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The social life of cognition

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ABSTRACT

We begin by illustrating that long before the cognitive revolution, social psychology focused on topics pertaining to what is now known as social cognition: people's subjective interpretations of social situations and the concepts and cognitive processes underlying these interpretations. We then examine two questions: whether social cognition entails characteristic concepts and cognitive processes, and how social processes might themselves shape and constrain cognition. We suggest that social cognition relies heavily on generic cognition but also on unique concepts (e.g., agent, intentionality) and unique processes (e.g., projection, imitation, joint attention). We further suggest that social processes play a prominent role in the development and unfolding of several generic cognitive processes, including learning, attention, and memory. Finally, we comment on the prospects of a recently developing approach to the study of social cognition (social neuroscience) and two potential future directions (computational social cognition and social–cognitive robotics).

1. Introduction

Human beings navigate the world by perceiving, attending to, and remembering incoming information within a framework of concepts such as "number" and "cause." While these general abilities form the bedrock of any theory of cognition, social life presents cognitive scientists with a unique set of questions. How is smooth interaction between individuals with diverse goals and interests even possible? What is the basis of the shared understanding that allows individuals in human societies to participate in social life, and how do they reach this understanding?

Sociology has sought answers to these and similar questions by exploring collective social structures; it has not, however, focused on how those structures take hold in individual minds (Rouse, 2007; Turner, 1994). In contrast, over nearly its entire history, social psychology has explored these and similar questions by focusing on cognitive phenomena, examining people's ability to perceive, attend to, and remember incoming *social* information. We briefly illustrate this history of social psychology and then examine its interplay with general cognition: whether *social* cognition entails unique concepts and processes that go beyond general cognition; and how social processes might themselves shape and constrain cognitive processes. Finally, we look toward the future, examining how social neuroscience, computational modeling, and cognitive robotics can further illuminate the social and cognitive nature of interactions between individual minds.

2. When and why cognition came to dominate social psychology

From its inception, social psychology resisted behaviorism (Jones, 1985; Ross & Nisbett, 1991). Some well-researched phenomena in the early 20th century, such as crowd behavior, social facilitation, and imitation were originally thought to involve rather minimal cognitive processes ("associationistic," as Berkowitz & Devine, 1995, call them), but, as early as 1908, McDougall (1908)

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accounted for these classic social phenomena by relying on judgments over and above instincts and emotions. Social psychologists rarely took the objectivist view of stimulus–response mechanisms but focused on what the stimulus *means to* the individual (Cantril, 1947; Heider, 1944) and how these subjective interpretations critically guide social behavior (Asch, 1952).

In the 1930s, the content matter of social psychology was at first largely focused on attitudes (Thurstone & Chave, 1929). Lewin (1936) then proposed a theory in which social perceivers represent themselves and their surroundings within a subjective psychological space. Lewin's thinking strongly influenced the next generation of social psychological research. Festinger (1954) proposed a *theory of social comparison* that described the cognitive processes by which people assess their own performance when physical reality does not offer enough information: people compare themselves to members of their group. With such comparison comes the possibility for tension and disagreement, which needs to be resolved either through changes within the individual, the group, or their relationship. This theory initiated work on group dynamics (e.g., how deviants are treated within a group) but, more influentially, set the stage for the most cognitive theory of its time: Festinger's (1957) *theory of cognitive dissonance*. Building on Heider's (1946) theorizing about cognitive inconsistency, Festinger examined the tension of disagreement and its possible resolution, but now this disagreement resided entirely inside the individual's mind. Clever experiments induced inconsistent cognitive states in research participants, and measurable changes in social behavior followed suit, explained by specific inconsistency-resolving cognitive processes. Other influential scholars revealed not just processes but the fundamental concepts and assumptions people bring to social interaction (Heider, 1958). Together, such analyses of processes and concepts defined social psychology as "cognitive" at least a decade before the cognitive revolution transformed other areas of psychology (for a nuanced review, see Hilton, 2012).

3. Finding the social in social cognition

But if social behavior fundamentally relies on *cognition*, what makes social cognition distinctively *social*? Fiske (1995), among others, proposed that the faculty of social cognition can be defined as "thinking about people." Rather than targeting math problems, paintings, or moving billiard balls, social cognition takes *persons* as its object. On this reading, social cognition is a subfield of cognitive psychology characterized mainly by the different contents of representations over which general cognitive processes operate.

But persons are more distinctive objects of cognition than the above account suggests. Several unique properties emerge when persons interact with each other in dyads and groups—properties that a social perceiver must fully take into account.

First, the social perceiver must recognize that what guides another person's behavior is a complex interplay of facts about the world and unobservable mental states that subjectively represent those facts (e.g., perceptions, beliefs, intentions); and the social perceiver must infer and track such mental states. Second, because these mental states dynamically change as the world changes, the social perceiver must constantly update her inferences about another's mental states and adjust her own behaviors accordingly. Third, social interaction between two or more such mutually perceiving people is deeply reflexive: The social perceiver must infer not only the other's mental states but also the other's inferences about the perceiver's own mental states (Hastorf, Schneider, & Polefka, 1970). And each time the perceiver adjusts her own behavior in light of these inferences about the other person's mental states, the other's behavior and mental states change in turn. This constant and reflexive updating of mental states presents a significant computational challenge, and people's ability to conduct such rich and dynamic social interactions is one of the greatest achievements of human cognition.

How do humans meet this challenge? For one thing, they are keenly sensitive to a vast and fast-moving stream of information—including the interaction partner's facial expressions, gestures, contact with objects, tone of voice, choice of words, and so on (Malle, 2005). For another, they organize this information into a set of concepts that are distinctly social in nature (often called *theory of mind*; Premack & Woodruff, 1978; Wellman, 1990). A prime function of these concepts is to bundle and classify certain incoming stimuli into basic categories that then guide further processing (Harnad, 2005).

For example, from the first year of life, humans classify self-propelled objects into the category *agent* (Premack, 1990); they see certain coordinated movements as goal-directed (Woodward, 1998); they track eye and head movements to predict the aimed-at goal (Phillips, Baron-Cohen, & Rutter, 1998); and they learn to distinguish intentional from unintentional behaviors (Carpenter, Akhtar, & Tomasello, 1998). Intentional actions, in turn, guide the search for characteristic mental states that underlie those actions, such as beliefs, desires, and intentions (Malle, 1999; Perner, 1991).

Thus, the concepts of a *theory of mind* provide a unique causal-explanatory framework for the interpretation of observable behavior in terms of mental states. Within this framework, numerous processes provide characteristic input information (e.g., face recognition, gaze following, goal detection) and additional processes allow the perceiver to reason over this information (e.g., inference of specific emotions, prediction of next action). Some of these processes may be domain-specific (with a "dedicated" sensitivity to particular social information) but fundamentally they are still perception, categorization, and inference; likewise, the reasoning processes that operate on those inputs arguably fall into familiar classes of cognition, with only their contents being distinct.

However, some social–cognitive processes are candidates for uniqueness in that they are not merely generic cognitive operations with selective content; rather, they process and transform information about persons and only persons. For example, humans "project" onto others their own ongoing states, perceptions, preferences, and even attitudes and beliefs. Whereas some authors have shown

conditions under which this tendency can be a cognitive distortion (Ross, Greene, & House, 1977; Van Boven & Loewenstein, 2003), others have highlighted its predictive and social benefits (Dawes & Mulford, 1996; Krueger, 2013). The underlying cognitive mechanism of such self-based prediction is likely a form of simulation, in which perceivers use their own state as default input into a predictive model of another person's experiences or behaviors (Goldman, 2006; Gordon, 1986). However, self-based simulation has no application in the nonsocial world. Only because humans have access to their own minds can they use the accessed information as an off-line model of what might be going on in other people's minds. Fundamentally, social simulation may be characterized as a form of "imagination"—but whether simulation arose as a social version of imagination or imagination arose as a generalization of social simulation is an intriguing open question.

Other candidates for uniquely social–cognitive mechanisms include:

- *imitation*—when people observe another person's actions and translate these percepts into own actions (Brass & Heyes, 2005);
- *automatic empathy*—when people imitate another person's behavioral expression of emotion, which triggers a parallel emotion in themselves (Hatfield, Cacioppo, & Rapson, 1994);
- *joint attention*—when two people attend to the same object and each recognizes that the other recognizes that both of them are attending to the same object (Eilan, Hoerl, McCormack, & Roessler, 2005).

Even though these phenomena all involve basic mechanisms of attention, perception, and memory, they have unique triggering conditions, representational content, and—most important—properties not entailed by their generic origins.

4. The impact of sociality on cognition

So far we have illustrated the prominent and rich role that cognition plays in social processes. But social processes also play a prominent role in the development and unfolding of many general cognitive processes. Human societies demand a unique blend of cooperation and competition (Wilson, 2012), and interactive communication is a powerful tool by which individuals represent others' perspectives and thereby more easily cooperate or compete with others as the need arises. Interactive communication is such a pervasive part of human social life that it also influences the development and form of more general cognitive capacities (Freyd, 1983).

Language acquisition offers a clear example of how interactive communication can influence cognitive development. The rate at which children learn the meaning and grammar of their native language depends on how often people engage the child in communicative activities and what kind of language those people model for the child (Hoff, 2006). For example, older siblings provide later-born children with more opportunities to communicate, and these communications often convey their conflicting perspectives and interests (Foote & Holmes-Lonergan, 2003). As a result, when compared to first-borns at the same age, later-born children show greater conversational skills and use personal pronouns to refer to persons (including themselves) earlier and more often (Oshima-Takane, Goodz, & Derevensky, 1996). Pronoun use correlates with more frequent references to mental states (Markova & Smolík, 2014), and, fittingly, children with siblings also show advanced theory of mind performance (McAlister & Peterson, 2013). Thus, communicative relationships may afford children the opportunity to acquire both language skills and social–cognitive skills, and the latter two may be mutually reinforcing (Milligan, Astington, & Dack, 2007).

Beyond its role in language acquisition, interactive communication shapes how people conceptualize their interactions with the physical world. For example, when people coordinate on what to call task-related objects and actions, they converge on how they conceptualize those objects and actions (Garrod & Anderson, 1987; Markman & Makin, 1998). Such coordinated conceptualization spreads through a group as its group members work together (Garrod & Doherty, 1994). This process of cognitive coordination through communication may explain how membership in a particular linguistic community influences one's mental representation of time, motion, spatial relations, musical pitch, and color (respectively, Boroditsky, Fuhrman, & McCormick, 2011; Choi, 1999; Choi & Bowerman, 1991; Dolscheid, Shayan, Majid, & Casasanto, 2013; Thierry, Athanasopoulos, Wiggett, Dering, & Kuipers, 2009).

Interactive communication also shapes people's attention, learning, and memory. For example, Voiklis and Corter (2012) compared how communicating dyads and individual learners performed in learning complex object categories. While aligning their perspectives on objects through conversation, dyads distributed selective attention to a larger number of object features and showed both faster and more accurate category learning. Without the benefit of interactive communication, individual learners performed poorly on these measures. In the domain of memory, research shows that people are more likely to retain information if they discuss it with others (Coman, Manier, & Hirst, 2009); they better understand and retain information that they receive through direct communication rather than by overhearing it (Schober & Clark, 1989); and when they tailor a message to an audience's expectation, they later recall the message to be true (Hausmann, Levine, & Higgins, 2008).

In sum, interactive communication influences both specialized cognitive processes such as language acquisition and general cognitive processes such as categorization, attention, learning, and memory. At the same time, communication relies heavily on these very cognitive processes and is thus itself a striking example of the interdependence of the social and the cognitive.

5. Future directions: from social neuroscience to social cognitive robotics

Over the last two decades, the application of cognitive neuroscience methods to fundamental questions of social cognition has generated considerable excitement (Decety

& Cacioppo, 2011; Lieberman, 2007). Initially, research in this area focused on localizing more coarsely defined constructs such as "theory of mind" in a circumscribed set of brain regions (Fletcher et al., 1995), followed by attempts to localize more specific constructs such as "belief inferences" (Saxe & Powell, 2006). These results have identified brain regions selective for inferences about social versus physical phenomena (Mitchell, 2006) and have demonstrated that reasoning about mental states is distinct from mere reasoning about *people* (Saxe & Kanwisher, 2003). While this approach certainly supports the broad idea that social–cognitive processes are in some sense domain-specific, it has not yet delivered on the promise (Decety & Cacioppo, 2011; Lieberman, 2005) of illuminating the precise mechanisms by which these processes work. This is partly because any given brain area is typically associated with several distinct experimental tasks (Anderson, Kinnison, & Pessoa, 2013), and any given experimental task typically activates several brain areas (Schurz, Radua, Aichhorn, Richlan, & Perner, 2014). More important, we currently know little about the computational mechanisms that underlie activation in specific brain areas; and rather surprisingly, we know little about the information processing that is triggered by standard social–cognitive tasks. A capacity like social cognition or theory of mind consists of a whole suite of distinct concepts and processes, as we argued earlier, and it is often entirely unclear whether a given task—such as verbal inferences from stories, photos, or videos—*validly* measures the participant's reliance on certain concepts and/or certain processes.

One way to invite rigorous consideration of mechanism at the neural level of analysis is to first attempt more fine-grained theorizing at the cognitive level of analysis. Just as phenomena like memory have been broken down into their temporal and processing components, so too should phenomena like theory of mind be analyzed into relevant components (Malle, 2008; Spunt & Adolphs, 2014). Such an analysis would identify distinct concepts (e.g., intentionality, belief, emotion) and distinct processes (e.g., inference, simulation, imitation) and would articulate the interactions between particular concepts (such as *goal*) and particular processes (e.g., parsing of human motion; drawing goal inferences from that motion). Knowing more about the interaction of concepts and processes would also help explain a variety of intriguing phenomena, such as why children acquire some social–cognitive concepts (intentionality and goal) earlier than other concepts (belief and personality) and why adults make faster inferences over the early-developing concepts than the later-developing ones (Malle & Holbrook, 2012).

The analytic approach to cognitive concepts, processes, and valid measurements may be enhanced by designing computational models of social–cognitive capacities. Whereas such modeling has become prominent in the domains of vision, reasoning, learning, and language processing, the social–cognitive domain has lagged behind. Computational modeling of social cognition would yield several benefits. When researchers develop models of, say, intentionality inferences or joint attention, they must be precise in describing and explaining the relevant social–cognitive concepts and processes and must make their theoretical commitments explicit. For example, while social psychologists often argue that people infer others' mental states both inaccurately and too infrequently, computational models would have to specify the conditions under which people make such inferences and how accurate they are likely to be. With sufficiently broad scope, such models can generate novel predictions both about cognitive function and its underlying neural process.

Finally, computational models can be implemented in robots—embodied machines that are able to interact with humans. Designing such robots offers appealing new avenues for research, not only to test computational models of social–cognitive capacities *in vivo* (e.g., the robot's ability to make intentionality inferences from live behavior) but to examine conditions under which humans ascribe features such as intentionality, free will, or blame to another agent (Monroe, Dillon, & Malle, 2014). By experimentally controlling the robot's real and apparent capacities, researchers may be able to identify the precise conditions that activate human social concepts and processes (e.g., Meltzoff, Brooks, Shon, & Rao, 2010) and perhaps even reproduce some of the familiar effects of interactive communication on cognition. The high level of control afforded by an artificial agent can provide a deeper understanding of the reciprocal influence that makes any interaction between human agents truly social. The more precisely we specify the informational inputs to an interaction and the cognitive processes prompted within each individual, the better we can capture what causes and constitutes such fundamentally social activities as joint attention, cooperation, and negotiation. Exactly what features, for example, must a human or robotic interaction partner display so that the other person is in the particular state (at the neural, cognitive, and computational level) that corresponds to "sharing an experience" (Higgins & Pittman, 2008)? The integration of experimental social psychology, neuroscience, computational modeling, and cognitive robotics could allow social psychologists and cognitive scientists to go beyond predicting patterns of individual cognition and action and account for the emergence of phenomena at the core of social life: collective, mutually dependent actions of dyads and groups.

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