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Socially Situated Cognition: Recasting Social Cognition as an Emergent Phenomenon

Gün R. Semin, Margarida V. Garrido, & Tomás A. Palma

In this chapter, we present human cognitive processes as situated and dynamic, a perspective identified by the umbrella term 'situated cognition', or 'socially situated cognition' (SSC). We argue that while the SSC approach does not present a theoretically unified framework, it constitutes an approach offering a set of general principles and emphases cutting across many scientific disciplines and with holding the promise of leading to a unified perspective on human functioning.

In the following we present the five pillars upon which SSC rests, namely that cognition is: an *emergent* phenomenon; is constrained by the architecture of our bodies; is for the adaptive co-regulation of action; and is biologically distributed across agents and the social world as well as tools as *scaffolds*. In conclusion, we raise theoretically and empirically unanswered issues and some open questions that are likely to direct future research.

Cognition *emerges* from dynamic and adaptive sensorimotor interactions with the social and physical environment. Human cognitive processes are welded to a changing social world, are inherently interactive, and grounded by the constraints of the human body and the environment. Acknowledging these characteristics of human cognition results in a view of cognitive processes as situated. The perspective that locates cognition in such a dynamic landscape is identified by the umbrella term "situated cognition", or "socially situated cognition" (Semin & Smith, 2002; Smith & Semin, 2004).

Situated cognition is not an overarching theoretical framework, but serves the generic function of covering a broad range of orientations that have emerged over the last two decades across the cognitive sciences, robotics, anthropology, philosophy, inter alia (cf. Robbins & Aydede, 2009). Notably, situated cognition consists of a set of general principles and emphases cutting across many scientific disciplines and with the potential of developing a unified perspective on human functioning.

As with the cycles of fashions and fads, intellectual traditions come and go. Some traces of the ideas on situated cognition can be found already by the mid-19th century psychology and were articulated in intellectual endeavors designed to overcome the then prevailing individual-centered orientation in German psychology. The first half of the 20th century figured prominent names such as William James, Vygotsky, Bartlett, Mead, and Dewey who emphasized the significance of environmental and situational determinants of human cognition and action. The ascendance of the cognitive revolution, heralded amongst other developments by Chomsky's influential critique (1959) of

Skinner's *Verbal Behavior*, introduced the "mind" as the object proper of scientific inquiry and isolated the focus of research across the cognitive sciences to the processing and representation of information. While this shift was very important in drawing attention to "cognitive processes", it also marked the beginning of an extended period which ignored the contextually embedded and embodied nature of human cognition. The metaphor of the mind and human functioning became the computer, which captured scientific as well as popular imagination: namely, an isolated, solitary tool with immense information-processing capacities. The situated cognition perspective developed as a reaction to explanations of human functioning that did not take context into account. This is not to deny the existence of innovative theoretical perspectives that incorporated the interaction between cognition and the environment during this period (e.g., Brunswik, 1955; Gibson, 1979).

In contrast to the metaphor of the human brain as the isolated, solitary information-processing device, advocates of the situated cognition perspective (e.g., A. Clark, 2008; Semin, 2000) maintain that cognitive activities extend to the social and physical environment, which become integral parts of cognitive activity in their own right (e.g., Hutchins, 1995).

Understanding the nature of situated social cognition therefore requires developing an idea of what is its appropriate level of analysis. This is the task of this chapter's five sections, which constitute the five pillars upon which situated cognition rests. In the *first* section, we locate socially situated cognition as an *emergent phenomenon*: namely, a level superseding individual cognition and action. The important implication of such localization is that the level of the phenomenon can be captured only with a macroscopic view because emergent phenomena control the parts that generate and constitute it and not vice versa (cf. Abler, 1989; Gazzaniga, 2010; Semin, 2008). A microscopic view focused on the analysis of the parts (i.e., the individual level) loses contact with the "plot" (i.e., the examination of socially situated cognition as an emergent phenomenon). Thus, an important aspect of situated cognition is the attempt to capture a level of analysis that supersedes the traditional individual- and representation-centered focus in mainstream psychology and its many disciplinary branches – including social psychology.

The *second* section introduces a feature of *social* cognition that is unique. Social cognition is not only socially but also biologically distributed across agents due to the fact that the architecture of the human perceptual-motor system is specifically designed for the reproduction of movements of conspecifics in a privileged way (Semin & Cacioppo, 2008, 2009). Research emerging since the 1990s on the mirror neuron system (cf. Rizzolatti & Craighero, 2004) has not only underlined the unique nature of conspecific cognition – namely, that it is distributed across brains – but is also a further window to how "the epistemic gulf separating single individuals can be overcome" (Gallese, 2006, p. 16).

The *third* section gets to the heart of the issue and to a principle that is central to the socially situated cognition perspective. Cognition is not detached thought but rather *adaptive* co-regulation of action. This emphasis on cognition as adaptive action is a distant cry from the traditional information-processing or representational perspective that loses sight of the function of social cognition. Obviously, adaptive action is not merely mind-play, but also involves successful physical interaction with other agents and the world.

The types of actions we can engage in are constrained by the architecture of our bodies – the cognitive and emotional implications of this constraint are the subject of the *fourth* section on *embodiment*. This section focuses on the neglected role that our physical bodies play in shaping cognition in a variety of different ways. We experience the world through bodily interactions and the architecture of human functioning is constrained and regulated by our bodies and brains. This particular aspect of the situated cognition approach, i.e., embodied cognition, is one of the central converging issues of current interest in philosophy, cognitive science, psychology, robotics, and neuroscience (cf. Schubert & Semin, 2009; Smith & Semin, 2004). However, research in social cognition that preceded these developments (e.g., Cacioppo, Priester, & Berntson, 1993; Strack, Martin, & Stepper, 1988; Valins, 1966; Wells & Petty, 1980) has already illustrated how sensorimotor processes affect mental states.

The *final* section draws attention to the *distributed nature* of social cognition, namely that in implementing action we make use of tools as well as the social world. Tools provide, in A. Clark's (1997) terms, *scaffolds* for cognitive activity. Such scaffolds release cognitive space, and contain knowledge that has been downloaded to different tools (e.g., the multiplication operation of a calculator) or persons with complementary knowledge and expertise.

In the concluding section to this chapter, we raise issues that remain unanswered both theoretically and empirically and pose some of the open questions that are likely to direct future research.

THE FIVE PILLARS OF SITUATED COGNITION

Determining the level of analysis: Emergence

Understanding the nature of social cognition requires developing an idea of what is its appropriate level of analysis. If, as a situated cognition perspective would suggest, social cognition is for adaptive co-regulation (e.g., the regulation of social interaction; Semin & Cacioppo, 2008, 2009), then the phenomenon to be explained and understood is at a macroscopic level: namely, social interaction in specific contexts and the processes driving it. This requires capturing the phenomenon at a level of analysis that surpasses the traditional individual- and representation-centered focus in mainstream psychology and social psychology. In other words, the molecular level impacts the atomic level. Such a higher-level organization has an entirely different quality than the single units that in their composition give rise to an emergent quality with a distinctive composition of the individual parts.

To illustrate, understanding the physical properties of atoms of hydrogen, silicon, sulfur, and oxygen is informative. However, their unique compositions at a higher level of organization – as in the cases of water (H_2O), sand (SiO_2), and sulfur dioxide (SO_2) or sulfuric acid (H_2SO_4) – constitute emergent molecular compounds that do not display any of the characteristics of the individual elements from which they are composed. The larger unit (e.g., H_2O) has an emergent quality. This is a feature that is not only specific to the composition of chemical compounds. The same recursive compositionality can be seen in the genetic makeup of the species that relies on the four nucleotide bases of DNA, abbreviated C (cytosine), G (guanine), A (adenine), and T (thymine) or for that matter in language use (cf. Semin, 2006). Language use displays the same recursive qualities and relies on a discrete set of basic units (*phonemes*) as constituents at the primary level of organization, with *morphemes* at the second, *phrase structure* at the third, and *utterance* at the fourth levels. The fourth level is where "situated meaning" is brought to expression with utterances (cf. Semin, 2006).

The distinctive feature of these examples is that the different syntheses of a set of discrete "elements" give rise to something that is not present in any of the constituents of the syntheses – in fact the range of creative syntheses is unlimited, as Humboldt (1836/1971) observed in the context of language: i.e., that language "makes infinite use of finite media" (p. 70) whose "synthesis creates something that is not present *per se* in any of the associated constituents" (p. 67). This is "emergence". What may at first glance appear to be remote from socially situated cognition is in fact a much more general principle and applies to all self-diversifying systems (cf. Abler, 1989). Moreover, it has a number of interesting implications that are relevant to socially situated phenomena that have gone largely unnoticed (cf. Abler, 1989 for a notable exception).

The permutation and combination of "units" leading to even larger units in a hierarchy of compositionality (e.g., atoms to molecules; words to sentences to utterances) yields an unbounded diversity of form and function. This is the distinctive and creative characteristic of situated social cognition: namely, infinite diversity as the outcome of a recursively generated system.

An important feature of such recursively generated systems is that each level of organization displays a new emergent quality. The variable combinations at different levels of organization display qualities and properties that are absent in their constituent elements. H_2O has properties and qualities that are distinctly different from the elements of H and O of which it is composed. Higher levels of organization have a propensity to act as shells, which enclose or hide their constituents – a consequence of the fact that the compositions are emergent and display unique and novel qualities. This does not mean that the constituents (e.g., phonemes, morphemes or atoms) lose their identity or are not retrievable – on the contrary. However, the fact that the higher-order compound conceals the characteristic properties of its constituents also means that these are not necessarily accessible and in the case of social phenomena are very likely to escape conscious access. When uttering a sentence we do not have access to the constituent elements from which it is composed.

The general implication of these considerations for the analysis of emergent phenomena such as adaptive co-regulation is a point that Gazzaniga recently made (2010). His observation is in the context of neuroscientific inquiries but has more general relevance: namely, emergent phenomena control the parts that generate and constitute it and not vice versa. It is the goals of a dialogue that organize the utterances and their compositionality and not the phonemes and morphemes that organize the utterance! Consequently, it is the higher level of organization that enables an understanding of how the parts are composed and not the reverse, as is the case, when parts are analyzed without the insight of the emergent whole as a guiding perspective. This is precisely what is meant with setting the level of analysis.

Two observations ensue from these considerations about the level of analysis in social cognition cast in the traditional mold. The first is that the prevailing mode of thinking about social cognition is driven by setting an erroneous level of analysis, which is based on the assumption that explaining a phenomenon at a lower level, for instance the individual level, will open the window to grasp something at a more complex level. This can be illustrated in the paradoxical nature of the classic domain of social cognition (e.g., Devine, Hamilton, & Ostrom, 1994; Jones, 1985) that has focused on individual processes and functioning by conveniently replacing the object of individual cognitive processes by mental structures and processes about social objects, such as stereotypes, persons, and social events. In this traditional mode, social cognition is treated as a disembodied structure: i.e., as a set of symbols and "rules" about how to combine them (e.g., Fodor, 1980; Smith, 1998). The second observation is the difficulty of identifying the macroscopic level of analysis that is appropriate for socially situated cognition. The insight of the emergent nature of socially situated cognition needs to be transduced into an operational handle that presents a researchable agenda. The next four sections are designed to deliver the pillars to this agenda. They address the details of the arguments that conspecific cognition is unique, that cognition is for adaptive action, is constrained by our bodies and the environment, and the significance of distributed knowledge as scaffolds for cognition. Together, these sections anchor the level and types of analysis that are introduced by a socially situated perspective.

The unique nature of social cognition

Understanding the social in *social* cognition has presented a number of challenges that have been with us from the very beginnings of "modern" psychology (cf. Semin, 1986). One of these is to come to terms with what the "social" means. As Gallese has noted recently: "The hard problem in "social cognition" is to understand how the epistemic gulf separating single individuals can be overcome" (Gallese, 2006, p. 16). This issue has occupied "modern" psychology in waves from the mid-19th century onwards. The dominant view resulted in an individual-centered view of mainstream social cognition and was underlined with reference to the biological finitude of the individual. Theory and research in psychology ended up regarding cognitive activity as processes that are locked in the cranial vault, and fostered the "epistemic gulf".

The way in which we represent the *social world* is fundamentally connected with the actions that our bodies perform.

> An adaptive and dynamic view of social cognition suggests that a model of social cognition should address the constraints and capacities provided by the perceptuomotor apparatus and the complex and continuously changing demands of the social environment in which social cognition evolved. Neural systems evolved that were tuned to particular embodiments and environments. In this view, social cognition is best understood as grounded in (rather than abstracted from) perceptuomotor processes and intertwined with a wealth of interpersonal interaction and specialized for a distinctive class of stimuli. In the course of our lives, we are exposed to a vast range of stimuli, cars, buildings, trees, household objects, books, and, of course, other humans and an array of other life forms. Other human beings and their bodily movements constitute a distinctive class of stimuli, because the movements of other human beings can be mapped onto our own bodies (Semin & Cacioppo, 2008, p. 120).

There is substantial evidence (cf. Iacobini, 2009; Rizzolatti & Craighero, 2004) showing this isomorphism and suggesting it to be a species-specific mapping process (cf. Buccino et al., 2004). The research also underlines the view that such isomorphism in mapping movements is due to "synchronization" processes that result from the formation of a type of sensory neural representation that has an entirely different ontological status than knowledge about the world in general. One can therefore regard this type of neurally emergent isomorphism as a *heritable foundation of communication and the embodied building block of social cognition* (Semin, 2007). In order to communicate efficiently, two or more agents have to be on the same page at multiple levels, from the neural to "content" (i.e., common ground, cf. H. Clark & Brennan, 1991), to subfeatures of a dialogue (cf. Pickering & Garrod, 2011).

The important point is that processes that rely on mutually privileged access drive human knowledge about conspecifics. Thus, the basis for "social cognition" relies on access due to being able to map the movements of another upon our own bodies. This gives a source of information above and beyond interacting. Thus, we can interact with objects and other species. These interactions define our knowledge of object worlds as well as our knowledge of other species (their affordances). However, our knowledge of our conspecifics has the added advantage of being mutually able to reproduce each other's movements. This species-specific advantage furnishes mutual access and the foundations of communication (cf. Semin, 2007).

The adaptive function of cognition

The standard representational or information-processing paradigm of social cognition involves the construction and manipulation of inner representations that have no bearing to real interaction in and with the world. One can characterize this view of cognition as a "glass bead game" (Hesse, 1943) that is for its own sake, and without much contact to the reality of the world in which bodily and verbal interactions define an agent's place and existence in relation to the social and physical environment. The representational view, locked in the cranial vault, has the further burden of explaining how it is possible for two individuals to achieve sociality (intersubjectivity), since the individual-centered conceptualization of cognition does not allow for the active reciprocal and co-regulative nature of social behavior.

Therefore, a minor change has to be introduced to the standard question "What is cognition?" from the socially situated perspective resulting in "What is cognition *for*?", introducing a set of significant implications. The answer to this, from both biological and cognitive scientific perspective, is "for action", for producing the next action. The fundamental evolutionary demands on cognition are the organism's survival and reproduction, which requires adaptive action and (for humans) always takes place in a social context (Caporael, 1997; Fiske, 1992). Thus, from a socially situated perspective, cognition has evolved for the control of adaptive action, not for its own sake. Accordingly, social cognition is for the adaptive regulation and adaptive co-regulation of behavior (Semin & Cacioppo, 2009). Consequently, understanding socially situated cognition entails explicating the processes by which the adaptive regulation of others' behavior and the co-regulation of social interaction is achieved. From this view, cognition is not coterminous with detached thought but with adaptively successful interaction with other agents and with the world. The mind contains "inner structures that act as operators upon the world via their role in determining actions" (Clark, 1997, p. 47).

One of the important implications of viewing cognition as adaptive action is to be found in the way we conceptualize, represent, and think about objects and persons. If cognition is for the control of action, then objects and persons must be represented in terms of their relations to the agent and not some abstract features as "objective" qualities. The type of actions and interactions that are possible between an agent and an object – their *affordances* (cf. Gibson, 1979) – or another person determines one's relation to them (see Glenberg, 1997, 2008).

The significance of actions that define relationships between an agent and the social and physical environment for the construction of meaning and concepts becomes clearer when one contrasts it with standard representational approaches to concepts. They are derived implicitly from a model of textual representations (propositions) or equivalent symbolic structures (schemas, etc.). In representational approaches, concepts were typically considered as abstract and amodal, such as semantic networks or feature lists. Being abstract, these descriptions are without a "subject" and constitute an extra-individual and systematic set of abstract properties with a life of its own. But feature lists present problems. Boroditsky and Prinz (2008) illustrate these problems with the instance of "ducks" as a category. A feature list of a duck is likely to include feet, feathers, a bill, swimming, and so on. Such an abstracted, amodal list has the advantage that we can actually use these features for representations of many different categories aside from ducks. Now, let us consider for the time being that you have no idea what ducks are. You have never seen one, but have access to only these features. How do you know, as Boroditsky and Prinz (2008) put it, the difference between a duck and a Las Vegas showgirl, who shares the same features with a duck: namely, feet, feathers, and swimming? This is the problem that arises when language and cognition are regarded as a closed loop of symbols or an internal model of the world, with the meaning of each symbol defined only by other symbols. This is analogous to learning Chinese from its ideograms in a dictionary. The ideograms provide no connection between anything outside of the dictionary. Any unknown character is defined only by reference to other unknown characters. The result is the so-called "symbol grounding" problem (Harnad, 1990).

We now review research that has a bearing upon the adaptive function of cognition as action. If the evolution of human minds was primarily for the on-line control of action under the demands of survival, then there should be a close connection between cognition and action. This section consists of two parts: the first part addresses the role of context as the arbiter of cognition and action; the second part focuses on what it means to say that cognition is for action and reviews the relevant research.

Context and cognition

Human cognition emerges in the interaction with a constantly changing social and physical environment (e.g., Semin & Smith, 2002). These dynamic contexts require adaptive responses that cannot be found and rely upon static and invariant internal representations. Obviously, off-line cognition (Wilson, 2002) is important in a variety of situations involving, for instance, forward planning. Nevertheless, even so-called "off-line" intrapsychological processes are the result of interpsychological functioning, as Vygotsky (e.g., 1981) has argued. Thus, even "off-line" cognition is situated in that it is a contextually simulated mental activity.

This section reviews research that highlights the situational influences on cognitive processes with adaptive implications. In the following we begin by reviewing work that displays the context sensitivity of mental representations and the research on the effects of context on cognitive processes and behavior. Subsequently, we expand on the notion of context, introducing the physical features of the environment as factors that influence cognition and action.

Context effects on mental representations and action

Modeling cognition in terms of abstract, detached symbolic representations has meant treating mental representations as invariant, timeless, and largely immune to contextual influences. This particular assumption has been the driving force across a number of fields from "classic" views on person and social cognition, to attitudes, and stereotypes, to name a few (e.g., Hamilton & Trolier, 1986). This view was also endorsed because enduring mental structures were assumed to play a key role in attaining cognitive economy. The principle of cognitive economy, it has been argued, is functional to the extent that processing potentially infinitely variable detail would induce a state of informational complexity that the cognitive apparatus would not be able to cope with (e.g., Crocker, Fiske, & Taylor, 1984; Taylor, 1981). Consequently, representations such as stereotypes were assumed to exhibit temporal inertia as well as resistance to fleeting contextual influences (e.g., Hamilton & Trolier, 1986; Snyder, 1981).

This pre-paradigmatic assumption was further bolstered with "evidence" suggesting that across a set of different conditions mental representations such as stereotypes are automatically activated, escaping conscious access (e.g., Bargh, 1999; Bargh, Chen, & Burrows, 1996; Devine, 1989), and therefore making their situational adjustment less likely.

Assuming that mental representations are immune to contextual factors flies in the face of the necessity of cognition to be adaptive to situational requirements and tuned flexibly. Indeed, there is cumulative empirical evidence documenting, for instance, that attitudes, frequently described as "enduring mental dispositions", are vulnerable to a multitude of contextual effects (e.g., Schwarz & Sudman, 1992). Similarly, stereotypes have been shown to display considerable malleability in the face of changing contexts and their spontaneous activation is neither inevitable nor universal. Rather than representing abstract and stable knowledge structures, stereotypes can be malleable and responsive to the changing contextual demand of situations (e.g., Blair, 2002). For instance, there is an extensive research tradition that has established that the accessibility of specific exemplars or group members affects category and subtype descriptions (e.g., Coats & Smith, 1999; Smith & Zaraté, 1992) as well as central tendency and variability judgments about the group as a whole (Garcia-Marques & Mackie, 1999, 2001). Different members of a group can also apparently make stereotypes differentially accessible (e.g., Macrae, Mitchell, & Pendry, 2002). Stereotypes are sensitive to subtle contextual cues (e.g., Wittenbrink, Judd, & Park, 2001) and to context stability (Garcia-Marques, Santos, & Mackie, 2006).

For example, Schwarz and Bless (1992) have shown that making the membership of a well-regarded politician to a specific political party salient increased the evaluation of his party, whereas its exclusion resulted in lower overall party evaluation. Similarly, recalling politicians that were involved in a scandal decreased evaluations of the trustworthiness of politicians in general. In a similar vein, the incidental exposure to atypical exemplars of a social group (e.g., exposure to well-liked successful African Americans like Oprah Winfrey), in a task-irrelevant context, was shown to be sufficient to produce the expression of more sympathetic beliefs about the group (Bodenhausen, Schwarz, Bless, & Wänke, 1995). The effect of variations in category exemplars on stereotypes was also investigated by Macrae and colleagues (2002), who observed faster judgments about stereotypic attributes when category exemplars had familiar names (John and Sarah) rather than unfamiliar ones (Isaac and Glenda).

Moreover, even subtle changes in the context were shown to significantly affect the stereotype content automatically activated (Macrae, Bodenhausen, & Milne, 1995). Participants who watched a woman with chopsticks in her hand (vs makeup brush) were faster to respond, in a lexical decision task, to personality traits related with "Chinese" than with "Women", and vice-versa. Similar subtle context manipulations such as presenting a picture of a Black American person in the context of a street scene produced more automatic negativity toward Black Americans than presenting the same picture framed in a church context, in which significant automatic positivity towards African Americans was observed (Wittenbrink et al., 2001).

Garcia-Marques and colleagues (2006) asked participants to read the description of a group member and to complete a stereotype trait assembling task across two sessions with a two-week interval. Stereotypes were stable when the context remained identical (i.e., the description of the group member was stereotype-consistent or stereotype-inconsistent across both sessions). However, stereotype stability declined considerably when the context differed across the two sessions.

A number of other lines of research support the claim that social context influences and shapes cognitive processes and outcomes which were assumed to be driven automatically and therefore stable. One illustration reveals the context sensitivity of the "fundamental attribution error" (Gilbert, 1991; Ross, 1977), allegedly driven by automatic and invariant cognitive processes, such as the increased salience of an actor in a relatively static situational background (Heider, 1958). However, as Norenzayan and Schwarz (1999) demonstrated, subtle situational cues could easily influence these "fundamental and automatic cognitive processes". When asked to provide causal explanations for a mass murder reported in a newspaper, participants responding to a questionnaire with a letterhead "Institute for Social Research" produced more situational explanations, whereas those responding to a questionnaire for the "Institute of Personality Research" produced more dispositional accounts.

These and other studies constitute compelling evidence of the adaptive and context sensitive nature of knowledge, and that such malleability depends on the incorporation of currently context-activated information into mental structures (e.g., stereotypes) and subsequent action. However as Smith and Semin (2007) noted, the context sensitivity of stereotypes has often been considered as reflecting a deliberate attempt to conceal socially undesirable stereotypic thoughts (cf. Fazio & Olson, 2003). Recent research contradicts this by revealing that stereotypes as assessed with implicit measures (more immune to intentional response bias) are also context sensitive (Blair, 2002). Moreover, non-social concepts, which are not subject to social desirability concerns, also reveal context sensitivity (Yeh & Barsalou, 2006).

It may perhaps appear to be self-evident that mental representations must be responsive to situated demands and thus be context sensitive if they are to guide adaptive responses. Obviously, mental representations would be useless if they were completely malleable, as would a complete lack of responsiveness to changing circumstances be.

The systemic view espoused by a situated approach to human functioning assumes the interdependence between psychological processes, the human body, and the material conditions of the environment, (e.g., Proffitt, 2006; Williams & Bargh, 2008a). Recent research has started to document the effects of the physical features of the environment upon social cognitive processes. Williams and Bargh (2008a) have shown that the actual physical sensation of warmth induced by a warm cup led participants to see a target person as more sociable and to become more generous relative to a physically cold condition induced by a cold cup. Warmer room temperature has also been demonstrated to lead to higher reported social proximity to a target person (Ijzerman & Semin, 2009) relative to colder room temperatures. Zhong and Leonardelli (2008) have taken the opposite implication and revealed that social exclusion leads people to feel colder. Another physical feature that has been shown to affect social judgment is distance. For example, participants primed with spatially proximal coordinates reported stronger bonds to their family members and their hometown than those primed with distant coordinates (Williams & Bargh, 2008b). More recently, Ijzerman and Semin (2010) have shown that inducing experiences of physical and verbal proximity gives rise to perceptions of higher temperature.

Scents have also been shown to affect cognition and behavior across a variety of contexts. For instance, the exposure to a cleaning scent makes the cleaning concept more accessible, accelerates the reaction time to cleaning-related words, guides expectations relative to future cleaning-related activities, and influences actual cleaning behavior (Holland, Hendriks, & Aarts, 2005). Other studies report that pleasant fragrances make it more likely that people help others (Baron, 1997); that human odors affect social interaction, including attraction to others (cf. Stockhorst & Pietrowsky, 2004); that neutral faces are rated as more likable (Li, Moallem, Paller, & Gottfried, 2007); and that male faces are rated by females as more attractive (Demattè, Österbauer, & Spence, 2007).

In a recent integration, Semin and Garrido (2012) have documented the significance of the physical features of the environmental context in person perception and judgment. Specifically, environmental contexts characterized by warm temperature, close distance, and pleasant smells promoted generalized positive evaluations not only of a social target but also of uninvolved others such as the experimenter, in contrast to the cold, distant, and unpleasant smell conditions. These and other findings highlight the interdependence between the material conditions of the environment and psychological processes – which opens new vistas to explore the role of not only physical features of the environment but also the significant role that modalities aside from the traditional ones (visually and linguistically manipulated variables) play in shaping human functioning.

Cognition as action

The "adaptive function of cognition" theme is continued here, first with an overview of the research highlighting the *functions* of mental representations – namely, as guides for action rather than internal states locked in the cranial vault. The action-oriented nature of representations is further underlined with research demonstrating how situated social *motives* and *relationships* with others shape mental representations, and guide psychological, communicative, and behavioral processes. In concluding the third pillar of socially situated cognition, we provide a brief overview of the situationally driven *informative function of feelings* in alerting us to the demands of social events and how we fine-tune our cognitive processes and actions to adapt to such circumstances.

Mental representations as guides for action

Mental representations are tuned and oriented toward adaptive action as a growing body of evidence suggests. Social perceivers seek, process, and retrieve information driven by pragmatic or functional concerns, aiding them to shape their actions flexibly in continuously changing situations. For example, the functional value of attitudes as action-oriented representations can be illustrated by the fact that they not only influence how a person thinks and represents an object but also they shape perceptions, judgments, and actions towards that object (e.g., whether to approach or avoid). Whether a person dislikes pre-Renaissance art, thinks highly of John Stewart, enjoys chocolate soufflé, or supports gay rights will influence the person's judgments and actions in the social and physical world. Automatically activated attitudes have a similar function; however, in this case, without a person's intent and awareness (e.g., Fazio, Sanbonmatsu, Powell, & Kardes, 1986). From the perspective of the social perceiver, the rapidity and flexibility of the automatic evaluation processes represent highly adaptive features of the evaluative system that is pragmatically responsive to dynamic changes in the social and physical environment (e.g., Schwarz, 2007; Smith & Semin, 2007).

Like attitudes, person impressions are also action-oriented representations, and have a functional value in guiding appropriate social action. We protect those we perceive as "vulnerable", recruit those who are "competent", and stay away from those who are "opportunistic". Indeed, research on the *stereotype content model* (SCM, e.g., Cuddy, Fiske, & Glick, 2008; Cuddy et al., 2009; Fiske, Cuddy, Glick, & Xu, 2002) has shown that "warmth" and "competence" constitute core dimensions that underlie perceptions of others and play an important role in the regulation of behavior and emotional reactions. Moreover, Fiske and her colleagues have argued that these dimensions are universal (Cuddy et al., 2008, 2009) because their adaptive function is central in regulating interpersonal relationships. Thus, person impressions contain useful cues about other's abilities, roles, and distinctive behaviors (Cantor & Kihlstrom, 1989; Carlston, 1994; Mischel & Shoda, 1998), as well as the type of relationships one has with different social targets (e.g., Baldwin, 1992; Fiske & Haslam, 1996; Fiske, Haslam, & Fiske, 1991; Holmes, 2000). The reliance on such representations facilitates interaction that underlines the pragmatic nature of social perception and is relevant for social interaction (Semin & Smith, 2002).

Adaptive action requires the rapid adaptation to the situated demands of a dynamically changing environment. Often, we have to orientate ourselves in novel situations without the advantage of much time and information. This means producing "good enough judgments" of other's makeup (e.g., Fiske, 1992) by means of heuristic methods. Such shortcuts facilitate smooth social interaction (Snyder, 1993; Snyder & Cantor, 1998), and suggest that in social interaction we are not necessarily driven by accuracy goals but by pragmatic concerns of processing efficiency that ensure sufficient accuracy to suit everyday demands for rapid adaptive action (Fiske, 1992). What was originally regarded as "biases", namely cognitive shortcuts and heuristics (e.g., Chaiken, Liberman, & Eagly, 1989), or the supposedly lazy and error-prone social perceiver (e.g., Nisbett & Ross, 1980), can be regarded as adaptive and functional processes that serve pragmatic ends.

Social motives as guides for action Cognition and action are not neutral and detached. Distinct motives and goals that a perceiver pursues mold cognition and action and serve the perceiver's interests. As mentioned earlier, the influence of contextual factors upon knowledge structures such as stereotypes displays their malleability, but context effects do not exhaust the factors contributing to their flexibility. The content of even implicitly measured stereotypes is apparently vulnerable to perceivers' current motives (e.g., Sinclair & Kunda, 1999), processing strategies (e.g., Blair, Ma, & Lenton, 2001), focus of attention (e.g., Macrae, Bodenhausen, Milne, Thorn, & Castelli, 1997), and emotional states in a given situation (Schwarz, 2002). For example, people rated their own abilities as high when the trait domain in question was personally relevant (Kunda, 1987; Kunda & Sanitioso, 1989), or when the outcome was desirable or important (Weinstein, 1980). Other studies revealed that participants' definitions of personality traits were not objective or invariant, but were shaped in self-serving ways by their own perceived standings on those traits (Dunning & Cohen, 1992). In situations of outcome dependency, perceivers attempt to form more accurate impressions in order to predict the other's behavior better and thus have greater control over their own outcomes. Outcome dependency thus facilitates the use of relatively individuating impression formation processes and less reliance on category-based impressions (Neuberg & Fiske, 1987).

Sinclair and Kunda (1999) highlight a different facet of how induced motives affect which of two stereotypes is activated in the case of a target person who is a member of both a negative and positive stereotype (e.g., an African American physician). They show in a lexical decision task that when the target criticizes the participant, then the negative stereotype is activated. In contrast, when the participant is praised, then the positive stereotype is activated. However, these effects were not found when the participants simply observed the target person praising or criticizing someone else, suggesting that the perceiver's current motives to accept praise and discard criticism differentially modulate the activation and use of stereotypes.

Other research reveals that the way social perceivers tune their attention and cognition to process social information in the environment depends on their current social connectedness needs (e.g., scoring high in loneliness or after social exclusion). Individuals high in the need to belong were particularly attentive to and accurate in decoding social cues (e.g., vocal tone, facial emotion; Pickett, Gardner, & Knowles, 2004).

Personal relevance, egocentric judgment, outcome dependency, self-serving motives, social connectedness needs, among others, illustrate that mental representations in the social domain are not invariant processes and depend, among other factors, upon perceivers' goals and motives. Such motivational factors trigger cognitive strategies that are used flexibly to meet the situational demands and to accomplish one's goals.

Feelings as guides for situated action

A further factor giving shape to cognition and action are feeling states that provide us with important information about the processing requirements we face (e.g., Martin & Clore, 2001; Schwarz & Clore, 2007). As Schwarz (2002) points out, different situations provide different affective cues depending on whether they are benign or problematic situations. These feeling or affective states, induced by the characteristics of different situations, regulate our cognitive processes, judgments, and behaviors as a substantial research tradition on mood and cognitive processing styles has uncovered.

The general pattern that has emerged in this literature is that benign situations induce a positive mood, signaling safety. In contrast, a negative mood arises if the nature of a situation is understood as problematic. This affective information leads to cognitive processes being tuned to the respective demands of different situations. According to the feelings-as-information hypothesis (for a review see Schwarz, 2011) and the mood-as-general-knowledge assumption derived from it (for a review see Bless, 2001), people in a positive mood are more likely to rely on past experience, reflecting generalized regularities, and to activate heuristic or global processing. They rely on general knowledge (Bless, Bohner, Schwarz, & Strack, 1990; Isen, 1987; Mackie & Worth, 1989) such as stereotypes or scripts (e.g., Bless, Schwarz, & Wieland, 1996; Bodenhausen, Kramer, & Süsser, 1994; Park & Banaji, 2000), use more inclusive categories when sorting exemplars (Hirt, Levine, McDonald, Melton, & Martin, 1997; Isen & Daubman, 1984), process visual stimuli more globally (Gasper & Clore, 2002), and are more prone to the fundamental attribution error (Forgas, 1998). In contrast, situations that signal danger and induce a negative mood lead to the adoption of a more effortful, analytic, and systematic processing style (for reviews, see Bless, Schwarz, & Kemmelmeier, 1996; Schwarz, Bless, & Bohner, 1991).

Situationally induced affect can also influence cognition in terms of its *content* (Schwarz & Clore, 2007). Thus, content, namely the information retrieved from memory and the current affective state of the person is reportedly congruent (e.g., Bower, 1981; Forgas, 1995; Sedikides, 1995). A range of judgments such as life satisfaction (Schwarz & Clore, 1983), risk (Gasper & Clore, 1998), and political judgments (Forgas & Moylan, 1987) have also been shown to be influenced by affect.

The relevance of this research from a situated cognition perspective lies in the significance of different situations inducing different moods or affective states, which in turn shape the style and content of our cognitive processes and thus also have an impact on our actions.

Cognition as constrained by our bodies

Our experience of the world and our functioning is constrained by a set of relatively invariable conditions (e.g., ecological, existential, material), including our body morphology, which determine the nature of the actions and interactions that we can engage in. Human functioning is therefore embodied.

As was argued earlier, the *meaning of an object or a person* is not determined by some abstract set of features, but by the nature of the actions that one can engage in with an object or the interactions with a person. This is one of the important senses in which cognition is *embodied*, since our experiences of the world (social or otherwise) originate from bodily interactions. This particular account of embodiment takes the "body" in embodiment as the direct reference point. Ideas that have entertained or fed into this perspective are to be found in early motor theories of perception such as William James' account of "ideomotor action" (1890/1950) or Jean Piaget's developmental psychology according to which cognitive abilities grew out from sensorimotor abilities, as well as the aforementioned ecological psychology of J. J. Gibson (1966). The more recent impetus comes from A. Clark (e.g., 2008), and developments in robotics (e.g., Brooks, 1999), but also from W. Prinz's (e.g., 1984) *common coding theory*, which claims a shared representation or common code for perception and action.

The embodiment perspective contrasts with previously described amodal approaches that conceptualize psychological functioning in terms of a closed loop of symbols or an internal model of the world. 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.

This section is organized into four parts. The first part reviews social psychological research that antedates the current surge in this field and its more current follow-ups. The second part describes how motor performance, bodily feedback, or behavior, influence language and evaluative judgments. The third part provides an overview of a substantial research area that has emerged over the last 10 years or so and has demonstrated what is currently referred to as "*motor resonance*". This "phenomenon", which has been demonstrated both by behavioral and neurophysiological research, indicates that words (language) recruit and activate the same neural substrates and motor programs that are active when the person is performing the action represented in the sentence. The reverse has also been shown to hold. Movement, or action, enhances accessibility of language related to the movement. Research findings in neuroscience have demonstrated the link between neural mapping of language and action verbs, in particular (cf. Pulvermüller, 2005). The final part of this section provides a brief overview of how abstract entities such as time, morality, and valence are grounded.

Social psychology and embodiment

Social psychology has had a long-standing tradition of investigating the interface between the body and cognition that precedes the current surge of interest in embodiment (Cacioppo et al., 1993; Strack et al., 1988; Valins, 1966; Wells & Petty, 1980). This research literature 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 (e.g., Adelmann & Zajonc, 1989; Laird, 1984; Neumann, Förster, & Strack, 2003; Niedenthal, 2007; Zajonc & Markus, 1984).

Surprisingly, and despite this rich research tradition, the role of the body, or, in short, "*embodiment*", has never occupied a central stage for theorizing and research in social psychology.

Nevertheless, one finds a collection of creative studies within this amodal framework which, although not formulated in terms of a "language and motor resonance" framework, highlight the relationship between language – broadly defined – and motor action. A classic illustration of this can be found in research reported by Bargh and colleagues (1996) in which participants who had constructed sentences with words implying the elderly (e.g., *Florida, gray, sentimental, bingo, wise*) were shown to walk significantly slower down the hallway than those in a control condition.

Macrae, and colleagues (1998) report a similar finding. They introduced a reading test, which was either labeled "The Shimuhuru Word Reading Test" or "The Schumacher Word Reading Test" (at the time Schumacher was the most famous Formula 1 driver). Participants' task was to speak each word on a list aloud while they were surreptitiously timed. Participants in the "Schumacher Word Reading Test" condition produced the words more quickly. In another study, Macrae and Johnston (1998) showed that participants primed with the concept of "helpfulness" were more likely to help the experimenter in picking pens than participants in a control group. Indeed, research in social psychology is replete with creative experiments such as these (for reviews, see Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Smeesters, Wheeler, & Kay, 2010).

This research reveals that linguistic stimuli (e.g., in the form of primes) influence or shape motor behavior. However, while creative imagination establishing empirical connections has been in abundance, theory construction has been barren when it comes to explaining the precise nature of the processes mediating the link between language and behavior.

The *motor resonance question* is precisely about *the processes* mediating the relationship between language and motor behavior and would benefit this field considerably by elucidating the processes mediating this link. Notably, this type of inquiry is being conducted outside of what is generally regarded as social cognition and social psychology (see Fischer & Zwann, 2008; Semin & Smith, 2008; Zwann, 2009) as it is illustrated in the third part of this section. However, besides examining how language affects behavior a substantial amount of research also illustrates how motor performance, bodily feedback, or behavior, influence language and evaluative judgments. We review this research in the next part of this section.

Body action, social cognition, and evaluation

This subject has a long tradition, starting with the early days of research on how inferences from one's body influence attitudes. For instance Valins' (1966) classic work showed how manipulated feedback of one's heartbeat rate increases one's liking for an "object" that one is observing. The role that the body (e.g., physical posture) plays in the acquisition and expression of attitudes has early origins (Darwin, 1965; Galton, 1884). Wells and Petty (1980) provided one of the very first demonstrations of this idea by revealing the importance of body movements in shaping attitudinal responses. Specifically, their results showed that for both pro- and counter-attitudinal messages, participants who had nodded their heads agreed more with the message than participants who had shaken their heads (see also Tom, Pettersen, Lau, Burton, & Cook, 1991). Moreover, vertical and horizontal head movements have been shown to impact also the degree of confidence people have in their own thoughts towards those messages (Brinõl & Petty, 2003; for a review, see Brinõl & Petty, 2008).

In an early seminal study, Solarz (1960) reported that participants were faster in pulling a lever towards themselves for objects they liked and faster in pushing the lever away from themselves for disliked objects. These results conform to the general embodiment argument that motor action congruent with the valence of the words would be facilitated (see also Chen & Bargh, 1999; Neumann & Strack, 2000). Cacioppo and colleagues (1993) also revealed the significance of approach and avoidance movements in the evaluation of neutral stimuli. Their study showed that participants rated more highly a set of novel Chinese ideographs while making approaching movements (press against the palm of their hand upwards from the bottom of a table) than while making avoidance movements (press downwards). This remarkable finding and its arm movement paradigm inspired a range of subsequent studies. In another study reporting the motor congruence effect, the authors showed that when participants were asked to generate names of famous people while performing approach and avoidance movements, the former facilitated the retrieval of liked names while the latter facilitated the retrieval of disliked names (Förster & Strack, 1997, 1998). Kawakami, Phills, Steele, and Dovidio (2007) applied this paradigm to attitudes towards stereotyped groups and showed that positive attitudes towards African Americans improved after participants had performed approach actions compared to avoidance actions (see also Paladino & Castelli, 2008).

In general, social psychology has had a longstanding tradition of showing the contribution of bodily factors on attitudes and persuasion (for a review, see Briñol & Petty, 2008). However, recent research suggests that the connection between specific arm movements and stimulus valence may not be an invariant one, but rather depends, for example, on the self-relevance of the movement (Wentura, Rothermund, & Bak, 2000), the initial stimulus valence (Centerbar & Clore, 2006), the goal-relevant outcomes of actions (Maxwell & Davidson, 2007), the subjective representation of the self (Markman & Brendl, 2005), or on contextual factors (Bamford & Ward, 2008).

Other subtler bodily processes have been shown to influence the way we experience and act towards the world. In a classic experiment, Strack and colleagues (1988) reported that participants judged a set of cartoons to be funnier when holding a pen between their teeth (inductor of a smile expression) than between their lips (inhibiting smiling; see also Ito, Chiao, Devine, Lorig, & Cacioppo, 2006; Stepper & Strack, 1993). In a set of studies addressing the relationship between action and language, Mussweiler (2006) induced participants to move in a portly manner, revealing that they were more likely than participants in a control condition to describe a neutral target person as overweight. If participants were induced to move in a typically elderly manner (i.e., slowly), then they were more likely to describe a neutral target person as old. Moreover, he showed that they responded faster to words associated with features of the stereotypically elderly.

Language and body: The research

The research on how language affects motor performance and recruits neural activity comes from two complementary research orientations: namely, behavioral and neurophysiological. The binding theoretical and empirical frameworks come from neurophysiological (cf. Rizzolatti & Arbib, 1998; Rizollatti & Craighero, 2004,) and action theory (Hommel, Müsseler, Aschersleben, & Prinz, 2001) backgrounds, as well as cognitive psychology (e.g., Barsalou, 1999; Glenberg, 2008) – all of which have converging assumptions, which are outlined briefly along with the distinctive features of their demonstrations.

The embodiment argument suggests that the comprehension of concepts (e.g., a dog) or action language involves the activation of the sensorimotor modalities that are recruited on-line and which can be reactivated off-line. The *perceptual symbol systems* (PSS; Barsalou, 1999) perspective suggests that multimodal stimuli give rise to *on-line* experiences inducing modal states in the somatosensory system, the visual system as well as in affective systems. According to PSS, once established in the brain, knowledge about the categories that are represented by multimodal associative structures can be used across a number of cognitive tasks. In this view, the representations that arise in dedicated input systems during sensation and motor action can be stored and used "off-line" by means of mental simulations that have become functionally autonomous from their experiential sources.

Hearing a sentence such as "She is brushing her teeth" activates the motor system that is related to the semantic content of the description and does so somatotopically. A number of studies, including functional magnetic resonance imaging (fMRI) research, provide support for this argument (see Hauk, Johnsrude, & Pulvermüller, 2004 for a review). A large range of research for the motor grounding of concrete concepts come from the language comprehension research providing evidence that a motor modality is involved in the comprehension of language describing actions (e.g., Fischer & Zwaan, 2008; Glenberg & Kaschak, 2002; Glenberg & Robertson, 1999; Zwaan & Taylor, 2006; however, see Ghazanfor & Schroeder, 2006; Mahon & Caramazza, 2008).

A substantial amount of research shows that the comprehension of language takes place by means of sensorimotor simulations or what Barsalou refers to as "the reenactment of perceptual, motor, and introspective states acquired during the interaction with the word, body, and mind." (2008, p. 618). A general, but not exclusive, feature of these studies is the use of perceptual and motoric "primes", which are either congruent or incongruent with the perceptual or motoric features in a sentence. What these studies essentially uncover is that congruence between "primes" and "sentence features" provides a comprehension and reading speed advantage, *inter alia*, and incongruence has, relative to the congruence condition, a disadvantage on the same variables. These studies revealed that *perceptual* (e.g., Connell, 2007; Holt & Beilock, 2006; Kaschak, Zwaan, Aveyard, & Yaxley, 2006; Richardson, Spivey, Barsalou, & McRae, 2003; Zwaan, Madden, Yaxley, & Aveyard, 2004) and *motoric* (e.g., Borreggine & Kaschak, 2006; Glenberg & Kaschak, 2002; Zwaan & Taylor, 2006) information is recruited during the processing of sentences.

In the following, we provide a few illustrative examples of this research. For instance, Zwaan and Yaxley (2003) show that spatial iconicity affects semantic-relatedness judgments. For instance, when word pairs were presented in iconic relation (e.g., *attic* presented above *basement*), then semantic-relatedness judgments were significantly faster than when they were presented in reverse iconic relation (e.g., *basement* above *attic*). Borghi, Glenberg, and Kaschak (2004) report a series of studies showing that the speed of part verification (e.g., steering wheel vs. tires) varied with the perspective imposed on the object by the language used to name the object (e.g., "You are driving a car" vs. "You are fueling a car"). Participants were slower when the perspective (e.g., driving) was incongruent with the position of the object (e.g., tires) compared to a congruent match (driving and steering wheel) – (see also Glenberg & Kaschak, 2002; Matlock, 2004; Spivey, Tyler, Richardson, & Young, 2000).

An embodied perspective suggests that language is modality specific – an idea that is alien to an amodal view: i.e., words that have to do with auditory input must be coded differently than words that are coded by visual input. From this, Pecher, Zeelenberg, and Barsalou (2003) have argued that modality specificity would mean that switching from one modality (e.g., auditory) to another (e.g., visual) when processing the features of the same object should have costs. The participant's task was to determine if an object had a particular feature or not (e.g., Is a blender loud?). This was preceded by another judgment that was modality congruent (e.g., Do leaves rustle?). When the modality between two judgments was incongruent (e.g., Are leaves green?), there was an increase in the time required to confirm the feature as belonging to the object.

Most of the behavioral studies that have been done and the small sample that we have reviewed for illustrative purposes have been conducted with either single words or entire sentences. However, two recent reports have investigated how motor resonance unfolds during sentence comprehension, providing some novel insights into the temporal resolution of motor resonance (cf. Taylor & Zwaan, 2008; Zwaan & Taylor, 2006).

Another field of investigation that reveals motor resonance effects is to be found in research on the consequences of facial expressions of emotions and its more recent extension to the link between linguistic expressions of facial expressions and how they affect facial musculature. It is well known that the observation of a smiling or frowning face induces a subtle movement of the smiling muscles (*zygomatic major*) and frowning muscles (*corrugator supercilii* muscle region; e.g., Dimberg & Petterson, 2000; Dimberg, Thunberg, & Elmehed, 2000). This occurs even when such faces are presented subliminally. These experiments suggest what has been referred to as an automatic mimicry effect. Recently, Foroni and Semin (2009) demonstrated an interesting motor resonance effect: namely, that reading or hearing a verb (e.g., to smile, to frown) or an adjective (e.g., happy, angry) has the same sensorimotor consequences as seeing a happy or angry face, providing further evidence for the motor resonance induced by language in the specific domain of emotional expressions and states (see Chapter 11).

Finally, there is evidence of the neural mapping of language and action verbs in particular (Pulvermüller, 2005). In a recent fMRI study, Hauk and colleagues (2004) showed that listening to verbs referring to leg actions activates regions of the motor cortex responsible for control of the leg; in the case of verbs referring to hand actions, motor cortex regions responsible for hand control are activated, and so on. Using fMRI, Tettamanti et al. (2005) demonstrated somatotopic representation of actions described by simple sentences (e.g., "I kick the ball"). Although the fMRI research constitutes a fascinating illustration of the neural grounding of action verbs, the data remain ambiguous: they might reflect simulation of action after hearing action verbs (i.e., an association), or they might instead indicate that activity in motor areas of the brain is important for understanding these verbs.

Grounding abstract concepts

While an embodied approach to action-driven sensorimotor-based grounding of concrete concepts and categories presents some plausibility, the direct sensorimotor-based grounding runs into difficulties when it comes to concepts that we cannot touch, see, taste, or smell (cf. Boroditsky & Prinz, 2008). There is an abundance of abstract concepts such as time, morality, truth, happiness, health, and valence. This question has been at the heart of recent discussions in embodied approaches to cognition (cf. Barsalou, 2008; Dove, 2009; Glenberg et al., 2008; Mahon & Caramazza, 2008).

One solution to this puzzle is furnished by *conceptual metaphor theory* (CMT; Lakoff & Johnson, 1999). In this view, thinking about abstract concepts is structured by perceptual experiences, such as space (Tversky, Kugelmass, & Winter, 1991). According to CMT (Lakoff & Johnson, 1980), only a few concrete concepts are learned through bodily experience such as spatial orientation and containment, while the majority of concepts are more abstract and their understanding is "accomplished" through repeated pairings with the concrete domains (e.g., Landau, Meier, & Kiefer, 2010). Thus, abstract concepts are understood through analogical extensions from concrete, bodily experienced domains. We review some illustrative domains to highlight the grounding of the abstract concepts: namely, morality, time, and valence.

The concept of *morality* is abounding with metaphors of cleanliness (e.g., Kövecses, 2000), including expressions such as a "clean conscience" or a "disgusting act". The interesting question this metaphorical association raises is: Do people "embody" the concept of morality with activities to do with cleaning? The first example comes from Zhong and Liljenquist (2006) who showed that recalling unethical actions or events from memory enhances the accessibility of cleansing-related words (e.g., soap or shower) and influences participants' desire and preference for cleansing products compared to recalling ethical behaviors.

Research by Schnall, Benton, and Harvey (2008) shows a bidirectional relationship between morality and physical cleanliness. They found that when participants were primed with cleanliness they made less severe moral judgments than participants in a neutral condition. In a second study, and after being exposed to a disgusting film clip, participants who washed their hands were milder in their judgments in moral dilemmas compared to those who had not washed their hands (see also Schnall, Haidt, Clore, & Jordan, 2008, and Wheatley & Haidt, 2005, for evidence of the link between disgust and morality). Refining the relevance of the cleanliness metaphor, Lee and Schwarz (2010) demonstrated that the metaphor *morality-cleanliness* is specific to the *type* of action involved in the production of the immoral action. They argue and show that people are more likely to purify those specific body parts involved in the production of the moral transgression.

Thus, participants who lied via voice mail preferred a mouthwash product and those who lied via e-mail preferred a hand sanitizer.

The abundance of metaphors that locate *time* spatially is comparable to those grounding morality with cleanliness (e.g., a *short* while ago, a *long* break, going for a *long* journey, looking *forward* to tomorrow). Moreover, the diverse devices that mark time physically resort to spatial relationships (analog watches, time-lines, clocks, sundials, hourglasses, etc. – see A. Clark, 1997; Traugott, 1978; Tversky et al., 1991). Deriving from CMT (Lakoff & Johnson, 1999), which proposes that thoughts about abstract concepts such as time are structured by perceptual experiences such as space, recent work has revealed the intricate subtleties through which the cognitive representation of time is inherently intertwined with the representation of space (Boroditsky, 2000, 2001; Boroditsky & Ramscar, 2002; Casasanto & Boroditsky, 2008) or the categorization of time-related words (Lakens, Semin, & Garrido, 2011).

For instance, bimanual response tasks have revealed compatibility effects between time-related stimuli and the spatial position of response keys (e.g., Ishihara, Keller, Rossetti, & Prinz, 2008). Similar stimulus–response compatibility effects have also been observed in other studies (e.g., Vallesi, Binns, & Shallice, 2008; Vallesi, McIntosh, & Stuss, 2011; Weger & Pratt, 2008). Lakens and colleagues (2011) showed that when past and future referent words are presented auditorily with equal loudness to both ears, participants disambiguate the auditorily equally balanced future words to the right ear and the past words to the left ear.

While the studies cited above examine spatial grounding that anchors time on an axis that runs from the left (past) to the right (future) that is cultural and probably writing direction specific, this is by no means universal. Research to date has shown time to be represented from not only left to right, but also right to left, front to back, or back to front (e.g., Boroditsky, 2000; Boroditsky & Ramscar, 2002; Fuhrman & Boroditsky, 2010). Notably, the reference point for these instances of grounding is relative to the body. In a recent paper, Boroditsky and Gabi (2010) report that Pormpuraawans (an Australian Aboriginal Community) arranged time according to *cardinal directions: east to west*. This fascinating report reveals both the relativity and generality of how the abstract concept of time is understood. Time is grounded spatially, which appears to be a universal: however, the spatial referents that ground time vary considerably across cultures.

Similar to time, *affect* is represented in space: however, now with the vertical dimension (e.g., "good is up") or alternatively as fluid in a container (She was filled with sadness. He was overflowing with joy) or as natural forces (She was swept off her feet. He was engulfed by anger) – (see Crawford, 2009).

Empirical evidence investigating the relation between affect and verticality has evidenced an explosive growth (cf. Crawford, 2009; Landau, et al., 2010), supporting the argument that metaphors alluding to the vertical spatial orientation like "I'm feeling up" or "I'm feeling down" serve to structure the way people think and represent affect-related concepts. For instance, Meier and Robinson (2004) were able to show that positive words (e.g., ethical and friendly) were classified more rapidly as positive when they were presented at the top rather than at the bottom of a monitor, while the opposite was true for negative words (see Casasanto, 2009). This idea of grounding affect in vertical space was soon extended to other areas beyond categorization, such as to spatial memory. For instance, Crawford, Margolies, Drake, and Murphy (2006), observed that participants' retrieval of presented images revealed an upward position bias for positive images and a downward bias for negative images. Recently, Casasanto and Dijkstra (2010) reported that people were faster in retrieving and generating positive autobiographical memories when performing upward movements and negative memories when performing downward movements (see also Lanciano, Curci, & Semin, 2010; Palma, Garrido, & Semin, 2011).

Another line of research has been showing the link between valence and size. For example, Meier, Robinson, and Caven (2008) have shown that positive words presented in a large font were evaluated more quickly and accurately than those presented in a small font, whereas the reverse pattern was true for negative words.

Other research has explored the metaphorical use of "bright" (e.g., "Bright ideas") or "dark" ("Dark days") to refer to positive or negative aspects, respectively, which seems to be an established association across different cultures (e.g., Adams & Osgood, 1973). Experimentally, this association finds support in the work of Meier, Robinson, and Clore (2004) who observed that participants' responses were facilitated when the word meaning (e.g., gentle) and the font color (white) were congruent with the metaphor. Related research has shown that stimulus valence biases brightness judgments in metaphor-congruent ways. For instance, Meier, Robinson, Crawford, and Ahlvers (2007) report that participants judge squares to be the lighter more often after evaluating positive words than negative words.

These diverse studies reveal that the different metaphors about space, size, or brightness affect the classification of valenced stimuli and have effects on memory and evaluative processes as a function of the congruence or incongruence between the source and target. With these studies on abstract concepts and how they are grounded, we come to the conclusion of the section on the fourth pillar of socially situated cognition.

Scaffolding cognitive activity

When we need money or wish to post a letter we resort to cultural artifacts such as cash dispensers or red postboxes (in some countries). When we want to know which platform the next train to our destination departs from we ask a railway official. Such artifacts and "experts" constitute crucial landmarks that provide reference points with their distinct markers (i.e., red boxes, uniforms) for the organization of complex goal-directed action, and also serve as external memory tools (cf. Caporeal, 1997).

Cognition makes use of tools and other aspects of the individual's environment, aside from people and groups. Moreover, to lean on people and groups one also needs tools (e.g., language) to coordinate and synchronize social interaction.

Tools provide scaffolds for cognitive activity (A. Clark, 1997). Mechanical tools such as hammers, saws, and drills provide scaffolds that aid achieving solutions (e.g., building a chair). Their absence would make such solutions difficult if not impossible. Other types of tools such as language (Semin, 1998) are used to synchronize and coordinate communication between, for instance, different crew members of a ship who are navigating it (cf. Hutchins, 1995). Such coordinated action is achieved by resorting to both physical tools (charts and compasses) as well as utilizing and coordinating the socially distributed knowledge between crew members through communication via language in which knowledge is literally stored. Thus, the physical tools and the coordinated use of socially distributed knowledge become scaffolds for the successful navigation of a large ship. Both internal (e.g., concepts) and external resources (e.g., tools) contribute to the regulation of action. It is self-evident that closer attention has to be paid to such artifacts in order to understand the coordination of social interaction (Hodges & Baron, 1992).

Social and material scaffolds are the result of cognitive efforts to find adaptive solutions to problems and constitute standardized solutions to recurring problems. What is the best solution to drive a nail into hard material? How do I navigate a vessel over open water? In short, scaffolds constitute solutions to problems. Their properties emerge adaptively for the type of task that is confronted. Moreover, they furnish socially situated cognition by delegating processing demands to external aids, and resources such as experts. Once they are shaped over time, they preserve the functional knowledge that has shaped their structure. Therefore, constraints upon human cognition are determined not only by the architecture of our minds and bodies but also by external resources or scaffolds.

Non-social scaffolds: Tools and the architecture of the human body

Tools and their shapes have evolved in order to solve recurrent situated problems. Thus, their design was constrained by the nature of the task they were expected to solve. But that contributes only to part of their design. The other part is they have to be adapted to the human body (cf. Semin, 1998, p. 230–231). The unique quality of such tools is their two-way adaptation. Tools are dually adapted to the constraints of the human body and to the constraints of the object to which they extend human action.

The design of tools is therefore highly informative because they display information about the constraints that have shaped their dual adaptation. They carry information about the type of task they have been constructed for. But equally important, they display information about the constraints that are introduced by our brain–body makeup. This is illustrated with the example of a pair of scissors. The shape of a scissors' handle is an adaptation to the particular grip that is the most efficient way of distributing pressure by the hand. In the case of writing, the particular spacing between letters in a word and between words is informative of the facilitatory link between perceptual processing, reading, and text comprehension. An interesting insight of tool properties can therefore be informative about both psychological and task constraints. Examining tool properties can also be informative about how an agent is coupled to the problem or task.

One of the ways in which the situated cognition approach opens new ways of thinking is by drawing attention to how much we rely on the environment to unload information and thus facilitate and structure cognition. An often-cited example of how such unloading takes place is illustrated by how we solve a difficult arithmetic operation like multiplying two three-digit numbers. The mental operations in this case are distributed by using pencil and paper. As we manipulate symbols, these external resources become part of an overall cognitive system, functioning as memory storage, offering cues for what digits to process next, and so on (A. Clark, 1999). Other classical examples of how we manipulate the physical environment as an aid for memory is leaving an empty milk bottle by the door as a reminder to get milk the next time we go out or placing important material on top of one's desk in order to focus one's attention on the relevant task (Kirsch, 1995; Kirsch & Maglio, 1994).

Another example of how people actively structure their immediate environment to optimize their performance can be observed in how bartenders structure bartending activities (Beach, 1988). Expert bartenders who are confronted with a number of diverse drinks orders line up differently shaped glasses. These glasses correspond to different kinds of drinks in a spatial order that reproduces the temporal sequence of drink orders. This type of exploitation of the physical environment releases memory resources. With the spatial organization of the glasses, the expert bartender does not have to think about either the sequence or the type of drinks that have to be prepared. Bartending is driven by cued action and recall, i.e., by *epistemic* actions (cf. A. Clark, 2008). In contrast to mere *physical* actions, epistemic actions make computation easier, faster, and more reliable. These types of epistemic actions that involve (*inter alia*) the exploitation of space by ordering glasses on the bar in a distinct fashion simplify choice and perception. These types of scaffolds induced by epistemic actions are different from designed tools such as a slide ruler, which reduces demands upon internal memory (cf. A. Clark, 2008). These examples illustrate how the external actions an agent performs on the physical environment can change its own computational state or otherwise cue, prioritize, and structure even the most demanding cognitive tasks.

While cognition can surely be distributed across artifacts and situations that effectively facilitate and structure cognition, extending cognitive processes out beyond the individual, a large amount of evidence emphasizes that cognition is also distributed across other people who participate in the construction of mental representations and the processing of information in a way that extends our cognitive powers.

Social scaffolds: Socially distributed cognition

Socially distributed cognition is best exemplified in tasks that supersede the abilities of an individual. Take navigating a large vessel (e.g., Hutchins, 1995) or performing open-heart surgery. These are tasks that require the finely tuned coordination of activities that brings together teams of "experts" who lean on each other's knowledge to be able to perform a collective task efficiently and successfully. What are the distinctive features of such teams? They consist of diverse experts (e.g., in the case of the heart surgery team, the surgeon, the anesthetist, etc.). They each have their own specialty and their unshared knowledge base that is highly relevant for the performance of the task at hand. What the team shares is knowledge about the joint activity and the coordination of these activities. Thus, the specialized knowledge that each individual holds is crucial for the performance of the task, and this knowledge is distributed across the individual members of the team. The coordinated product of the individuals constitutes a type of collectively constituted knowledge or cognition that is unique because the entire process of the operation is not a single person's production but a collectively coordinated "cognition as action" that drives the operation from its beginning to its end. Thus, the successful accomplishment of such tasks that supersede an individual's capabilities relies on members "leaning" on each other's competencies and being scaffolded by the others in the team without having to know the details of the other member's expertise.

Hutchins (1995) provides an excellent analysis of this type of socially distributed cognition with a systematic investigation of how a large Navy ship is navigated. The particular activity of navigating is a cyclical one and involves processing complex, socially distributed information. The task is executed by a number of individuals with discrete roles (reading a timepiece, identifying a landmark, communicating a bearing, etc.), who in turn are served by a number of physical and computational tools (charts, protractors, compasses, etc.). The performance of the task is achieved in a series of coordinated activities between a number of different individuals who draw on each other's expertise and thus establish a type of knowledge that supersedes the unique specialisms of the individuals involved. A team member does not need to know the specialized knowledge that is distributed among the other members. However, the execution of the task requires that the members share knowledge, which makes it possible to apply the distributed expertise. Thus, similar to our knowledge of how to use "tools", we utilize each other's specialized knowledge to perform a task, thereby engaging in a process that "extends out beyond the individual" (A. Clark & Chalmers, 1998).

One of the best examples of socially distributed processing in social psychology is the study of *transactive memory* (e.g., Wegner, 1986, 1995; Wegner, Erber, & Raymond, 1991; Wegner, Giuliano, & Hertel, 1985). This research highlights how memory becomes progressively specialized, socially shared, indexed, and complementary among people who know each other well. The research conducted on this subject suggests that individuals in close relationships develop a distributed memory system, such that they divide responsibility for the encoding, storage, and retrieval of information from different domains, according to their implicitly shared knowledge of each other. Through self-disclosure and shared experiences, members of the system become aware not only of what information they themselves know but also what the other members know across knowledge domains. The important aspect of transactive memory in this context is that the coordination of the inter-individual memory expertise gives rise to a *qualitatively different memory system*. By leaning on each other, the individual minds are enhanced by the socially available and accessible scaffolds. This scaffolded memory system is more elaborate than that of any single individual member's memory (Wegner, 1986). Transactive memory is a system that is irreducible, operates at the group level, and depends on a distribution of specializations within this system, as in the case of partners (Wegner, 1995). Note that each person in the system individually lacks critical pieces of information. Nevertheless, such specialization reduces the cognitive load of each individual, while providing the dyad or group access to a larger pool of information across domains and reduces the wasted cognitive effort represented by overlapping individual knowledge.

This is illustrated by the fact that friends and couples jointly remember information better than strangers do (e.g., Andersson & Rönnberg, 1995; Hollingshead, 1998a,1998b; Wegner, 1986, 1995; Wegner et al., 1991). Other findings about collaborative remembering in older couples lend additional support to this idea. Although elderly individuals exhibit memory deficits relative to younger adults, when elderly couples who have been married for 40 year or more are allowed to work together, they remember just as much as young couples (Dixon & Gould, 1996). By this account, individual memory systems can become involved in larger, organized social memory systems that have emergent group mind properties not traceable to the individuals.

The comparison of individual and group performance constitutes a further related line of research, exploring the distributed nature of cognition. A common and not surprising set of findings are that: groups recall more than a single individual (e.g., Lorge & Solomon, 1961); group recognition is more accurate (Clark, Hori, Putnam, & Martin, 2000; Hinsz, 1990); groups are more confident in their answers, but discriminate less well between their accurate and inaccurate answers (e.g., Stephenson, 1984); and groups show more extreme biases in their recall than do individuals. Finally, there is evidence that groups arrive at stable accounts of their experience more rapidly than do individuals, implying that group recollection may lead to a more rapid consolidation of a long-term account of an event (Clark & Stephenson, 1989; Weldon, 2001; Weldon & Bellinger, 1997). These studies constitute specific instances of socially scaffolded memory.

Notably, distributed cognitive processes do not always result in positive outcomes. An example is the case of groupthink phenomena (Janis, 1972), collaborative memory (e.g., Barnier & Sutton, 2008; Barnier, Sutton, Harris, & Wilson, 2008; Echterhoff & Hirst, 2009; Garcia-Marques, Garrido, Hamilton, & Ferreira, 2012; Garrido, Garcia-Marques, & Hamilton, 2012a, 2012b; see Rajaram & Pereira-Passarin, 2010 for a review) or even socially induced false remembering. Groupthink (e.g., Janis, 1972), constitutes an example of group cognition in which certain conditions lead groups to make risky and poor decisions. Other studies have shown that memory performance is impaired when people collaborate at recall compared to nominal groups (created by pooling the non-redundant responses of individuals working alone), a phenomenon termed *collaborative inhibition* (Basden, Basden, Bryner, & Thomas, 1997; Basden, Basden, & Henry, 2000; Meudell, Hitch, & Boyle, 1995; Meudell, Hitch, & Kirby, 1992). Another illustration is to be found in research on the social contagion of memory, where the incorporation of others' memories may lead to socially induced false remembering (e.g., Meade & Roediger, 2002; Roediger, Meade, & Bergman, 2001).

The "harmful consequences" of collaboration on memory and other distributed cognitive processes have met resistance because they are counterintuitive, given lay and scholarly beliefs in the benefits of collaboration. This is probably the result of the mainstream emphasis on accuracy and efficiency. However, other social, cultural, and political goals such as the development of positive social relationships (Clark & Stephenson, 1989), arriving at a shared representation of the past (Coman, Manier, & Hirst, 2009; Cuc, Ozuru, Manier, & Hirst, 2006), or to establish group identity (Hirst & Manier, 2008; Wertsch, 2008) constitute substantial benefits of distributed cognitive processes in general, and collaborative memory in particular. Shared memories also facilitate communication of events, interpersonal relations, group histories, and government and social policy, as well as the characterization of groups and institutions (Weldon & Bellinger, 1997). Indeed, even the social contagion of memory may have an adaptive function. People with a bad memory can rely on others who can supply detailed accounts of events that have been collectively experienced, and thus update their memoires (Meade & Rodiger, 2002). As Rajaram and Pereira-Pasarin (2010) have pointed out, taken together, the advantages of collaborative memory systems may overcome their ill effects.

Given the pervasiveness of distributed cognition in our daily social lives (e.g., Levine, Resnick, & Higgins, 1993) it is surprising to note that relatively little social psychological research has explored its dynamics. Notably, a purely individual level of explanation fails to account for the often distributed nature of cognition, nor does it address the possible influence of the social contexts and purposes that often determine the processes and contents of our cognitive activity. Nevertheless, many cognitive processes are distributed, and to study and account for them seems crucial for a complete understanding of our social-cognitive processes.

CONCLUSION AND OPEN QUESTIONS

The main goal of the preceding five sections started with a specification of the level of analysis afforded by a socially situated approach to cognition. The dynamic nature of the phenomena under examination – namely, their emergent nature – supersedes individual cognition and action and is best captured with a macroscopic view because emergent phenomena control the parts that generate and constitute it and not vice versa.

The way cognition emerges from the interaction with the social and physical world is driven by unique features of the architecture of the human perceptual-motor system that is specifically designed for the reproduction of movements of conspecifics. This biologically driven advantage furnishes privileged knowledge about conspecifics and constitutes the basis for interaction, namely communication.

Another important assumption that is made throughout this chapter is that "cognition is for adaptive action". The implications of this assumption are unfolded in the subsequent sections. If cognition is for action, then concepts cannot be understood as abstracted, timeless, amodal representations. They have to be understood as the result of the interaction between an agent and the social and physical world. As such cognition can only be addressed by considering the contextual and situational influences that shape cognitive processes and behavior as well as the functional role of our mental representations, goals and feelings as guides for action.

A situated view of cognition holds that objects and persons retain in their representations the sensorimotor features of the actions that bond them with agents. This bonding is retained in the nature of concepts, and fundamental sensorimotor experiences are used to ground even abstract concepts, which do not have any "immediate" bodily experiential elements. The fact that sensorimotor bonding is necessary invites the integration of "body architecture" into how concepts have evolved, i.e., embodiment.

Finally, our interactions with the social and physical environment are not mere "direct" physical exchanges but largely mediated by "tools". Tools are culturally evolved artifacts that are designed for the specific and regular tasks that are faced in everyday realities. They (e.g., pocket calculators, hammers, languages) have very distinctive features in their design – they are adapted to both human propensities (body, brain) and the task at hand (putting a nail into a hard surface or communication). Moreover, a distinctive feature of our social environment is that we contribute to this environment and utilize it at the same time, since we are an integral part of a socially distributed network of knowledge that supersedes individual cognition. Thus, instead of using a single computer with massive processing power as the model for human cognition, the socially situated perspective invites thinking of cognition as a network of interconnected computers that have computational resources superseding the capacities and potential of a single computer. This metaphor captures the essence of socially situated cognition but needs biologically endowed bodies as its operational basis.

The socially situated cognition perspective is no more than a set of pre-paradigmatic assumptions in the Thomas Kuhnian sense. They represent the rumblings of dissatisfaction with the "standard representational" paradigm, but the current situation is no way near to having a fully interwoven, integrated, and mature theoretical framework to guide systematic research. Certain elements of situated cognition's pre-paradigmatic assumptions have captured the imagination and opened visions of research that would not have been possible prior to these developments. Chief amongst these is the work emerging under the broad but diffuse and ill-defined notion of embodiment. The number of demonstrations (Pillar 4) across a whole range of issues – from language and motor resonance to abstract concepts such as time, morality, and valence – is breathtaking. Nevertheless, the theoretical integration is loose and mostly local, with a somewhat global reference to metaphors. Other elements – such as the socially distributed cognition as action – require the introduction of novel research paradigms. For instance, Richardson's work on joint perception is one such innovative approach (e.g., Richardson, Hoover, & Ghane, 2008).

What stands out in the research streams evolving under the situated cognition perspective is the discrepancy between the individual foci that have captured attention (e.g., embodiment, cognition is for action, cognition is socially distributed) and the lack of integration between the different pillars, assumptions. For instance, embodiment research as a burgeoning field does not even pay lip service to the social aspect of concepts. The entire work in the embodiment field refers to individual reasoning, thinking, and representation. Obviously, concepts not only evolve to serve individual reasoning but also social communication. They are fundamental in grounding the basis for socially distributed cognition. Not surprisingly, communication constraints must play an important role in the evolution of concepts – abstract or concrete – since concepts are as much for communication as they are for intra-psychological processes. Thus, the cross-fertilization between the pre-paradigmatic assumptions is not necessarily current, but an integrated vision of human functioning requires an integrated conceptual framework rather than succumbing to the inspiration of one of the pillars at the expense of considering the informative constraints of the other pillars.

Most of the work developed by those who claim a socially situated nature of cognition has not yet been incorporated into mainstream social psychology and social cognition. Nevertheless, the central assumptions of situated cognition are crucial for the development of an informed and informative social cognition that is not merely a subdomain of social psychology, but a centerpiece of any psychology.

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