Rev.Phil.Psych.
DOI 10.1007/s13164-011-0073-0

Editorial: Social Cognition: Mindreading and Alternatives

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Human beings, even very young infants, and members of several other species, exhibit remarkable capacities for attending to and engaging with others. These basic capacities have been the subject of intense research in developmental psychology, cognitive psychology, comparative psychology, neuroscience, and philosophy of mind over the last several decades. Appropriately characterizing the exact level and nature of these abilities and what lies at their basis continues to prove a tricky business.

The contributions to this special issue investigate whether and to what extent the exercise of such capacities count as, or are best explained by, a genuine *understanding* of minds, where such understanding depends on the creatures in question possessing capacities for attributing a range of mental states and their contents in systematic ways. The question that takes center stage is: Do the capacities for attending to and engaging with others in question involve *mindreading* or is this achieved by other means?

In this editorial we will review the state of the debate between mindreading and alternative accounts of social cognition. The issue is organized as follows: the first two papers review the experimental literature on mindreading in primates

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Published online: 11 September 2011

(Bermúdez) and children (Low & Wang), and the kinds of arguments made for mindreading and alternative accounts of social cognition. The next set of papers (Hedger & Fabricius, Lurz & Krachun, Zawidzki, and de Bruin et al.) further critique the existing experimental data and defend various mindreading and non-mindreading accounts. The final set of papers address further issues raised by phenomenological (Jacob, Zahavi), enactive (Michael), and embodied (Spaulding) accounts of social cognition.

1 Mindreading

What does mindreading (also referred to as "mentalizing," "theory of mind" and "folk psychology;" Davies and Stone 1995; Goldman 2006; Nichols and Stich 2003) *minimally* require? The standard view is that an agent X engages in mindreading only if:

1. X conceptually represents mental states (e.g., beliefs, desires and perceptions).
2. X represents mental states with their intentional (with a "t") content, i.e., that which they are "about" or "directed toward." Mental contents are typically assumed to be propositions specifiable by "that" clauses—for example, someone might believe that "the food is located under the bucket."
3. X understands, by some means, the relations between an agent's mental states, their environmental conditions, and their behavior. This understanding enables X to make predictions about others' behaviors and to explain those behaviors.

When these three conditions are met to the greatest extent, we may say the attributor possesses the capacity for *full-blown mindreading*: i.e., the attributor possesses the full range of mental state concepts—including, in particular, the propositional attitudes such as belief—and can represent all relevant types of mental state contents and relations between mental states, environmental conditions, and behavior.[1] More *minimal* forms of mindreading would be characterized by conditions (1)–(3) being weakened in various ways. For example, an infant or animal might qualify as engaging in mindreading even if it turns out that they are using different and/or fewer mental state concepts than adult humans use, or if they fail to represent all the relevant mental contents (e.g., being sensitive to the way in which subjects conceive of objects—see section 3.1 below). Nevertheless, for an act to count as mindreading conditions (1)–(3) must be met in some form or other. Note that this characterization of mindreading abstracts from the debate between theory theory and simulation theory about the psychological processes by which the relations between mental states are understood and used in prediction and explanation of behavior (see, e.g., Davies and Stone 1995).

[1] To be a full-blown mindreader does not entail there are no biases or other performance limits on the *use* of such mindreading capacities. For a recent summary of research on adult mindreading capacities, see Apperly (2011, ch. 5).

2 Puzzles About Development

Normal adult humans are capable of full-blown mindreading. The standard developmental story is that children become increasingly sophisticated in their mindreading over the first several years of life. Much of the initial research on children's mindreading abilities used verbal tasks focusing on children's understanding of beliefs, particularly, the fact that beliefs can *falsely* represent the world. The ability to appreciate false beliefs has been widely regarded to express itself around 4 years of age (Wellman et al. 2001), when children are able to reliably pass verbally based, first-order false belief tasks (e.g., Wimmer and Perner 1983; Baron-Cohen et al. 1985). Prior to this milestone children can pass experimental tasks testing understanding of goals, desires, intentions, perceptions, emotions, knowledge and ignorance—roughly in this order (for a recent review, see Wellman 2010). What accounts for this developmental trajectory has been subject to debate among developmentalists. Many argue that it is due to the gradual acquisition of the various mentalistic concepts, with concepts of knowledge and belief developing later in childhood (e.g., Wellman 2010). Those of a more nativist bent believe these mentalistic concepts mature much earlier, but that this conceptual understanding of mental states such as belief suffers from performance limitations early in childhood, for example, because of executive functioning limitations (e.g., Leslie 2005). It is fair to say, however, that the status quo in the literature until recently has been that belief understanding is exhibited around age 4 when children pass standard verbal false belief tasks.

In addition to the traditional, *elicited-response*, verbal tasks, mindreading capacities have in recent years been studied using *spontaneous-response*, nonverbal tasks, including "violation of expectation" studies measuring looking time (e.g., Woodward 1998) and tasks requiring more active, interactive responses (e.g., Meltzoff 1995).[2] Spontaneous-response nonverbal tasks have been used to suggest infants understand goals and dispositions (e.g., Csibra 2008; Luo and Baillargeon 2005; Woodward 1998) and perception (e.g., Luo and Baillargeon 2007; Luo and Johnson 2009). Advocates of the traditional, conceptual-change view see these results as posing no particular challenge. What has been treated with much greater skepticism is research from the last several years on false belief understanding in infants, since such results call into question the status quo about mindreading development. A range of experiments using violation of expectation (e.g., Onishi and Baillargeon 2005) and anticipatory looking (e.g., Southgate et al. 2007) paradigms show that even infants in their first year of life (Kovács et al. 2010; Luo in press; Surian et al. 2007) can pass language-free versions of false belief tasks. These nonverbal tasks have been supplemented with what Baillargeon et al. (2010) call *indirect-elicited-response* tasks (Buttelmann et al. 2009; Southgate et al. 2010) that involve language but in the context of social interaction, without explicitly asking participants to predict or explain another's behavior as in elicited-response tasks. For a more comprehensive review of this recent infant literature on belief understanding, see Low and Wang (this issue). Mentalistic interpretations of this data assert that "Young children can track the content of others' epistemic states, and take

[2] For the terminology of elicited- and spontaneous-response tasks, see Baillargeon et al. (2010).

into account their false belief when predicting their actions" (Southgate et al. 2010, p. 907; see also, e.g., Baillargeon et al. 2010; Buttelmann et al. 2009, pp. 341–342; Fletcher & Carruthers in press; Herschbach 2008a; Southgate et al. 2007, p. 591).

At the very least, authors of the studies on infant false belief understanding propose that infants represent others as having mental representations with propositional content. Like Premack and Woodruff (1978), the work of many developmental and comparative psychologists has been primarily preoccupied with the question of whether infants attribute unobservable mental states to others at all. While infants have been shown to explain and predict others' behavior in terms of what appear to be folk-psychological concepts like "goal" and "desire," a number of researchers have explained this understanding without recourse to mental states. For example, Gergely and Csibra (2003) argue that infants in the first year of life understand goals non-mentalistically, as the future environmental states toward which agents' actions are directed. Thus, the search has been on for evidence that infants are representing others' mental representations in order to predict their behavior, by focusing on mental states like belief without an understanding of which it would be difficult to make a behavioral prediction. For many philosophers, the important question has become to what extent the mentalizing abilities of infants (if they indeed have them) might compare with full-blown adult mindreading.

Prima facie, to accept that infants are capable of taking stock of the beliefs of others and keeping track of believed contents appears to rule out holding that mastery of language is necessary for having and ascribing beliefs with propositional content, as a number of scholars have argued (Bermúdez 2003, 2009, this issue; Davidson 1984; De Villiers 2005; Hutto 2008). Certainly, if mentalistic interpretations are the best way to accommodate the psychological evidence, then there are cases of nonverbal mindreading. But if it is found that there is a more plausible alternative to a mentalistic account of the infant false-belief data, then the hypothesis that language is necessary for mindreading is not challenged. There may, however, also be other ways in which language can play a role in mindreading development even if we accept that infants are indeed solving these tasks by appealing to unobservable mental states (see section 3 below).

Understanding the data in a mentalistic way, the age of possessing the essentials of belief understanding is pushed down from later childhood to the first year of life. Although this apparently conflicts with the fact that children fail elicited-response false belief tasks until at least age four, the possibility that such capacities might be in place early on, perhaps innately, is logically consistent with the fact that younger infants might only bring their competence to bear in quite restricted ways. Thus, according to defenders of this view, these limits on infant mindreading performances can be explained by other mitigating factors involving executive control, as discussed above. Only once these factors are no longer an issue does the child's mindreading competence become evident.

One of the important challenges is to explain why, if infants indeed possess the ability to mindread about propositional attitudes such as belief in the first year of life, older children continue to exhibit substantial limitations in their ability to express this understanding. For example, Hedger and Fabricius (this issue) provide a comprehensive analysis of children's performances on false *and true* belief tasks. These authors highlight evidence that 4- and 5-year-olds err, systematically and

profoundly, on standard true belief tasks. Combining these findings with an analysis of false belief performance, we might gain a fuller picture of children's abilities—one that suggests that only about 35% of 5-year-olds seem to genuinely understand belief (Fabricius and Khalil 2003; Fabricius et al. 2010). On these grounds, Hedger and Fabricius conclude that children do not acquire an understanding of belief until after 6 years of age. This work on true belief tasks complements other evidence on the limitations of older children's understanding of belief and its relations to other mental states. Research shows that "5- and 6-year-old children (who are old enough to pass false-belief tasks) still have problems understanding how beliefs are acquired (Carpendale and Chandler 1996; Robinson and Apperly 2001), how beliefs interact with desires (Leslie et al. 2005; Leslie and Polizzi 1998), and the emotional consequences of false beliefs (e.g., Harris et al. 1989; Ruffman and Keenan 1996)" (Apperly and Butterfill 2009, p. 957). Such problems do not preclude that infants might operate with a genuine understanding of belief—after all, even adults (who presumably have full-blown mindreading abilities) make mindreading errors (e.g., Keysar et al. 2003)—but they would imply that mindreading development proceeds beyond infancy. As some have argued (e.g., Zawidzki this issue), it may be that neither success on existing nonverbal *nor* standard verbal false belief tests can be taken as evidence for full mastery of the concept of belief if such mastery, as many philosophers claim, involves the capacity for representing intensional (with an "s") contents (see section 3.1 below), and abilities for assigning such contents holistically (see also Apperly 2011; Spaulding this issue).

In sum, recent developmental studies pose some challenging questions about the nature of children's mindreading abilities, particularly their understanding of belief. Experiments using spontaneous-response and indirectly-elicited-response tasks suggest infants possess the ability to attribute mental states with propositional content. However, the limitations described above exhibited by much older children continue to pose a challenge for this conclusion. With this in mind, a number of more modest mindreading interpretations of the infant data have been proposed (see below, section 3, for some of these proposals). Success in this endeavor requires specifying the special character and features of the sort of mindreading exhibited by nonverbal infants. Similar debates between mindreading and alternative accounts are under way in cognitive ethology and primatology. New behavioral experiments in those fields, using similar methodologies to those in developmental psychology, raise afresh the question of whether nonhuman primates and other animal species might also qualify as mindreaders (for a recent review see Call and Tomasello 2008). The game is afoot to determine if this is true, and—if so—in exactly what way and to what extent nonverbal infants and animals minimally qualify as mindreaders.

3 Alternatives to Full-blown Mindreading

Many contributions to this special issue offer novel proposals that seek to clarify both the precise level and nature of elementary infantile and animal social cognition in ways that fall short of endorsing the full-blown mindreading interpretation. The positive offerings in this volume, outlined below, fall into three broad categories: *belief-like mindreading, perceptual mindreading*, and *non-mindreading* accounts.

These categories cover many, but not all, of the possible explanatory accounts. For example, there is space for accounts that fall short of full-blown mindreading—since they do not include possession of the concept of belief—but which posit more sophisticated mindreading than those developed in this special issue. One possibility in this conceptual space, raised by one of the guest editors (VS), is that children begin with a single epistemic state concept covering knowledge, thoughts, and beliefs, which only gradually becomes differentiated when the differences between them are made clear through language. Such a basic concept would still be propositional (knowing, thinking and believing are all mental state concepts of propositional attitudes), but since full-blown mindreading requires an appreciation of the full array of mental states, then this is one way in which infants may fall short. This position is somewhat akin to the proposals of Scholl and Leslie (1999) and Wellman (1998), according to which there exist core mindreading concepts which are universal, but that further concepts may be dependent on environmental (linguistic) input. Such a view shares with the ones described below, however, the goal of characterizing forms of social cognition which fall short of the full-blown mindreading found in normal adult humans.

3.1 Mindreading with Belief-like States

Inspired by the work of Apperly and Butterfill (2009), Low and Wang (this issue) canvass the much discussed recent proposal that there may be more than one psychological system or mechanism for false belief reasoning: in addition to the explicit, flexible understanding of propositional attitudes we see in adulthood, there may be an early developing, modular system allowing an efficient but less flexible understanding of the links between visual access, knowledge or false belief, and consequent behavior (Apperly 2011; Baillargeon et al. 2010; Kovács et al. 2010; Low 2010; Senju et al. in press). If such an additional system exists it would explain why infants have some understanding of another's cognitive perspective while also explaining limits to that mentalistic understanding.

Spaulding (this issue) articulates a strategic rationale that encourages defenders of mindreading proposals to occupy this sort of middle ground position for understanding nonverbal social cognition—a position lying between full-blown mindreading and non-mindreading accounts. Accordingly, she rejects the sharp distinction that sees the only option for making sense of infant and animal social cognition as "mindreading or bust." On this view, while some forms of social cognition engaged in by nonverbal infants and animals are different from that of adult humans, they are not *wholly* different. Specifically, for those who adopt this variant of mindreading proposal, rather than operating with the concept of belief, infants and animals are thought to have command of a logically distinct mental state concept; they are capable of ascribing *belief-like* states but not beliefs per se.

What is a belief-like state? In introducing the notion, consider Malcolm's (1977, pp. 49–50) dog that barks up the wrong tree in pursuit of a cat. We are naturally inclined to attribute to the dog the belief that "There is a cat up the oak tree" based on the situation and its behavior. But what entitles us to suppose, for example, that the concepts "cat" and "oak tree" accurately characterize the content of the dog's psychological state? Why assume this succeeds in capturing the precise way that it

thinks about this situation? Might the dog be thinking of the tree, for example, not as an oak per se, but as simply a "tree," or some other alternative? This question concerns specifying what philosophers call the *intensional* (with an "s") content of an *intentional* (with a "t") mental state. To review, mental states are intentional (with a "t") if they have contents, i.e., are about or represent something. To specify the *way* in which the object of a mental state is represented—e.g., representing a particular tree (the *extension* or *target* thing referred to) *as* an oak tree or *as* a tree—is to specify its intensional (with an "s") content (also referred to as its *sense* or *mode of presentation*).[3] In cases like Malcolm's dog, we often make fine-grained ascriptions of specific intensional contents—but are they more justified than any other referring to the same objects? Attributions of this kind seem rather off the cuff and context-driven; they are motivated by the particularities of the episode in question, by what we take to be afforded to the target agent in their immediate environment. For example, had the dog chased a weasel up the tree we would incline to a different content ascription. But if so, it appears to be a mistake to attribute sophisticated doxastic states, such as beliefs with intensional (with an "s") contents, based on limited behavioral evidence alone. Admittedly, this mistake is hard to avoid. Gendler (2008) regards this tendency as the result of "an overextension of a heuristic: it depends on treating something that is a general indicator of belief as if it were a necessary and sufficient correlate of belief" (p. 566).

Cases such as this have led a number of theorists to propose that there exist types of mental states that lack content of the standard intensional (with an "s") sort—for example, *belief-like* states that are not a species of belief at all.[4] This was what motivated Gendler (2008) to introduce the notion of *alief*, a paradigmatic belief-like state, which she defines as follows:

> To have an alief is, to a reasonable approximation, to have an innate or habitual propensity to respond to an apparent stimulus in a particular way. It is to be in a mental state that is … associative, automatic and arational. As a class, aliefs are states that we share with non-human animals; they are developmentally and conceptually antecedent to other cognitive attitudes that the creature may go on to develop. Typically, they are also affect-laden and action-generating (p. 557).

Despite being importantly different from beliefs, aliefs are, nevertheless, conceived of as intentional (with a "t"), i.e., as representational states of mind having some sort of content. Thus, Gendler tells us that the BB-chasing behavior of a frog "can be explained by an alief with the content that might be expressed, among other ways, as follows: The frog alieves (all at once, in a single alief): small round

[3] Psychologists may be more familiar with these ideas in discussions of visual perspective taking. Level-1 visual perspective-taking only requires understanding what objects others can or cannot see, while level-2 visual perspective-taking requires appreciating that the very same objects have different visual appearances from different lines of sight (Flavell 1974). The standard interpretation (although not often put in these terms) is that the former only requires appreciating the extensional contents of perception, while the latter involves appreciating their intensional contents. As we discuss below in section 3.2, however, Lurz and Krachun (this issue) appear to reject this standard interpretation.

[4] Gendler (2008) holds that we should reserve the title of belief only for states of mind with other features beyond intensionality: "belief aims to 'track truth' in the sense that belief is subject to immediate revision in the face of changes in our all-things-considered evidence" (p. 565).

black object up ahead; appealing in foody sort of way; move tongue in its direction" (p. 559).

With respect to the mindreading debate, if there are such things as belief-like mental states, then having a capacity to attribute them could sponsor the illusion of having the ability to attribute belief proper. This could potentially explain how, by using simpler mental state concepts, infants come to have, *incidentally*, expectations about more complex mental states, including beliefs. Tracking belief-like states that happen to correlate with beliefs would be a crude, but reliable enough, way of developing expectations about another's beliefs without being able to represent beliefs *as such* or being able to represent truth-conditional, intensional (with an "s") contents. Thus, as Apperly and Butterfill (2009) show, it is possible to deny that infants can represent and attribute beliefs even though they have the "ability to ascribe *simple forms of mental content*, at least in the form of belief-like states" (p. 965, italics added).

One feature of Spaulding's proposal is that belief-like states are represented as being tied to current and recent observations, whereas beliefs proper can be represented as having contents unrelated to proximal observable stimuli. While some tasks (e.g., Onishi and Baillargeon 2005; Southgate et al. 2007) indeed only ask whether infants can reason about epistemic states tied to recent observations, it is less clear that other tasks can be so easily explained in this way. For example, Scott et al. (2010) provide evidence that infants expect an agent's belief to be generated by an inference that "similar objects have similar non-obvious properties," content that is not tied directly to what the agent has seen in the recent past. While not endorsing the belief-like state account, Zawidzki (this issue) voices somewhat similar objections, arguing that infant's behavior on nonverbal false belief tasks reveals them to be incapable of appreciating the holistic nature of belief, and thus lack the concept of belief proper. In this context, the holism of belief means that the belief generated in response to an environmental stimulus will depend on the agent's indefinitely many other mental states—i.e., that an agent's background knowledge will affect the inferences they make about the perceived world—and that a particular behavior can potentially be caused by a host of different interlocking sets of mental states. Zawidzki argues that infants in the penguin paradigm of Scott and Baillargeon (2009) cannot be reasoning about beliefs proper because they fail to recognize a relevant feature of the observed agent's experience (that the 2-piece penguin can be transformed into a 1-piece-penguin) in generating these attributions. However, Scott and Baillargeon might well retort that a crucial element of their familiarization is to teach infants that the 2-piece-penguin is disassembled at the start of each trial—and so, on a relatively sophisticated mindreading account, it makes sense that infants would assume that the agent should share this assumption, and thus, when faced with a 1-piece-penguin under the transparent cover, assume that the 2-piece-penguin must be under the opaque cover. Thus, one could conclude that infants are indeed appreciating the holistically-mediated influence of beliefs on behavior, since they bring to bear not only relevant information from the familiarization, but also attributions that were not generated during the experiment (e.g., that similar objects have similar properties).

Therefore, in addition to the need to further specify how belief-like-state mindreading is supposed to differ from mindreading with the concept of belief proper, there remain open empirical questions about whether infants' understanding

of others' epistemic states are indeed limited in the ways suggested by advocates of these minimal mindreading accounts.

3.2 Perceptual Mindreading Accounts

Hedger and Fabricius (this issue) posit that younger children indeed mindread but possess concepts of neither belief nor belief-like states. This more minimal form of mindreading they call *perceptual access reasoning* (PAR) (Fabricius and Imbens-Bailey 2000; see also Bermúdez this issue). PAR only requires possession of the mentalistic concepts of seeing, knowledge, and ignorance, and makes use of two folk psychological rules: (a) seeing leads to knowing, and not seeing leads to not knowing; and (b) knowing leads to "getting it right," i.e., correct action toward the relevant object, and not knowing leads to "getting it wrong" (sometimes referred to in the literature as the "ignorance leads to error" hypothesis; see, e.g., Baillargeon et al. 2010). PAR purportedly enables success, however, on standard false belief tasks. For example, on a change of location false belief task with two locations, if the agent does not see the target object being moved, children using PAR will, by applying rule (a), think the agent is ignorant of the location of the object, and, by applying rule (b), will predict that the agent will choose the incorrect location when looking for it. Since the incorrect location is where the agent falsely believes the object to be located, the child using PAR thus responds in the same way as someone representing false beliefs would. Hedger and Fabricius stress that what differentiates between PAR and false belief reasoning is performance on *true* belief tasks—for example, where the agent loses perceptual access to the target object, during which it moves but ends up returning to the location originally witnessed by the agent. Children using PAR will judge that upon returning to the scene, the agent is in a different situation and thus ignorant of the object's location and will choose the wrong location—even though their belief about its location remains true. PAR thus predicts correct responses on false belief tasks, but failure on true belief tasks, while full-blown mindreading predicts success on both true and false belief tasks. In addition to the need for further testing of their empirical claims about the developmental patterns of children's responses on true versus false belief tasks—Hedger and Fabricius believe most developmental experiments have failed to contain the proper controls to distinguish between PAR and false belief understanding—it will be important to determine whether other minimal mindreading or non-mindreading accounts make the same empirical predictions as PAR.

Primarily focusing on the primate data, Lurz and Krachun (this issue) advance a similar proposal in defending the idea that certain forms of social cognition may depend only on the capacity to ascribe perceptual contents—those based on appearances of how things look, smell, and sound—and not the ascription of belief contents. Highlighting the important distinction between ascribing to agents *external goals* (the environmental objects or states of affairs toward which an agent's actions are directed, which can be understood without attributing any mental states) and *internal goals* (the intentional states in an agent's mind motivating their actions), these authors argue that if a subject in fact predicts a target's behavior by making ascriptions of action-guiding perceptual states, then this type of attribution counts as a kind of mindreading. They conjecture that it is knowledge of perceptual

experiences, perhaps gained via introspection, that enables certain kinds of mindreaders to attribute contentful mental states to others.

Crucially, the ability to ascribe perceptual contents does not, according to Lurz and Krachun, imply a capacity to ascribe propositional contents, and hence it does not require having a grasp of the notions of truth or falsity, veridicality or unveridicality, or representation. Apparently, all that perceptual mindreaders need to be able to do is to represent that a particular object looks is certain way to another even if it currently does not look that way to the mindreader. This entails a capacity to represent the other as, for example, failing to see the distant piece of fruit in its line of gaze *as* a piece of fruit, and instead seeing it as, perhaps, a dark spot on the forest floor. Mindreaders of this more basic variety are differentiated from mere behavior-readers because they can appeal to the subjective ways environmental objects perceptually appear to agents in order to predict their behavior, as opposed to relying solely on reality-based, mind-independent facts.

The idea that purely perceptual states differ in important respects from beliefs finds support in Crane's (2009) rejection of the propositional attitude thesis about perception (see also Bermúdez this issue). Importantly, Crane argues that that thesis can, and should, be abandoned but without surrendering the idea that perceptual states possess representational content. Perceptual states may have accuracy or correctness conditions that come in degrees and are not to be identified with truth conditions. Like pictures, experiences can be more or less accurate, but they are not intrinsically true or false. If so, purely perceptual content is of a different sort than that had by propositional attitudes such as beliefs.

Nevertheless the challenge remains for defenders of perceptual mindreading accounts to clarify exactly what properties distinctively perceptual contents have and provide an adequate framework for understanding them. For example, if this option is be distinguished from full-blown mindreading involving propositional attitude understanding, it falls to its advocates to explain how it is possible to ascribe to another agent a perceptual content that presents an object under an aspect without this reducing to or entailing the ascription of some kind of intensional (with an "s") content. Understanding that an agent sees an object *as* something or other seems to imply having an appreciation of how the other represents what they see.

3.3 Non-mindreading Accounts

Some of the first responses to Onishi and Baillargeon's (2005) groundbreaking violation of expectation study of false belief understanding were to claim that infants' behavior on these tasks could be explained without any mindreading abilities: for example, that infants were simply forming agent-object-location associations (Perner and Ruffman 2005; Ruffman and Perner 2005), or using behavioral rules (see Low and Wang this issue). While the association hypothesis has been severely criticized (see Scott et al. 2010), two papers in this issue offer alternative non-mindreading accounts of the infant data (we will return to the issue of behavior-rule based accounts below in section 4).

Zawidzki (this issue) canvasses the possibility that pre-linguistic infants may be basing their expectations about relatively brief episodes of behavior by adopting an enhanced version of Gergely's (in press; Gergely and Csibra 2003) teleological

stance account. To adopt the teleological stance is to parse episodes of behavior into goals (characterized externally, i.e., non-mentalistically) and to be sensitive to rationally constrained means of achieving them. Although Gergely and Csibra (2003) are clear that, in their view, the teleological stance applies only to real (rather than imagined or believed) states, Zawidski argues that the teleological stance is enhanced in the second year of life by an ability to recognize an agent's informational access to environmental objects as situational constraints on the achievement of their goals. This enhanced teleological stance is supposed to explain infants' behavior on spontaneous false belief tasks without actually requiring any mindreading, since on this view goals and informational access are characterized in non-mentalistic terms. However, Zawidski does not tell us how informational access could be construed non-mentalistically: how does the infant know that a barrier is a situational constraint on perceptual access for another individual, without representing the mental state of "seeing"? And, how does such an account differ from, for example, the "doesn't see—doesn't know" rule-based account that Hedger and Fabricius (this issue) advocate?

De Bruin et al. (this issue) also seek to promote a non-mindreading alternative—one that denies that infants are reasoning about belief-like states but which, nevertheless, does not reduce their capacities to mere behavior-based rules or associations. Their proposal is that infants keep track of and form expectations about relations that hold between another agent, an object and a location, as well as the array of possible actions that are afforded to the other in such circumstances. Structurally, their affordance-based account builds on Apperly and Butterfill's (2009) account of belief-like states, which is characterized in terms of the notion of *registration*, that is in turn characterized in terms of an *encountering* relation between an agent and an object at a location. De Bruin et al. replace the mentalistic notion of registration with the non-mentalistic notion of being sensitive to another's action affordances relative to objects at locations, and being able to track the fact that changes in, for example, the location of an object will not affect an agent's action affordances if such changes were not perceptually accessible to (encountered by) the agent. An obvious difficulty for this account is that it needs to explain what informs infant expectations about the connections between a person's perceptual access to items and the possible actions that a given situation affords to the other, and when and how. Another important question is whether acts of referential communication, of the kind studied by Southgate et al. (2010), are the kind of affordances included in this account, or whether interpreting communicative acts requires genuine mindreading. Although its advocates admit that their affordance-based proposal is not yet fully developed, if this general sort of account could be made to work it would obviate the need to assume that infants must be reasoning about internal mental states of some kind rather than the open-to-view possibilities for action that given situations afford to others.

A challenge for both these accounts is to defend their non-mentalistic accounts of perceptual access. Recent research (e.g., Meltzoff and Brookes 2008; Senju et al. 2011) suggests—indeed, for one of the editors [VS], clearly demonstrates—infants have an appreciation of the mental state of seeing. All parties in this debate agree that infants appreciate more than the physical behavior of "orienting towards" an object, but it will be important for future research to determine whether non-

mentalistic conceptions of perception adequately accommodate the existing experimental data and what future experiments, if any, could empirically distinguish them.

3.4 Beyond Infancy

An issue all accounts of human social cognition must address is how infant abilities relate to those of older children and adults. For full-blown mindreading accounts, the same basic mindreading capacities are used from infancy onward. But for those positing alternative explanations of the infant data, do these simpler, alternative means of social cognition get replaced across development, or do they persist into later childhood and adulthood? If the latter, it can be asked why, if such simpler, alternative means to explaining and predicting others' actions are available, do older children and adults not also employ them for passing behavioral tasks usually treated as evidence of sophisticated mindreading, such as standard, elicited-response false belief tasks? Perhaps they do, as proposed by the dual-systems accounts discussed above in section 3.1. But this possibility raises a host of questions for future research about the nature of human social cognition in later childhood and adulthood and the developmental progression from infancy onward, which all of the accounts proposed in this special issue must address.

4 How to Decide Between Accounts?

A venerable tradition, one that informed the birth of the modern era, has it that in the best cases science can and ought to proceed by identifying, with precision, testable predictions of competing theoretical hypotheses in order to eliminate them. The aim of designing an *experimentum cruces* is to put hypotheses to a definitive test. Deciding between alternative proposals in this way gives maximum weight to empirical findings, relegating any philosophical work to that of developing proposals and clarifying their commitments and implications in order to enable such testing. Given the complex relationship between the mind and behavior, however, it is often difficult to design single behavioral experiments that *definitively* rule out particular psychological hypotheses. But psychological research on human and animal social cognition has made much progress in designing such experiments whose results provide evidence consistent with particular mindreading or non-mindreading accounts and inconsistent with others. For example, as Low and Wang (this issue) discuss, the new wave of violation of expectation and anticipatory looking research on infant false belief understanding has controlled for association and ignorance explanations (although see Hedger & Fabricius, this issue, for a defense of the latter).

Skeptics such as Povinelli, however, highlight the difficulty in designing experiments to separate the mentalistic wheat from the non-mentalistic chaff. This is because, according to Povinelli's reinterpretation theory, mindreading abilities are thought to build upon and re-interpret the deliverances of non-mindreading capacities, bringing new explanatory depth and predictive possibilities to the latter (e.g., Povinelli and Vonk 2003, 2004). If mindreading uses the same classification of

behaviors (i.e., the same "inputs") as non-mindreading capacities, then one could in principle construct a set of behavioral rules to solve practically any socio-cognitive task (i.e., mapping from input about the behavior of an observed agent to a behavioral response on the part of the observer) solvable by mindreading. Focusing on the primate data, Povinelli and Vonk (2003, 2004) claim that, to date, there are no experimental protocols intended to test mindreading capacities that could not also in principle be explained by the use of purely behavioral, non-mentalistic rules, however complex.

Taking up the gauntlet, Lurz and Krachun (this issue) argue that it is nevertheless possible to meet what they call Povinelli's challenge, offering a new type of experimental protocol as a decisive test for internal-goal attribution (as opposed to the attribution of non-mentalistic external goals) in chimpanzees.[5] Their protocol is based on the *appearance-reality mindreading* (ARM) theory, the central feature of which is their alternative theoretical account of perceptual mindreading described above. Extending this to cases of apparent infant mindreading, Lurz and Krachun assume that the best test for such capacities will require finding evidence of attributions of discrepant or "false" perceptions.

Low and Wang (this issue) also address this methodological issue, but are less sanguine about developing decisive tests of mindreading abilities. Focusing on the infant data, they argue that to date, no single behavioral experiment has been designed that can be uniquely explained by a mindreading account rather than behavioral rules. Instead of a single decisive test, they argue that the way forward for defenders of mindreading accounts involves appealing to parsimony. Considerations of cognitive and computational complexity are associated with Povinelli's type of challenge to mindreading accounts, since, according to Povinelli, behavioral rules are the cognitively simpler, and thus more parsimonious explanations of behavior on single experimental tasks.[6] But, as Low and Wang describe, parsimony arguments have also been used to defend mindreading accounts when the data to be explained are successful performances across a *variety* of experimental tasks (see Whiten 1994, for an illustrative example). Indeed, as they show, this is exactly the move used to defend mindreading interpretations of verbal false belief tasks used with older children: it is purportedly simpler to explain this success across different false belief tasks via mindreading than by a large set of ad hoc and complex behavioral rules.[7] Following Perner (2010), however, Low and Wang argue that the success of such parsimony arguments about the coherence of responses across multiple task conditions crucially depend on how behavior and mentalistic rules are characterized and counted. They suggest that the way forward for research on nonverbal false belief understanding is to use within-subject experiments examining the coherence

[5] Penn and Povinelli (2007) describe experimental protocols they believe would provide evidence of mindreading in nonverbal creatures. Indeed, such functionally equivalent experiments have recently been carried out with human infants (Meltzoff and Brookes 2008; Senju et al. 2011) with positive results. For arguments against such a definitive experiment, see Lurz (2009).

[6] Zawidski (this issue) makes the same kind of move, arguing that his enhanced teleological stance account is a simpler explanation of the infant data than belief-like state or full-blown propositional attitude mindreading. See also Spaulding's (this issue) discussion of a parsimony argument for the non-mindreading "embodied simulation" account.

[7] Call and Tomasello (2008) make the same kind of move to defend the claim that primates engage in some mindreading.

of infant's responses across a variety of belief-formation and belief-use conditions. Such coherence would, on their analysis, genuinely require fewer rules than corresponding non-mindreading, behavior-rules accounts.

As Low and Wang recognize, however, this type of parsimony argument in favor of mindreading is persuasive but not decisive. It depends on a rational analysis of the cognitive tasks facing infants, and there is no guarantee that the messy process of evolution has given human children (or animals) optimally designed information-processing mechanisms. Thus additional sorts of evidence must be marshaled from cognitive psychology (e.g., dual task interference tasks, reaction time studies), comparative psychology, and neuroscience in making an inference to the best explanation of children's socio-cognitive abilities.

How such inductive reasoning should proceed is a notoriously difficult question. Bermúdez (this issue) argues that appealing to general considerations, such as elegance, predictive power, parsimony, is often too crude a means for settling such theoretical debates effectively. In his discussion of what an appropriate relation between theory and evidence should look like, he makes a plea for more fine-grained use of empirically accountable but nevertheless purely *conceptual* constraints when it comes to evaluating theories. He defends the view that those offering such constraints on the empirical evidence should also be responsible for developing plausible frameworks for interpreting that evidence. Bermúdez discusses one such constraint, defended in other writings, that would have important implications for mindreading debates: that non-linguistic thought cannot be second-order or reflexive. Because beliefs and other propositional attitudes are representational, they would require second- or higher-order metarepresentations in order to represent them. If, as Bermúdez argues, nonverbal infants and animals are incapable of such metarepresentations, this would mean they cannot be mindreaders of propositional attitudes.

Another conceptual consideration of direct and critical importance to the mindreading debate concerns hotly contested issues about the general integrity and explanatory value of the notion of representation in the cognitive sciences (Chemero 2009; Ramsey 2007; Shapiro 2011). Although many researchers take it for granted that the notion of mental representation is in good order, embodied and enactive approaches to cognition have brought into question its viability and capacity to provide fundamental support to the cognitivist framework. In threatening the cognitivist framework in a wholesale manner, the new anti-representationalist movement in cognitive science also threatens specific theoretical proposals, including mindreading proposals that are advanced under its auspices. For those motivated by these developments, the focus is not primarily whether infants and animals might be representing and reasoning about mental representations as opposed to behaviors; the question is, more fundamentally, whether basic forms of mentality should be understood as essentially representational and whether intelligent behavior, in general, involves the manipulation of representations. Adoption of this framework rules out the possibility of giving any account of nonverbal social cognition that requires the postulation of mental representations. It requires nothing short of radically reconceiving the nature of the *explanandum* and its possible *explanans*.

We cannot understate how controversial these types of conceptual considerations can be—especially if they are defended via a priori arguments. But it seems

unavoidable that such theoretical considerations—even if they often lay unnoticed as basic assumptions—play a role in deciding between mindreading and nonmindreading accounts of social cognition.

5 Phenomenological, Embodied and Enactive Accounts of Social Cognition

Advocates of mindreading proposals all subscribe to a common philosophical framework defined by a set of core assumptions. Mindreading theorists assume that the primary function of social cognition is to predict, explain and control actions of others and that this must be achieved by the attribution, and hence representation, of the other's inner mental states. The big issue for those working within this framework is whether such attributions are achieved by means of theoretical inference, simulative analogy, or a bit of both.

These local disagreements about how best to explain what enables encounters with other minds operates against the backdrop of a general agreement about what is necessarily required for any kind of encounter with other minds. Specifically, it is assumed that there is always a gap to be bridged between individual minds—one that is present even in the most basic of encounters. That such a gap exists and can be bridged only by making mental state attributions by some or other means is only true if it is not possible to directly perceive the mental states of others. Many take it as obvious that the latter is ruled out a priori for the following reason: it is only possible to be perceptually acquainted with another's outward behavior, even when that behavior is the causal product of behind-the-scenes mental activity. The mental states that drive behavior are not open for direct viewing because they are in some sense inner, lying somewhere between perceptual inputs and behavioral outputs.

Inspired by broadly phenomenological considerations, a number of philosophers have questioned the legitimacy of the assumed philosophical framework within which mindreading theories operate (see, e.g., Hutto 2004; Gallagher and Zahavi 2008; Ratcliffe 2007). These authors argue that to assume a gap between minds, especially when it comes to thinking about basic forms of social cognition, is to mischaracterize the nature of the intersubjective situation. The need to make mental state attributions is obviated if the psychological situation of others can be perceived in and through their expressions. Accordingly, primary, and even secondary, intersubjective engagements (see Jacob this issue) do not require mindreading abilities on the assumption that individuals come equipped with capacities for directly perceiving and responding to the psychological states of others. From this vantage, the great bulk of social cognition—and certainly its most basic varieties—takes the form of perceiving and being moved by others' expressions and actions, where these are assumed to be of immediate significance to and revelatory of mentality.

A related complaint is that mindreading proposals overly intellectualize what is involved in our basic encounters with others. For such accounts assume that one needs mastery of the concept of a given mental state in order to ascribe it to another, but arguably a great deal of social cognition involves cases of recognizing and

responding appropriately to another's mental states without having to conceptually represent or ascribe those mental states as such (see the discussion between Jacob and Zahavi this issue).

Focusing on the phenomenon of empathy, Jacob (this issue) raises a number of general worries about the idea that it is possible to have direct perceptual experience of another's psychological states. One major concern he identifies, which is commonly voiced, is that endorsing all of the features of this approach leads to behaviorism. This apparently follows if there is no way to cleanly distinguish between some bout of expressive behavior and the mentality that underlies it. Yet phenomenologists have long argued that conceiving of mentality as constituted by expressive, embodied activity does not entail any objectionable kind of behaviorism about the mind, although it is often mistaken as having this implication. This is because to reject the idea that mentality is best understood as logically distinct from expressive behavior in a wholesale way is at the same time to reject that the relevant embodied activity can be identified with behavior understood as mindless bodily movements. According to the phenomenologists, the bodily activity of living beings is assumed to be fully experiential and purposeful. This can be so, even if, as Zahavi (this issue) argues, not every aspect of the mental life of others is perceptually accessible.

Another major worry with the approach is that it fails to provide an adequate explanation of what makes purely perceptually based social cognition possible. Emphasizing this, Jacob takes issue with Gallagher's (2008) claim that perception, in general, can be smart without involving inferential processes. The problem for this proposal is that it apparently fails to recognize that perception, in any domain, will only be smart if it is grounded in knowledge of the right contextual cues and background conditions. As Michael (this issue) observes, perception must be supported by interpretative process in some sense (see also Herschbach 2008b).

Jacob insists that the capacities in question depend on being able to cognitively represent situations and contexts since it is only by representing relevant contextual cues that it is possible to disambiguate between, for example, facial expressions of another's experience of pain as opposed to disgust. By way of reply, Zahavi stresses that there is no incompatibility in holding both that perceptual experience depends upon and is influenced by background knowledge, contextual cues and past experiences and that it is direct. He gives the example of enjoying a glass of 1982 Chateau Margaux and appreciating its properties in ways that require sophisticated capacities but which nevertheless constitute a direct experience of those properties.

Zahavi claims that talk of direct perception does not oppose contextualized perception but only mediated perception. Yet at the same time he stresses that it is possible that such direct perception might be enabled by various subpersonal mechanisms—even those that involve rule-based manipulations of mental representations. Mindreading theorists are bound to see this as giving the game away. For they will claim that the important question remains: whether perceptually-based social cognition is, in fact, mediated at the subpersonal level by representational processes involving mindreading (Herschbach 2008b; Spaulding 2010; Michael this issue).

In this light, a stronger reply is to take up the challenge and develop the direct perception proposals in line with theories that reject mentalizing accounts of the relevant subpersonal processes or mechanisms. In this respect, direct perception approaches are natural allies for models of social cognition being actively developed

using the tools of newly emerging radically embodied and enactive approaches to cognitive science (De Jaegher 2009; De Jaegher and Di Paolo 2007; De Jaegher et al. 2010; Gallagher 2001, 2005).

Michael (this issue) examines a number of existing proposals that seek to do just that and finds them wanting. Grouped under the banner of "interactionism," he argues that these proposals either fail to provide a credible alternative to mindreading or embed other commitments that warrant skepticism. Nevertheless, he supplies reasons for thinking that such accounts need not compete with but might instead positively enrich the mainstream mindreading framework.

Michael admits his analysis does not suffice to refute the proposals under scrutiny, but more modestly challenges enactivist interpretations of specific examples of social cognition and raises doubts about the viability of interactionism as a general approach to social cognition (see Herschbach in press, for an extensive analysis and critique of De Jaegher and colleagues' enactivist account of social cognition). Interestingly, given the discussion in section 1, a key complaint Michael makes against these radically enactive approaches is that it is difficult to sustain a non-mindreading account of child development in the face of recent evidence that infants display a spontaneous understanding of others' false beliefs.

There is other potential support for the phenomenological framework for understanding basic social cognition. The empirical discovery of mirror neurons and systems in motor and emotional regions of the brain is thought by some to constitute a kind of understanding of goal-directed acts, intentions, and emotions that is wholly distinct from, and comes before and below, mindreading capacities (Gallese 2001, 2005, 2007; Gallese et al. 2004; Rizzolatti and Sinigaglia 2006). Spaulding (this issue) considers the argument that a direct, embodied understanding of other minds—one that does not depend on mindreading capacities—might be sufficient for explaining the great bulk of social interactions, including providing some understanding of beliefs, without and thus obviating the need for full fledged representations of another's propositional attitudes. She takes this to be the most important argument offered by proponents of embodied account of social cognition, since—to borrow her turn of phrase—this would make the posits of mindreading accounts profligate. In making her counter argument, Spaulding leans heavily on new evidence concerning infant false belief understanding to show that non-mindreading proposals run out of explanatory steam at a critical point.

On this analysis, whatever merits embodied and enactive theories might have for thinking about the most basic forms of social cognition, they have limited scope. Certainly, on standard assessments, they cannot reasonably hope to explain more sophisticated ways in which we understand others' actions in terms of reasons—the home turf for mindreading theories. Bolstering their arguments against non-mindreading proposals, both Jacob and Spaulding critically examine the divide and conquer strategy adopted by some who promote embodied alternatives to mindreading accounts—that is, to invoke a strong version of the *narrative practice hypothesis* or NPH (Hutto 2008), in order to provide a non-mindreading account of the source and nature of sophisticated social cognition. The NPH builds on the idea that children come by the component capacities needed for full-blown mindreading competence slowly and in a partial and piecemeal fashion. It assumes that they advance beyond purely embodied

modes of basic social cognition and acquire new capacities, including the ability to attribute propositional attitudes such as beliefs and desires, by engaging in scaffolded discursive practices—i.e., by discovering that others hold divergent points of view by conversing about various topics, and eventually by hearing and learning to tell narratives about people's reasons for action.

As Jacob makes clear, the NPH is no threat to mindreading theories as long as such shared discursive and narrative practices are seen as putting the icing on the mindreading cake as opposed to serving as its very basis (see also Currie 2008). But both Jacob and Spaulding independently propose that the NPH runs into obvious difficulties unless it avails itself of some or other mindreading account to explain how children come by an understanding of belief and other mental states needed to enable them to engage in the relevant discursive practices in the first place. The gap between non-mentalistic embodied understanding and full-blown folk psychological competence is too wide to be bridged without intervening support—support apparently provided by a pre-existing ability to attribute mental states, including, false beliefs to others.

In this light, it is easy to see the pivotal and strategic importance for both sides in these larger debates regarding phenomenological, embodied and enactive accounts of social cognition of deciding whether some or other mindreading account is the best way to account for the kinds of social cognition exhibited by very young infants and animals.

6 An Interdisciplinary Endeavor Continues

As Apperly (2011) notes, "From its inception the modern study of mindreading has involved close collaboration between psychologists and philosophers" (p. 4). Premack and Woodruff's (1978) pioneering exploration of whether chimpanzees are mind-readers had accompanying commentaries by two philosophers (Bennett 1978; Dennett 1978) and a psychologist (Pylyshyn 1978) that helped to generate the standard change-of-location false belief task so important to the last several decades of mindreading research. While the level of active collaboration and interaction between psychologists and philosophers on these topics has ebbed and flowed over the decades—for example, the debate between theory theory and simulation theory about the psychological processes enabling mindreading has at times been rather isolated within philosophy—this special issue shows some of the benefits of such interdisciplinary dialogue and collaboration. We hope it continues in order to address the various empirical, methodological, interpretative, theoretical and philosophical issues at issue in the debate between mindreading and alternative accounts of social cognition.

References

Apperly, I.A. 2011. *Mindreaders: The cognitive basis of "theory of mind"*. New York: Psychology Press.

Apperly, I.A., and S.A. Butterfill. 2009. Do humans have two systems to track beliefs and belief-like states? *Psychological Review* 116(4): 953–970.

Baillargeon, R., R.M. Scott, and Z. He. 2010. False-belief understanding in infants. *Trends in Cognitive Sciences* 14(3): 493–501.

Baron-Cohen, S., A.M. Leslie, and U. Frith. 1985. Does the autistic child have a "theory of mind"? *Cognition* 21: 37–46.

Bennett, J. 1978. Some remarks about concepts. *The Behavioral and Brain Sciences* 1: 557–560.

Bermúdez, J.L. 2003. The domain of folk psychology. In *Royal institute of philosophy supplement*, *Minds and persons*, vol. 53, ed. A. O'Hear, 25–48. New York: Cambridge University Press.

Bermúdez, J.L. 2009. Mindreading in the animal kingdom. In *The philosophy of animal minds*, ed. R. Lurz, 145–164. Cambridge, UK: Cambridge University Press.

Buttelmann, D., M. Carpenter, and M. Tomasello. 2009. Eighteen-month-olds show false belief understanding in an active helping paradigm. *Cognition* 112: 337–342.

Call, J., and M. Tomasello. 2008. Does the chimpanzee have a theory of mind? 30 years later. *Trends in Cognitive Sciences* 12(5): 187–192.

Carpendale, J.I., and M. Chandler. 1996. On the distinction between false belief understanding and subscribing to an interpretive theory of mind. *Child Development* 67: 1686–1706.

Chemero, A. 2009. *Radical embodied cognitive science*. Cambridge, MA: MIT Press.

Crane, T. 2009. Is perception a propositional attitude? *The Philsophical Quarterly* 59(236): 452–469.

Csibra, G. 2008. Goal attribution to inanimate agents by 6.5-month-old infants. *Cognition* 107(70): 705–717.

Currie, G. 2008. Some ways of understanding people. *Philosophical Explorations* 11(3): 211–218.

Davidson, D. 1984. *Inquiries into truth and interpretation*. Oxford: Clarendon.

Davies, M., and T. Stone (eds.). 1995. *Folk psychology: The theory of mind debate*. Oxford: Blackwell.

De Jaegher, H. 2009. Social understanding through direct perception? Yes, by interacting. *Consciousness and Cognition* 18: 535–542.

De Jaegher, H., and E. Di Paolo. 2007. Participatory sense-making: An enactive approach to social cognition. *Phenomenology and the Cognitive Sciences* 6(4): 485–507.

De Jaegher, H., E. Di Paolo, and S. Gallagher. 2010. Can social interaction constitute social cognition? *Trends in Cognitive Sciences* 14(10): 441–447.

De Villiers, J.G. 2005. Can language acquisition give children a point of view? In *Why language matters for theory of mind*, ed. J. Astington and J. Baird, 186–219. Oxford: Oxford University Press.

Dennett, D.C. 1978. Beliefs about beliefs. *The Behavioral and Brain Sciences* 1: 568–570.

Fabricius, W.V., T. Boyer, A.A. Weimer, and K. Carroll. 2010. True or False: Do five-year-olds understand belief? *Developmental Psychology* 46: 1402–1416.

Fabricius, W.V., and A.L. Imbens-Bailey. 2000. False beliefs about false beliefs. In *Children's reasoning about the mind*, ed. P. Mitchell and K. Riggs, 267–280. Hove: Psychology Press.

Fabricius, W.V., and S.L. Khalil. 2003. False beliefs or false positives? Limits on children's understanding of mental representation. *Journal of Cognition and Development* 4: 239–262.

Flavell, J.H. 1974. The development of inferences about others. In *Understanding other persons*, ed. T. Mischel, 66–116. Oxford: Blackwell.

Fletcher, L., and Carruthers, P. in press. Behavior-reading versus mentalizing in animals. In *Agency and joint attention*, eds. J. Metcalfe & H. Terrace. Oxford: Oxford University Press.

Gallagher, S. 2001. The practice of mind: Theory, simulation or primary interaction? *Journal of Consciousness Studies* 8(5–7): 83–108.

Gallagher, S. 2005. *How the body shapes the mind*. Oxford: Clarendon.

Gallagher, S. 2008. Direct perception in the intersubjective context. *Consciousness and Cognition* 17(2): 535–543.

Gallagher, S., and D. Zahavi. 2008. *The phenomenological mind: An introduction to philosophy of mind and cognitive science*. London: Routledge.

Gallese, V. 2001. The "shared manifold" hypothesis: From mirror neurons to empathy. *Journal of Consciousness Studies* 8: 33–50.

Gallese, V. 2005. Embodied simulation: From neurons to phenomenal experience. *Phenomenology and the Cognitive Sciences* 4: 22–48.

Gallese, V. 2007. Before and below "theory of mind": embodied simulation and the neural correlates of social cognition. *Philosophical Transactions of the Royal Society Series B* 362: 659–669.

Gallese, V., C. Keysers, and G. Rizzolatti. 2004. A unifying view of the basis of social cognition. *Trends in Cognitive Sciences* 8: 396–403.

Gendler, T.M. 2008. Alief and belief. *Journal of Philosophy* 105(10): 634–663.

Gergely, G. in press. Kinds of agents: The origins of understanding instrumental and communicative agency. In *Blackwell handbook of childhood cognitive development (2nd ed.)*, ed. U. Goshwami. Oxford: Blackwell.

Gergely, G., and G. Csibra. 2003. Teleological reasoning in infancy: The naive theory of rationale action. *Trends in Cognitive Science* 7: 287–292.

Goldman, A.I. 2006. *Simulating minds: The philosophy, psychology, and neuroscience of mindreading*. Oxford: Oxford University Press.
Harris, P., C.N. Johnson, D. Hutton, G. Andrews, and T. Cooke. 1989. Young children's theory of mind and emotion. *Cognition & Emotion* 3: 379–400.
Herschbach, M. 2008a. False-belief understanding and the phenomenological critics of folk psychology. *Journal of Consciousness Studies* 15(12): 33–56.
Herschbach, M. 2008b. Folk psychological and phenomenological accounts of social perception. *Philosophical Explorations* 11(3): 223–235.
Herschbach, M. in press. On the role of social interaction in social cognition: A mechanistic alternative to enactivism. *Phenomenology and the Cognitive Sciences*.
Hutto, D.D. 2004. The limits of spectatorial folk psychology. *Mind and Language* 19(5): 548–573.
Hutto, D.D. 2008. *Folk psychological narratives: The sociocultural basis of understanding reasons*. Cambridge: MIT Press.
Keysar, B., S. Lin, and D.J. Barr. 2003. Limits on theory of mind use in adults. *Cognition* 89: 25–41.
Kovács, Á.M., E. Téglás, and A.D. Endress. 2010. The social sense: susceptibly to others' beliefs in human infants and adults. *Science* 330: 1830–1834.
Leslie, A.M. 2005. Developmental parallels in understanding minds and bodies. *Trends in Cognitive Sciences* 9: 459–462.
Leslie, A.M., T.P. German, and P. Polizzi. 2005. Belief–desire reasoning as a process of selection. *Cognitive Psychology* 50: 45–85.
Leslie, A.M., and P. Polizzi. 1998. Inhibitory processing in the false belief task: Two conjectures. *Developmental Science* 1: 247–253.
Low, J. 2010. Preschoolers' implicit and explicit false-belief understanding: Relations with complex syntactical mastery. *Child Development* 81: 579–615.
Luo, Y. in press. Do 10-month-old infants understand others' false beliefs? *Cognition*.
Luo, Y., and R. Baillargeon. 2005. Can a self-propelled box have a goal? Psychological reasoning in 5-month-old infants. *Psychological Science* 16: 601–608.
Luo, Y., and R. Baillargeon. 2007. Do 12.5-month-old infants consider what objects others can see when interpreting their actions? *Cognition* 105: 489–512.
Luo, Y., and S. Johnson. 2009. Recognizing the role of perception in action at 6 months. *Developmental Science* 12: 142–149.
Lurz, R. 2009. If chimpanzees are mindreaders, could behavioral science tell? Toward a solution of the logical problem. *Philosophical Psychology* 22(3): 305–328.
Malcolm, N. 1977. Thoughtless brutes. In *Thought and knowledge*. New York: Cornell University Press.
Meltzoff, A.N. 1995. Understanding the intentions of others: Re-enactment of intended acts by 18-month-old children. *Developmental Psychology* 31: 838–850.
Nichols, S., and S.P. Stich. 2003. *Mindreading: An integrated account of pretence, self-awareness, and understanding other minds*. Oxford: Oxford University Press.
Onishi, K.H., and R. Baillargeon. 2005. Do 15-month-old infants understand false beliefs? *Science* 308 (5719): 255–258.
Penn, D.C., and D.J. Povinelli. 2007. On the lack of evidence that non-human animals possess anything remotely resembling a "theory of mind". *Philosophical Transactions of the Royal Society Series B* 362: 731–744.
Perner, J. 2010. Who took the cog out of cognitive science? In *Cognition and neuropsychology: International perspectives on psychological science*, ed. R. Schwarzer and P.A. Frensch, 241–262. New York: Psychology Press.
Perner, J., and T. Ruffman. 2005. Infants' insight into the mind: How deep? *Science* 308(5719): 214–216.
Povinelli, D.J., and J. Vonk. 2003. Chimpanzee minds: Suspiciously human? *Trends in Cognitive Science* 7: 157–160.
Povinelli, D.J., and J. Vonk. 2004. We don't need a microscope to explore the chimpanzee's mind. *Mind & Language* 19: 1–28.
Premack, D., and G. Woodruff. 1978. Does the chimpanzee have a theory of mind? *The Behavioral and Brain Sciences* 1(4): 515–526.
Pylyshyn, Z.W. 1978. When is the attribution of beliefs justified? *The Behavioral and Brain Sciences* 1(4): 592–593.
Ramsey, W.M. 2007. *Representation reconsidered*. Cambridge: Cambridge University Press.
Ratcliffe, M. 2007. *Rethinking commonsense psychology: A critique of folk psychology, theory of mind and simulation*. Basingstoke: Palgrave Macmillan.

Rizzolatti, G., and C. Sinigaglia. 2006. *Mirrors in the brain: How our minds share actions and emotions*. Oxford: Oxford University Press.

Robinson, E., and I.A. Apperly. 2001. Children's difficulties with partial representations in ambiguous messages and referentially opaque contexts. *Cognitive Development* 16: 595–615.

Ruffman, T., and T.R. Keenan. 1996. The belief-based emotion of surprise: The case for a lag in understanding relative to false belief. *Developmental Psychology* 9: 89–102.

Ruffman, T., and J. Perner. 2005. Do infants really understand false belief?: Response to Leslie. *Trends in Cognitive Sciences* 9: 462–463.

Scholl, B.J., and A.M. Leslie. 1999. Modularity, development and 'theory of mind'. *Mind & Language* 14 (1): 131–153.

Scott, R., and R. Baillargeon. 2009. Which penguin is this? Attributing false beliefs about object identity at 18 months. *Child Development* 80: 1172–1196.

Scott, R., Baillargeon, R., Song, H., and Leslie, A. 2010. Attributing false beliefs about non-obvious properties at 18 months. *Cognitive Psychology* 63.

Senju, A., Southgate, V., Snape, C., Leonard, M., and Csibra, G. in press. Do 18-month-olds really attribute mental states to others? A critical test. *Psychological Science*.

Shapiro, L. 2011. *Embodied cognition*. London: Routledge.

Southgate, V., A. Senju, and G. Csibra. 2007. Action anticipation through attribution of false belief by 2-year-olds. *Psychological Science* 18(7): 587–592.

Southgate, V., C. Chevallier, and G. Csibra. 2010. Seventeen-month-olds appeal to false beliefs to interpret others' referential communication. *Developmental Science* 13: 907–912.

Spaulding, S. 2010. Embodied cognition and mindreading. *Mind & Language* 25: 119–140.

Surian, L., S. Caldi, and D. Sperber. 2007. Attribution of beliefs by 13-month-old infants. *Psychological Science* 18(7): 580–586.

Wellman, H.M. 1998. Culture, variation, and levels of analysis in folk psychologies: Comment on Lillard (1998). *Psychological Bulletin* 123: 33–36.

Wellman, H.M. 2010. Developing a theory of mind. In *The Blackwell handbook of cognitive development*, 2nd ed, ed. U. Goswami, 258–284. Oxford: Blackwell.

Wellman, H.M., D. Cross, and J. Watson. 2001. Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development* 72(3): 655–684.

Whiten, A. 1994. Grades of mindreading. In *Children's early understanding of mind: Origins and development*, ed. C. Lewis and P. Mitchell, 47–70. Hove: Lawrence Erlbaum.

Wimmer, H., and J. Perner. 1983. Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition* 13: 103–128.

Woodward, A. 1998. Infants selectively encode the goal object of an actor's reach. *Cognition* 69: 1–34.