenge to social psychological theorizing that arises from the embodiment approach. As we said earlier, most of today's social psychology theorizing builds on the notion of semantic networks comprised of amodal, symbolic nodes. Depictions of such networks (symbols linked by arrows) are frequent in the field's textbooks and journals, and they have become entrenched in our thinking. Some theorists have tried to extend this view by assuming that modal, especially behavioral, representations enrich this network, leading to a mix of modal and amodal representations (Bargh, Chen, & Burrows, 1996; Carlston, 1994; Dijksterhuis & Bargh, 2001; Mussweiler, 2006; Strack & Deutsch, 2004). But almost nobody seems ready to dispense the notion that our representations are primarily made up of concepts stripped of their perceptual qualities.

Embodiment theorists, on the other hand, have repeatedly discussed whether assuming the existence of amodal representations is warranted and necessary. For instance, Barsalou (1999) has argued that even seemingly abstract concepts such as TRUTH can be represented by a conglomerate of perceptual symbols formed on the basis of concrete experiences. This argument is hotly debated (Mahon & Caramazza, 2008). Not surprisingly, then, the authors of the current issue give a wide range of answers to this question. Some point out that there is actually no evidence for the existence of amodal representations (Morsella et al., 2009; Zwaan, 2009), while there is now plenty of evidence for modal representations. Others work explicitly from the assumption that embodied and symbolic (and presumably amodal) processes work in parallel in adults, but have different developmental trajectories (Daum et al., 2009).

It is perhaps not surprising that the "working model" of embodiment often seems to default back to the notion of an amodal network of semantic representations that are linked to perceptual, modal content. From this perspective, embodiment seems to denote a link between the two levels. Ironically, the notion of embodiment may suggest that there is something disembodied that needs embodiment. This may lead to the intuitive view that there are indeed separate semantic representations that are grounded in sensorimotor codes. This separation of semantic and sensorimotor representations runs through most of the contributions to the current issue. For instance, Cohen and Leung (2009) assume that complex social representations such as norms are primed by bodily actions and comportments. Implicit in this view is that the complex social representations are stored in separate mental representations.

However, as Hommel (2009) points out in the current issue, this may not be the most parsimonious account for many of the findings that show an interaction of sensorimotor information and higher-order cognition. Instead, he argues, the assumption that there are semantic codes that are separate from sensorimotor codes may not be necessary when one can explain the effects simply by assuming an overlap of sensory and motor codes, and an activation of these sensorimotor codes by cognitive processes such as language understanding. Applied to the instances of social embodiment, we can ask ourselves whether we need to assume that there are independent, so-called semantic and presumably amodal representations of social concepts such as norms that are linked to motor representations of bodily comportments, or whether the motor representations of comportments themselves *are* the representations of norms, in combination with other sensory and motor cues.

Hommel (2009) pleads for asking this question and thereby taking the grounding problem seriously (Harnad, 1990). However, our very paradigms may all too often prompt us to talk about semantic concepts and grounding sensorimotor codes as separate entities. For instance, when investigating the grounding of power in size cues, Schubert, Waldzus, and Giessner (2009) applied an interference paradigm in which participants had to judge the power of groups whose labels were presented in small or big font size. A font size compatible with the group's power increased speed and accuracy. However, that accuracy was high even in incompatible tasks, and participants were in fact able to control the effect when instructed about it. This outcome seems more amenable to an interpretation in which a power judgment is primed by size cues, but does not consist entirely of it. Taking the embodiment approach seriously would imply analyzing this outcome in terms of modal representations only—but this is a lot harder than assuming a link between amodal semantic representations and modal stimuli such as size.

One strategy to overcome the seductive theoretical separation of semantic and sensorimotor cues may be to look for cases where sensorimotor processes are indispensable for what one would normally construe as cognitive processes running on purely amodal representations. Zajonc and Markus (1984) already proposed that in addition to mental representations, be they of propositional or modal form, the motor system can serve a representational function. In such a case, embodiment is literally a mediating mechanism. Evidence for this argument is slowly accumulating. For instance, effects of experienced emotions on the perception of others' emotional facial expressions are mediated by actual changes in one's own face (Niedenthal, Brauer, Halberstadt, & Innes-Ker, 2001). Increased liking of read unknown words after mere exposure is mediated by covert activation of articulating motor programs during exposure (Topolinski & Strack, 2009). Finally, effects of subliminally primed verbs denoting facial expressions ("smile" vs. "frown") on subsequent ratings of cartoons are also mediated by subtle activations of facial muscles (Foroni & Semin, *in press*; for further examples, see Glenberg, 2009).

In all these cases, blocking the respective facial muscles prevented the effect, thus showing mediation. These studies only investigate what Zajonc and Markus (1984) termed "hard embodiment" in actual changes in the motor system. We believe that in order to show the grounding of conceptual representations in sensorimotor representations in a convincing way, meditational studies analog to those just cited are needed. This view is shared by critics of the embodiment approach (Mahon & Caramazza, 2008), creating the possibility for a critical test. A study on the recognition of tone pitch may serve as an example (Douglas & Bilkey, 2007). In this study, it was shown that performance in a spatial mental rotation task, but not performance in a task not involving spatial imagery, suffers from a concurrent pitch discrimination task. This shows a mediation of pitch recognition by activation of spatial codes. Similar studies in the social domain may show that processes that were thought to involve amodal semantic codes in fact rely on sensorimotor processing.

Origin of Groundings

A sizeable portion of embodiment research has focused on establishing the role of sensorimotor representations on conceptual processing without necessarily focusing on the precise origins of the link. For instance, in the literature on grounding of abstract concepts, one most often finds references to metaphor theories that assume top-down activation of sensorimotor representations (Casasanto & Boroditsky, 2008; Lakoff & Johnson, 1999; Meier & Robinson, 2004). An alternative notion is the idea that actual experiences are schematized into perceptual symbols while preserving their modal format (Barsalou, 1999). Yet others have argued that some behaviors cause changes in cognitive processes by changing physiological parameters of the brain, such as temperature (Zajonc, 1985). The authors of the current issue seem to take a renewed interest in the origin and developmental trajectories of embodied representations. The answers are varied, and compatible instead of mutually exclusive.

One frequently mentioned origin of links between sensorimotor representations and conceptual representations is the concept of affordances (Gibson, 1979; Kaschak & Maner, 2009; Marsh et al., 2009). Some sensory and motor representations acquire meaning simply because their outcomes and implications are determined by the shape of our bodies and environmental constraints. For instance, it is a simple fact of biological life that larger bodies tend to be heavier and stronger and are thus able to bring more potential and kinetic energy to encounters with smaller bodies. Consequently, any child engaging in competitive bodily interactions will quickly learn that size and power are correlated. Another example is gravity, which leads to invariant outcomes during interactions with the environment and imbues meaning on the vertical dimension (Clark, 1973).

Another possibility discussed is a learning process that links sensorimotor cues to conceptual representations without immediately visible affordances. For instance, Cohen and Leung discuss in this issue cases such as crossing oneself as an arbitrary behavior evoking the Christian concepts (possibly of humbleness and awe). As Garcia-Marques and Boto Ferreira (2009) point out, even though many of such links may seem arbitrary, they might in fact be rooted in meaningful and concrete experiences, and have become schematized and de-contextualized in the process of cultural transmission.

A recurrent theme in the current issue is that specific sensorimotor representations are associated with certain affective and behavioral representations in a hard-wired, evolutionarily prepared way (Kaschak & Maner, 2009). However, these links may be modified by specifying the precise outcome out of a broad range of possible activations (Cohen & Leung, 2009), or by using them as scaffolds for other, possibly more abstract concepts and processes (Williams et al., 2009).

Note that distinguishing between early learning experiences during infancy and evolutionary preparedness may turn out to be difficult in many cases. Take as an example again the association of size and power. Size differences are experienced as determining power throughout childhood, and this may by itself suffice to create an association of size and power. However, processes of Baldwinian selection (A. P. Fiske, 2004; Richards, 1987) may prepare a species to learn such links faster (Öhman & Mineka, 2003).

Instead of being competitive explanations, when combined, these proposals lead to a mutually reinforcing causal process. This process can have several starting points: Affordances, hard-wired predispositions, and observation of correlations between sensorimotor stimuli and abstract concepts. For instance, size may initially be equated with power because of affordances of large bodies in interaction with small bodies, because of a hard-wired association, or because of observing that more powerful people are associated with other stimuli of larger size (territory, possessions, followers). When one of these leads to an initial link between sensorimotor representations and conceptual representations, this link will by itself cause the production of an environment that confirms it. This can happen not only in the physical ecology but also in language, which by itself goes beyond activation of amodal meaning and has impact on modal representations (Pickering & Garrod, 2009; Rueschemeyer et al., 2009; Zwaan, 2009). More powerful people, or people motivated to attain power, will strive for and link themselves in reality to larger stimuli. Language introduces metaphors and further links the two concepts. This reifies the initial mental association in reality and serves as a source for subsequent learning processes by the same or other individuals—producing a self-reinforcing circle with embodiments of several kinds (for a similar notion on the relation between language and culture, see Holtgraves & Kashima, 2008).

To sum up, analyzing embodiment in its social context provides a much-needed foundation for the analysis of how embodied conceptual representations develop. This analysis is needed because until then, all studies showing grounding effects remain basically correlational where only intuition, sharp observation, and post hoc rationalization is able to explain why a semantic concept like power is associated with a perceptual feature like size. Indeed, it seems that this is one of the topics where social psychology has to contribute most to the field of embodiment research.

EMBODIMENT AS A UNIFYING PERSPECTIVE

Perhaps the most striking fact about the current Special Issue is the emerging compatibility between the different contributions. The analytic sketch above reveals that embodied mechanisms and representations can serve as a common denominator for social cognition, an analysis of culture, evolution, and language. The bridge-building function of an embodied perspective is also demonstrated in contributions underlining the much-needed convergence between cognitive psychology, the study of affect (Niedenthal, 2007), and neuropsychological aspects (Glenberg, 2009; Morsella et al., 2009). Grounding human functioning in experience and behavior furnishes a common basis for research fields that have for a long time had largely divergent theoretical vocabularies. It was the aim of this Special Issue to further this emerging dialogue between different disciplinary perspectives and we hope that the current contributions enhance this goal.

ACKNOWLEDGEMENTS

The preparation of this paper and editing of this Special Issue were supported by a Humboldt Foundation Feodor-Lynen-Fellowship awarded to Thomas Schubert, and by Royal Netherlands Academy of Arts and Sciences grant ISK/4583/PAH awarded to Gün Semin.

REFERENCES

- Adelmann, P. K., & Zajonc, R. B. (1989). Facial efference and the experience of emotion. *Annual Review of Psychology*, 40, 249–280.
- Bargh, J. A., Chen, M., & Burrows, L. (1996). Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of Personality and Social Psychology*, 71, 230–244.
- Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral and Brain Sciences*, 22, 577–609.

- Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology*, 59, 617–645.
- Cacioppo, J. T., Priester, J. R., & Berntson, G. G. (1993). Rudimentary determinants of attitudes: II: Arm flexion and extension have different effects on attitudes. *Journal of Personality and Social Psychology*, 65, 5–17.
- Carlston, D. E. (1994). Associated Systems Theory: A systematic approach to the cognitive representation of persons and events. In R. S. Wyer (Ed.), *Advances in social cognition* (Vol. 7, pp. 1–78). Hillsdale, NY: Erlbaum.
- Casasanto, D., & Boroditsky, L. (2008). Time in the mind: Using space to think about time. *Cognition*, 106, 579–593.
- Clark, H. H. (1973). Space, time, semantics, and the child. In T. E. Moore (Ed.), *Cognitive development and the acquisition of language* (pp. 27–297). Oxford, England: Academic Press.
- Cohen, D., & Leung, A. K.-Y. (2009). The hard embodiment of culture. *European Journal of Social Psychology*, 39, 1278–1289. DOI: 10.1002/ejsp.671
- Daum, M. M., Sommerville, J. A., & Prinz, W. (2009). Becoming a social agent: Developmental foundations of an embodied social psychology. *European Journal of Social Psychology*, 39, 1196–1206. DOI: 10.1002/ejsp.672
- Dewey, J. (1929). *Experience and knowledge*. New York: Dover.
- Dijksterhuis, A., & Bargh, J. A. (2001). The perception-behavior expressway: Automatic effects of social perception on social behavior. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 33, pp. 1–40). San Diego: Academic Press.
- Douglas, K. M., & Bilkey, D. K. (2007). Amusia is associated with deficits in spatial processing. *Nature Neuroscience*, 10, 915–921.
- Fiske, S. T. (1992). Thinking is for doing: Portraits of social cognition from Daguerreotype to laserphoto. *Journal of Personality and Social Psychology*, 63, 877–889.
- Fiske, A. P. (2004). Four modes of constituting relationships: Consubstantial assimilation; space, magnitude, time, and force; concrete procedures; abstract symbolism. In N. Haslam (Ed.), *Relational Models Theory: A contemporary overview* (pp. 61–146). Mahwah, NJ: Lawrence Erlbaum Associates.
- Froni, F., & Semin, G. R. (in press). Language that puts you in touch with your bodily feelings: The multimodal responsiveness of affective expressions. *Psychological Science*.
- Franklin, S. P. (1998). *Artificial minds*. Cambridge, MA: The MIT Press.
- Garcia-Marques, L., & Boto Ferreira, M. (2009). The scaffolded mind: The why of embodied cognition? *European Journal of Social Psychology*, 39, 1272–1275. DOI: 10.1002/ejsp.694
- Gibson, J. J. (1979). *The ecological approach to visual perception*. Boston: Houghton Mifflin.
- Glenberg, A. M. (1997). What memory is for. *Behavioral and Brain Science*, 20, 1–55.
- Glenberg, A. M. (2009). Prediction and emotion in dialogue. *European Journal of Social Psychology*, 39, 1169–1172. DOI: 10.1002/ejsp.678
- Harnad, S. (1990). The symbol grounding problem. *Physica D*, 42, 335–346.
- Holtgraves, T. M., & Kashima, Y. (2008). Language, meaning, and social cognition. *Personality and Social Psychology Review*, 12, 73–94.
- Hommel, B. (2009). Taking the grounding problem seriously. *European Journal of Social Psychology*, 39, 1191–1193. DOI: 10.1002/ejsp.682
- James, W. (1890). *The principles of psychology*. New York: Dover Publications.
- Kaschak, M. P., & Maner, J. K. (2009). Embodiment, evolution, and social cognition: An integrative framework. *European Journal of Social Psychology*, 39, 1236–1244. DOI: 10.1002/ejsp.664
- Keysers, C., & Gazzola, V. (2006). Towards a unifying neural theory of social cognition. *Progress in Brain Research*, 156, 379–401.
- Knoblich, G., & Sebanz, N. (2006). The social nature of perception and action. *Current Directions in Psychological Science*, 15, 99–104.
- Laird, J. D. (1984). The real role of facial response in the experience of emotion: A reply to Tourangeau and Ellsworth, and others. *Journal of Personality and Social Psychology*, 47, 909–917.
- Laird, J. D. (2007). *Feelings: The perception of self*. New York: Oxford University Press.
- Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh*. New York: Basic Books.
- Mahon, B. Z., & Caramazza, A. (2008). A critical look at the embodied cognition hypothesis and a new proposal for grounding conceptual content. *Journal of Physiology—Paris*, 102, 59–70.
- Marsh, K. L., Johnston, L., Richardson, M. J., & Schmidt, R. C. (2009). Toward a radically embodied, embedded social psychology. *European Journal of Social Psychology*, 39, 1217–1225. DOI: 10.1002/ejsp.666
- Mead, G. H. (1934). *Mind, self and society*. Chicago: University of Chicago Press.
- Meier, B. P., & Robinson, M. D. (2004). Why the sunny side is up. *Psychological Science*, 15, 243–247.
- Morsella, E., Lanska, M., Berger, C. C., & Gazzaley, A. (2009). Indirect cognitive control through top-down activation of perceptual symbols. *European Journal of Social Psychology*, 39, 1173–1177. DOI: 10.1002/ejsp.679
- Mussweiler, T. (2006). Doing is for thinking! Stereotype activation by stereotypic movements. *Psychological Science*, 17, 17–21.
- Neumann, R., Förster, J., & Strack, F. (2003). Motor compatibility: The bidirectional link between behavior and evaluation. In J. Musch, & K. C. Klauer (Eds.), *The psychology of evaluation* (pp. 371–391). Mahwah: Erlbaum.
- Neumann, R., & Strack, F. (2000). Experiential and non-experiential routes of motor influences on affect and evaluation. In H. Bless, & J. P. Forgas (Eds.), *The message within: The role of subjective experience in social cognition and behavior* (pp. 52–68). Philadelphia: Psychology Press.
- Niedenthal, P. M. (2007). Embodying emotion. *Science*, 316, 1002–1005.

- Niedenthal, P. M., Barsalou, L. W., Winkielman, P., Krauth-Gruber, S., & Ric, F. (2005). Embodiment in attitudes, social perception, and emotion. *Personality and Social Psychology Review*, 9, 184–211.
- Niedenthal, P. M., Brauer, M., Halberstadt, J. B., & Innes-Ker, A. H. (2001). When did her smile drop? Contrast effects in the influence of emotional state on the detection of change in emotional expression. *Cognition and Emotion*, 15, 853–864.
- Öhman, A., & Mineka, S. (2003). The malicious serpent: Snakes as a prototypical stimulus for an evolved module of fear. *Current Directions in Psychological Science*, 12, 1–5.
- Pickering, M. J., & Garrod, S. (2009). Prediction and embodiment in dialogue. *European Journal of Social Psychology*, 39, 1162–1168. DOI: 10.1002/ejsp.663
- Richards, R. J. (1987). *Darwin and the emergence of evolutionary theories of mind and behaviour*. Chicago: University of Chicago Press.
- Rizzolatti, G., & Craighero, L. (2004). The mirror-neuron system. *Annual Review of Neuroscience*, 27, 169–192.
- Rueschemeyer, S.-A., Lindemann, O., van Elk, M., & Bekkering, H. (2009). Embodied cognition: The interplay between automatic resonance and selection-for-action mechanisms. *European Journal of Social Psychology*, 39, 1180–1187. DOI: 10.1002/ejsp.662
- Schubert, T. W., Waldzus, S., & Giessner, S. R. (2009). Control over the association of power and size. *Social Cognition*, 27, 1–19.
- Smith, E. R. (1998). Mental representation and memory. In D. T. Gilbert, & S. T. Fiske (Eds.), *The handbook of social psychology* (pp. 391–445). New York: McGraw-Hill.
- Smith, E. R., & Semin, G. R. (2004). Socially situated cognition: Cognition in its social context. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 36, pp. 53–117). San Diego, CA: Elsevier Academic Press.
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review*, 8, 220–247.
- Strack, F., Martin, L. L., & Stepper, S. (1988). Inhibiting and facilitating conditions of the human smile: A nonobtrusive test of the facial feedback hypothesis. *Journal of Personality and Social Psychology*, 54, 768–777.
- Topolinski, S., & Strack, F. (2009). Motormouth: Mere exposure depends on stimulus-specific motor simulations. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 35, 423–433.
- Valins, S. (1966). Cognitive effects of false heart-rate feedback. *Journal of Personality and Social Psychology*, 4, 400–408.
- Wells, G. L., & Petty, R. E. (1980). The effects of overt head movements on persuasion: Compatibility and incompatibility of responses. *Basic and Applied Social Psychology*, 1, 219–230.
- Williams, L. E., Huang, J. Y., & Bargh, J. A. (2009). The scaffolded mind: Higher mental processes are grounded in early experience of the physical world. *European Journal of Social Psychology*, 39, 1257–1267. DOI: 10.1002/ejsp.665
- Wilson, M. (2002). Six views of embodied cognition. *Psychonomic Bulletin & Review*, 9, 625–636.
- Zajonc, R. B. (1985). Emotion and facial efferece: A theory reclaimed. *Science*, 228, 15–21.
- Zajonc, R. B., & Markus, H. (1984). Affect and cognition: The hard interface. In C. Izard, J. Kagan, & R. B. Zajonc (Eds.), *Emotion, cognition, and behavior* (pp. 73–102). Cambridge: Cambridge University Press.
- Zwaan, R. A. (2009). Mental simulation in language comprehension and social cognition. *European Journal of Social Psychology*, 39, 1142–1150. DOI: 10.1002/ejsp.661