

Do Infants and Nonhuman Animals Attribute Mental States?

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Among psychologists, it is widely thought that infants well under age 3, monkeys, apes, birds, and dogs have been shown to have rudimentary capacities for representing and attributing mental states or relations. I believe this view to be mistaken. It rests on overinterpreting experiments. It also often rests on assuming that one must choose between taking these individuals to be mentalists and taking them to be behaviorists. This assumption underestimates a powerful nonmentalistic, nonbehavioristic explanatory scheme that centers on attributing action with targets and on causation of action by interlocking, internal conative, and sensory states. Neither action with targets, nor conative states, nor sensing entails mentality. The scheme can attribute conative states and relations (to targets), efficiency, sensory states and relations (to sensed entities), sensory retention, sensory anticipation, affect, and appreciation of individual differences. The scheme can ground explanations of false belief tests that do not require infants or nonhuman animals to use language. After the scheme is explained and applied, it is contrasted with other, superficially similar schemes proposed in the literature—for example, those of Gergely and Csibra, Wellman and Gopnik, Perner and Roessler, Flavell, and Apperly and Butterfill. Better methods for testing are briefly discussed.

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A widespread view among psychologists is that infants well under age 3, monkeys, apes, birds, and dogs have been shown to have rudimentary capacities for representing and attributing mental states or relations. I believe this view to be mistaken. It rests on overinterpreting experiments. It often rests on assuming that one must choose between taking these individuals to be behaviorists and taking them to be mentalists. This assumption underestimates a powerful nonbehaviorist, nonmentalist explanation that attributes action with targets and sensing the environment. Neither action with targets nor sensing the environment entail mentality.

Better understanding of mental kinds, and correspondingly sharper experimental methods for evincing such kinds, are needed, if a lasting understanding of the phylogeny and ontogeny of “theory of mind” is to be achieved.

I think that we do not know whether nonhuman animals attribute mental states at all. We do not yet know at what stage human children attribute them. I think that a good guess, given present evidence, is that human children begin to attribute them between 3 and 7 years old. Even the view that 4-year-olds attribute mental states, though perhaps correct, is not as well-grounded as it is widely thought to be. I focus on the view that infants well under age 3 and certain nonhuman animals attribute mental states.¹

By 6 months, human children have the basics of an attribution scheme that adults use to explain actions and sensory relations, for both psychological and nonpsychological agents. Some nonhuman animals use parts of this scheme to attribute agency and sensory relations (Carey, 2009, chapter 5; Csibra, Bíró, Koós & Gergely, 2003; Csibra & Gergely, 2007; Csibra, Gergely, Bíró, Koós, & Brockbank, 1999; Hare, Call, Agnetta, & Tomasello, 2000; Kano & Call, 2014; Marshall-Pescini, Ceretta, & Prato-Previde, 2014; Sommerville, Woodward, & Needham, 2005; Tomasello, Carpenter, Call, Behne, & Moll, 2005; Woodward, 1998). My main point is that natural elaborations of this scheme have been overlooked or underestimated. Natural elaborations can better explain evidence that is commonly used to take infants and nonhuman animals to attribute mental states. The scheme is neither behaviorist nor mentalist. It is *not behaviorist* because it uses notions of action and action targets, because it can invoke complex interlocking internal states (which can in principle be explained computationally), and because it employs a notion of function. I will be explaining wherein it is not mentalist.

I use ‘mental’ and ‘psychological’ interchangeably here. Philosophical tradition over the last century has reached a rare near-consensus on the most general marks of mentality. To specify a state as mental, a scheme must specify it either (a) as conscious or

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¹ Of course, this view is not unanimous among developmental psychologists. Some take infants and animals to be behaviorists. Some are skeptical about the work that I criticize, but do not advance an alternative view. Those who hold some version of the targeted view differ on what *sorts* of mental attributions occur and when. The science is not stable on these issues.

(b) as involving representation or intentionality in a distinctively mental sense—or both (a) and (b).²

Representation will be our main focus. A state is *representational in a distinctively mental sense* if and only if the state is, constitutively, either itself capable of being accurate or true under certain specific conditions, or is a representational part of such a state (as the state of attributing a property is a representational part of a perception or thought). For such a capability to mark a kind of state (help make it the kind of state that it constitutively *is*), this capability must figure in law-like patterns. Common sense has a role here. But the best sign for whether being capable of being accurate or true helps mark a kind of state is whether stable science makes systematic reference to the state as having truth- or accuracy conditions in the science's law-like explanations. Nonscientific explanations in mentalistic terms are cheap. One can explain the growth of a tree or the movements of bacteria or ticks, or even movements of planets, in terms of their wants, perceptions, and beliefs. But science does not use mentalistic explanations in such cases. By contrast, perceptual psychology, which has become stable science, gives law-like explanations that refer systematically to states capable of being accurate.³

I think that there is strong empirical reason to deny that bacteria, snails, and ticks have any kind of mentality. What we know about bases for consciousness indicates that they are not conscious. No stable science attributes to them representational states in the distinctively mental sense. Nor is there reason to think that explanations of their behavior are relevantly incomplete.

I take it as established that infants and certain animals *have* mental states. Our question is when, and in the case of animals whether, taking human children or nonhuman animals to *attribute* mental states explains their behavior better than alternative explanations.

Attributing a mental state involves two representational tasks. The first is specifying (I say '*indicating*') a mental kind—such as desire, intention, perception, belief, feeling, or conscious awareness, *as* that kind. For representational states, the full specification indicates a kind via its *mode* (say, belief) and a *representational content* (*food is in that box*) that is capable of being accurate or true. The second task is to use the indicated kind to characterize something ('*attribute*' that kind). To attribute a belief that food is in that box, one must use a representation to indicate the mental kind *belief that food is in that box* as such, and to attribute that kind to an individual or state. Not only individuals, but states, attribute things. Perceptual states attribute properties and relations to particular entities.

The scheme that I feature attributes sensing, action, and action targets. It is teleological, and not mentalistic. It is silent on whether the action has a *mental* cause and whether the sensing is mental. Understanding the scheme depends on understanding some often neglected distinctions.

First, there is a distinction between generic sensing and mental sensing. Sensing is not in itself mental. Primitive organisms that lack minds sense things. Bacteria sense light. Ticks sense arms by sensing their heat. Sensing does not imply mentality—consciousness, or representation/intentionality in a distinctively mental sense. The generic notion of sensing is old. It is present in Aristotle. It is part of common sense, as well as science.

All sensory states function to causally covary with sensed entities. I call functional causal covariation '*information registration*.'

Bacteria, ticks, and snails sense—and informationally register— aspects of the environment. In flight, bees sense distance by retinal flow. Humans unconsciously sense direction of the ground via pressure in the inner ear. Sensory states covary with various types of entities, and function to be caused to covary. To attribute sensing, one need not assume that the sensory states are conscious, or representational/intentional in a distinctively mental sense. One need not take a position. Bacteria and snails sense nonmentally. Humans sense by both mental and nonmental mechanisms. Sensing is a genus that comprises mental and nonmental subspecies.⁴

Perception is a mental subspecies of sensing.⁵ Perceptual psychology employs the sensing-perceiving distinction. Its causal explanations of some states—such as a perceptual state that represents one surface as being farther away than another—take them to be capable of being accurate or inaccurate. Explanations of other sensory states—such as registration of the light array striking the retina—do not treat them in that way. Such states register information, but are not taken to be representational in a distinctively mental sense.

The distinction in explanatory approach is forced, I think, by the fact that perceptual states are embedded in perceptual constancies. A *perceptual constancy* is a certain competence with a range of interlocking sensory states all of which represent a given property,

² I caution against claiming, in response to what follows, that I rely on overly high standards for attributing mentality. I think that such claims tend to trade on lack of conceptual clarity. The near-consensus notion of mentality that I outline has no clear rival. The counterclaim needs to explain how that near-consensus notion is needed to account for evidence better than the generic notions of action, conation, sensing, affect, and function. I also caution against responding to my arguments by saying that infants and nonhuman animals attribute a "low grade" of mentality. I believe that such a claim, again, tends to trade on conceptual unclearness. It also directly begs the central question at issue. I think that the evidence that I discuss is *incorrectly* explained by taking these individuals to make *any* mentalistic attributions. There may be borderline cases, or vagueness in our mentalistic notions or their application, though I know of no convincing examples. However, I think that mentality does not come in gradations. An infant's attribution's being a borderline case does not make it an attribution of a lower grade of mentality. It is a case in which there is no clear answer as to whether the attribution is mentalistic. Consciousness may be more or less dim. But any consciousness at all counts as mental. Having mental states with accuracy or truth conditions does not come in gradations. Of course, different mental capacities are more or less complex. Perceptions and nonpropositional conative states are structurally less complex than beliefs and propositional intentions. I will touch on these differences. What is at issue, however, is whether infants and animals attribute any mental states or relations at all.

³ These points are elaborated in Burge (2010, chapters 8 and 9) and Burge (2014). The term 'representation' is commonly used both in the sense of *information registration*, explained below—which is not a mentalistic sense—and in the mentalistic sense explained above. The two senses of 'representation' should be strictly distinguished.

⁴ For more on sensing, see Burge (2010, chapter 8). Terminologically, I say that plants are *sensitive* to things, but do not *sense* things. Sensing is associated with action as well as reaction. I think that plants do not act. I call a conscious sensory state a *sensation*. Not all sensing is conscious. Organisms like paramecia sense things. Such organisms surely lack sensations. Incidentally, it is known that bees have visual perception, but use only nonperceptual sensing (retinal flow) to determine distance in flight.

⁵ Distinguishing perception from nonmental sensing may not be as old as the generic notion of sensing. The modern distinction between perception and nonmental sensing may originate in Leibniz and Kant. Modern psychology textbooks distinguish mere sensing from perception, although the distinction is often badly explained.

relation, kind, or object, even though they are caused by significantly different proximal stimuli.⁶ Bacteria, snails, and ticks lack perceptual constancies, whereas slightly higher animals exhibit them. I discuss testing for infants' *sensitivity* to perceptual constancies in the section "Testing for attribution of representational mental states."

This article's critical points, and its support for a generic action-sensing scheme, do not depend on locating the boundary between perception and nonmental sensing. They depend on recognizing the old, common-sensical, *generic* notion of sensing, used in the biological sciences, and on recognizing that that notion is not mentalistic, on any standard understanding of the term. I think that current evidence supports taking infants and nonhuman animals to make attributions with the generic notion of sensory state, not a mental subspecies, perceptual state.

Further, there is a distinction between attributions of action that do and do not attribute mental guidance.⁷ A lot of animal action involves no mentality. A snail's crawling toward a leaf that it comes to eat is action caused by nonmental *conative* states. The action is target-oriented. It and the conative states function to realize the action's *target*. The conative states do not represent a goal or target, as an intention would. No stable science attributes consciousness or representation/intentionality in a distinctively mental sense, in explanations of snail behavior.

A *conative state* is a state that not only provides energy to cause an action, but functions to do so. Like sensory states, conative states are not in themselves mental. They need not be conscious; they need not be representational in the required sense. States like desire or intention are mentalistic species of the genus, conative state. Conative states share functions with actions that they cause. Thus conative states function to cause realization of targets. This notion of *function* is not mental. The function of generic conative states can, in simple cases, be understood biologically: a state-type functions to *x* if *x*-ing contributes to fitness in a way that helps ground the state-type's evolutionary emergence or survival (Wright, 1973). The snail's crawling to and eating a leaf functions to help it survive long enough to reproduce. The act and the conative state that causes it function to causally covary with reaching and eating the leaf. Although 'conative state' may sound technical, the notions of action, state, event, cause, and function that it comprises are ordinary, and known to be used by infants and apes.

I think that every action is caused by one or more conative states. Every action is endogenously caused by some state or event. To be an action, the action must result from a competence to initiate the action. That competence must share the action's function: it would not be a competence to initiate the action if it did not have the function that the action has. The most basic types of action are evolutionarily selected via selection of their conative causes.

I use '*target*' to apply to the would-be successful fulfillment of an action's function. The snail's crawling has the target of reaching and ingesting the leaf. A scientist's investigation has a target of solving a problem. I reserve '*goal*' for targets that are represented by the agent—the scientist's target, not the snail's. In ordinary usage, both terms, and the term '*purpose*,' are not clear on the point. My term '*target*' is silent on whether or not an agent represents the target. I distinguish targets and *target objects*. Target objects are objects within a more complex target. Food is the

target object within the target of crawling to and ingesting the food.

Here is an overview of a basic application of the action attribution scheme that I develop. In accounting for active behavior, the scheme attributes an action with a target, and perhaps a conative state that causes, and functions to cause, the action and realization of the action's target.

The scheme attributes a sensory state and/or sensory relation. Commonly, sensing a target object is taken to guide the action. A sensory state can be taken to cause or modulate the conative state.

The nonmentalistic action-attribution scheme, used in biology, explains a snail or tick's behavior in a scientifically and commonsensically acceptable way. The animal is taken to sense a target object. The sensory state triggers a conative state—which might be called a drive, impulse, or just a functional, internal cause. The sensory state guides the animal's active movement. The action's function is to lead to ingesting food. The sensing and the action might be more or less efficient and more or less successful. Sensory states *count* as sensory states in that they function to be caused to covary with biologically significant conditions. Conative states *count* as conative states in that they function to cause active behavior and covary with realizing targets.⁸

This scheme is applied, commonsensically and in science, to many organisms that either lack minds or are not presumed to have minds. The scheme can explain the behavior of certain robots that simulate or engage in active behavior. Adults sometimes use it to explain actions of other humans, in cases where the richer resources of mentalistic schemes are not needed. There is evidence that infants and some nonhuman animals use the scheme.

Many psychologists recognize a distinction between action attributions that do and do not attribute mental sources of action. However, the recognition tends to underestimate resources for explaining action without attributing psychological states. As I will show, the scheme can be used in explanations that are *much* richer than common-sense explanations of action by ticks or snails. The scheme can attribute not only agency, conative states and relations, sensory states and relations, and action targets. It can be sensitive to efficiency. It can attribute sensory retention and sensory anticipation. It can attribute affect and can be sensitive to individual differences.

I assume a methodological principle in the spirit of Ockham and Morgan. When infants and nonhuman animals are known to attribute a certain property (or relation or kind), an explanation that takes them to attribute a further property that is a subspecies of the first is to be rejected, unless it is supported by evidence that shows that relevant subjects have capacities specific to the subspecies. To take infants or animals to attribute *mentalistic sensing*, science

⁶ I provide a more detailed account of perception in Burge (2010, chapter 9). There I discuss perceptual constancies as marking the difference between perception and nonmental sensing—grounding the postulation of accuracy conditions in a distinctively mental sense.

⁷ See Burge (2010, chapter 8, the subsection "Primitive Agency").

⁸ For examples of scientific use of this scheme, see the works cited in note 14.

must have evidence of abilities specific to *mentalistic sensing*, in contrast to the genus, *sensing*.⁹

To give a crude analogy: An infant who interacted with bodies containing carbon, but whose behavior in no way distinguished carbon-containing bodies from other types, should not be taken to be using a notion that attributed the specific kind *carbon-containing body*, or have a rudimentary “theory of carbon,” even if the infant met many more carbon-containing bodies than other kinds. The infant should be taken only to be attributing the genus, *body*. (I assume that the infant responds differently to bodies than to events and other relevant kinds in the environment, and is sensitive to basic macrocharacteristics of bodies and bodily motion.)

Infants and nonhuman animals mostly interact with agents that have minds. It is not enough for mentalistic attribution that an infant’s attributions covary with others’ mental states and relations. Infant’s attributions also covary with generic conative and sensory states and relations. An infant must be sensitive to some *mental differentiae* in the generic sensory, conative, or agency categories. Making mentalistic attributions does not require fully understanding them. It does require some ability specific to mentalistic states.

In acting on a conative state, an individual acts on a state that causes and functions to cause the action, and functions to realize the action’s target. Intentions are a subspecies of generic conative states. A differentiating feature of the subspecies is that intentions *represent* the action’s target or target object. I leave open for now whether an infant must represent conative states’ representing the target, if it attributes intentions. But to attribute intentions, intentional relations, or intentional action, an infant must have *some* attributional ability that is distinctive to their mentality. Merely causing action, functioning to do so, and functioning to realize the action’s target do not suffice to be mental. No evidence has shown that infants under age 3, or nonhuman animals, attribute mental subspecies of the genus *conative state* (or *relation*), or *intentional action*, as opposed to the genera.

We know that children come to attribute mental states. We do not know that nonhuman animals do so. Some take this difference to ground taking infants to attribute mental states, even if evidence equally supports taking them to make more modest attributions. I think that this view will not be sustained by scientific practice. The Ockham-like principle will assert itself.

We know that adults often attribute mental states when there is no good basis for their doing so. Some infer that infants attribute them despite lack of specific evidence that they do so. This inference begs the question. We know that adults attribute mental states. Given this knowledge, we can show that they overattribute them. Whether infants attribute mental states is not known, apart from specific evidence that they do so. They cannot overattribute mental states unless they have representations of mental states to attribute.

Attribution of Action and Sensing in Infants and Nonhuman Animals

Discussion of early attribution of mental states caught fire with false belief tests. Such tests remain the most prominent evidence adduced for taking children to attribute mental states. I return to these tests in the section “False belief tests.” In the section “Do 5-

to 18-month-olds or non-human animals attribute intentions, perceptions, or emotions?” I discuss the widespread view that at whatever age children attribute beliefs, they attribute desires, intentions, attention, perceptions, emotions, or intentional (mentally informed) action sometime between 5 and 18 months. I think this view mistaken. Discussing this issue will prepare us to understand the issue over belief.

In this section, I summarize what is known about infants’ response to agency.¹⁰ It seems established that infants have a nonmentalistic system for identifying and attributing agency by 5 to 6 months of age, at latest. Many believe this system to antedate attribution of mental states. I discern little agreement over what distinguishes attribution of mind-caused agency. I believe, however, that bracketing issues about when attributions of agency involve attributions of mentality, my summary will, in its main outlines, be relatively uncontroversial.

From birth, human infants and some nonhuman animals distinguish the motion of inert bodies from that of animate beings (Bardi, Regolin, & Simion, 2011). The latter is called ‘biological motion.’ It is endogenously caused, animal-like movement.

Biological motion is usually associated with agency. But agency is a richer phenomenon. To represent it, infants must track further cues to agency and functional upshots of biological motion. They do so. From birth, response to biological motion—and to static shapes of faces, snakes, and spiders—is integrated with social responses or responses to threat. At 4–6 months, infants respond to self (endogenous)-propulsion, to whose agential functions they are sensitive (Baillargeon, Wu, Yuan, & Li, 2009; Gao, McCarthy, & Scholl, 2010; Leslie, 1982; Meltzoff & Moore, 1983; New, Cosmides, & Tooby, 2007; Öhman & Mineka, 2003; Rakison & Derringer, 2008). Such facts suggest that attribution of agency may be present at birth. Indeed, it may be present in human visual perceptual systems.

By 3–6 months, infants associate an agent with a target and expect given agents to pursue given targets in given situations (Carey, 2009, chapter 5; Csibra, 2008; Csibra et al., 1999, 2003; Hunnius & Bekkering, 2010; Király, Jovanovic, Prinz, Aschersleben, & Gergely, 2003; Luo, 2011a; Luo & Baillargeon, 2005; Luo & Johnson, 2009; Woodward, 1998). Roles are assigned to agents—for example, chaser and chased. Role reversal occasions longer-looking.

By 3–6 months, infants anticipate efficiency in actions, given target and circumstances. They infer environmental constraint if an agent takes an inefficient means to a target. Suppose that an infant is habituated to an agent’s moving along the ground and then taking a trajectory that leaves the ground and returns. Suppose that during habituation, the area over which the trajectory occurs is occluded from the infant’s vision. After habituation, the occluder

⁹ The principle is similar to Morgan’s Canon: “In no case is an animal activity to be interpreted in terms of higher psychological processes if it can be fairly interpreted in terms of processes which stand lower in the scale of psychological evolution and development” (Morgan, 1903, p. 59). I do not rely on Morgan’s Canon, because to assume that action attribution precedes mentalistic attribution in development would beg a question at issue. I believe that it does precede. But I want to argue this, not assume it.

¹⁰ I will not trace relations between agency attribution and animacy attribution. For an excellent review of the latter, see Opfer and Gelman (2011).

is removed. Infants dishabituate if there is no obstacle that occasioned the trajectory. Similarly, infants are habituated to a chased agent passing through an opening in a barrier too small for the chaser to get through and the chaser going around the barrier. Infants dishabituate, if the opening is widened so that the chaser can get through and the chaser still circumvents the barrier (Carey, 2009, chapter 5; Csibra et al., 1999, 2003; Kamewari, Kato, Kanda, Ishiguro, & Hiraki, 2005; Y. Luo, 2011a; Scott & Baillargeon, 2013).

Six-month-olds anticipate more entities as likely agents. Hands, as well as faces and animal-shaped bodies, are included (Leslie, 1984; Saxe, Tzelnic, & Carey, 2007). Six-month-olds generalize about character. After watching an agent help or hinder another, infants prefer helpers over hinderers, and hinderers of hinderers over ordinary hinderers (Hamlin, Wynn, & Bloom, 2007; Hamlin & Wynn, 2011). Nine-month-olds show impatience when another agent refuses to give a toy, but are more tolerant if the agent starts to give a toy, but is prevented by circumstances (Behne, Carpenter, Call, & Tomasello, 2005).

Seven-month-olds are likelier to imitate human agency than nonhuman agency. Ten-month-olds anticipate targets for agents, even when they have watched only an agent's *failing* to reach a target. Twelve-month-olds infer both from action to anticipated target and from target to anticipated action. They associate agency with certain types of bodies, such as human bodies and hands, in contrast to toy trucks and bean bags, *without* seeing them move (Brandone, Horwitz, Aslin, & Wellman, 2014; Carey, 2009, chapter 5; Csibra & Gergely, 2009; G. Csibra et al., 1999; Mahajan & Woodward, 2009; Rochat, Striano, & Morgan, 2004; Saxe et al., 2005; Sommerville et al., 2005; Tomasello et al., 2005; Woodward, 1998).

At 13 months, infants anticipate specific actions by others, based on what others have been observed to sense, even when these actions and sensings differ from what the infant would do, or what it senses (Onishi & Baillargeon, 2005; Southgate, Senju, & Csibra, 2007). Eighteen-month-olds appreciate diversity of action-targets among agents and aid others in reaching targets, even if the targets differ from the child's own. 18-month-olds, but not 14-month-olds, give an adult more of what the adult usually takes as target object, even if the infant has a different preference. Controls show that infants do not merely hoard their preferred targets. Eighteen-month-olds use observation of positive or negative reactions to a target to ground aiding others in reaching targets, even if the infant does not share them. Two-year-olds anticipate others' behavior by anticipating others' different targets (Buttelmann, Carpenter, & Tomasello, 2009; Egly, Király, & Gergely, 2013; Repacholi & Gopnik, 1997; Wellman & Liu, 2004). Three-year-olds use information about an agent's conative states to anticipate behavior, to anticipate positive or negative affective states in relation to success or failure in reaching targets, and to anticipate change of an agent's conative states and targets, influenced by failure or success with targets (Bartsch, 1996; Moses, Coon, & Wusinich, 2000; Rakoczy, Warneken, & Tomasello, 2007).

Attribution of agency with this developing structure combines, from early ages, with attribution of sensing. From 3 months, possibly from birth, infants follow others' gaze. By 6 months, they connect an agent's gaze direction with an agent's targets. By 9 months, children display objects for others to sense, monitoring the line between others' eyes and the objects (De Groote, Roeyers, &

Striano, 2007; Hood, Willen, & Driver, 1998; Johnson, Ok, & Luo, 2007; Luo & Baillargeon, 2005; Luo & Johnson, 2009; Tomasello et al. 2005).

Twelve-month-olds who hear an adult use a term for an object that they are gazing at acquire the term, but only if the adult gazes at the object. If the adult looks elsewhere, infants do not acquire the term (Baldwin, 1991; Johnson, Slaughter, & Carey, 1998; Sodian, Shoenberger, & Metz, 2004). Two-year-olds communicate differently with adults who can reach an object that the child wants but cannot reach, depending on whether the adult could sense the object. They point more if they notice that the adult has not sensed the object (O'Neill, 1996).

Emergence of gaze-following is closely connected, from 9 to 15 months, with emergence of joint attention, command gesture and speech, and descriptive use of language. *Joint attention* involves two people's monitoring coordination of sensory orientation to the same object and coordinating actions on the object. *Command gestures* and *command speech* indicate that a certain action is to be done. *Descriptive use of language* gets another to orient to and sense a situation. These skills of social cognition emerge gradually from 9 to 15 months, taking on richer forms. The skills are mutually interactive. Gaze following is integrated with spotting action targets and with spotting entities that are sensed, to anticipate actions (Carey, 2009, pp. 185–186; Carpenter, Nagell, & Tomasello, 1998).

Attributions of agency and sensing come to be associated with attributions of affect. Affect is evinced by body/face figurations. Infants attend differentially to faces and facial expressions from birth. By 6–7 months, they use facial expressions to anticipate specific action types and targets. By 8 months, they anticipate affects that are appropriate or inappropriate to an act's fulfilling or not fulfilling its target. For example, they look longer if an agent produces an expression that we know to be sad, after the agent obtains some attractive object. By 9–12 months, they use others' affect expressions to determine whether to approach or avoid a novel object. They do so when and only when they see the adult gaze at the object. They approach and play with an object if they perceive a positive expression, but avoid the object if they perceive an expression that we know to be one of fear, disgust, or anger. At 12–14 months, they use an adult's gaze to determine the target of an affect expression as a target for potential action or avoidance. By 18 months, they anticipate when they are a likely target of an individual's affect, based on memory of how that individual responded to another person who acted as the infant will act. Infants' anticipations depend on their assessment of whether the individual that shows the affect can sense the infant acting (Baldwin & Moses, 1994; Carey, 2009, p. 180; Repacholi, 1998; Moses, Baldwin, Rosicky, & Tidball, 2001; Phillips, Wellman, & Spelke, 2002; Repacholi & Meltzoff, 2007; Repacholi, Meltzoff, & Olsen, 2008; Skerry & Spelke, 2014; Sorce, Emde, Campos, & Klinnert, 1985; Striano & Vaish, 2006; Walden & Ogan, 1988; Walker-Andrews, 1997).

Results for apes, some monkeys, and other animals are similar to results for infants on action-target-efficiency issues and issues combining understanding of sensing and affect with understanding action. Many animals follow gaze, with special attention to eyes. Monkeys and apes identify actions, targets, target objects, and means–end relations. They anticipate efficiency. Macaques, for example, look longer at an act that follows an inefficient indirect

path to a target than an act that follows a direct path (Schloegl, Kotrschal, & Bugnyar, 2007; Rochat, Serra, Fadiga, & Gallese, 2008; Stulp et al., 2009). Chimpanzees and monkeys grow more impatient—leaving the room or begging for more—when a provider refuses to give food, but clearly can, than when a provider seems ready to give food, but drops it or is prevented from giving food (Call, Hare, Carpenter, & Tomasello, 2004; Phillips, Barnes, Mahajan, Yamaguchi, & Santos, 2009).

Integration of gaze following with action in apes and other animals is similar to that in 6- to 15-month-old infants (Rosati, Santos, & Hare, 2010). An ape or dog can note whether a dominant con-specific has food in a sight-line. It seeks the food if the sight-line is occluded, and defers if it is not (Flombaum & Santos, 2005; Hare et al., 2000; Soproni, Miklósi, Topál, & Csányi, 2001; Tomasello, Call, & Hare, 2003; for an analogous result using hearing, see Melis, Call, & Tomasello, 2006). Chimpanzees remember what another ape has sensed, or failed to sense, and act accordingly (Hare, Call, & Tomasello, 2001). Apes engage in command gestures, but rarely in joint attention or descriptive communication.

Do 5- to 18-Month-Olds or Nonhuman Animals Attribute Intentions, Perceptions, or Emotions?

In the section “Attribution of action and sensing in infants and nonhuman animals,” I described evidence that subjects represent agency, sensing, and affect. I did not describe it as showing them to attribute mental states or relations. Most researchers on these matters take some or all the evidence to show mentalistic attribution, often by 5–6 months in infants, usually by 12–13 months. Apes and other animals are taken to make mentalistic attributions similar to those by infants. I think that what has been shown is that the subjects use *generic* notions of agency, conative states and relations, sensory states and relations, retention of both, anticipations of both, and affect—not mentalistic notions. The research uncovers a structure that scaffolds eventual mentalistic attributions by humans.

No good scientific theory holds that evidence should be explained by postulating attribution of more specific kinds, if attribution of a more generic kind is known to be in play and postulating attribution of that more generic kind explains evidence satisfactorily. Some capacity must be more fitted to the species than to the genera—if subjects are to be tenably taken to attribute mental states. I think that no such capacity has been exhibited.

What has led much of the field to interpret the experiments as revealing attributions of mental states? There are several factors.

Perhaps the simplest is failure to distinguish generic notions from mentalistic subspecies. Agents that relevant subjects interact with *in fact* act from mental sources. It is easy to assume that infants represent acting *as having* mental causes and sensing *as being* mentalistic.

There is a common tendency to infer from attribution of action with a target directly to attribution of conative sources like intention or desire. There is a tendency to describe any action as ‘intentional action,’ implying mentality (Bartsch & Wellman, 1995; Carruthers, 2013, p. 143; Dasser, Ulbaek, & Premack, 1989; De Vignemont & Haggard, 2008; Fogassi et al., 2005, p. 666; Goldman, 2008; Iacoboni et al., 2005; Luo & Baillargeon, 2005; Perner & Roessler, 2010, p. 213; Perner, Rendl, & Garnham, 2007,

pp. 475–476; Repacholi & Gopnik, 1997; Scott & Baillargeon, 2009, pp. 1173–1175; Tomasello et al., 2003; Wellman, 2014, pp. 17, 82–90, 175–178; Wellman, 1990; Wellman & Woolley, 1990).¹¹

A lot of action lacks mental sources. Every action has a target and can be successful or unsuccessful in realizing it. A snail’s crawling may function to get it food. It may or may not succeed. In saying this, we do not assume that the snail represents its target, or has intentions.

Of course, it is not my view that infants represent actions as *lacking* mentality, as adults mostly do for snails. To represent lack of mentality, one would have to be able to represent mentality. Infants represent acts and targets generically or unspecifically. As far as current evidence has shown, an infant’s representation is like the common-sense attribution of generic agency to a snail in being silent about whether the agent has a mind. Similar nonmentalistic generic explanations can be correctly given for agents that have minds. The explanations are not as specific or rich as mentalistic explanations, but they remain correct.

It is also not my view that infants’ attributions are as simple as common-sense explanations of snail behavior. As indicated in the section “Attribution of action and sensing in infants and nonhuman animals,” infants use a very nuanced version of the generic scheme. My point in citing attributions to simple organisms is always *purely* to show that generic conative, sensing, and affect notions do not imply mentality. I do think that attending to ways in which common sense and science explain acts by organisms that lack minds would enrich theorizing about infants and higher animals.

A variation on the error of moving without evidence from action with a target to intentions is an inference from action to trying, where trying is conceived as mental (Premack & Premack, 2003, 146; Tomasello et al., 2005). Attributing action that succeeds or fails to meet a target does not imply that the action has a mental source. Attributing conative states that function endogenously to cause action does not imply that the states are mental.

Although some psychologists infer directly from attribution of action with a target to attribution of a mentally guided action, the inference often rests on more. Each of the following has been cited as ground to take subjects to attribute mentality. An infant may anticipate action from an agent’s bodily or facial orientation. An infant may be sensitive to individual differences in targets. An infant may be sensitive to roles and role-reversals. An infant may respond differently to agents that do not help them, but can, from agents that do not help them, but are prevented by circumstances. An infant may anticipate efficiency in an action (Buttelmann, Carpenter, Call, & Tomasello, 2007; Byrne, 1995; Carpenter et al., 1998, p. 122, 124; Csibra et al., 1999; Gao, Scholl, & McCarthy, 2012; Gergely, Nádasdy, Csibra, & Bíró 1995; Gergely et al., 1997; Meltzoff, 2010; Meltzoff & Moore, 1995; Schwier, van Maanen, Carpenter, & Tomasello, 2006, p. 304; Scott, Baillargeon, Song, & Leslie 2010; Seyfarth & Cheney, 2015; Surian, Caldi, & Sperber, 2007; Tomasello et al., 2005).

¹¹ Baillargeon et al. (2009) even claim that to represent self-propulsive movement as agency, a child must have ‘unambiguous’ evidence of mental states. By contrast, several psychologists laudably avoid inferring directly from attribution of action to attribution of mentality (Gergely et al. 1995; Leslie, 1994; Woodward, 1998).

Attributing all of these features is part of any reasonably rich generic action-attribution scheme. Even in aggregate, such attributions do not evince attribution of mentally guided action.

Two of the features are associated with terminological unclarity, similar to use of ‘intentional’ and ‘trying.’ Often bodily or internal action-orientation is called ‘attention.’ It is natural to take eye direction rather than hand disposition as a cue to how an agent or internal state is oriented toward a target. ‘Attention’ can be generically understood as orientation or allocation of an individual’s central resources. So understood, the term is not mentalistic. The term normally implies allocation of central *mental* resources. One needs specific evidence to show that orientation of an agent’s central resources is mentalistic attention.

Similarly, efficiency, not a mental notion, is often conflated with rationality, a notion with mental implications. A snail’s crawling toward its target can be evaluated for efficiency without any attribution of mind. Although the distinction has been drawn in the literature (Gergely et al., 1997; see the section “Some approaches with points in common with the present approach” below), it has not been sufficiently attended to.

As noted, some theorists infer attribution of *desire* and *intention* from an infants’ attribution of different action targets to different agents. The idea is that different targets evince for an infant different internal states in different agents that cause different actions with different targets. Different internal states are then counted different “subjective” mental states (Gao et al., 2012; Repacholi & Gopnik, 1997; Wellman, 2014, p. 75). Recognition of individual differences in action targets, and acknowledgment of different internal conative states, which function to cause different actions, does not imply taking the states to be mental. There is nothing unusual about different agents’ having different targets, or changing targets, over time—even if one does not assume that the agents have minds. The move from varied-and-internal to subjective-and-mental has no conceptual or evidential basis.

Attributing roles in action, including evaluation of whether the roles involve aiding or hindering, is an important part of any rich generic action-attribution scheme.

Parallel to overinterpreting agency is overinterpreting sensing. Recall that sensing is a form of information registration. It causally covaries with objects or properties, and functions to do so. Sensing is not in itself either conscious or representational/intentional in a distinctively mental sense. A mollusk senses light and may sense a predator by sensing a change in light. Conflation of generic sensing with mental sensing—specifically, perception—is nearly ubiquitous in the literature (Byrne, 1995, p. 104ff; Carey, 2009, p. 181ff; Csibra et al., 1999; Dasser et al., 1989, pp. 365–367; Gergely et al., 1995; Kovács, Téglás, & Endress, 2010; Luo & Baillargeon, 2007; Luo & Johnson, 2009; Meltzoff, 2010; Moll, Carpenter, & Tomasello, 2007; Perner & Roessler, 2010, p. 221; Rochat et al., 2004; Schwier et al., 2006, p. 304; Senju, Southgate, Snape, Leonard, and Csibra, 2011; Surian et al., 2007; Tomasello et al., 2003; 2005; Wellman, 2014, p. 178, 216; Wellman, 1990; 1993). Correlatively, the generic *retention* of sensing is conflated with knowledge or belief. All organisms with nonmental sensory states retain them for shorter or longer periods.

In an experiment cited earlier, chimpanzees modified their behavior depending on whether they took a dominant to be gazing at some food. If the food was occluded from the dominant’s line of sight, the chimpanzee retrieved the food; otherwise not (Hare et al.,

2000; Melis et al., 2006; Tomasello et al., 2003, p. 154; Tomasello, Call, & Hare, 2003a; for good review with some criticism, Whiten, 2013).¹² The authors took this result to show that apes have a rudimentary capacity to attribute mental states—perceptions. The experiments show only that apes represent action-relevant entities as sensed by competitors, and that they represent retention of sensory information, and connect such retention with anticipated action and conative states.¹³ These points do not make the results less interesting. They do show that the experiments are not breakthroughs (as Tomasello et al., 2003, p. 154, claim) in revealing that apes have mentalistic representations. Visual sensing is not line of gaze, as behaviorists might hold. It bears a functional information-registration relation to sensed entities and to action. Attribution of sensing can involve attribution of internal sensory states.

Similar points apply to animal deception (Kirkpatrick, 2011). Such deception can be explained in terms of an ability to represent sensory availability and action targets. Apes can recognize, even produce, presence or absence of sensory relations. They determine action-relevant target objects that other agents sense. They attribute states that retain sensory information. They use these skills to anticipate action, and to deceive. An individual can deceive by preventing another’s sensory information from linking with successful action. No attribution of mental states is needed.

I mentioned that some theorists distinguish subjects’ attributions of mind-driven agency by invoking evidence that subjects *coordinate* anticipations of agency with other anticipations—for example, anticipations of efficiency or differences in goals for different individuals. A more basic inference is to maintain that the subjects’ coordination of agency attribution with attribution of sensing itself marks mentalistic attribution (Call & Tomasello, 2008; Carey, 2009 chapter 5; Leslie, 1994; Surian et al., 2007; Wellman, 2014, 85–86). But generic conative states and generic sensory states (and their nonmental subspecies) interact in a way that is structurally analogous to belief-desire- or subpropositional psychology of action. These nonmentalistic action-attribution schemes have the same basic structure. Action-causing, conative states are guided by information-yielding sensory states, or retentions or anticipations of such states. Generic action explanations applied to ticks and hydra, as well as to higher animals and humans, take this form.¹⁴ The structure is not inherently mental. The assumption that behaviorism is the sole alternative to mentalism commonly obscures this common-sense point.

¹² Tomasello and Haberl (2003) infer directly from a child’s ability to anticipate selectivity in sensed objects to a child’s ability to attribute attentional mental states. I criticized this sort of inference above. Tomasello et al. (2003, p. 679) maintain that attributing persistence and cessation of action “involves an understanding that [agents] perceptually monitor their actions so that they can recognize when they have succeeded.” This claim is unsupported. It derives again from conflating generic sensing with perception. All animals, including humans, have some non-mental, unconscious sensory feedback mechanisms that regulate persistence and cessation of action. Evidence is needed to show that subjects attribute *mental* mechanisms for such monitoring and regulation.

¹³ Most of my points about apes apply to theory-of-mind literature on birds. See Clayton, Dally, and Emery (2007); Clayton and Emery (2007), and Emery and Clayton (2007).

¹⁴ The common sense point guides nonmentalistic, nonbehaviorist approaches even to lower animal behavior (Carlisle, 1975; Gallistel, 1980, 1990; Van Houten, 2000).

The basic scheme that takes actions to have targets and to be caused by conative states and guided by sensory states (or states of sensory retention or anticipation), can be enriched by integrating conative states and sensory states with affective states. There is a genus of affective state with mental and nonmental species. The mental species is emotion. Passive uptakes, including positively or negatively valenced responses to and anticipations of actions, need not be mental. Wasps' or snails' generic intensified affect that derives from being threatened is called 'angry' or 'upset.' But this is metaphorical talk without serious commitment to mentality in the wasps' or snails' affect. We note that animals respond to behavior associated with other animals' degree of satisfaction or frustration—and relate such states, which surely have a function, to sensing and action—without assuming that the animals attribute emotions. Attributing emotions involves attributing either consciousness or representation/intentionality. So far, I see no evidence that in attributing affective states, infants or animals attribute either property. Evidence supports taking them to attribute generic affect, not emotion. Combining attributions of sensory, conative, and affective states no more evinces mentalistic attribution than combining sensory and conative states. Such combinations are central to the generic scheme.

Some psychologists have claimed that infants in their 2nd year attribute only behavioral rules or low-level perceivable physical connections, based on association (Heyes, 2014, 2014a; Penn & Povinelli, 2007; Perner & Doherty, 2005; Perner & Ruffman, 2005; Povinelli & Barth, 2005; Povinelli et al., 1996; Ruffman, 2014; for a reply to Heyes, 2014, see Scott & Baillargeon, 2014). Such approaches do not feature an action-sensing scheme. At latest by 6 months, infant responses to behavior show a unity fitted to central aspects of agency. Infants' holding together action targets, anticipation of agential roles, anticipations of efficiency, use of sensory information to guide anticipations, and so on, constitutes a system of abilities so fitted to action-guided-by-sensing that taking them to use behavioristic schemes appears explanatorily inadequate (For criticism of such positions, see Carey, 2009, p. 185ff.).

A basis for rejecting behaviorist and other very low-level attribution schemes is the complexity and interaction among states that children and nonhuman animals attribute to others. Behaviorist schemes have never done well when confronted with coordinated richness among internal states. I believe, with most developmental psychologists and ethologists, that appeals to such low-level schemes lack explanatory power and fruitfulness. I think that this near consensus, however, has led to a complacency about the security of theory-of-mind accounts. Complacency derives from assuming that the only viable alternative to low-level accounts is a mentalistic account, and from underestimating the power of the generic action-sensing scheme.

Attempts to support early emergence of theory of mind so far discussed are inferences from aspects of infants' and animals' responses to others' behavior. A further line takes infants to make simulation-type, 'like me' inferences. From recognition of how they experience a situation, they are taken to infer to others' experiencing similar situations.

Twelve-month-olds were blindfolded. After experiencing the blindfolds, they were less likely to follow the gaze of a blindfolded adult. Eighteen-month-olds do not need laboratory experience not to follow the gaze of blindfolded adults. They had

already learned the inefficacy of blindfolded visual sensing. Eighteen-month-olds were, however, given devices that looked opaque, but that could be seen through when worn. After experience with such devices, they followed the gaze of a blindfolded adult. These results were taken to show that 18-month-olds understand their own and others' experiences—represent their and others' sensory states as mental (Meltzoff & Brooks, 2008; also Meltzoff & Gopnik, 1993; Povinelli & Vonk, 2003; Senju et al., 2011; Wellman, 2014, p. 21).

This experiment explores a subject-to-other transition, instead of a transition based on another's behavior. Subject-to-other transitions figure in development. The issue is what, in the subject, is mapped onto others. The theorists assume that infants map their own experiences *as such* onto others.

No evidence is cited to show that the subjects represent themselves *as* conscious, or *as having* specifically mental representational sensory states—perceptions—as opposed to generic sensing. It is not plausible that the infants represent themselves as having *conscious* visual sensory states. The infants experience consciously. But being conscious and representing consciousness as such are different. Subjects' visual experiences are notoriously nonsalient for the subjects. Their focus is on experienced entities, not the experiences. G.E. Moore said that experience is transparent for experiencers (Moore, 1903). In visual experience, infants do not seem to have a use for isolating consciousness as a distinctive property of their visual experience.¹⁵ Similar points apply to infants' isolating representation/intentionality in a distinctively mental sense. The point at issue is whether they attribute to anyone—themselves or others—a mental subspecies of sensing. Infants can dissociate a generic notion of sensing an object from their or others' having ordinary blindfolds. They can associate it with their and others' having transparent devices that look like blindfolds.

One gets mentalistic attribution from "like me" experiments only if one assumes that the infants attribute mentality to themselves. It needs to be shown, not assumed, that mental aspects of themselves are what they differentiate in attributing "like" aspects to others. No evidence so far cited shows that they do not rely on a generic notion of sensing.

Two further inferences center on infants' early *linguistic usage*. One inference moves from use and understanding of language to attribution of mental states. Some developmental psychologists assume that understanding language, or understanding effects of linguistic usage on others, evinces or even conceptually entails attribution of mentality. The idea is that to understand another's use of a term, one must understand the term *as* being used intentionally.

This inference is unsound. Communicating and understanding require coordination of mental states between sender and receiver. One cannot assume that such coordination requires *representation* of mental states or relations as such. It appears enough to find environmental entities that covary with and connect functionally with language use. Learning language has not been shown to require theorizing, even "implicitly," about

¹⁵ I discuss a case (pain), in the section "Attributions of pre-representational emotions and conscious sensations," that does not involve sensing entities in the environment.

mental states. One cannot assume, as a conceptual truth, that understanding and communicating meaning require *metarepresentation* of meaning, reference, intention, belief, or the like. It is one thing to use and understand language. It is another to have a metarepresentational understanding of the psychological or semantical facts that go into that use and understanding. One needs evidence that early language learners attribute mental states in learning language.¹⁶

A second inference is more specific. A common view is that children attribute intention and desire before they attribute belief. The view is partly grounded on children's use of terms like 'wants' in their 2nd year, before they use 'believes.' They explain actions using terms like 'wants,' 'likes,' 'is pleased' (Bartsch, 1996; Bartsch & Wellman, 1995; Hadwin & Perner, 1991; Moses et al., 2000; Perner, Sprung, Zauner, & Haider, 2003; Rakoczy et al., 2007; Wellman, 2014, chapter 4).

Early use of these words is to be expected. Action is an overwhelmingly dominant topic of early speech. Adults use the words. Children pick them up. Whether and when children attach meanings that imply mentality invites investigation. 'Wants,' 'likes,' and 'is pleased' plausibly apply, at earliest stages, to any conative or affective state that functions to cause action. The words connect agent and action to target or target object. Similarly, for words like 'see.' The structures of simple mentalistic explanations closely parallel structures of generic explanations of action as guided by generic conative states, generic sensing (or sensory retention-anticipation), and generic affect. I know of no evidence that such words carry for children mentalistic meaning from the outset. A more critical approach to early word meaning would be salutary. Much current work is handicapped by assuming, on grounds criticized earlier, that infants attribute intention and perception before they use language. Theorizing about linguistic use is biased by these views. I take no stand on whether use of words like 'want' indicate mental states for, say, 3- or 4-year-olds. Claims that they do, however, need scrutiny.

I have argued that imputing to infants and nonhuman animals a generic attribution scheme accounts for evidence adduced to credit them with theory of mind. Infants attribute agency and sensing at birth to 6 months. Absent evidence for mentalistic attribution, the default position is that they continue to use this scheme, with growing sophistication. I next discuss whether false belief tests, for infants under age 3 and nonhuman animals, affect this situation.

False Belief Tests

Modern discussion of primitive attribution of mental states begins with a 1978 paper by David Premack and G. Woodruff (Premack & Woodruff, 1978, p. 515). They proposed attributing a theory of mind to chimpanzees. They cited a 14-year-old chimpanzee's anticipation of behavior by a human who was faced with such problems as obtaining an out-of-reach fruit. They showed that the ape chose from a set of photographs the one that depicted the best solution to the problem. The authors took the chimpanzee's behavior to require it to attribute 'at least two states of mind to the human actor, namely, intention or purpose on the one hand, and knowledge or belief on the other' (Premack & Woodruff, 1978, p. 518).

This conclusion was criticized in commentaries published in the same journal issue. Three philosophers independently claimed that

the chimpanzee might simply anticipate what it would do to solve the problem. They thought that the conclusion would be more convincing if the ape anticipated the agent's acting differently from the way the ape would act (Bennett, 1978; Dennett, 1978; Harman, 1978).

This suggestion was taken up in developmental psychology for children some years later. Heinz Wimmer and Josef Perner ran what came to be known as a *false belief test* (Gopnik & Astington, 1988; Wimmer & Perner, 1983) In what follows, I use the term 'false belief test' to apply to members of the family of tests inspired by Wimmer and Perner's test. Emphatically, I do not imply that they are good tests for false belief.

In the original false belief test, children saw a puppet's storing chocolate, then leaving the room. Another puppet moves the chocolate. The first puppet returns. The children are asked where that puppet will look for the chocolate. Children younger than 4-years-old do not say that the puppet will look where he left it. Most say that he will look where the second puppet put it. Most children 4 to 6 years old say that the first puppet will look where he left it. This result and variants have been massively replicated (Wellman, Cross, & Watson, 2001). The result was regarded as showing that 3-year-olds do not attribute beliefs, whereas 4-year-olds do (Flavell, 1988; Ferguson & Gopnik, 1988; Wimmer & Perner, 1983).

Various other capacities emerge around age 4. These capacities seemed to support the authors' conclusion. Four- to 6-year-olds give coherent explanations of behavior, using language that for adults represents mental states. Their explanations ostensibly distinguish wants, perceptions, emotions, and beliefs. Four-year-olds are fairly good at simple explanations of sources of their beliefs—ostensibly from perception, from being told, from figuring something out. Four-year-olds seem to distinguish sources that guess answers from sources that know answers, relying on the latter more than the former. Children use contrastives to mark discrepancies between an individual's state and reality. They do fairly well on other appearance-reality tests. Their language ostensibly attributes deception and change of mind. Although these changes emerge at different times, there is a broad change in behavior in this period (Bartsch & Wellman, 1995; Flavell et al., 1986; Flavell, Green, & Flavell, 1990; Gopnik & Wellman, 1992; Harris, Rosnay, & Pons, 2005; Lagattuta & Wellman, 2002; Sabbagh & Callanan, 1998; Siegal & Peterson, 1998; Wellman, 1990). Even 4-year-olds, however, show serious deficits in understanding basic aspects of mental states—such as that "beliefs" represent some, not all, features of their referents (Apperly & Robinson, 2003). These deficits urge extreme caution about concluding that even 4-year-olds' mentalistic words have mentalistic meaning.

Some years after the original false belief tests, Kristine Onishi and Renee Baillargeon conducted an ingenious variant. Fifteen-

¹⁶ Some psychologists' belief that using and comprehending language requires being able to represent semantical and psychological facts is influenced by H. P. Grice. They think that Grice showed that intentional use of language requires having metarepresentational capacities to believe that one is causing others to recognize one's own intentions and to act or think in accord with this recognition (Grice, 1957). For unargued assimilation of Grice's account into psychology, see Tomasello (2008). Examples of avoiding this error are Csibra and Gergely (2009) and Gergely (2011). I doubt that Grice took his account to apply to infants. If he did, his analysis is the weaker for it.

month-olds passed this variant. The test was designed to circumvent infants' having to answer questions. Subjects were habituated to an actor's hiding an object in one of two boxes, then retrieving the object. In the crucial condition, the actor put the object in one box. Then the infants were shown the actor behind a screen that blocked the actor's vision of the boxes. The infants then saw the object moved to the other box. The screen was removed, and the actor looked into one of the boxes. The infants looked reliably longer when the actor opened the box that contained the object than when the actor opened the box in which the actor had left the object. The authors claimed that this result showed that 'even young children appeal to others' mental states—goals, perceptions, and beliefs—to make sense of their actions' (Onishi & Baillargeon, 2005, p. 257).¹⁷ A run of work in the same vein followed (Baillargeon, Scott, & He, 2010; Buttelmann et al., 2009; Luo & Baillargeon, 2010; Onishi, Baillargeon, & Leslie, 2007; Scott & Baillargeon, 2009; Southgate et al., 2007; Surian et al., 2007; Träuble, Marinovic, & Pauen, 2010). (For philosophers who endorse this work's conclusions, see Goldman, 2012; Carruthers, 2013; Jacob, 2013).

Among those who take false belief tests to show that children attribute false beliefs, there is a large, persistent divide.

Some follow Onishi and Baillargeon in holding that attribution of false belief emerges at 13–15 months. These psychologists maintain that difficulty in language production, or use of an "implicit," unarticulateable attribution system, blocks explicit attribution by 3-year-olds in the original experiments. Others hold that attribution of false belief develops only after age 3. They cite the earlier-sketched range of capacities that seem to emerge around age 4. They explain the results for 15-month-olds without appealing to beliefs.

Some psychologists, defending later emergence, take infants to operate according to learned behavioral rules, or other low-level associations (Heyes, 2014, 2014a; Perner & Ruffman, 2005). Perner claimed that the children anticipate the actor's going to the empty box because the actor, the object, and the box were together when last seen. This rule fails to account for many subsequent experiments (Scott & Baillargeon, 2009; Song & Baillargeon, 2008; Southgate et al., 2007). More generally, as indicated earlier, low-level explanations fail to match the apparent unity in infants' attributional capacities and fail to yield predictive or explanatory power (Baillargeon et al., 2010; Carruthers, 2013, 150). I believe that most psychologists are right in rejecting these explanations.

Other explanations of the capacities of infants in their second year that avoid taking them to attribute *belief* take infants to attribute *lower-level mental states*, such as perceptions and nonpropositional intentions (Andrews, 2012, pp. 26–33; Butterfill & Apperly, 2013; Perner & Roessler, 2010, pp. 212–214; Wellman, 2014, chapter 8; the view has antecedents—for example, Gopnik & Wellman, 1992). My earlier criticisms apply to these initiatives. None makes a good case that the infants attribute any mental states at all.

I take no position on details of development between 18 months and 4 years. I shall explain why taking the experiments with 13- to 18-month-olds to show that they attribute any mental states, much less beliefs, is unfounded. I begin with some general points.

The false belief test was mis-named from the beginning. The experiment is certainly not a crucial test for attribution of belief. Neither the original test nor subsequent variants *in themselves* show anything at all about belief. Belief is a *propositional attitude*. That is, it has the representational content, truth conditions, and

structure of a complete sentence (though the structure need not be linguistic). To be relevant to belief, the tests would have to show that children attribute states with these features. No false belief test bears directly on this issue. The fact that children anticipate where an individual will look, even when the individual will not look where the children would look, *could not* show anything about whether the children attribute the attitude *belief*. Attributing other characterizing mental states, such as nonpropositional perceptual memory, could produce the same behavior.¹⁸

The situation is more serious than this point suggests. False belief tests not only show nothing about attribution of belief. They do not in themselves show attribution of any mental states. All the experiments bear on subjects' assessing whether an action will meet its target. All hinge on what *sense-based states* (sensory states, sensory retention, sensory anticipation) the agent acts on and whether such states will yield successful agency. Sensing, sensory retention, sensory anticipation, and agency—combined—do not require mentality.

Some theorists who use false belief tests to argue that 13- to 15-month-olds attribute beliefs have admitted that the tests by themselves do not support their position (Scott & Baillargeon, 2009, 2014; Scott et al., 2010). They appeal to the variety of experiments to support their views. For infants under age 3, the variety consists almost entirely of variants on the false belief test. I return to this issue in the section "Generic schemes and false belief tests in the 2nd year."

The admissions that false belief tests do not themselves show anything about belief mask the enormous influence that the tests continue to have in convincing researchers that children, at one or another age, attribute mental states. A great many developmental psychologists, ethologists, and social scientists agree in thinking that false belief tests are substantial evidence that those who pass them attribute if not beliefs, at least some mental states (Gómez, 2004; Southgate et al., 2007, p. 587; Wellman et al., 2001, p. 656; the consensus affects interpretations of neuro-imaging: Saxe & Kanwisher, 2003).

What is it about false belief tests that has persuaded so many that the tests evince mentality? In accord with the criticisms of the Premack-Woodruff experiment, many assume that if an infant anticipates another agent's acts and states to vary, in specific ways, from its own, the infant attributes mental states.

This assumption does not withstand scrutiny. A lot of divergent action, with specifically anticipated targets, that is guided by specifically different sensory information, stems from states that are not mental. Infants in their first and second years have a rich generic attribution scheme that centers on action and sensing. This scheme grounds explanation of their passing nonverbal false belief tests.¹⁹ I develop this point in the next two sections.

¹⁷ The view is endorsed in Carey (2009, pp. 209–211).

¹⁸ This issue is rarely acknowledged. Exceptions are Butterfill and Apperly (2013) and Carruthers (2013, pp. 156–162). Carruthers writes, "since infants have propositional thoughts from the outset themselves, they can take whatever proposition they have used to conceptualize the situation seen by the target agent and embed that proposition into the scope of a 'thinks that' operator" (p. 162). His account assumes, without argument or evidence, that infants have such an operator.

¹⁹ The generic scheme would explain 4-year-olds' behavior on classical false belief tests, if there were no other evidence that they attribute mental states. As intimated earlier, it is far from obvious that the other evidence available about 4-year-olds' speech cannot be explained via the generic action-sensing scheme.

Decoupling: Generic Action-Sensing Schemes in the 1st and 2nd Year

Passing all false belief tests, early and late, evinces an agent's capacity to decouple its own information, and how to act on it, from an anticipation of how another agent will act on the world, given that the other agent's sensory information differs. This is a large developmental step. Infants at 13–15 months take it. They show *decoupling* in that (a) they anticipate others' acting in specific ways that differ from how they would act; and (b) they take others to have or to retain states that provide different sensory information—vary with the world differently—in ways that bear on the others' specific actions.²⁰

Slightly older infants represent others as having *consistently* different action targets from their own. Doing so amounts to a further decoupling—attribution of different *standing* conative states in others. At 14 months, infants offer an experimenter food that they prefer. At 18 months, they offer food that the experimenter prefers, even if the infant does not prefer it (Repacholi & Gopnik, 1997).

Even before decoupling, a child or ape can distinguish another agent's sensory relations and action targets, from its own. Apes and 6-month-old infants anticipate how an agent will act, depending on whether the agent has sensory access to relevant information (Carey, 2009, chapter 5; Tomasello et al., 2003).

What differentiates decoupling from this capacity is anticipation of *specific* targets on the basis of *specific* information that differ from the infant's. In attributing occlusion of sensory access, a child or ape can expect an agent to stand pat. If an ape sees an obstacle between food and a rival, it anticipates a free path for itself to the food. After decoupling, infants anticipate *specific* actions that fail to reach their targets because of *specific*, unshared sense-based states. Recently, apes have been shown to decouple and to pass nonverbal false belief tests (Buttelmann, Buttelmann, Carpenter, Call, & Tomasello, 2017; Krupenye, Kano, Hirata, Call, & Tomasello, 2016).

Recall that to represent actions as having targets is not in itself to represent actions as intentional, intended, or desired. Recall that to represent sensory states as carrying environmental information is not in itself to represent mental sensing (perception). Information here is not a mental notion (see note 20). The decoupling description just given does not take infants or apes to represent mental states. They distinguish targets and target-objects of specific actions by others from what they would take as targets and target-objects for themselves. They understand interrelations among action, conative states, and sensory information that differ from their own. To do this, they need not attribute mental conative or mental sense-based states.

As noted earlier, many psychologists—including most on both sides of the dispute about whether 13- to 15-month-olds attribute *beliefs*—agree that, *even before decoupling*, infants and higher animals attribute mental states. I have criticized this view. My present aim is to challenge the idea that preverbal false belief tests provide any ground to take infants or apes to attribute *any* mental states. The issue is whether an individual's recognition of discrepancy of specific information between itself and another evinces attribution of mentality.

False belief tests seemed to evince theory of mind because decoupling seemed to evince understanding a difference between

appearance and reality, or between matching and not matching the world. Such understanding was taken to be a hallmark of understanding mentality.

False belief tests seemed to mark a departure from “reality based” representation. Some took this departure to be the point at which action-centered schemes give way to theory of mind. Others took the departure to mark a change from representing “purely relational” mental states to representing belief, which could be true or false.

These attitudes again underestimate the explanatory power of a generic agency-sensing scheme. To review, sensing is an information-registration relation between organism and environment. It functions to covary with certain environmental objects and attributes that are statistically likely to cause it. States in such relations function to guide behavior. Sensory states are not themselves mental.

A consequence of conflating generic sensing with mental sensing is conflating the matching/nonmatching of the world that is characteristic of generic sensing with the matching/nonmatching of the world that is characteristic of mental representation. Generic sensing is causal covariation with a function. For sensory states, the function is practical not semantical. In science, in simple cases, the practical function of sensory states is usually biological—roughly, serving fitness long enough to mate.²¹ More narrowly, the function is to guide action. Truth/falsity and accuracy/inaccuracy are clearly not the same as statistically normal/abnormal covariation. They are also not the same as success/failure in realizing *any* practical function, biological or otherwise. Regular inaccuracy of a mental state is compatible with practical success, including contributing to fitness. Regular accuracy of a mental state is compatible with practical failure, including undermining fitness. Accuracy/inaccuracy are also not the same as just any match/mismatch between a state and an environmental feature. An instance of a generic sensory state can fail to match an environmental condition that it tends to causally covary with, and functions to causally covary with. Such a failure of match need not be or involve inaccuracy of a mental state. I illustrate this point shortly.

Infants do not analyze information registration. They are tuned to matches and mismatches between instances of sensory states and the environment, where the type of sensory state tends to causally covary with certain environmental features, and functions to guide action. Infants have a generic notion of function—or point—even though they lack the specifically biological notion of function. They are sensitive to how matches (instances of functional covariation) and mismatches bear on practical success in

²⁰ The term ‘information’ is to be understood here in the strict, statistical, information-theoretic sense. It is not a psychological term. For discussion of this notion and the richer notion of information-registration, see Burge (2010, chapter 8). The term ‘decoupling’ is used in Leslie (1987), Sommer et al. (2007), and Scott & Baillargeon (2009). I construe decoupling more austere than these authors do. For me, decoupling does not imply mentalistic attribution.

²¹ Sciences of the sensory systems of simple organisms do not take the laws by which such states are formed to cite anything capable of accuracy or inaccuracy. The nearest analog is such sciences' appeal to success or failure in realizing biological function. By contrast, in perceptual psychology, the basic form of causal-computational explanation of the formation of perceptual states identifies the states partly in terms of their conditions for being accurate/inaccurate. See notes 3, 4, 6, and 20.

meeting action targets. Showing that infants respond to a sensory state's matching or mis-matching the environment is not showing them to respond specifically to the accuracy/inaccuracy of mental states. The experiments do not show that the matching/mis-matching that infants respond to is mental. They show only that infants respond to the not-specifically mental genus.

A lot of work on the sensory systems of lower organisms centers on failures of match. Consider circadian body clocks (Hut & Beersma, 2011; Johnson et al., 2003). Very simple organisms that lack mental states show circadian rhythms in their activity. The rhythms are kept in sync with the day-night cycle by sensory entrainment mechanisms—for example, by exposure to a change from dark to light every morning. If the organism is kept in a constantly lit environment, it continues for a while to act roughly on the rhythm of the day-night cycle. Because such rhythms are never perfectly in sync, they go out of phase if they are not entrained. If an organism is not entrained, it will operate on outdated sensory information that may lead it to act in ways that do not meet targets. Scientific explanations need not and do not postulate mental states.

Consider another example. Suppose that a tick senses the heat of a human arm and crawls toward it. Suppose that the tick's progress is arrested, but not displaced. The arm is moved out of sensory range. Suppose that the tick's sensory condition is not relevantly affected. Perhaps the effect of the original sensing is retained. The tick is allowed to crawl again. We expect the tick to crawl toward where the arm had been, not toward the arm. The case has the structure of a false belief test. Our, and the scientist's, expectation does not attribute an outdated perceptual memory, or a false belief, or any other mental state, to the tick. The tick's action fails to reach its target because its retained sensory states are out of sync with the target object—the arm as food source. The point is not that infants treat others as being as simple as we treat ticks. Infants use their action-sensing scheme in complex, flexible ways—sketched in the section “Attribution of action and sensing in infants and nonhuman animals.” The point is that attribution of sensory states and actions that do not match reality, and that differ from what the attributer senses and would do, does not require attribution of mental states.

As adults who distinguish mental and nonmental sensory states, we make judgments that use mental concepts. We can deny that a tick's agency and sensory capacities involve mentality. I do not suggest that infants deny mental capacities, as we do for the tick. I suggest that at the generic level of attribution of action and sensing, the distinction is not represented.

Here again, a generic scheme for attributing agency is open to simulation models. An infant can draw on what it would do in the agent's situation, even if it cannot attribute mental states. Insofar as it represents internal states, they can be *generic*.

Generic Schemes and False Belief Tests in the 2nd Year

I now sketch how the generic action-sensing attribution scheme accounts for 13–18-month-olds' successful responses to false belief tests (Kovács et al., 2010; Luo, 2011b; Onishi & Baillargeon, 2005; Southgate et al., 2007; parallel points apply to Surian et al., 2007). When infants see an actor hiding and retrieving an object, they attribute acts with targets of placing the object inside the box and retrieving it. They attribute generic sensing of the object in the

box. When the actor is screened from the scene, they attribute retention of this generic sensory state. They then see the object moved, and decouple their sensing of its position from attribution of the retained sensory state to the actor. The actor's retained sensory state tracks the object in the first box. When the actor returns, infants anticipate an act with retrieval as target. Given that they anticipate the action to be guided by the retained sensory state, they anticipate a conative state that functions to cause searching the first box. They attribute actions, sensory states, retention of sensory states, and conative states, specified by their role in functioning to cause reaching a target. These are not attributions of mental states, much less false beliefs.

The false belief tests show that in their 2nd year, infants decouple expectations of specific actions, targets, conative states, and sense-based states in another individual from the infant's own. Decoupling enriches the simplest action-sensing attribution scheme that we know infants to have by 6 months. The scheme acquires a complex structure of targets of actions associated with specific agents, capabilities of various agents in achieving targets, various ways in which sensory information might be obtained or blocked, and so on. Decoupling is an important developmental step. But no evidence has been adduced to show that, in taking it, infants depart from the generic attribution scheme that they already have.

As noted, supporters of taking false belief tests to evince theory of mind in the 2nd year cite the variety of tests that have been carried out. I believe that all those so far produced submit to the type of explanation just illustrated. I sketch a range of such tests.

Infants pass false belief tests when doing so hinges on tracking an identified object (Scott & Baillargeon, 2009). From almost birth, infants can track objects. The case does not imply an attribution of perception. Generic sensing can track objects by tracking relevant properties.

Infants pass false belief tests when doing so hinges on connecting agents to properties or parts of a sought object rather than the object itself (Song & Baillargeon, 2008). Subjects were familiarized with an actor's reaching for a doll with blue hair and shunning a toy skunk. Before a test trial, subjects saw the doll placed in a plain box and the skunk placed in a box with a tuft of blue hair attached to the box. In the present-condition, the actor was present when this placement was made. In the absent-condition, the actor left the area. In the test trial, subjects saw the actor reach for the plain box or for the box with the blue hair attached. When the actor had been absent in the doll/skunk placement, subjects looked longer if the actor opened the plain box. They seemed to anticipate that the actor would follow the blue-hair clue.

Functional, causal covariation between generic sensory states, or their retention, and the environment holds between any given sensory state and any properties that it functionally covaries with. An infant can package salient properties that covary with the target or target-object, and can take the agent to track the target by any of these properties.

The infant takes the doll to be a target-object for the actor. It takes the actor to retain sensory information that connects to the doll with its salient properties, including the blue material. The infant takes the actor, on return from absence, to sense the blue material. The infant anticipates the agent's tracking the doll by tracking the blue material. So the infant anticipates the actor's opening the box with the blue hair attached. The evidence is

explained by taking the infant to attribute a generic capacity to chain sensing of the doll with sensing of blueness. The mechanisms of sensory tracking need not be taken to be mental.

Another paradigm tested whether 18-month-olds anticipate that sensory states that mislead agents can be chained to nonobvious properties (Scott et al., 2010). With agent and infant present, an experimenter showed a box to rattle when shaken. The infant had been shown the agent to take rattling the box as a target. In the test phase, the agent picked one of two boxes. One was type-identical to the initial box. The other differed in color and pattern. The infant but not the agent had been shown that the differently colored box rattled when shaken, but the type-identical box did not. Infants looked longer when the agent picked the differently colored box, thus succeeding in realizing the action's target, than when the agent picked the type-identical box, thereby failing.

The authors took the results to show that mentalistic reasoning extends to false beliefs about nonobvious properties of objects. The evidence is, however, explained by taking infants to chain generically sensed properties (the outer properties of the box that contained the marbles) to dispositional properties (the tendency to rattle). Infants anticipate that an agent engages in similar chaining. They attribute a capacity to anticipate sensing of rattling by an object box that is disposed to rattle, when it contains small objects and the container is shaken. They recognize that such anticipation can mislead if conditions change. Like retention, anticipation is not itself mental. The evidence is explained by taking the infant to take the actor to retain the effect of the sensory states when she leaves the room, and anticipate sensing of rattling, if the originally sensed box is shaken.

An infant's attribution of chaining of properties via generic sense-based states is not attribution of classical *association*. The infant picks out chains as *functionally* relevant to an agent's actions. Sensory and conative states, and correlative environmental properties, are identified in terms of function. The infant's scheme is neither behaviorist nor mentalist.

Eighteen-month-olds helped an actor go to the box containing a target object, after the object had been switched when the actor was absent (Buttelmann et al., 2009; Buttelmann, Over, Carpenter, & Tomasello, 2014). This case differs from previous ones in that subjects actively helped agents reach a target, when the subjects had information that the agent lacks. This case can be explained using the same generic resources already discussed, together with the assumption that the child wants to help the actor reach the actor's target.

Eighteen-month-olds anticipate that an agent's actions can be corrected by appropriate, but not inappropriate, communication. An agent hides a ball in a box and is not present when an experimenter moves the ball to a cup. When the agent reappears, the subjects anticipate the agent's searching in the cup if the experimenter says, 'The ball is in the cup.' The subjects anticipate her looking in the box if the experimenter says, 'I like the cup' (Song et al., 2008).

This experiment shows that infants take other agents to respond appropriately to language. The infants have some understanding of the language. It does not follow that they understand terms like 'like' mentalistically, or that they take the agent to have psychological states, like understanding. These are points made in the section "Do 5- to 18-month-olds or nonhuman animals attribute intentions, perceptions, or emotions?" Comprehending language

does not entail—and as far as anyone knows, does not require—understanding the psychological and semantical conditions that make language possible. The experiment leaves opaque how infants construe the mechanism of the agents' responding to language. The experiments do not show that infants go beyond the generic action-attribution scheme.

Fifteen-month-olds anticipated an agent's states that involved pretense (Onishi et al., 2007; also Leslie, 1987). The infants were shown two empty cups. An actor pretended to pour liquid into one. The actor then pretended to drink either from that cup or from the other cup. Infants looked longer when the actor pretended to drink from the cup into which she had not pretended to pour. Further experiments featured pretend pourings into unusual or impossible receptacles—one of two shoes, and one of two bottomless tubes. If the infant was familiarized with pretend drinking from such receptacles, the infant anticipated drinking behavior with the receptacle into which the actor pretended to pour.

The authors take response to active play to be a 'hallmark of mentalistic understanding' (Onishi et al., 2007, p. 125). I think that this claim is mistaken. The evidence can be explained by taking infants to understand *play* as a transformation on familiar real-world action and generic sensing that omits some normal physical conditions. The infants must identify the play target (drink liquid). They must transform remembered nonplay action sequences—drinking liquid from a receptacle into which the liquid had been poured—to allow for lack of normal physical conditions (there being real liquid, the tubes' having a bottom). And they must take the actor to play at sensing, and retaining the sensing, of a target object (a liquid). Transformation of real means-end sequences into play counterparts requires flexibility and ingenuity. The infant's behavior can, however, be explained by taking it to anticipate actions based on play targets and play generic sensings. Such explanation does not require the infant to attribute mental states.²²

Some Approaches With Points in Common With the Present Approach

I now discuss approaches that are superficially similar to the present approach in their handling of action and/or sensing. By emphasizing differences, I hope to further illuminate underestimation of the generic action-sensing scheme.

Some psychologists do emphasize that infants can attribute action without attributing psychological sources (Poulin-Dubois & Shultz, 1988). György Gergely and Gergely Csibra's work is the best-known example. They proposed that if and only if, in representing agency, an individual is constrained by a 'principle of rationality,' the individual attributes psychological sources of the agency. Their principle stated that an individual expects efficient action relative to its target (Gergely et al., 1995).

The proposal was mistaken. One can expect a tick to crawl efficiently, taking a short route to the target. One does not thereby attribute psychological states. One may evaluate how well it acts in fulfilling norms for meeting its targets. These are norms of efficiency, not rationality. Rationality implies mentality. The proposal conflated efficiency and rationality.

²² Brandl (2012, p. 157) criticizes mentalistic views of pretense expressed in the cited articles, but takes infants to attribute mental states.

Shortly after making the proposal, Gergely and Csibra rejected it. They distinguished representation of action that does not attribute intentions, and does not attribute *mentally guided* action, from representation of mentally guided (intentional) action. They separated anticipating efficiency from attributing mental states (Csibra & Gergely, 1998; Csibra et al., 2003; Gergely, 2003; Gergely & Csibra, 1997, 2003). They took what they still misleadingly call a ‘principle of rationality’ to explain not representations of agents’ mental states or relations, but representations of relations between actions, target, and external constraints.²³ When an infant represents an agent’s circumventing an obstacle to grasp a toy, the infant is taken to anticipate efficient action. The authors note that the infant does not thereby represent the agent as intending to reach the toy, or as *reasoning*. Here are key features of the revised account.²⁴

First, explanation of action is entirely in terms of its target. So the explanatory ground for the action occurs later than the *explanandum*, the action itself. The authors point out that this feature contrasts with causal explanation.

Second, action explanations refer to only three factors: (a) the agential behavior; (b) a target—perhaps including a target object—in relation to which the action is anticipated to be efficient; and (c) environmental conditions for allowing the behavior to be efficient. The account leaves no room for attributing antecedent conative or sensory states of the agent.

Third, the account is “reality based.” The subject can observe and infer actions and action-targets that differ from the subject’s own. The subject can note that an action fails to meet its target. The failure can be represented as resulting from lack of informational access to an environmental feature. But since there is no room for representing states of the agent, there is no room for representing states that are out of sync with reality (Csibra & Gergely, 1998, p. 258).

None of these features is necessary to generic attribution of agency. First, such attribution can be causal. Second, it can attribute states of the agent. Third, it need not be “reality based.” An individual can represent generic sense-based states as not matching reality.

Gergely and Csibra postulate a developmental change from teleological explanation to causal mentalistic explanation at around 12–13 months (Csibra & Gergely, 1998; Gergely, 2011). They cite two bases for the change.

First, they see the teleological scheme as “breaking down” in the face of infants’ responses to prelinguistic false belief tests and to pretend play. They think that if a child attributes a conative or sensory state that does not match reality, that state is a mental state.

Second, they regard their scheme as unable to account for modification of another’s actions, except by coercion. They think that, lacking representation of an agent’s states, the scheme cannot accommodate an infant’s anticipation that communication modifies an agent’s *states*. Such anticipation is supposed to evince attribution of mental states.

These positions reflect on Gergely and Csibra’s model, not on generic, nonmentalistic action attribution per se. Neither claim about experimental conditions that support taking infants to attribute psychological states is correct.

First, because nonmentalistic action attribution can attribute generic sense-based states, it can attribute states that do not match reality.²⁵ Second, states that are attributed can be modified by

communication. An infant need not construe communication in mentalistic terms. Knowing how to use language in communication does not entail *representing* mental states or relations.

Gergely and Csibra were right to stress that action attribution does not entail attribution of mental states. They were right to disassociate attribution of mentality from anticipation of efficiency. However, their restrictive model helped lead the field to underestimate the explanatory power of generic action attribution.

In sum, their nonmentalistic action-attribution scheme is not as rich or powerfully explanatory as the present one. It cannot attribute internal states, or explain action in terms of those states’ causing it. It does not allow for mismatches in sensing of reality, or for an infant’s decoupling from another’s conative or sensory states. And it takes understanding language to entail (meta-) representation of mental states.

A second approach that bears some similarities to the present one is authored by J. Perner and J. Roessler (Perner & Roessler, 2010). The model is congenial in taking infants, under age 4, to be mainly action attributers, and not attributors of beliefs or desires. Like the scheme of Gergely and Csibra, theirs does not take young children to explain actions in terms of states of the agent, like belief and desire or even perceptions and nonpropositional but representational conative states. The model takes infants to explain action purely in terms of relations between agent and environmental facts, relations that they call ‘objective reasons.’ Such relations are said to help an action make sense *as rational* from the perspective of the user of the scheme.

The authors claim that their teleological approach gives the infant a ‘primitive notion of intentional action—arguably a psychological notion’ and a primitive, purely relational notion of intention (Perner & Roessler, 2010, p. 213). They therefore take the infant to be a mentalist, albeit a restricted one. The appeal to rationality and objective reasons, not efficiency, also takes infants to use mentalistic notions.

As indicated in the sections “Do 5- to 18-month-olds or non-human animals attribute intentions, perceptions, or emotions?” and “False belief tests,” I believe that evidence regarding children age 3 and younger does not support taking them to attribute intentional action—mentally informed action—let alone reasons. I believe that postulation of an attribution of reasons or rationality, as distinguished from efficiency, lacks empirical support. Moreover, the authors take infants to attribute attention, mentalistically understood (Perner & Roessler, 2010, p. 210). Again (section “Do 5- to 18-month-olds or nonhuman animals attribute intentions, perceptions, or emotions?” above), I think that postulation of mentalistic-attention-attribution—as distinct from attribution of orientation of an agent’s generic central resources—lacks evidential support.

The authors rest their teleological model on evidence from the *verbal* behavior of children 3-years-old and younger. They rightly

²³ Mascialzoni, Regolin, and Vallortigara (2010) avoid the misleading term “principle of rationality.”

²⁴ Compare the less restrictive Heider (1958). Heider takes ‘try’ and ‘can’ to be key notions. As noted earlier, ‘try’ need not be used. Infant schemes are more complex than Heider’s.

²⁵ Gergely and Csibra’s claim that nonmentalistic action attribution must be “reality based” has many adherents who do not accept all aspects of their teleological account. See Scott and Baillargeon (2009, p. 1173).

take *nonverbal* evidence to be, so far, insufficient to support postulation of attribution of “objective reasons.” The authors do not propose a detailed model for infant action attributions that are evinced by nonverbal behavior. They do, however, take such behavior to support taking infants to make mentalistic attributions. For example, they take infants to attribute emotion, merely claiming that such attributions do not enter into “reason-based” explanations of action (Perner & Roessler, 2010, pp. 222–223). Although attributions of affect enter into infant anticipation of action, the authors provide no evidence that infants attribute emotion—specifically mental affect. Similarly, the authors take nonverbal evidence to show that infants “compute likely actions” on the basis of records that they keep of what others can and cannot see (Perner & Roessler, 2010, p. 221). Seeing implies mentality. The approach joins many others in eliding the distinction between perceiving and nonmental sensing. The generic action-attribution scheme suffices to explain the evidence.²⁶

The scheme that infants 3 years and younger (and apes) apply nonverbally certainly involves a decoupling that is apparently absent in their verbal behavior. I have emphasized their decoupling of sensory states. But as the section “Attribution of action and sensing in infants and nonhuman animals” indicated, they also decouple targets of conative states, hence conative states. Apes are sensitive to competitive differences in targets. Although infants are slow to catch on to competition, they anticipate unshared action targets, sensing threat, from nonhuman agents. And 13- to 18-month-olds anticipate specific actions of humans with unshared targets. Infants employ richer resources in the generic action-attribution scheme in their nonverbal behavior than they apply verbally. However, neither verbal nor nonverbal evidence supports taking them to make mentalistic attributions.

To summarize: Perner and Roessler share with the present view an emphasis on action attribution and a doubt about attribution of belief-desire psychology, for children younger than 4. They differ in taking such children to make other types of mentalistic attribution—rationality, intentions, “objective reasons,” and mentalistic attention, on the basis of verbal behavior; and emotion and seeing, on the basis of nonverbal behavior. I think that these differences derive from not making distinctions outlined in earlier sections, thus overinterpreting evidence.

A third body of work that overlaps the present approach stems from J. Flavell’s distinction between Level-1 and Level-2 understanding (Flavell, 1977; Flavell et al., 1986; Flavell, Everett, Croft, & Flavell, 1981, 1988; Lempers, Flavell, & Flavell, 1977). Flavell takes both sorts of understanding to attribute mental states.

Level-1 centers on a subject’s capacity to determine what another individual senses and to distinguish it from what the subject senses. Such understanding allows another individual to sense something different, and to sense the same object from a different angle. A child is familiarized with a card that pictures a cat on one side and a dog on the other. The child faces one side, while an adult faces the other. The child is asked whether it sees a dog or cat, and whether the adult sees a dog or cat. Correct answers are taken to indicate Level-1 understanding.

Psychologists differ over when Level-1 understanding emerges. Some take it to show up early in the 2nd year, or earlier; others, at 24 months. These differences hinge partly on different interpretations of what Level-1 understanding consists in. My points will be independent of these differences (Caron, Kiel, Dayton, & Butler,

2002; Deak, Flom, & Pick, 2000; Dunphy-Lelii & Wellman, 2004; Gopnik & Wellman, 1992; Luo & Baillargeon, 2007; Moll & Tomasello, 2006; Sodian, Thoermer, & Metz, 2007; Wellman, 2014, p. 84ff.).

Level-2 understanding is understanding another individual to note not only what is sensed, but how. A child is shown a picture, flat on a table, of a dog. The dog’s feet are closer to the child than the head and trunk are. An adult sits opposite the child. The child is asked whether it sees the dog on its feet or on its back, and analogously for how the adult sees. Correct answers are taken to show Level-2 understanding, which is believed to emerge at 3 years or later.

Flavell claims that one need take children with Level-1 understanding only to understand others’ perceptions as connecting them by lines of sight to objects. Desires are understood only to connect agents to targets. Level-2 understanding is supposed to exhibit understanding of perception and desire as representational. Children are supposed to take others’ visual states as representing objects as being a certain way—for example, the dog as standing up or lying on its back. I return to Level-2 understanding in the section “Testing for attribution of representational mental states.” Here I focus on Level-1 understanding.

One of the points of contact between this framework and the one proposed here is that Level-1 understanding does not take conative states or sensory states to be representational. Alison Gopnik and Henry Wellman write about Level-1 understanding:

Desire and perception may be construed either nonrepresentationally, or representationally. In fact, in the adult theory, desire and perception are as representational as belief. What we want and see (by and large) is not the thing itself but the thing as represented. Understanding some aspects of desire and perception requires this sort of understanding. (Gopnik & Wellman, 1992, p. 157)

They think that 3-olds construe perception and desire nonrepresentationally. I agree that infants do not construe sensory, conative, or affective states representationally. I do not agree that infants have been shown to understand desire, perception, or emotion—mental states—in any way.

To attribute mental states or relations, even without attributing their representational content, an individual must be able to respond to them differently than to generic counterparts. Sensitivity to covariation between individuals and functionally important objects or properties does not evince understanding of any *mental* connection—for, example perception or conscious awareness. Ev-

²⁶ The authors are right to distinguish different types of mentalistic attribution. Attribution of reasons, beliefs, and propositional desires should be distinguished from attribution of subpropositional representational mental states and relations—like perceptions and like mental conative states that represent a target nonpropositionally. The authors ignore nonpropositional representational mental states and focus on nonpropositional relations, like seeing and attending. Below, I express doubt about Apperly and Butterfill’s taking relational *mentalistic* attributions to occur systematically without attributions of mental *states*, as Perner and Roessler also do in their appeal to “objective reasons.” The nonmentalistic action-attribution scheme that I highlight allows nonmentalistic attributions of relations. But I doubt that attributions of relations come systematically apart from attributions of states. Infants attribute event- and state-causation in other domains. I see no evidence that they cannot attribute it in anticipating action.

idence for Level-1 understanding is not evidence for attribution of mental states, or mental relations to the environment.

In discussions of Level-1 understanding, some theorists invoke “extensionalist” or nonrepresentational, *types* of desire, intention, or perception. The subject is supposed to pick out a kind of mental state that is purely relational, not a representational state (Apperly, 2011; Apperly & Butterfill, 2009; Gopnik & Wellman, 1992, p. 157; Perner & Roessler, 2010; Rakoczy, 2017; Wellman, 1990; Wellman & Woolley, 1990). Ian Apperly and Stephen Butterfill take such a position (Apperly & Butterfill, 2009; Butterfill & Apperly, 2013). They distinguish ‘minimal theory of mind’ from ‘theory of mind cognition.’ The latter involves representing mental states or processes ‘as such.’ By contrast, a minimal theory of mind ‘does not involve representing propositional attitudes as such, but does involve representing simpler, relational mental states.’

The relational states are explained in terms of ‘*encountering*’ and ‘*registering*.’ Encountering is explained geometrically. It is clearly not a mental relation. I do not find registering to be clearly explained. It is said to be a ‘relation between an individual, an object and a location which will be implicitly defined by principles linking it to encountering and action.’ The implicit definition is not elaborated. The authors do say that registration is ‘like belief in that it has a correctness condition which may not obtain: a registration is correct when the object is in the location.’ But generic conative and sensory states also have correctness conditions in this weak sense. A generic conative state is “correct” if the action that it functions to cause meets its target. A generic sensory state is “correct” if it is a sensing of an instance of a type of entity that it functions to covary with. This notion of correctness condition does not imply mentality. All primitive actional and sensory states have functions and hence practical fulfillment conditions of this sort. Fulfilling biological or other practical functions is not meeting the truth- or accuracy conditions that are distinctive aspects of mental states (see above, the section “Decoupling: Generic action-sensing schemes in the 1st and 2nd year”; Burge, 2010, chapters 8 and 9; Burge, 2014, 2018).

To have a theory of mind, an individual must attribute some relation or property that is distinctive to mentality. To do so, a child must have capacities that fit mental states or relations differently from the way they fit other states that are common and known to be represented. The authors’ explications of registering and tracking mental states do not clearly differ, in relevant ways, from the nonmentalistic notion of information registration that I explained earlier. Functional covariation with mental states does not suffice to having a “theory” of them—or to engaging in mentalistic attribution. The carbon analogy given at the outset is applicable.

Generic conative, affective, and sense-based states covary with mental species. The account does nothing to show that infants differentiate mental species. The authors’ “minimal theory of mind” is not a theory of mind at all.²⁷

I think that there is a further basic mistake in such initiatives. There is no such thing as a purely relational mental state that “connects” to the environment. All mental states that “connect” to the environment do so by representing it in a specific way. No science, certainly not perceptual psychology, invokes such supposed nonrepresentational, relational mental states. I see no good philosophical reasons to recognize them (Burge, 2005, 2011).²⁸

We do talk reasonably about mental states in purely relational ways. We speak of seeing or wanting something, while saying nothing of any representational way in which the thing is seen or wanted.²⁹ We say that *A* sees or desires the toy, without mentioning *how* *A* represents the toy. One should not infer that there are sensory or conative mental states that relate to objects, without doing so in representational ways. Seeing and wanting are representational states.³⁰ The purely relational language abstracts from their representational structure and content.

Could infants do what adults do—and attribute mental states in purely relational ways? Adults attribute mental states in these ways with a background understanding of mental states. They take most seeings to be conscious. They recognize that a perceptual state involved in seeing could have been inaccurate in other situations. They know that when one sees something, one sees it as having some properties and not others. Purely relational *attributions* do not make explicit such background understanding. But adults could not attribute seeing in purely relational ways, if they could not also attribute seeings as having further mental properties. The same point applies to infants. Absent an ability to attribute properties of consciousness or representation, purely relational attributions are nonmentalistic, generic attributions.

The central point does not depend on my firm view that there are no purely relational mental states. It does not depend on my view that one could not attribute mental states in purely relational ways unless one had richer ways of attributing them. The central point is that no evidence has been adduced that infants attribute seeing, as a mental state *or* relation. Evidence that infants and nonhuman animals represent relations between conative or sensory states and the environment is not evidence that they attribute mental states.

²⁷ Butterfill and Apperly (2013) hold that mentalistic, preverbal attribution of nonpropositional mental relations by infants is relatively modular. I believe that this view is flawed, not only in taking infants to be rudimentary mentalists, but also in underestimating the flexibility of the (nonmentalistic) nonverbalized attribution system. For evidence of richness and flexibility, see Poulin-Dubois, Polonia, and Yott (2013). I think that the scheme that I have elaborated explains, for infants and 3-year-olds, both verbal and nonverbal behavior, and both behavior that shows decoupling and behavior that does not. As indicated, I think that it may explain verbal behavior by 4-year-olds.

²⁸ Some psychologists take Dretske’s *simple seeing* or *nonepistemic seeing* to be a “reality-based,” nonrepresentational form of seeing (Dretske, 1969). This view misinterprets Dretske. Dretske took states of simple seeing to involve representation. Simple seeing or nonepistemic seeing is characterized as seeing that bears no essential relation to *belief*. Most accurate visual perception is simple seeing in this sense.

²⁹ We can also use ‘seeing,’ ‘wanting,’ and ‘knowing’ metaphorically. We can say that a clam sees a shadow and clams up, or that a tick wants to suck the arm’s blood. One cannot use these terms in metaphorical ways unless one can attribute mental states literally. We can say that the tick *knows how* to find the arm. This locution again metaphorically suggests mind. Scientific explanations of simple organisms’ activity are nonmentalistic. They avoid the metaphors. Some philosophers think that all knowing is knowing-that (Stanley & Williamson, 2001). This view is out of touch with scientific accounts of motor action and skill. Relevant sciences need not and do not attribute *propositional* attitudes like knowing-that.

³⁰ Pylyshyn, 2003 claims that some visual-perceptual reference to individuals occurs via a demonstrative content unaccompanied by any attributive that encodes a property. Mainstream visual psychology has not taken up this view. I criticize it in Burge (2010, p. 453n, 455n). Because of the postulated demonstrative representation, even this view does not accept purely relational, nonrepresentational perceptual states.

To summarize: Level-1 understanding is not even a rudimentary understanding of mental states or relations. Covarying with (“tracking”) mental states and relations does not suffice to have any understanding of mentality, or to attribute even primitive mental states or relations. To evince a capacity to refer to or attribute mental states or relations, something in an individual’s behavior must be specific to core marks of mind: consciousness or representation/intentionality in the distinctively mental sense explained in the section “Attribution of action and sensing in infants and nonhuman animals.”

Testing for Attribution of Representational Mental States

The account that I have proposed implies that the route from attribution of action and sensing to mentalistic attribution proceeds from the generic to the specific. The structure of early mentalistic explanation remains the same: conative and sense-based states, and correlative affective states, are combined to anticipate and implicitly explain action and other behavior. The attribution of the generic states and relations becomes specifically mentalistic. The key difference is a specification of types of representational states in terms of the way they represent objects, not in terms of the objects themselves.

The move is not only from generic to specific. Mentalistic attribution is much richer than generic action attribution. Nonmentalistic conative states are individuated by their targets; nonmentalistic sensory states, by what they sense. Mentalistic attribution tracks representational perspective that is not reducible to relations to targets and sensed entities. There can be multiple representations with a given *representatum*—even with a given external access route to the *representatum*. Differences can derive from access route, circumstances of original acquisition, speed of application, history of learning, priming, adaptation, associations with or inferences from other representations, and so on. These richer resources provide for vastly more detailed tracking and insight into the internal states of others, and correspondingly richer explanations.

These points apply not just to propositional states like belief and propositional-intention. They also apply for nonpropositional perceptions and wantings. So although generic attribution explanation is extremely powerful and fully adequate to explain a wide range of behavior, it lacks the richness and nuance needed to capture subtleties in human social- and self-understanding.

What evidence *would* show that, and when, children make mentalistic attributions? I have no recipe. I think that the problem is very hard. I make only some tentative suggestions.

Between ages 3 and 7 children use language whose normal content would cite representational mental states to explain others’ behavior and the sources of their own states. Some time in this period, evidence probably does show what it is widely taken to show.

Before discussing promising directions in current work, I enter some caveats. As noted, earliest uses of ‘want,’ ‘desire,’ ‘see,’ ‘feel sad,’ ‘is pleased,’ ‘believe,’ are probably best explained as representing generic conative, sense-based, or affective states. Use of such terms by 4- to 6-year-olds in explanations that *broadly* match basics of adult explanations does not show that they attribute mental states. For the structure of generic action explanation

broadly matches the basic structure of mentalistic explanation. Language by 4-year-olds that covaries with guessing correctly and knowing may initially track more or less firm tracking of generic sensory information. Early talk ostensibly of deception and change of mind may be similar. Given the power of generic action explanation, I think that many adults who use and minimally comprehend mentalistic language in action explanation rely only on the underlying generic explanation scheme.

So, much of the linguistic evidence cited to show that 4-year-olds attribute mental states may show merely that they make verbally explicit the decoupling of generic states that occurred in their 2nd year. Language by 3- to 7-year-olds should be critically scrutinized for its meaning. Currently we are very far from a stable, experimentally grounded understanding of meaning- or concept-acquisition, especially for mentalistic meanings and concepts. Still, I conjecture that some of the explanations by children between ages 3 and 7 do evince mentalistic attribution.

I highlight two threads in developmental work that I think should be built upon.

One is emphasis on the systematicity of mentalistic attribution. Single-response tests *could not* demonstrate attribution of mental states. Mentalistic attribution is essentially associated with attribution of causally and functionally interrelated states. How children *explain* behavior is especially relevant to determining whether they attribute mental states. Wellman, Gopnik, and others have rightly stressed that mentalistic attribution must be embedded in a *system* of attribution, especially a system of explanation (Bartsch & Wellman, 1995; Gopnik & Wellman, 1992; Perner & Ruffman, 2005, p. 215; Wellman, 1990). Despite the focus on false belief tests, the relevant evidence in the 3- to 7-year-old period involves how children explain. What counts as minimum understanding of their mentalistic language is the crux of a deep problem in developmental psycho-linguistics.³¹

Emphasis on the systematic nature of mentalistic attribution has been directed mainly at attribution of belief, not to perception, desire, or emotion. All representational states are embedded in causally and functionally related competencies. Testing for attribution of such states must test for system in attribution.

As I have stressed, not just any system of interlocking internal states that grounds explanation of behavior is a system of mental states. One should avoid assuming that if behaviorist models are defeated, mentalistic schemes are vindicated. Behaviorist models do avoid attributing interacting internal states. But such models fail more broadly than in explaining mentally caused behavior. They do not account well for action by nonpsychological animals. Computational accounts that attribute networks of internal conative and sensory states—hence allow internal complexity and make use of functional notions—are better at explaining a lot of non-mentally guided behavior (Gallistel, 1980, 1990) Testing that uncovers attribution of a system of internal conative and sense-based states that cause behavior does not in itself uncover theory of mind.

A second promising thread in developmental science aims to address this issue. Some researchers have tested for mental states’ distinctive way of being “about” the environment (Apperly &

³¹ Neural evidence suggests the difficulty of the problem (see Saxe, 2013). Saxe has relied on the views criticized here, but her puzzlement over the neural evidence is congenial.

Robinson, 1998, 2003; J. Flavell et al., 1981; Kamawar & Olson, 1999, 2011; Lempers et al., 1977; Low & Watts, 2013; Rakoczy et al., 2015; Sprung, Perner, & Mitchell, 2007).

The mark of such states is said to be “aboutness” or “intentionality.”³² Intentionality allows failure of reference. Ava can imagine and pretend to play with a cup, although no relevant cup exists. It allows for partial connection to a subject matter (often called ‘aspectuality’)—connection to some properties and not others. Bert can perceive a body that is an X-ray machine without perceiving it as an X-ray machine. By contrast, he cannot push a body that is an X-ray machine without pushing an X-ray machine. It allows for inaccuracy or falsity. Cass can believe that a body is located in one place, whereas it is actually in another.

Reference failure, perspective-limitation, and being subject to inaccuracy or falsity are all basic features of mentality. Unfortunately, conceptions of intentionality and aboutness used by researchers are not sharp enough to guide empirical research. The three just-cited features of intentionality have analogs in generic and nonmental sense-based states.

An artificial sensory stimulus can cause a nonmental sensory state in a tick that functions to register and track warmth, when no warmth is there. Or as illustrated, a tick can act on retention of a sensory state that derives from a warm arm, when the arm is no longer there. These are generic or nonmental analogs of intentionality without present referents.

A nonmental sensor can respond to one feature and not another. An organism lacking a mind can sense and be attracted to a mass by sensing its airborne chemical properties, but not sense the mass’s radioactivity or internal rottenness. By contrast, in picking up the mass, one picks up something with airborne chemical properties, radioactivity, and rottenness. Analogs of aspectuality hold for both nonmental and generic sensory and conative states.

The tick-arm example, section “Decoupling: Generic action-sensing schemes in the 1st and 2nd year,” shows that generic, and nonmental, sensory or conative states can suffer functional matching failure. Such failure is an analog of failure to satisfy conditions for accuracy or truth. As noted, these functional failures are not failures of mental states to be accurate or true. To discern theory of mind, experiment must elicit attributions distinctive to mental subspecies of the neutral genera.

Here is an example of how work with the right aims can fail to make the key distinctions. Ian Apperly and Elizabeth Robinson conducted this experiment (Apperly & Robinson, 1998, 2003). A child is shown a toy figure, Peter, dressed normally. Then Peter is said to be a fire-fighter; and a firefighter uniform is put on, so that one could not recognize Peter. In the experiment’s first stage, the figure is put into box 1 with child and actor present. Both see the figure, at this stage, normally dressed. In the second stage, the figure is retrieved from the box, changed to reveal its second guise, and put back into the box 1. In the third stage, actor and child watch the object moved in this second guise from box 1 to box 2. The three-stage sequence is carried through in several conditions. In the crucial condition, the actor is absent at the second stage, and lacks information that there is a single figure with two guises. The test question is where the actor will look for Peter.

There is a high correlation between how 3–6-year-olds answer the question and whether they pass a verbal false belief test. Accurate answers do not congeal until age 4. Children under age

3 answer box 2 (Kamawar & Olson, 1999, 2011; Low & Watts, 2013; Sprung et al., 2007; Rakoczy et al., 2015; Rakoczy, 2017).

Although the tests are taken to show that children attribute propositional psychology, the tests do not distinguish belief from nonpropositional representational states. More importantly, the tests conflate children’s tracking *properties* with their tracking *mental modes of presentation* (or representations). As argued earlier, nonrepresentational sensed-based states, occurrent and standing, can track properties—or objects by their properties. A tick can track an arm by its warmth and may fail to track it by its color.

The child could take the actor to track Peter via generic sensing of Peter’s outline. When Peter is dressed as a fireman, the actor lacks access to that property. The child then anticipates the actor’s searching box 1, not box 2. 18-month-olds take others to chain objects to properties and to track objects by tracking the properties (Song & Baillargeon, 2008, the skunk-tuft-of-hair experiment, the section “Generic schemes and false belief tests in the 2nd year”). Attributing such tracking need not attribute mental states. Here, the older children may verbalize nonmentalistic decoupling already achieved at 13–18 months.

If evidence is to show that children attribute mental states “about” the environment, tests must show *how* they take agents’ internal states to track given objects *and* properties. Children must respond specifically to the mental character of an agent’s tracking-states. To find such character, tests must center not on mastering “aspectuality,” but on mastering representation.

Some research points in this direction. Flavell’s early appearance-reality tests are examples (Flavell et al., 1986). A child is shown an object with a familiar color—a paper cut-out of a white cup. The child is asked the object’s color. Then a green filter is slowly slid over the cut-out. The child is asked what color the object is, and what color it appears.³³

The standard tests were preceded by pretests. Passing the pretests was a condition for taking the standard tests. The key pretest asked children who had seen the filter slid over the object what color the object will be when the filter is removed. The point of the pretest was to establish that subjects know that the filter does not permanently change the object’s color and that the questions bear on the object’s color not the filter’s color.³⁴ There remain gaps. The experimenter asks about an object’s look, how the object appears, as opposed to its reality. But a key issue is whether the child distinguishes a mental state from a property of the object, rather just distinguishing a sensory access route that includes the filter from a property of the object. The child could translate ‘what color does the object appear?’ (answer: green) into ‘what color does the sensing route go through?’ (answer: green). Experiment must determine two things. One is that the child focuses on an internal state, not an external access route, which might be com-

³² The term derives from F. Brentano, who also used “intentional inexistence of the mental” (Brentano, 1874/1970). Modern expositions are not clearer than this barbarism. They rely almost entirely on examples. The terminology has caused mischief in philosophy—even more than in psychology. Psychologists were influenced by Searle (1983) and Dennett (1987).

³³ Others have tried to reduce linguistic demands (Sapp, Lee, & Muir, 2000). Flavell’s object-identity tests are more problematic than the color-filter test, which itself needs more controls. See also Deak (2006).

³⁴ For refinement of Flavell’s approach, see H. Moll and A. Meltzoff (2011).

mon between generic and mental states. The other is that the internal state is mental. The first issue is delicate, but seems experimentally tractable. The second issue is the crucial one.

Flavell's understanding of the problem points further than the experiment just sketched, and indeed than any experiment that I know of: '. . . knowledge about the appearance-reality distinction is but one instance of our more general knowledge that the self-same object or event [or property or relation] can be "represented" (apprehended, experienced, etc.) in different ways by the same person and by different people' (Flavell et al., 1986, p. 2).³⁵ Although I think that the color tests do not succeed as they stand, their aim is strong. They try to force the child to focus both on a single property—the color—and on the fact that it can yield different internal viewing states that connect to that property, with different behavioral upshots. The point applies not just to misleading states—a state that connects to whiteness through a green filter—but to different internal states that match the same property (indeed, including a green filter over a green object).

Flavell in effect recommends finding a sensitivity to perceptual constancies. Different states present something to the individual in representationally different ways. I think perceptual constancies mark the boundary between nonmental sensing and perception (See note 6).

Testing for sensitivity to perceptual constancies requires finding anticipation of a range of differentiated internal states caused by significantly different stimulus conditions, all of which lead to successful responses to a given focal property or object. Let the property be whiteness or a certain 3-D shape. Significant difference in stimulus conditions might involve representation (to the individual that the child responds to) of whiteness under different illuminations, or of the 3-D shape under different orientations. Once a child is shown to focus on an internal state, not an external access route, the child should be shown to anticipate variations in states similar to state-variations in perceptual constancies. For example, adults expect accurate perceptions of a surface's whiteness, even in many cases of red or blue illumination. The perceptions differ psychologically. The child might be shown to anticipate that the other is slower to respond to the whiteness—but still responsive—with blue illumination than with neutral illumination. Or the child might be shown to anticipate slower response to a shape in an unfamiliar orientation than in a familiar orientation—in both cases still anticipating response to the shape. The child should also be shown to anticipate the other's mismatching the color or shape in cases in which we would expect misperception. These anticipations should exhibit some complexity and system.

Further evidence for attributing perceptual states would accrue if the child were shown to systematically differentiate factors that affect different internal "takes" on the same focal property: same color, different illumination; same shape, different orientation; same size, different distance. Children's explanations are the most natural forms of exhibiting such understanding. Of course, explanations must be analyzed to evaluate children's linguistic understanding. Ideas already used in testing for Level-2 understanding could enrich these points (Moll & Meltzoff, 2011; Frick, Möhring, & Newcombe, 2014; also Perner, 2000).

I do not prejudge whether there is evidence for children's attributing perceptual states that is independent of children's linguistic explanations. So far, the evidence that is most nearly

convincing comes from such explanations. Experimental ingenuity may do better.

I have focused on mental *sense-based* states. Testing for attributing propositional attitudes must elicit understanding that the attitudes are embedded in a system of inferences that depend on propositional structure. This is a very hard problem, bound up with issues about meaning- and concept acquisition in developmental psycho-linguistics. These issues themselves need clarification. I think that little is known about when children first verbally attribute states with propositional structure, such as belief.

Attributions of Prerepresentational Emotions and Conscious Sensations

There are two types of attribution that differ somewhat from those so far discussed: attributions of very primitive emotions and attributions of sensations. First, emotions.

Infants distinguish facial expressions that derive from emotions like fear or joy (Farroni et al., 2007). Representing an expression caused by fear, and functionally related to appropriate responses to fear, is not in itself representing *as fear* the cause of the facial expression.

What would it take to represent causes of emotion expressions as emotions? It would take representing such causes as embedded in a causal and functional network for affect. And it would require representing them as either representational or conscious.

Infants attribute causal relations among perceived entities, between their own states and their actions, and between unperceived physical events and perceived events. Infants probably can represent unperceived causes of perceived facial expressions. They also associate perceived expressions, and their affective causes, with functional upshots—such as avoidance and protective behavior. To attribute the emotion *fear*, they would have to represent the cause of the perceived expressions either as representational or as conscious. As argued, infants and nonhuman animals have not been shown to represent internal states as representational.

Salient emotions *are* representational. Most human fear of dogs involves perceptual memory and perceptual anticipation of dogs. I doubt that all emotions are representational. An unconscious olfactory state may trigger fear, even if the olfactory state is not conscious or representational in a distinctively mental sense. Perhaps an infant could represent an emotion's causal, sensory, and functional aspects without being able to represent it as representational.

Then to represent affect as *mental*, as emotion, an infant would have to represent it as conscious. Primitive emotions involve conscious *feeling*. There are unconscious emotions. But I think one cannot represent nonrepresentational emotion, unless one can represent some emotion as conscious. Absent such capacity, only generic affect is represented. Whether infants attribute nonrepresentational emotions hinges on whether they attribute conscious feelings.

³⁵ The bracketed insertion is mine.

Take pain as a conscious state. Pain is not itself representational.³⁶ Representing it is not representing a representational state, in the distinctively mental sense of ‘representational.’ One can represent pain by conceiving it or by sensorily imagining it. Contagious pain involves low-enough-level capacities to think that infants have it. *Contagious pain* is the vicarious feeling one gets on observing someone’s response to pain. The issue is whether such vicarious feelings are a type of sensory imagination of another’s feelings. If they are guided by representations of others’ bodily expression and situated in systematic representation of relevant causal and functional patterns, perhaps they could represent feelings and associated emotions in others.³⁷

Infants and animals feel their own feelings. They would have to retain a marker of feelings in their absence—in memory-based sensory imagination. They would have to attribute such feelings to others. There is well-known neural and behavioral evidence that they have simulation-mirroring resources that might be relevant. There is as yet no evidence that these resources are best accounted for in terms of representational sensory imagination. But being able to imagine one’s own feeling and attribute a pale analog of it to others seems less demanding than being able to attribute representational mental states. Perhaps we are closer to having evidence that infants and nonhuman animals attribute sensations and non-representational emotions than we are to having evidence that they attribute representational mental states.

Summary

I have argued that there is currently no good evidence that nonhuman animals or children under age 3 attribute any mental states, much less belief. Theory-of-mind capacities may emerge early. So far, there is no evidence that they do. Even grounds presented for taking 3- to 4-year-olds to represent mental states are not as solid as they are widely taken to be.

The view that current evidence supports taking nonhuman animals and infants to attribute mental states derives partly from lack of conceptual clarity about mentalistic notions. The idea that false belief tests test for belief attribution depends on ignoring the fact that beliefs are propositional attitudes. The tests provide no evidence at all for attribution of propositional states. This mistake is now recognized in some quarters. But many continue to make it.

I identified five further distinctions elided in current theorizing: the distinction between information registration (often called ‘representation’) and mental representation; the distinction between generic sensing and perception; the distinction between generic action and action guided by intentions or other mental states; the distinction between generic conative states and mental conative states; and the distinction between generic affect and mental affect (emotion). Current evidence supports taking subjects to attribute first, not second, members of each pair. First members are not distinctively mentalistic.

Retrenchment to talk of infants’ referring to mental states without characterizing them is an error. Reference to instances of kind *K* requires different responses to *K* than to kinds that co-occur with *K*. Relevant evidence has not shown different responses to mentalistic species-kinds than to genera that are not mentalistic.

The view that infants and nonhuman animals attribute mental states also derives from underestimating a generic action-sensing attribution scheme that infants and nonhuman animals certainly

have. This underestimation and overfocus on behaviorism have encouraged oversimple views on what it takes to attribute mental states.

A capacity to attribute action is probably present at birth. By 3–6 months, such attribution becomes agent- and task-specific; it integrates attribution of sensory states or relations. Decoupling another’s targets and sensory information is present early in the second year of human development and in apes. These nonmentalistic capacities underlie passing nonverbal false belief tests.

A value of exploring this scheme is that it jibes with the earliest uses of language. These uses do not feature mental states. They center, almost obsessively, on action.³⁸

³⁶ There are dissenters (Dretske, 1995; Tye, 2006) For overview, see (Aydede, n.d.). Representationalist views about pain trade on a notion of representation—information registration—that is too weak to be distinctively mental.

³⁷ The account derives from de Vignemont and Jacob (2012). They divide imagination into imagining-that and imagining-doing-such-and-such. Imaginations derived from sensations, or indeed perceptions, are neither. On contagious pain, see Avenanti, Minio-Paluello, Sforza, and Aglioti (2009).

³⁸ An example from the huge literature on the early dominance of action verbs in the speech of first-language learners is Hirsch-Pesek and Golinkoff (2006).

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