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Interfaces of social psychology with situated and embodied cognition

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Abstract

The recent rise of interest in situated and embodied cognition has a strong interdisciplinary flavor, with contributions from robotics, cognitive anthropology, cognitive psychology, and developmental psychology, among other disciplines. However, social psychology has been almost completely unrepresented. Social psychologists investigate the ways people perceive, interact with, and influence each other, and this field therefore offers an ideal standpoint for the investigation of many of the most central aspects and themes of the situated cognition approach—because the relevant 'situation' in which cognition takes place is, almost always, a *social* situation defined by an individual's group memberships, personal relationships, and social and communicative goals. This paper briefly reviews social psychological research and theory related to five major themes of situated and embodied cognition. The themes are: cognition is for action; cognition is situated (radically affected by situations, and makes use of situations as resources); artifacts and situations effectively extend cognitive processes out beyond the individual; cognition is embodied; and situated cognition affects and interacts with symbolically based thought.

The recent rise of interest in situated and embodied cognition has—as one of its most salient and attractive features—a strong interdisciplinary flavor. Contributors have come from backgrounds as diverse as robotics (Brooks, 1999), cognitive anthropology (Hutchins, 1995), cognitive psychology (Barsalou, 1999), and developmental psychology (Thelen & Smith, 1994). However, a major subdiscipline of psychology has been almost completely unrepresented: social psychology. Social psychologists investigate the ways people perceive, interact with, and influence each other, studying specific topics such as person perception, group prejudice and stereotyping, personal relationships, group processes, persuasion, and social influence. A recent and authoritative overview of the field is provided by Gilbert, Fiske and Lindzey (1998). Social psychologists generally work with laboratory experimental methods and theoretical constructs with close parallels to those in cognitive psychology. Although a few isolated voices have been heard within social psychology advocating the study of the situated nature of cognition (e.g., Schwarz, 2000; Smith & Semin, 2001), for the most part this represents a novel viewpoint in the

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context of a field that still largely accepts traditional notions of internal representation and computation.

Despite the minimal interaction between social psychology and situated cognition to date, our message in this paper is that the fields actually have a great deal in common. In fact, we believe that social psychology offers an ideal standpoint for the investigation of many of the most central aspects and themes of the situated cognition approach—because the relevant 'situation' in which cognition takes place is, almost always, a *social* situation defined by an individual's group memberships, personal relationships, and social and communicative goals.

In this paper, we briefly review social psychological research and theory related to several major themes of situated and embodied cognition. Our reviews will be illustrative rather than comprehensive, since our purpose is to demonstrate the richness of relevant work in social psychology to people interested in situated and embodied cognition who may not be aware of the contributions (current and potential) of our field. For the same reason, we will give an overview of research contributions by many different groups rather than focusing specifically on work in which we personally have been involved. This paper is not intended to survey all work on situated and embodied cognition, nor to summarize the major and ongoing contributions of disciplines other than social psychology. In limiting this paper's goal to the presentation of relevant work from social psychology, we have no intention of de-emphasizing the importance of other, complementary conceptual and methodological approaches, only of arguing that social psychology should become a part of the interdisciplinary mix around these issues.

The five themes we will address include major tenets of situated and embodied cognition. One theme is that cognition is for action; under this heading we review social psychological research that shows how cognitive processes and representations are effectively shaped by social goals and the requirements of action. Another theme is that cognition is situated (is radically affected by situations, and makes use of situations as resources); social psychological work has examined many ways in which, rather than being invariant and self-directed, psychological processes are specific to particular social situations and contexts (such as social relationships). Situated cognition holds that artifacts and situations participate in 'cognition', effectively extending cognitive processes out beyond the individual; similarly, social psychological research has emphasized how dyads and social groups extend the cognitive powers of the individual. The theme of embodiment is also important to the situated cognition movement; similarly, social psychology has documented how social thoughts and judgments are affected by bodily states, motivations, and actions. Finally, the relations between situated cognition and symbolically based thought have been an important topic; social psychological research has addressed this issue from the viewpoint of 'dual-process' theories.

1. Cognition is for action

The first, and perhaps most central theme of situated cognition is that cognition is for action; intelligence is shown not in detached thought but in adaptive behavior. Social psychology has often recognized this, and has developed a conceptual understanding of attitudes, person impressions, stereotypes, and other types of action-oriented representations. The insight that cognition is for action dates back to William James (1890) and has been quite prominent in recent years within social psychology (Fiske, 1992). Specifically, social psychological theory recognizes that social perception and judgment are embedded in a practical context of interaction, the perceiver's motives, and so on. Implications of this point are many. For one thing, the accuracy of social judgments (for example, judgments about another's personality) is not absolute, but is usually found to be 'good enough' (Fiske, 1992; Kenny & Albright, 1987) for practical purposes. Even well-documented biases in social perception, which have occasionally led to caricatures of social perceivers as almost doltish (e.g., Nisbett & Ross, 1980), can reasonably be viewed as socially functional. For example, the overweighting of negative information relative to positive information in person perception has pragmatic utility (Skowronski & Carlston, 1989; Peeters, 1991).

Another aspect of the pragmatic nature of social perception is that traits, stereotypes, and the other

constituents of impressions are used precisely because they have implications for action. Traits and other personality constructs (such as hostile, smart, or honest) serve as summaries of people's social goals, abilities, or typical behaviors, that are important to us as we interact with those people (Cantor & Kihlstrom, 1989; Mischel & Shoda, 1998). Similarly, social categories such as gender, age, and ethnicity are important in person perception because they are cues to many important social roles and behaviors (Eagly, 1987).

Finally, social psychologists have focused much research attention on the ways perceivers' social goals and motives, along with other pragmatic concerns, pervasively influence social perception. For example, in perceiving others our goals are not always to form the most accurate impressions, but often to form impressions that will let social interaction proceed smoothly and predictably (Snyder, 1993). At other times, accuracy goals become less important than pragmatic concerns related to processing efficiency, so we dispense with careful thought and arrive at conclusions based on quick-and-dirty heuristic methods that can lead to 'good enough' judgments with high efficiency (Gilbert, 1991; Chaiken & Trope, 1999).

1.1. Mental representations are for action

A related theme is that mental representations are also tuned and oriented toward adaptive action. Social psychologists have extensively studied one class of action-oriented representations: attitudes. Attitudes, or evaluations of persons, objects, or ideas, have been considered perhaps the most characteristically social psychological concept (Allport, 1954). A person's dislike for spinach, or affection for her children, or distrust of tax-cut proposals, has implications for her judgments and actions in the social world. These evaluations become part of the perceiver's mental representations of the attitude objects, along with other, more objective features. Thus, attitudes represent *relationships between the agent and the attitude object*, which have implications for the way the agent perceives the object and acts toward it, as well as for the way the person thinks about it and mentally represents it. The power and functional value of attitudes is attested by research showing that attitudes can be automatically activated—without the person's intent or even awareness—to color perceptions and influence judgments and behaviors toward the objects (Fazio, Sanbonmatsu, Powell & Kardes, 1986). Attitudes are a preeminent example of action-oriented representations, because they specify not just the nature of the object but how to behave toward it (e.g., whether to approach or avoid it).

Person impressions as well as attitudes are action-oriented representations. First, as already noted, traits, social categories, stereotypes, and other components of person impressions are important because they are useful guides to appropriate social action. We avoid others that we perceive as 'hostile', ask for advice from people who are categorized as 'smart', and so on. In addition, according to Carlston's (1994) Associated Systems Theory (AST), social behaviors are directly represented as part of our mental representations of other people. These representations include several different types of information that reflect contributions from four underlying representational systems: visual, verbal, affective, and action. For example, an impression may include images of the person's appearance (visual system), emotions felt toward the person (affective system), and traits believed to characterize the person (verbal system). Importantly, the impression also includes representations of the perceiver's own behaviors toward the person (action system), such as giving the person hugs or teasing him. Evidence of several types (reviewed in Carlston, 1994) supports the general postulates of the AST model as well as the specific proposition that impressions contain behavioral components. Thus, impressions are action-oriented representations.

Impressions of others are also regulated by the relationships we have with them and the ways we act toward them. Research supporting this point (e.g., Baldwin, 1992; Holmes, 2000; Fiske, Haslam & Fiske, 1991) suggests that relational interdependence and its action implications are integral to the way we represent people. For example, other people with whom one has the same type of relationship (as categorized by Fiske's model, (Fiske, 1991)) tend to be confused with each other. This pattern of confusions holds independent of the targets' personal characteristics, such as age, race, or personality traits

(Fiske & Haslam, 1996). These findings suggest that people mentally represent others in terms of the types of relationships that they have with those people, and therefore the types of actions that they perform toward each other, such as communal sharing, market-oriented bargaining, etc.

2. Socially situated nature of cognition

One of the enduring slogans of social psychology is the 'power of the situation' over human behavior. Social psychologists studying relationships, groups, and other aspects of larger social contexts are in an ideal position to diagnose the exact aspects of social situations that are significant for adaptive behavior. The notion of the 'power of the situation' captures, for example, our field's findings that social behaviors such as helping (Latane & Darley, 1968) and harming others (Milgram, 1974) are not driven by the individual's internal dispositions and desires so much as by detailed aspects of the social situation. More broadly, this notion stands in opposition to the assumption that automatic, inner cognitive/computation processes operate in rather invariant fashion, without much regard to the details of the immediate social situation. Of course, an analytic and empirical focus on the causal flow from the social environment to aspects of cognitive process and social behavior is not inconsistent with the idea that behavior itself in turn constrains and constructs ongoing interaction and therefore the emergence of future situations.

One striking example of the power of social situations over cognition can be found in recent research on the 'fundamental attribution error'. This is a label for the finding that people generally attribute behaviors to the inner characteristics or dispositions of the person who performed the behavior, rather than seeking the causes of behavior in the social situation (Ross, 1989; Gilbert, 1991). This error has in the past been explained as due to properties of automatic, invariant cognitive processes, such as the idea that 'behavior engulfs the field' or that the salience of an actor's movement against a relatively static situational background makes the actor automatically attract attention and hence inferred causal power (Heider, 1958). Recent research, however, decisively reveals that even the subtlest of situational cues can influence these supposedly fundamental and automatic cognitive processes (Norenzayan & Schwarz, 1999). The researchers asked experimental participants to read a newspaper report on a mass murder. The participants then had to give their causal explanations for the event on a questionnaire. For some participants, the first page of the research questionnaire had a letterhead reading 'Institute for Social Research' while for others it read 'Institute of Personality Research'. This subtle change influenced participant's causal explanations: they used more situational explanations and fewer dispositional ones in the former case, whereas the 'Personality' context resulted in more dispositional causes. Thus the 'fundamental attribution error', the tendency to overemphasize dispositional explanations for behavior, is not solely due to automatic and invariant inner cognitive processes, such as the greater salience of actors than of their surroundings. Instead, attributions are highly sensitive to participants' perceptions of what is epistemically relevant to their communicative partners (in this case, the researchers).

Diverse lines of research have provided generally similar findings, supporting the argument that social contexts fundamentally condition cognitive processes. Seemingly automatic cognitive processes and outcomes that actually turn out to be deeply affected by social contexts include self-esteem (e.g., Crocker, 1999), the self-concept (McGuire & McGuire, 1988; Tice, 1992), and social stereotypes (e.g., Schaller & Convey III, 1999). Numerous studies conducted within a communication framework show that the characteristics of the recipient of a message systematically influence the attitudes, beliefs and knowledge of a speaker who formulates a message (Krauss & Fussell, 1996; Semin, 2000). Even the operation of memory (seemingly the most internal of cognitive processes) is found to be flexible and responsive to the emergent qualities of different social situations (e.g., Dodd & Bradshaw, 1980). All of these studies show that situations and particularly social contexts, including the relationship of the individual to partners, communicators, audiences, or fellow group members, are among the most important regulators of cognition. Of course, the recent explosion of research on cultural psychology (including, notably, findings on the culture-specificity of the 'fundamen-

tal attribution error') also offers strong support for the same conclusion (Markus, Kitayama & Heiman, 1996).

2.1. The illusion of inner causes of behavior

As we just discussed, many aspects of behavior are actually structured by situations. At the same time, research on the fundamental attribution error has documented that observers generally explain behaviors by pointing to the actor's inner beliefs, goals, or personality traits (Ross, 1989). In fact, people do this when explaining not only other people's behaviors but also their own. We must do this because we lack direct introspective access to the mechanisms directing our behavior (Bem, 1967). As sense-making and narrative-constructing creatures, we construct rationales and explanations for many things that we observe—especially those, like our own behaviors, that are inescapably important to us. These explanations are based on a variety of observable cues, such as our inner thoughts and feelings and other people's reactions to us (Baumeister, 1998). Because our self-attributions are inferences from such cues (rather than being self-knowledge arising from direct introspection) they are extremely sensitive and responsive to immediate social situations. For example, if people are instructed to present themselves in a particular way (e.g., as extraverted or introverted) to an audience, their appraisals of their actual degree of extraversion or introversion change accordingly (Rhodewalt & Agustsdottir, 1986).

If our subjectively perceived inner characteristics (such as goals or desires) are often constructed online as post-hoc rationalizations for our actions, intriguing questions must be raised about our beliefs that our inner mental representations and characteristics—beliefs, goals, personality traits, values, and so on—actually direct and control our actions. Suppose that a person performs an action, then through self-perception processes infers corresponding inner characteristics such as traits, goals, or attitudes. In this case, the match between the inferred internal states and the overt behavior, which naturally seems like the strongest evidence that the behavior was generated by those states, actually may not demand that conclusion at all. Wegner and Wheatley (1999) have made this argument, demonstrating that people mistakenly infer that they willed specific behaviors under certain conditions—such as when the thought of the behavior enters conscious awareness a short time before the behavior is actually performed. In related research, Chartrand and Bargh (1999) and others have demonstrated that social behaviors can be triggered by subtle environmental stimuli—such as subtle presentations of words related to the behavior. For example, presentation of words like 'polite' in a seemingly unrelated context causes research participants to wait markedly longer before interrupting someone who goes on talking and talking at great length. In such cases, stimuli in the environment (the experimentally presented words) actually cause the behavior, but the stage is set for self-inference processes to operate and lead the person to conclude that he or she willed the behavior.

3. Groups extend the cognitive powers of the individual

One of the most conceptually significant claims of situated cognition is the idea that people rely on the environment to facilitate and structure cognition in fact, we often directly manage the environment to aid cognitive tasks. Examples include putting an empty milk bottle by the door so that we remember to get milk the next time we go out, or putting materials related to a current task on top of other materials on a desk, to focus our thinking on one task and avoid distraction from unrelated matters (Kirsh, 1995; Kirsh & Maglio, 1994). Thus the physical environment can actively participate in cognitive processes, by cueing, aiding, prioritizing, or otherwise structuring the processes. Social psychology contributes research evidence on how social groups can do the same things: participate in the construction of mental representations and the processing of information, in ways that go beyond what an isolated individual could do. Social psychologists have investigated this theme under a number of related terms including shared reality (Hardin & Higgins, 1996), socially shared cognition (Resnick, Levine & Teasley, 1991; Levine, Resnick & Higgins, 1993), and group cognition (Tindale & Kameda,

2000; Kerr, Niedermeier & Kaplan, 2000; Gigone & Hastie, 1997; see review by Thompson & Fine, 1999).

One of the tenets driving social psychology from its beginnings is the assumption that the central function of human interaction is the production of a socially shared reality (Asch, 1952; Festinger, 1950; Heider, 1958; Sherif, 1936). One of the earliest classics in experimental social psychology investigated how socially shared knowledge structures emerge and are maintained. Sherif (1936) used the autokinetic effect, the fact that people put in a dark room perceive a stationary light spot as moving, to illustrate the emergence of socially shared knowledge structures. When a group of participants are put in a completely darkened room and asked to describe the light moments aloud, then their respective illusory perceptions of movement quickly converge. Moreover, once a group frame of reference is established regarding the illusory movement then this 'norm' is maintained even when members of such a group join other groups with movement 'norms' that are different from the one in the individual's original group.

The common denominator of a number of research traditions that emerged in the 1950s is the importance of understanding how social reality is created, validated and maintained by means of comparison and communication processes between individuals and in groups. Moreover, the notion that cognition is shared and not limited to the individual, that communication processes allow shared representations to be constructed and cognitive effort to be distributed among individuals, has attracted much attention in social psychology (Zajonc & Adelmann, 1987).

Another line of research has addressed the distributed nature of cognition and how communication itself has to be treated as cognition at the service of providing ongoing solutions to tasks that exceed the capacities of any one individual. Caporeal (1997), working from an evolutionary perspective, believes that the demands of human survival led to the emergence of psychological tendencies adapted specifically to group life. Among these tendencies is the ability to distribute cognition within small (size around five) groups as they jointly focus attention on and communicate about aspects of an immediate task. Exemplifying this point, researchers have focused on specific types of tasks (e.g., navigation) that require the coordination and synchronization of knowledge that is divided among a number of specialists. The socially organized coordination of knowledge, which is public and accessible in communication, is a product that has different properties than individuals (e.g., Hutchins, 1995).

Transactive memory systems, in which memory is socially shared and indexed (Wegner, 1995), are another example of socially distributed processing. Research shows how communication processes and the knowledge that other people have stored knowledge can serve as resources to complement individual memory. The successful retrieval of an individual item from memory can be regarded as relying on other persons—as an external scaffold or external storage. Indeed, recent research has shown that group memory is often superior to individual memory (e.g., Clark & Stephenson, 1989; Hinsz, 1990). In all these cases, we can meaningfully speak of cognition as distributed, occurring not only within an individual mind but extended across other people or elements of the environment. Put another way, the cognitive powers of the mind are enhanced by social or environmental supports or scaffolds.

4. Cognition is embodied

Until the last decade or two, psychologists considered motivation and cognition to be entirely separate, even opposing systems. Motivation was analyzed using theoretical terms (e.g., psychodynamic models) completely distinct from those used to understand cognition (e.g., computational models). More recently, however, theorists have recognized the importance of the constraint of embodiment. Nervous systems have evolved for the control of bodies, because organisms must adapt their behavior to meet bodily requirements in a rapidly changing environment. With this recognition, psychological theory and research has increasingly focused on the interdependence between cognition and motivation, affect, and action. Thus, cognition is now broadly understood as part of an overall functional and motivational system.

Although human motivation is certainly not narrowly limited to the basic matters of seeking nutrition and avoiding predators, a number of theoretical approaches to 'self-regulation' make converging assumptions that fundamental motivational systems organized around approach and avoidance still underlie human self-regulation (e.g., Cacioppo, Gardner & Berntson, 1999; Higgins, 1997). For instance, research on the function of affect and attitudes as preparatory for action has systematically examined the interface between approach and avoidance motivation, affect, and primitive approach and avoidance behaviors (motor programs). Research shows that information linked to positive affect induces an approach motivation and increases the tendency to engage in approach related behaviors. In contrast, the processing of negative affective information activates avoidance motivation and an increase in the likelihood of withdrawing from an object. A substantial amount of the research work has shown that such affective-motor program links are immediate and automatic, 'impulsive' and not 'deliberate' (e.g., Neumann & Strack, 2000a,b) since the organism needs to select appropriate responses in an environment that changes rapidly. Although the terminology of embodiment and embodied cognition has to our knowledge not been used in social psychological work there is a substantial body of research that falls directly into this domain.

Another dimension of embodiment is the fact that motor plans (facial expressions and postures) influence subjective feelings (cf. Adelman & Zajonc, 1989) including evaluative or non-evaluative judgments. For instance, facial expressions influence judgments of how funny a cartoon is (Strack, Martin & Stepper, 1988). Holding a pen with your teeth creates a facial expression similar to smiling, whereas holding a pen loosely between pursed lips resembles frowning. Researchers find that these manipulations influence people's judgments of the funniness of cartoons—importantly, without the research participants' being aware of the links of the facial expressions to emotions. Similarly, non-affective feelings can also be influenced by expressions. The furrowing of a brow is likely to induce the feeling of mental effort (e.g., Larsen, Kasimatis & Frey, 1992). Similarly, isometric flexion (pulling) and extension of the upper arm (pushing) can have an impact on evaluative processes, whereby arm flexion towards the body is broadly interpreted as approach and away from the body as avoidance. Thus, the type of arm movement people make during the presentation of Chinese ideograms has been shown to influence their subsequent evaluation of those figures (Cacioppo, Priester & Berntson, 1993). By the same token, horizontal or vertical head movements (nodding or shaking) influence evaluations (Wells & Petty, 1980). Moreover, motor movements such as moving the head vertically or horizontally have also been shown to enhance recognition memory for positive and negative words, respectively (Foerster & Strack, 1996) and thus show the influence of bodily action on memory performance. More recently, Neumann and Strack (2000b) have demonstrated that participants were faster in classifying positive affective words than negative ones when pressing their palm upwards against the underside of a table (approach movement). In contrast, when they were pressing their palm down on the top of the table (activating the avoidance system), they were faster in classifying negative words than positive words. Moreover, the researchers found that the perception of movement towards or away from a person has a similar effect, facilitating how positive and negative affective information is processed.

A corollary of the embodiment of cognition is the ideomotor link. Interest in the 'ideomotor' or perception-behavior link has a long history in psychology, dating back to William James (1890). For example, researchers have demonstrated that witnessing aggressive behavior (e.g., in the media) can increase the likelihood of actual aggressive behaviors (Berkowitz, 1984). More recently, researchers have demonstrated the same principle with regard to other types of social behavior. Perceiving another person performing a behavior or having the concept of a behavior activated through priming methods leads to the actual performance of the behavior (Chartrand & Bargh, 1999; Bargh, Chen & Burrows, 1996). In other words, representations of behaviors are action-oriented in the sense that activating those representations—even in the course of perceiving another person or for similar extraneous reasons—tends to lead to the production of the behavior (Prinz, 1990).

We use our bodies in the process of perceiving behaviors.

5. Situated cognition and symbolic thought: dual-process models

In humans, situated cognition (based on implicit, action-oriented representations) coexists with a more explicit, symbolic style of processing. Social psychologists have studied these two systems under the banner of 'dual process models' contrasting heuristic and automatic versus systematic and more thoughtful processing (see Smith & DeCoster, 2000; Chaiken & Trope, 1999). These models hold that much of our thought and action, especially in routine, everyday situations, is generated by implicit and relatively automatic processes (Wegner & Bargh, 1998) that are strikingly akin to those of the other higher mammals and especially primates. On the other hand, especially in situations involving uncertainty, motivational conflict, or multiple difficult-to-discriminate alternatives for action, people can draw on a more symbolically based style of thought in which they devote conscious and effortful consideration to their plans and actions. In this mode, we use language and symbolic structures effectively as tools.

Support for this notion of dual types of processing comes from an incredibly wide range of studies in many topical domains within social and cognitive psychology. As summarized by Smith and DeCoster (2000), people can use these two basic types of processing in such areas as problem solving (Sloman, 1996), analyzing persuasive messages (Chaiken, Liberman & Eagly, 1989), perceiving persons (Brewer & Harasty, 1996), and generating behavior from attitudes (Fazio, 1986). With this widespread empirical support and the emergence of largely compatible dual-process theories in diverse domains (see Smith & DeCoster, 2000), this general picture seems to be well accepted within social psychology (although not universally so; Kruglanski, Thompson & Spiegel, 1999). Beyond social psychology, other evidence comes from cognitive psychology. Sloman (1996) argues that a key indicator of the dual processing systems is the experience of seeing two incompatible answers to a problem, each with its own subjectively compelling 'pull'. An example is an optical illusion, where one can simultaneously 'know' that two lines are the same length yet 'see' that one line is obviously longer than the other. Another example is problems illustrating the so-called conjunction fallacy, such as the 'Linda' problem. 'Linda' is described to participants in a way that makes her seem liberal and socially concerned, and they are then asked whether it is more likely that (a) Linda is a bank teller or (b) Linda is a bank teller and a feminist. Many participants give the logically incorrect (b) response. Sloman (1996) argues that this response reflects the operation of a more automatic, heuristic processing system that relies on the association between Linda's attributes and being a feminist. Most participants also, however, can recognize the logical necessity that response (a) must be correct because (a) includes (b) as a subset.

Other compelling evidence for dual processing systems comes from studies of arithmetic skills. Dehaene (1997) and Dehaene, Spelke, Pinel, Stanescu and Tsivkin (1999) summarize evidence from laboratory studies in adults, infants, and animals, as well as lesion and brain-imaging studies that demonstrate two separate systems underlying our numerical abilities. One system deals with approximations and with relative quantities as well as with a few absolute numbers (1, 2, 3). This system is shared with infants and nonhumans, and is spared in patients with language impairments. Imaging studies suggest that this system is mediated by brain regions also implicated in visuo-spatial tasks. Another system deals with exact arithmetic relations, is absent in nonverbal creatures, and is damaged by brain lesions that interfere with language abilities. Imaging studies suggest that this system is mediated by regions close to the language centers in the brain. This array of converging evidence from cognitive, neuropsychological, and brain-imaging studies strongly suggests that two separate although interacting systems, analogous to the automatic/associative and verbal/symbolic systems of the social psychological dual-process models (Smith & DeCoster, 2000) also underlie human numerical competence. Full *understanding* of arithmetics depends on the interaction and cooperation of both systems: the ability to calculate exact answers to problems *and* the biologically more basic ability to grasp intuitively, for

example, that 90 is larger than 40. We are reluctant to attribute true knowledge of arithmetic to a pocket calculator, though it can do exact calculations much better than we can, precisely because it lacks a linkage between the explicit symbols and the more intuitive number sense.

These dual-process models have clear implications for situated cognition. The more implicit, automatic behavior-generation system, the one that is continuous with that of our evolutionary ancestors, is well characterized by the postulates of situated cognition as they have been explored to date. For example, this system relies on mental representations and behavioral tendencies activated and elicited by environmental cues (Gollwitzer, 1999). These representations and behaviors are shaped through learning in the same or similar concrete situations in the past.

In contrast, the verbal/symbolic system, at least on the surface, seems to operate much more like the traditional non-situated, representation-centric or information-processing view of cognition. Humans evidently do at least sometimes construct abstract, explicit inner descriptions, and use them to think about objects or situations that are long ago, far away, counterfactual, or otherwise far removed from the immediate world of situated action. Does it therefore make sense to say that verbal/symbolic thought, when it occurs, is not subject to the constraints of situativity or embodiment and in fact reflects the traditional picture of cognition as detached, abstract information processing?

Our answer is no. While humans' abilities to conceptualize and reason symbolically give us important powers, they do not allow complete escape from the constraints of the social situation and the body. Here are several ways in which situated and embodied cognition affect even abstract, symbolically mediated thought, as investigated by social psychology:

(a) Our verbal thought and overt communications are often shaped and tuned by our audiences, social relationships, or communicative partners (Semin, 2000).
(b) Symbolic thought makes use of concepts that are shaped not only by intrinsic or epistemic needs, but also by the constraints of interpersonal communication (Yamauchi & Markman, 2000).
(c) Even thought or communication about abstract ideas such as justice, knowledge, or love generally relies on bodily metaphors, as documented by Lakoff and Johnston (1999).
(d) Verbal, symbolic thought allows us to think about abstract properties of objects (such as ownership or value) that are seemingly far removed from the perceptual-motor properties that drive situated thought. Yet even these abstract properties are significant to us precisely because of their action relevance: for example, ownership and value sharply constrain what we can do with an object.
(e) Finally and perhaps most important, even verbal/symbolic thought is motivationally driven and goal-oriented (Higgins, 1997; Kruglanski, 1996). Social psychological research on dual-process models clearly establishes that this mode of thought is effortful and therefore optional—not engaged in constantly, but only when situationally elicited goals demand it. Thus the very occurrence of symbolic reasoning, as well as (to some measure) the directions it takes, are subservient to motivational constraints and hence to the demands of situations and embodiment.

Thus, although it cannot be claimed simply that 'all cognition is situated', the constraints of situated action and embodiment actually reach deeply even into the realm of abstract, symbolic cognition—the one of our two processing modes that might be thought to most closely resemble the traditional picture of cognition as abstract, disembodied information processing.

6. Conclusion

Our hope is that this brief article has demonstrated that many key research areas relevant to situated and embodied cognition are associated with rich existing bodies of research and theory in social psychology. In general, the social psychological research supports the themes and claims of situated cognition, although almost none of the research reviewed here was originally generated from that particular viewpoint. The situated cognition viewpoint helps organize that research into a coherent whole, however, by showing

how different areas, such as the idea that cognition is for action and the idea that cognition is distributed across other people and the environment, relate to each other. Situated cognition also potentially puts social psychology into the context of other areas of the cognitive sciences and points out important conceptual continuities with areas of cognitive psychology, developmental psychology, linguistics, etc., where the core ideas of situated and embodied cognition have been developed and refined to date. For this reason, we hope that this paper will help researchers in these adjoining areas of the cognitive sciences understand why the field of social psychology is important, even central to the analysis of the situated nature of human behavior. We believe that the most important aspects of the 'situation' that is so conceptually central in the situated cognition perspective are *social*—people live their lives in the context of personal relationships, group memberships, and socially defined roles, obligations, and motives. The term 'socially situated cognition' (Smith & Semin, 2001) might be appropriate for emphasizing the immense areas of potential conceptual overlap between social psychology and situated cognition.

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