What does the study of autism tell us about the craft of folk psychology?

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Richard Griffin
Tufts University

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What Does the Study of Autism Tell us about the Craft of Folk Psychology?

Richard Griffin and Daniel C. Dennett

Introduction

Autism is a neurodevelopmental condition characterized by difficulties in social interaction (APA, 2000). Successful social interaction relies, in part, on determining the thoughts and feelings of others, an ability commonly attributed to our faculty of folk or common-sense psychology. Because the symptoms of autism should be present by around the second birthday, it follows that the study of autism should tell us something about the early emerging mechanisms necessary for the development of an intact faculty of folk psychology. Our aims in this chapter are threefold; (1) to examine the literature on "social-understanding" mechanisms in autism, particularly those assumed to develop in the first years of life; (2) to examine the related literature on typically developing infants and toddlers, and (3) to examine the theoretical approaches that attempt to characterize the early stages and development of this impressive skill. In doing so, we hope to help resolve some of the disagreements and sticking points that riddle the topic. In particular we will attempt to shift the focus from whether children have this or that specific mental-state concept (which they use to predict behavior of others) to a more developmentally friendly approach centered around the notion of reasons, recognizing that they may well exist *before they are represented,* and hence before they can be appreciated, or expressed.

The peer commentary in *Behavioral and Brain Sciences* following Premack and Woodruff (1978) - "Does the chimpanzee have a theory of mind'" - not only introduced the "false-belief' task (Dennett, 1978; Wimmer & Perner, 1983), but addressed a host of issues surrounding the characterization of second-order intentional systems, systems that may (or must) be interpreted as having *beliefs about beliefs* (or desires or intentions ...), *desires about beliefs* (or fears or hopes ....), and so forth. Many of these issues remain unresolved thirty years later. While the commentators generally found the evidence of a "mindreading" chimpanzee less than convincing, Premack and Woodruff's claim that the attribution of "intentions" was at the basis of folk psychology has seen something of a resurgence. In the 1980s and 1990s, the child-development literature focused largely on what Bennett (1978) called the "rockbottom issue" of mental-state-attribution - beliefs about beliefs - publishing hundreds of experiments on the topic (Wellman, Cross & Watson, 2001). Yet, with technical advances in probing the knowledge of infants and the ascendance of neuroimaging, the focus on belief has waned, and has shifted to the putatively "simpler" mental states of intentions, goals, and desires (Johnson, 2000).

According to a recent *New York Times* article entitled "Cells that read minds" (Blakeslee 2006), Premack and Woodruff's initial claim appears to have been vindicated. The article touts the properties, or at least certain claims about the properties, of "mirror" neurons, first discovered in the premotor cortex of macaque monkeys (Gallese, Fadiga, Fogassi, & Rizzolatti, 1996). The headline is not, as one might expect, a journalistic overstatement of the more cautious claims typically found in peer-reviewed journal articles. Iacoboni et al. (2005) state it baldly: "Thus, premotor mirror neurons... previously thought to be involved only in action recognition are actually also involved in understanding the *intentions* of others. To ascribe an intention is to infer a forthcoming new goal, and this is an operation that the motor system does automatically" (p. 529, italics added). In a similar vein, other "mirror-system" cells in the superior temporal sulcus, which respond to eye direction and object-directed reaching, are claimed to encode the "intentions behind" these acts, and even whether the agent under interpretation is "rational" (Mosconi, Mack, McCarthy, & Pelphrey, 2005).

The tug-of-war between "romantic" and "killjoy" interpretations described by Dennett (1983) continues to shape the experimental exploration of cognitive development in infants and the cognitive competence of animals, under various descriptions. Do preverbal infants infer the intentions of others (Bloom, 2000; Tomasello, Carpenter, Call, Behne, & Moll, 2005)? Do they also evaluate their rationality in some explicit fashion or are "the constraints embodied in the infant's naïve theories" (Csibra, Gergely, Biró, Koós, & Brockbank, 1999, p. 2)? Are these constraints akin to the tacit assumption by visuo-motor systems that light travels in straight lines? There is a growing consensus that the false-belief task has set the mindreading bar too high (Johnson, 2000), and the game appears to have changed to limbo: how low can the bar go? There has been some nice work on the firing properties of "looming" neurons in locusts (Santer, Rind, Stafford, & Simmons, 2006). These neurons, in concert with descending contralateral motion-detector neurons, detect the forthcoming goals, or intentions, of approaching predators. How do we know this? We know this because the story does not end immediately after they fire; the locusts, if allowed, will then enter into elaborate evasive maneuvers. It seems to follow then that these are not simply *motion-detection* neurons, but rather *goal* detection neurons. Since the most important goals (or intentions) to predict are those that have *you* as the target, with being eaten as the conditions of satisfaction, this role makes evolutionary sense. Indeed, there will be cases when these locusts' neurons, like mirror neurons, get it wrong about the agent's intentions, resulting in the locusts' frenzied flight for no good reason, or at least not the right reasons. Are we then obliged to say, in keeping with the principles of intentional-stance interpretation, that these neurons encode (or *have?)* both true and false beliefs about the intentions of others? Looking back in history (Lettvin, Maturana, McCulloch, & Pitts, 1965), should we say that the frog's eye *believed* what it told the frog's brain? And what *exactly* was the propositional message sent through the optic nerve? The fog of tug-of-war still obscures the path from intentional interpretation to inner mechanism.

To some, letting the lowly locust into the club of second-order intentional systems may seem to be a loose metaphor at best, or, worse, yet another instance of anthropomorphism gone wrong. Others might make this same charge against the claims of mindreading mirror neurons, which respond to relatively narrow classes of stimuli and cannot be said to have beliefs about anything. Some of the confusion here is probably due to confusing the *craft* of folk psychology - how we work the tools of the trade - with a few misleading elements of the *ideology* of folk psychology, the often benighted lore about how the craft works (Dennett, 1991). In particular, according to the ideology, there has to be some clear line between real believers/intenders and mere *as if* believers/intenders. A sea slug would seem to fit snugly into this latter category, and language-having humans are paradigmatic of the former. According to the ideology, as elaborated and elevated into constraints on *scientific* (non-folk) psychology by Fodor (1980) and others, there must be certain properties *internal* to the agent that serve as the definitive criterion for category membership. Lay folk psychologists don't have "brainoscopes" with which to peer inside heads (Baron-Cohen, 1995, p. 23), so we will have to leave it up to the experts to discover the essential properties of belief, whatever they might be. To most of us, gold and fool's gold are perceptually indistinguishable, but we can always rely on a trained chemist with a microscope to reliably distinguish the real from the fake (Putnam, 1981).

The ideology of folk psychology is realist and largely dualist (Bloom, 2004). But, when the ideology is combined with materialism, as it is with many educated adults, including scientists and philosophers, the realism remains but the dualism is replaced by one or another brand of reductionism, along with the mistaken assumption that looking inside heads will help us distinguish the real believers from the imposters. Now that we do have "brainoscopes" (for example, such techniques as neuroimaging, single-cell recording, and the like), this intuitive reduction has resulted in the discovery of neurons that represent an agent's intention to bring it about that *p,* a discovery eerily reminiscent of the imagined discovery of homunculi in sperm cells following the invention of the microscope.

The materialist reduction of the ideology is also reflected in (and infected by) opinions about how internal mental states cause behavior, via a system of presumably salient and distinct *attitudes* - belief, desire, intention, hope, fear, and so on - each with a slot for a propositional *content,* so that the mental state of belief that *it is raining* is distinct from the mental state of belief that *the cat is on the mat,* which is distinct from the *hope* that the cat is on the mat, and so forth. Thus, if behavior is caused by the *belief* that *p,* coupled with the *desire* to bring it about that *q,* a successful folk psychology is simply a matter of hooking up the correct attitudes with their proper *ps* and *qs*. But, of course, folk psychology can serve us quite well, whether or not propositional attitudes and their modulating contents are states discoverable - independently identifiable - somewhere in the neural architecture. The craft has been around far longer than functional neuroimaging. Fortunately, we should be able to determine how the craft does its work - in different species, and in human beings at different developmental stages - without having to wait until neuroscientists reach a consensus on the essential properties of adult belief.

Before we begin our review of "mindreading" mechanisms and of what might be going wrong in autism, we would like to point out another distinction that, if overlooked, has the potential to make mischief: the distinction between the mechanism (or the "performance" of the mechanism) and the competence. Roughly, competence-level descriptions characterize what a system can do (in a larger context) and mechanism-level descriptions characterize how the parts work or perform. (We assume that the characterization of mechanisms in this literature will be in functional rather than structural terms.) Competence models often specify far more than the actual work being done by the underlying functional mechanisms (Clark, 1990). For instance, the painstaking and detailed treatment of communication by Grice (1989) is compelling as an analysis of the competence that must exist *one way* or *another* for there to be genuine communication, but is well-nigh incredible as a description of internal machinery in the infant communicator. Thus, while an infant's impatient gestures will communicate to us that she wants us to hand over a certain toy, it is unlikely that she has *framed the intention* to bring it about that we hand over the toy by causing us, via those gestures, to believe that she wants us to do this, as Grice might put it. Her act already plays the functional role of communication, even though she has not yet grown into the role of a suitably circumspect communicator. Young children can be the beneficiaries of their own communicative acts without having to know that they are communicating, just as locusts can be the beneficiaries of their innate predator-detection modules without having to know what they are doing or how they are doing it. The reasons are implicit in the design of the mechanisms, and in the case of the child may eventually be represented in such a way that they can be both expressed and reflected upon, but the *representation* of the reasons is not, in simple cases, a design requirement on the mechanisms.

As a way of structuring our review of the literature, we will focus on "mindblindness," the model of autism introduced by Baron-Cohen (1995). While there are other accounts of autism, Baron-Cohen's model has not only delivered on a large number of its predictions (see Baron-Cohen, Tager-Flusberg & Cohen, 2000), but is the only cognitive model of autism that is explicit about the function and onset of mindreading mechanisms in the first few years of life, moreover, the model attempts to characterize the development of mental-state attribution in typically developing children as well, thereby allowing us to address some outstanding issues regarding the development of mental-state attribution in general.

Autism and Mindblindness: The Four Steps to Mindreading

Theory-of-mind mechanism (18-48 months)

While the false-belief task was the centerpiece of the work by Baron-Cohen, Leslie and Frith (1985) - "Does the autistic child have a 'theory of mind'?" - a large part of the motivation for the study surrounded the concept of pretense rather than the concept of belief. A lack of spontaneous pretend play, sometimes referred to as a failure in imagination (Wing & Gould, 1979), is one of the diagnostic criteria for autism (APA, 2000) and, for reasons that will become clearer below, the theory-of-mind mechanism (TOMM) (Baron-Cohen, 1995) is centered around the propositional attitude of pretense. This is despite the fact that children's pretense typically emerges around 18 months, whereas understanding false belief in others is not consistent until children are around 4 years old, a full 2 ½ years later.

The function of TOMM is not only to represent the full range of mental states, but also to connect them into a coherent folk theory of mind. As mentioned above, the mechanism takes some years to develop, and its onset is heralded by children's engagement in pretense and shared pretense. The mechanism is borrowed from Leslie (l987), who argues that children's understanding of the propositional attitude of pretense is served by the maturation of a meta-representational “decoupler" mechanism, allowing children to hold online simultaneous representations of reality (for example, the banana is a banana) and of the content of the pretense (for example, the banana is a phone), without confusing the two. In accord with the ideology, Leslie sees this ability as indexing the distinction between propositional attitudes and propositional contents.

While the mental-state verb "to pretend" carries with it all the interesting properties of intentionality, such as aboutness and referential opacity (Dennett & Haugeland, 1987), simply engaging in pretense does not tell us much about how children understand acts of pretense. More important in this regard is how children interpret pretending in others. This is currently a topic of considerable debate (Friedman & Leslie, 2007; Lillard, 1998). A number of controlled experiments by Lillard and colleagues suggest that children may be interpreting pretense in behavioral rather than mentalistic terms, or as external actions rather than internal representations. For instance, most 4-year-olds will say that a hopping doll is *pretending* to be a kangaroo, even if they are told that the doll does not *know* that kangaroos hop, or was not *thinking* about kangaroos, or was not *trying* to hop like a kangaroo.

Despite these difficulties, their behavior during pretense tells us that they realize in some sense that pretend statements and actions need not be true of the world (for example, whoever is playing mommy is not really mommy), a property that is shared with belief. Yet belief states purport to represent reality correctly, whereas states of pretense do not. Perner (1995) claims that 2- and 3-year-olds have an amalgam concept of pretense and belief, which he calls "prelief." Only later in development is the child able to differentiate between pretense and belief, as indexed by understanding false belief. The concept of "prelief," Perner claims, does the work of "belief' in the young child's folk psychological reasoning schema (Perner, 1991, 1995), though the child cannot yet be considered to understand that minds are representational.

Fodor (1992) disagrees that "prelief” can do the work of belief. He writes: "Pretending involves acting as though one believes that P is true when, in fact, one believes that P is false. It would thus seem to be impossible for a creature that lacks the concept of a belief being false" (p. 290). For Fodor, the child's early theory of mind (his very simple theory of mind, or VSTM) consists of the standard two concepts - beliefs and desires - but not more complex concepts such as yens or suspicions, and so on. Because Perner's and others' data show that young children do not understand false beliefs, he avoids having the child's concept of pretense depend on the concept of false belief by construing it in behavioristic terms, as "acting *as if.”* Fodor claims that he cannot have this either, speculating as follows: "Presumably even young children know the difference between acting as if P because one is pretending that P and acting as if P because one believes that P" (p. 290, n. 9). Lillard's data, however, suggest that Fodor's seemingly innocuous assumption may not, strictly speaking, be the case. Her data appear to show that if you are not an x then acting as if you are an x = pretending - whether or not you believe you are an *x* or are x-ing. The "beliefs" that seem to be doing all the work are those of the interpreter, not the subject of the interpretation. Thus, while Fodor's second-order intentional description may be true of the child's competence, this description does not seem to reflect the reasoning by which children understand pretending in others. The evidence points to the fact that children can successfully engage in shared pretense without explicitly representing (namely, being capable of expressing the opinion) that their partner is pretending that P is true while at the same time believing that P is false. Certainly there are mechanisms that control the child's coherent behavior, but they do not appear to be doing so by explicitly representing the situation in these high-level terms - that is, in a language of thought with belief and desire concepts and slots for their contents.

Autism and pretense

As noted above, part of the diagnostic criteria for autism is reduced or absent pretend play. This is part of the DSM-IV largely as a result of the seminal work of Wing and Gould (1979) defining the triad of autistic features as abnormalities in *socialization, communication,* and *imagination*. Wing and Gould considered the paucity of pretend play to result from "problems in imagination," and clinicians currently take the existence of stereotyped and repetitive behaviors to reflect problems of this kind. Several empirical studies have confirmed Wing and Gould's contention that absent or reduced spontaneous pretend play is common in autism (for a review, see JarroId, 2003). Pretend play is, however, sometimes seen in children with autism, though it is seen less frequently than in control groups, even those matched on receptive language ability (Jarrold, Boucher, & Smith, 1996).

More relevant to our question is whether these children will engage in shared pretense. Interestingly, several controlled studies have shown that children with autism will, in fact, engage in shared pretense if encouraged to do so (Lewis & Boucher, 1988). Indeed, in structured settings, children with autism will produce as many relevant pretend acts (for example, a doll wearing a silly hat or eating something biscuit-like) as matched control children (Charman & Baron-Cohen, 1997). Kavanaugh and Harris (1994) found that children with autism were even able to draw pretend consequences from pretend assumptions. For instance, they were able to say that a toy would be "wet" rather than dry after pretending to pour tea into it (the tea cup was empty). Importantly, they were not biased to the reality of the situation, as the target was, of course, still dry.

Thus, while the TOMMs of both Leslie (1987) and Baron-Cohen (1995) are based on the logical properties of the propositional attitude of pretense, as well as the diagnostic criterion of impaired pretend play, the ability of children with autism to engage in pretend scenarios with others argues against a straightforward connection. Moreover, the difficulty that typically developing children have with describing acts of pretense in terms of the mental states that underlie them suggests that the onset of pretense or even shared pretense may not index an understanding of propositional attitudes after all. Friedman and Leslie (2007) argue that toddlers have the innate concept PRETEND but not the concept MENTAL STATE. If this is the case, it would be a severely impoverished concept, in that PRETEND derives its meaning from the related concepts of BELIEF, IMAGINE, and ACTING *AS IF*. Baron-Cohen (1995) acknowledges the gap between engaging in pretense and attributing false beliefs, and the apparent need for additional mechanisms between the ages of 2 and 5 to fill this gap.

Shared-attention mechanism (9-14 months)

Baron-Cohen proposed two novel mechanisms in his model: A shared-attention mechanism (SAM) and an eye-direction detector (EDD). He suggested that autism is not merely the result of a faulty TOMM, but that a faulty TOMM is probably the result of a dysfunctional SAM, which emerges around the first birthday. The function of a SAM is to build triadic representations from pre-existing dyadic ones. Thus, while the infant might appreciate that she can see the toy (dyadic) and that mommy can see the toy (also dyadic), SAM combines these into a representation that is something like "I see that mommy sees the toy" or "mommy sees that I see the toy." This three-way relation typically includes the child, another individual, and an object/individual. The existence of a SAM may be indexed by gaze monitoring, where an infant follows the direction of another's gaze to an object, and looks back and forth between the object and the other's face. Pointing may also serve as an index, particularly if the child is pointing out an object to another to share interest. This is often referred to as protodeclarative pointing and is contrasted with its protoimperative counterpart, where children point out an object that they want, as a request or demand. While protoimperative pointing is also triadic (child-other-object), Baron-Cohen (1995) argues that it need not require SAM. Indeed, pointing or gesturing to another for one's own wants and needs may be instrumental and does not require an understanding of attention, nor does it necessarily reflect a "*desire to share interest* with another person for its own sake" (p. 69, emphasis added). While there is little mention of issues of emotional connectedness (for example, a desire to share interest) in his (1995) model, it is reflected in later work on empathizing deficits (Baron-Cohen, 2003, 2005).

As of 2007 there is considerable debate whether gaze monitoring requires an understanding of attention or whether lower-level learning mechanisms are sufficient. Chimpanzees and monkeys will follow direction of gaze (or head direction), though they do not appear to need a concept of attention, or even seeing, in order to do so (Povinelli & Eddy, 1996; but see Tomasello, Call, & Hare, 2003). Even newborns will follow the direction of another's gaze, provided the target is within their own visual field (Farroni, Menon & Johnson, 2006). Could innate biases of this ilk, combined with correlational learning mechanisms, be enough to account for gaze-monitoring *behaviors* in infants and the other primates, or do these skills require more sophisticated conceptual tools? Even protodeclarative gestures are open to leaner, non-mentalistic, interpretations. "Showing" behaviors, for instance, may be a means to change the parents' overt emotional expression, or to induce positive feedback from them, rather than reflecting an understanding of attention or internal emotional states (Moore & Corkum, 1994; Perner, 1991).

Shared attention in autism

Children with autism show delays in both gaze monitoring and pointing (Leekam, Lopez, & Moore, 2000). Pointing does not typically appear until 20-30 months mental age (MA), and the ability to follow a point may arise earlier than the ability to follow a gaze (Mundy, Sigman, & Kasari, 1994). This is the reverse of typical development. Moreover, pointing in autism tends to be protoimperative in nature (for example, requesting or demanding) rather than protodeclarative (for example, showing or pointing out something of interest) (Baron-Cohen, 1989). This is also the *reverse* of typical development, where protodeclarative behaviors tend to precede protoimperative *behaviors* (Carpenter, Nagell, & Tomasello, 1998).

Spontaneous gaze following is present in children with autism, particularly if their verbal mental age is 4 years or older (Leekam, Hunnisett, & Moore, 1998). A verbal mental age of 4 is, however, quite sophisticated, and this finding jeopardizes claims of the necessary relation between gaze monitoring and language learning (Baldwin & Moses, 1994). The fact that the frequency of joint-attention behaviors, including gaze monitoring, predicts language ability in autism (Sigman & Ruskin, 1999) suggests that following gaze is an aid to comprehension and vocabulary, but that at least certain aspects of language learning can precede nonetheless without it.

While important social information can be obtained by following another's direction of gaze, even more social information can be obtained by noting another's emotional reaction toward an object/individual. This is called social or emotional referencing and, while not specifically addressed in Baron-Cohen's model (1995), it is an important subcategory of joint or shared-attention behaviors. Infants arc particularly sensitive to the facial and vocal expressions of others and will modify their behavior toward various objects as a function of another's emotional expression. For instance, a parent's facial expression can influence whether a 12-month-old will cross a visual cliff or whether a 10-month-old will interact with a stranger (Feinman and Lewis, 1983; Sorce, Emde, Campos, & Klinnert, 1985). These particular examples may be explained by contagion, where the fear signals in a parent trigger fear in the infant, thus inhibiting their exploratory or interactive behavior. Other studies have found that older children can discern the particular object or referent of another's emotional expression, and will behave differentially toward that object as a function of the expression. Repacholi (1998), for instance, found that 14-18-month-old children would interact more with the target of another's happy display than a disgust display, even though the targets (toys) were hidden in boxes. These data show that these children were not, via a simple association mechanism, mapping the emotional displays to the box but likely understood that the expressions referred to hidden objects within the boxes.

Griffin and Baron-Cohen (2006) carried out Repacholi's study (1998) with 2- and 3-year-olds with Autism Spectrum Conditions (ASC). They found that, while all of the children would search for the contents of the boxes, apparently appreciating that the emotional displays signaled hidden contents, only the control groups were influenced by the emotional displays. The search behavior of the ASC group appeared to be random. Though the ASC group may have appreciated that the facial-vocal cues signaled something *inside* the box (apparently a triadic computation), they did not appear to use the emotional expressions as a source of information *about* those objects. A follow-up experiment using a preferential-looking technique found that the ASC children were capable of *distinguishing* between different emotional expressions (for example, happiness and fear), but simply distinguishing between expressions is not the same as understanding what they mean - that is, how they may relate to objects in the world or to internal states. It is not yet clear whether the difficulties with emotional referencing found in this study are due to problems understanding the referential nature of emotions or whether the deficit is more basic, reflecting an altered sensitivity to others' emotional states (Hobson, 2003).

Eye-direction detector (0-9 months)

The eye-direction detector (EDD) has three functions, two of which may be considered perceptual and a third of which is ostensibly conceptual. The perceptual functions include (1) detecting the presence of eyes, and (2) detecting the direction of gaze. The conceptual function is the inference that eyes are for “seeing." Thus during mutual contact, the EDD represents that "agent sees me" and "I see agent" (Baron-Cohen, 1995, 42--43).

Recent experiments by Farroni and colleagues suggest that the first two functions are present at birth (Farroni, Csibra, Simion & Johnson, 2002). Newborns can detect the difference between direct and averted gaze, and will look longer at the former. This effect, however, can be influenced by the location of the eyes within the face. The effect is not found when the face is inverted or when it is rotated 45 degrees (Farroni et al., 2006). Farroni and colleagues argue against the existence of a modular EDD, because of the fact that facial configuration can influence the effect, contending instead that their results reflect an innate face-processing template. However, Baron-Cohen (1994) argues that these modules need not be strictly informationally encapsulated in Fodor's sense (1983), so these findings are consistent with his characterization of EDD perceptual functions.

The perception of averted gaze will automatically trigger shifts of attention in infants only a few months old (Farroni, Johnson, Brockbank, & Simion 2000). In these studies, infants are faster at locating peripheral targets that are congruent with the direction of another’s gaze than targets that are incongruent with the direction of gaze. To achieve this effect, however, a period of mutual gaze is necessary at the start of the procedure. Also, the centrally presented face must be extinguished before the targets appear (hence the procedure is typically done on a computer monitor). The continued presence of a face apparently demands more attentional resources than the peripheral targets for these young children (Johnson et al., 2005). The relation between the eyes and facial configuration makes a difference here as well, as the finding is not obtained when the face is inverted. It is important to note that this gaze-cueing effect is not properly a joint- or shared-attention behavior in that these children will not saccade to the location of the target *before* it appears (typically 1000 ms after the gaze cue), but simply show faster reaction times to the target *after* it has appeared (for a review, see Johnson et aI., 2005). Even typically developing 3-year-olds, who will follow someone's gaze to almost any location, show this same pattern. Thus the mechanism that realizes this effect does not appear to be employing any notion of "seeing" or "attending" but is probably triggered by the direction of motion of facial features, particularly eyes or eye-like stimuli (Farroni et aI., 2000).

Evidence for EDD's third function - the attribution of "seeing" - is not as straightforward, particularly in the first year of life. This is due to the fact that the concept of seeing derives its meaning from related concepts, such as attention or even knowledge, which are later emerging concepts according to the model. As Ryle (1949/2002) noted, "see" is what he called a success verb: you can look at something and fail to see it, so the attribution of seeing requires discerning - or hypothesizing - that success. ("She's looking right at us, but does she see us?" "Yes, now she's waving. At last she sees us.") But even 3-year-olds have trouble determining how knowledge is obtained through the various senses, and cannot accurately report whether they learned the identity of an object from seeing it, touching it, or inferring its presence from verbal clues (O'Neill & Gopnik, 1991). Such surprising gaps in their understanding are valuable reminders of how easy it is for adults to overestimate such competences. How tempting it is to think that anyone who can enjoy the game of hide and seek so much must have a solid appreciation of the perceptual sources of their own, and others', *knowledge*.

Eye-direction detection in autism

Baron-Cohen suggested that the EDD was intact in autism. Studies with school-age children with autism support this view in that they are able to determine whether someone is looking at them or at another object. They are also able to determine which object (among distractors) a person is looking at (Leekam, Baron-Cohen, Brown, Perrett, & Milders, 1997) and will use the word "see" in their everyday speech. While verbally able children with autism appear to have some notion of "seeing" or at least "looking at," they have difficulty in making the seemingly short leap to the axiom that "seeing leads to knowing." At least one study found these children could report that someone was "looking" in a box and that another person was "touching" the box, but were unable to determine which one "knew" what was in the box (Baron-Cohen & Goodhart, 1994). This is in keeping with Baron-Cohen's model in that "seeing" is computed by the EDD whereas "knowing" is computed by the TOMM.

But evidence with younger children with autism suggests that the EDD may not be spared after all. Johnson, Griffin and colleagues (Johnson et al., 2005) used the gaze-cueing paradigm described above with 2- and 3-year-olds with autism. They found that the children with autism were no faster at locating targets congruent with the direction of gaze than they were in the incongruent condition. That is, they did not show the gaze cueing effect. Nor did they show any problems shifting their own attention, a deficit which some have considered to be fundamental to the phenotype (Courchesne et al., 1994). In fact, the group with autism actually showed faster reaction times (RTs) than the controls in both the congruent and incongruent conditions, despite showing no evidence of cueing. These faster RTs have also been found by Chawaska, Klin, and Volkmar (2003) and may reflect a decreased attentional load to the centrally presented face (Johnson et al., 2005). If these children are not processing the face as fully or deeply as the control subjects, their attention may be more easily disengaged from the face, resulting in faster RTs to the peripheral targets (Lavie, Ro, & Russell, 2003).

Gaze cueing has also been studied with older children with autism. Senju, Tojo, Dairoku, and Hasegawa (2003) found that 10-12-year-olds with autism can be cued by gaze direction, and even by arrows. Yet, unlike an age-matched control group, the children with autism continued to be cued by the arrows even when they predicted the location of the targets on only 20 percent of the trials. This failure to show the differential sensitivity to the social nature of gaze cueing suggests that the group with autism may be using a different mechanism than typically developing children, treating the gaze direction as a symbolic cue. It is noteworthy that 2- and 3-year-olds do not show cueing to (non-social) arrows, which probably need to be understood as symbols that signify direction before this effect can occur (Charwaska, Klin & Volkmar, 2003).

Intentionality detector (0-9 months)

The intentionality detector (ID) is similar to the innate mechanism proposed by Premack (1990), who claimed that the mental state of "intention" is automatically attributed to anything that exhibits *self-propelled* or *self-initiated* motion. Baron-Cohen (1995) does not use the term "intention", owing to the fact that it is too closely linked to the concept of belief, instead claiming that the ID interprets motion stimuli in terms of "goals" and "desires" - for example, "Her *goal* is to go over there;" "It *wants* to get the cheese" (p. 33). The ID, like the EDD, can produce only dyadic mental representations. The output of each can be processed by the SAM so that their specific computations can be combined and the child can compute, for instance, that someone can desire (ID) the object he or she is looking at (EDD).

The studies that investigate intentionality detection in infants tend to focus on two main features of agency: motion properties (for example, self-initiated movement, action-at-a-distance, contingent interaction) and object-directed motion associated with agent-typical features such as eyes and hands. Our focus here will be on the former. The experiments investigating motion properties typically use simple geometric shapes, such as triangles and circles, which lack any agent-typical features. In adults, motion properties alone are enough to elicit elaborate folk psychological descriptions (Heider & Simmel, 1944), and infants may focus more on the motion properties of an object than the features that signal its kind of category (for example, color, shape) (Xu, Carey, & Quint, 2004).

At the time Baron-Cohen proposed his model, there was little evidence about the kinds of distinctions infants could make regarding motion properties. The ascendance of social-cognitive neuroscience and preferential-looking techniques with infants has begun to fill this gap. Perhaps the best evidence of goal attribution in infancy comes from a set of studies by Gergely, Csibra, and colleagues (Gergely & Csibra, 2003; Gergely, Nadasdy, Csibra & Biró, 1995), who find that 9-12-month-old infants will disregard the perceptual similarity between two motion trajectories (for example, arcing or jumping), instead encoding its relation or directedness toward another object. An illustration will help to clarify.

Infants who are habituated to a ball jumping over a barrier (Figure 17.1, Habituation), will show "surprise" (will dishabituate) to a test condition with the same arcing motion, albeit with the barrier removed from its path (Figure 17.1, Old Action). Note that this is perceptually more similar to the habituation animation than the other test condition, where the ball moves in a direct path toward the other ball (Figure 17.1, New Action). While younger infants (6 months old) will dishabituate to the perceptually dissimilar condition (new action), most older infants (9-12 months old) will not, apparently because they expect the ball to move in a direct path toward the other ball. Gergely and Csibra argue that the older infants are representing the ball's "goal," which is to contact the other ball, and also that the goal will be satisfied by the optimal means available. They call this latter constraint the "principle of rationality." Importantly, they do not grant infants the means to attribute mental states as internal and *causal* to the action. The goals in

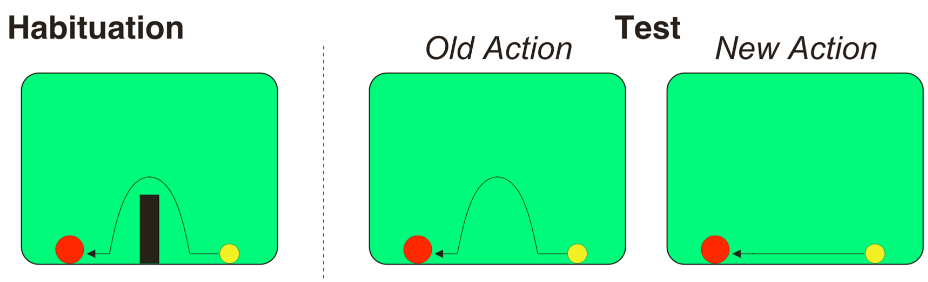

Figure 17.1. Stimuli from Gergely & Csibra that demonstrate infant sensitivity to rational action at 9 months of age. *Note:* For a full description of the paradigm, see p. 265.
Source: Gergely et al. (1995).

their model are the action outcomes - the act of getting to the other side, as it were. They call this the "teleological stance," whereby infants determine the future goal and then predict that agents will act in such-and-such a (rational) way *in order to* achieve that goal. "In order to" clauses signal teleological explanations. Gergely and Csibra's overall conceptual program is provocative, clearly articulated, and will be addressed in more detail below.

Intentionality detection in autism

Baron-Cohen speculated that the ID was intact in autism, based on the fact that reference to desires and goals sometimes occurs in their spontaneous speech and in experimental settings. Bowler and Thommen (2000) found that school-age children with autism were able to distinguish self-propelled from non-self-propelled motion in a Michotte-style launching event, and also that they described the Heider and Simmel (1944) stimuli using the same amount of mental-state language as controls. Abell, Happé, and Frith (2000) took the paradigm a step further, creating Heider and Simmel-style animations depicting three conditions: random movement, goal-directed movement, and "theory-of-mind" movement, of which the latter depicted the most sophisticated social scenarios (for example, tricking or mocking). They found that the autism group, when compared to typically developing 8-year-olds, produced less accurate mental-state language for the "theory-of-mind" condition, though the autism group did not differ from IQ-matched controls. Studies of this kind do not typically find impairments in the descriptions of goal-directed or simple purposive scenarios, such as chasing or fighting (see also Castelli, Frith, Happé, & Frith, 2002; Klin, 2000).

These studies test older, verbally able, individuals with autism. Because autism is not typically diagnosed before the age of 3, there are few data on toddlers and preschoolers with autism and almost no data on autism in early infancy. There are, however, a couple of studies that have investigated goal detection, broadly construed, in 2- and 4-year-old largely preverbal children with autism. Perhaps the best evidence of goal-detection capabilities in young children with autism comes from a study using Meltzoff's paradigm (1995) of "unfulfilled intentions" or "procedural imitation" (Aldridge, Stone, Sweeney, & Bower, 2000). In this paradigm, typically developing 14- and 18-month-old children who witness an actor unsuccessfully attempting to complete an act (for example, pulling apart miniature dumbbells), will complete that act if given the chance to do so (Carpenter et al., 1998). Because the children have not witnessed the completed act, some researchers claim that these infants have inferred the actor's *intention* to complete the act and are not merely copying an action. Aldridge et al. found that 2-4-year-old preverbal children with autism actually performed better than controls on these tasks, despite the fact that they showed no gestural imitation (for example, tongue protrusion, wiggling the ears with both hands) (see also Carpenter, Pennington, & Rogers, 2001). The authors were quite surprised by these results in that they expected, based largely on the work of Meltzoff and Gopnik (1993), that gestural imitation was a necessary precursor to the imitation of intentions. They assumed, moreover, that a "theory of mind" was necessary to complete these procedural tasks, echoing Premack & Woodruff (1978) (Aldridge et al., 2000, p. 300; but see Charman & Huang, 2002; Griffin, 2002; Griffin & Baron-Cohen, 2002). Interestingly, the "goals" of gestural imitation may not be as readily apparent as the outcomes of the procedural imitation conditions. To wiggle your ears in response to someone else's wiggling is likely to require, at the very least, an understanding that they "want" you to wiggle your ears as well. We could also construe this as an understanding of their intention for you to participate in the "ear-wiggling" game. Of course, even if this were understood, the child must be motivated to share emotions and activities with other individuals, an ability that may be lacking in children with autism.

Another study directly relevant to intentionality detection in preverbal children with autism was carried out by Griffin, Baron-Cohen, & Johnson (forthcoming), and used the stimuli from Gergely et al. (1995), depicted in Figure 17.1 above. While the studies reviewed above lead to the reasonable prediction that the ASC children would perform similarly to controls, the results are not kind to this prediction. After the groups had been familiarized to the ball surmounting a barrier (Figure 17.1, Habituation), the autism group, and only the autism group, looked longer at the perceptually dissimilar straight approach on the test trials (Figure 17.1, New Action). While these results do not fit with others that support the notion that young children with autism can predict goals (as event outcomes, at least), they fit well with another literature on autism that finds a pervasive bias to attend toward local rather than global features. This is sometimes referred to as weak central coherence (Happé, 1999). Because the ASC group in this study failed to incorporate the contextual constraints (for example, the barrier and/or the goal ball) and attended primarily to the salient perceptual feature of the stimuli (the arcing motion), the authors prefer an interpretation in perceptual rather than conceptual or "folk-theoretical" terms.

A bias toward local information can result in the omission of important contextual factors with which to constrain interpretation. Such integration failures have been found at a relatively low-level of visuospatial processing, and may account for why children with autism sometimes have difficulty seeing 2-D and 3-D visual illusions (Happé, 1996). A local processing bias can also result in enhanced performance when contextual factors typically interfere with performance, such as in the embedded-figures task, where individuals with autism outperform controls (for a review, see Happé, 1999). This processing bias is not by itself enough to account for theory-of-mind difficulties, as it is found across the spectrum, even with those who pass higher-order theory-of-mind tasks (Happé, 1995a).

The variation in age, IQ, number, and severity of traits, along with issues of comorbidity, virtually preclude any one cognitive or neurological model from characterizing the entire spectrum. Baron-Cohen's "mindblindness" model is most successful when applied to the subset in the medium-to-high functioning range, with enough language to participate in tasks that probe an understanding of mental state concepts, and the research generating from the model shows us that it is not the power of language alone that gives rise to the idea of a representational mind. Typically developing children with a verbal mental age of 4 begin passing many theory-of-mind tasks, but children with autism require a verbal mental age of more than 9 years to achieve the same probability of success (Happé, 1995b). This suggests that they are using language as a crutch, as it were, to compensate for their impoverished inferential abilities in the social domain.

A possibility consistent with this is that individuals with autism, both children and adults, are the *only* people who really do have, and use, an articulated *theory* of mind (Dennett, 1990). That is, lacking the well-functioning mindreading mechanisms that permit typically developing children to adopt the intentional stance quite effortlessly (without even realizing they are doing it), individuals with autism must literally and explicitly consult the rules and generalizations of folk psychology in order to infer the likely mental states of those they encounter. While the generalizations of folk psychology could in principle be laid out in a (vast) list (for example, "People who are overtired are generally irritable"), the craft does not appear to require a "look-up" function of this imaginary list. Indeed, to be socially skillful, the *ceteris paribus* clauses endemic to these generalizations must be replaced with useful information. All things are not equal. A constructive criticism can be crushing to one individual and galvanizing to the next. People have different moods, interests, knowledge, opinions, status, and histories. A remark made to a sibling might not have the same social effects at school, at a dinner party, or at church.

Anecdotal evidence in support of this hypothesis comes from writers with autism such as Donna Williams (1998) and Temple Grandin (1995), who find themselves forced to ask some very difficult questions about the nature of folk psychology – questions about what it is to "like" something or "want" something, whether preferences and desires are caused by internal or external factors, and what the "self" has to do with all this (see Griffin, 2000). Articulate individuals with autism or Asperger syndrome may tell us more about the relationship between the ideology and the craft of folk psychology than those at the lower end of the spectrum. As many as 50 percent of people with autism will never speak, and the majority of children with autism have an IQ of 70 or less (APA, 2000; Volkmar & Klin, 2000). This "classic" autism is often accompanied by other medical or psychiatric problems as well as executive function deficits, the latter of which may be more diagnostic of the condition than theory-of-mind measures (Russell, 1997). Because a host of problems outside the domain of social cognition can, and do, accompany autism, Baron-Cohen considers "pure" autism to be reflected by those with Asperger syndrome, a condition where language deficits are not part of the diagnostic criteria and IQs range from normal to above average. When we look at this end of the spectrum, however, those with autism do not seem to have problems with the propositional attitudes, or even with embedding them into higher-order constructions (for example, Peter thinks that Jane thinks that...) (Bowler, 1992). Indeed, Ludwig Wittgenstein has been posthumously diagnosed with Asperger syndrome in a peer-review psychiatric journal (Fitzgerald, 2000), and, while he *certainly* had trouble with the propositional attitudes, it was not because he did not understand them as well as the typical layperson. His problems lay with the false premises of the ideology (Wittgenstein, 1953).

Indeed, finding "theory-of-mind" deficits in very high-functioning individuals on the spectrum requires far more sensitive measures, such as determining whether someone is contemplative, concerned, or dispirited, for example, from photographs of the eye regions of the face (Baron-Cohen, Wheelwright, Hill, Raste, & Plumb, 2001), or recognizing irony, sarcasm, or social faux pas (Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999). While these problems clearly interfere with important "theory-of-mind" inferences, leading, for instance, to misunderstanding speakers' intentions, the reasons for these misreadings may be better understood as due not to a lack of "theory" but to impaired "evidence gathering" through misdirected attention (Klin, Jones, Schultz, Volkmar, & Cohen, 2002), failures to inhibit the more frequent associations, deficits in activating weaker, more distant, associations, or difficulties incorporating contextual constraints. These important quasi-perceptual talents need not be mutually exclusive. Each is necessary to note the difference between, say, content and content (or read, tear, bow, or row), and each is necessary to determine what someone means by "nice hat" (Brownell, Griffin, Winner, Friedman, & Happé, 2000). Individuals with right-hemisphere damage also show difficulties on these tasks, and, like that of high-functioning individuals on the autism spectrum, their performance may improve when time constraints are relaxed (Brownell et al., 2000; Griffin et al., 2006).

But real-world social interaction does not afford us the luxury of unlimited time to work through the possible meanings of an utterance, or of saying the right thing at just the right time. We all know the phenomenon of missing a double entendre or finding the perfect retort well after it was due. Most of us simply have the *knowhow* of the principles of relevance, clarity, quantity, or ambiguity, and so on, without reading Grice (1989), and without knowing *that* we were (typically) abiding by such principles. This is all part of the craft of folk psychology, and it is the part of the craft that is the least understood. We do not know *how* we know not to stand too close when speaking, read a "knowing" glance, or sense the proper rhythm of turn-taking in conversation. These so-called undercurrents are where high-functioning individuals on the spectrum appear to have the most difficulty, and, because opinions about these mechanisms are not part of the ideology, they have remained largely outside the focus of empirical study.

Separating the Craft and the Ideology of Higher-Order Intentional Attributions

As we have seen, the theoretical accounts of early intentional interpretation tend to focus on children's beliefs about one or another of the propositional attitudes - more specifically, on the beliefs, goals, desires or intentions of an agent. But when a child (or chimp) is shown to predict an agent's behavior, there is uncertainty whether he or she is representing, say, Big Bird's *intention* to *p* (or, better, bring it about that *p),* Big Bird's *desire* to (bring it about that) *p,* or Big Bird's *goal* to bring it about that *p*. (Philosophers insist that logic demands whole propositions, not mere verbs or verb phrases, as the permissible values of "*p*" and "*q,*" but we will adopt a more casual and familiar usage here, counting on conscientious readers to supply the obligatory paraphrases, when needed.) It might seem to be more acceptable, less "mentalistic," to describe the child's competence in more "behavioristic" terms - for example, the child is representing that Big Bird is *attempting* to *p,* or *trying* to *p,* but these terms are not really less mind-involving, since only agents with minds (and goals, desires, intentions...) can *attempt* or *try*. Actions are a special class of events involving agent causation (Jackendoff, 2007). "Attempting," "trying," and the like refer to potential outcomes and provide reasons for an agent's actions, specifically those in the service of bringing *p* about. To see something as making an attempt is already to have adopted an intentional stance toward it.

Bare *event* descriptions, as contrasted with *action* descriptions, might then be closer to the mark. Perhaps the child is representing that Big Bird *will likely p,* or is *going to p,* or is *about to p,* and so forth. While *p* in each case may refer to a future (non-existent) state of affairs, predicting that someone or something is "about to" or "will likely" *p,* need not require a mechanism in the service of action explanation. Statistical or probabilistic learning could suffice. Just as we might predict that the falling bowl will hit the floor, or the cookie will get wet in the milk, a similar mechanism could predict that the doll (or mommy) will get wet in the bath. These predictions do not appeal to a purpose and describe events rather than actions. This difference is somewhat obscured by the fact that we speak casually about "reasons" in both kinds of cases: the "reason" the ice disappeared from the sidewalk is because it melted because the air got warmer, but the ice did not have this *purpose,* and neither did the air.

While philosophers have debated the fine points of these different descriptions (for example, attempting versus trying versus intending) and their implications for decades - are they descriptions of the same action (e.g. Anscombe, 1963; Davidson, 1980) or descriptions of different actions (e.g. Goldman, 1970)? – the task of developmental psychologists should be clear enough: to illuminate the mechanisms by which children encode and anticipate these behaviors. It is not clear that *any* of the action descriptions reflect the mechanisms that preverbal children use to predict actions or events. Language has a tendency to cut too fine in such cases. Differences in implication and assumption that can be discerned by adult philosophers may not engage any question that needs answering at the level of cognitive mechanisms in the child, and insisting on making such distinctions can tend to drive theorists toward a more *intellectualist* or "language-of-thought" perspective on these mechanisms than is warranted by any of the evidence.

In these simple scenarios, it may not appear to make much of a difference if the child characterizes an agent's reasons for acting as reflecting the agent's intention (and content) or desire (with the same content), but intentions and desires serve very different functional roles in the abstract calculus of folk psychology. The content of a desire (to bring it about that *p)* can be distinguished from the content of an intention (for example, to do such and such) in order to bring it about that *p,* in a variety of ways. Intentions and desires are different from beliefs in that they are neither true nor false, but are either fulfilled or unfulfilled (or pending). Studies that test whether children can distinguish between intentions and desires typically do so by creating scenarios with distinct satisfaction conditions for each. For instance, Phillips, Baron-Cohen and Rutter (1998) had children attempt to shoot targets in order to win a prize. The situation was manipulated such that children would (1) miss the target yet win the prize (satisfying the desire but not the intention), (2) hit the target and not win the prize (satisfying the intention but not the desire, (3) hit the target and win the prize (satisfying both), and (4) miss the target and not win the prize (satisfying neither). The test questions ask the children which target they "meant" to hit. Their answers belie their aim, tending to refer to the overall outcome - that is, whether (or not) they won the prize (desire content). Overall, these studies find that children are unable to distinguish accurately between intentions and desires until around the time they pass false-belief tasks (Feinfeld, Lee, Flavell, Green & Flavell, 1999; Shult, 2002). Because children with autism have difficulty with such tasks, Baron-Cohen relegates the concept of intention to the TOMM, along with epistemic states such as belief and knowledge.

In a recent, extended, defense of infant's understanding of intentions, Tomasello and colleagues (2005) write: "If we want to know how people understand intentional action, we must first have a model of exactly what intentional action is" (p. 676), and continue "the prototypical exemplar is, of course, the thermostat" (p. 676). Following Weiner (1948) and Ashby (1956), they go on to describe a model of intentions using the internal goal states, sensors, and feedback loops typical of cybernetic models. While the thermostat does provide a vivid minimalist example of an intentional system (Dennett, 1971), their citation of it may mislead people into thinking that all attribution of intentional action is *ipso facto* the attribution of some quite specific sort of internal mechanism - like the readily understood innards of a thermostat. It is important to bear in mind that, although thrifty engineering and conservative tradition restrict thermostat mechanisms to a handful of distinct types, there are in principle indefinitely many distinct mechanical ways of achieving the goal-directedness and feedback that constitutes a thermostat (you could even put a shivering or sweating midget inside, with a rule book to consult before acting - a literal homunculus).

More important than any specific prototypical mechanism is a folk conceptual analysis of these concepts (Jackendoff, 2007), and a breakdown of their function in folk psychological reasoning (Malle & Knobe, 2001). Such a breakdown provides a better yardstick against which to measure children's progress than an analysis of the feedback systems of heat-seeking missiles or thermostats. Intentions, unlike desires, involve action plans that signal a certain degree of commitment (Bratman, 1987). Moreover, one can desire to do something (one believes to be) impossible, but one cannot intend to do something (one believes to be) impossible. Malle and Knobe (2001) claim that social perceivers take desires (and beliefs and values) to be inputs to reasoning and intentions to be outputs, where they become the formation of the action plan. In this way, knowledge of an intention allows for greater predictive accuracy than knowledge of a desire. Intentions have action content of one's own actions, whereas the content of a desire can be much broader, and can include another's action or an unlikely outcome, and so on. For example, I can intend to spin the roulette wheel but I cannot intend *you* to spin it. I can *want* you to spin it, of course. Moreover, I cannot strictly speaking intend to win a million at the roulette table because it is out of my control. I can want, wish, or hope (desire verbs) to win, but I cannot intend, plan, or decide (intention verbs) to win. And, because intentions are closer to actions than desires, with more specific content, one cannot have conflicting intentions, even though one may have conflicting desires.

While there may be prototypical examples of intentions and desires, the degree of controllability and commitment can blur the lines between these attributions. Consider a more difficult shooting game than the one mentioned above. Someone with no shooting experience and poor eyesight might want to hit a bull's eye at 100 m but cannot intend to. If he purchased a scope, and set out practicing daily, we might shift from attributing to him a desire to hit the target to an intention to hit it (consisting of the action plan content, and because of his increasing skill and commitment).

Once someone has formed an intention, whether we consider the completed action *intentional* depends on whether it was executed as planned. Thus, even if he were an excellent shot, dropping the gun and hitting the bull's eye would not count as intentional, in most people's mind anyway (Knobe, 2003). He may have wanted to hit the target but he did not do so *intentionally*. We are not entirely consistent in these types of attributions, however. Say he wanted his neighbor dead and brought his gun to the hilltop to get a good angle. If he then tripped, dropped the gun, and killed the neighbor, a jury would probably find him guilty of *intentionally* killing the neighbor. Indeed, moral factors related to assessing blameworthiness will factor into whether we consider an action to be intentional. This blameworthy dimension of intentional attribution is seen in 4- but not 3-year-olds, again around the time they pass false-belief tasks (Leslie, Knobe, & Cohen, 2006). In sum, there are many ways to distinguish between intentions and desires, but doing so will rely on other concepts such as belief, commitment, skill, the action's consequences, and so on (Jackendoff, 2007). An excellent case in point is a recent study of pointing and point following by infants (Tomasello, Carpenter, & Liszkowski, forthcoming), in which the authors first describe the surprisingly complex adult competence involved in pointing and point following, to wit: "she intends that I attend to X (and wants us to know this together) for some reason relevant to our common ground" (p. 10), and then go on to ask their central question: "the degree to which, and the ways in which, infant pointing shares all of the social-cognitive complexities of the adult version of this communicative gesture." Their conclusion about the competence they uncover in the year-old infants is remarkable for its mixture of insight and awkwardness: "they do this on a mental level involving the intentions, attention and knowledge of their partner" (p. 35). What is this "involving"? Is it explicit representing? Does it require, as Fodor would insist, *having the concepts* of intentions, attention and knowledge? Moses (2001) puts the problem clearly: "The difficulty, then, is to find a vocabulary that does justice to children's often impressive cognitive capacities without doing violence to the meaning of the full-blown adult concepts" (p. 69).

What Grice uncovered in his analysis of the (brilliant, sophisticated!) complexities of communication is parallel to the discoveries made by biologists of the (brilliant, sophisticated!) strategems unwittingly pursued by animals. The low-nesting bird whose distraction display lures the predator away from the vulnerable fledglings in the nest is like the infant proto-communicator attracting his or her mother's attention. The bird is not just succumbing to paroxysms of fear and thrashing; she is monitoring the gaze direction of the predator, and making sure she wins the competition for attention, turning up the volume and allowing the predator to approach closer if the predator shows signs of giving up (Ristau, 1991). But the bird surely does not have to know she is doing all this! Neither does the pointing infant, who is "in some sense trying to influence her intentional/mental states" (Tomasello et al., forthcoming). An agent can X quite competently without having any explicit idea that he is Xing, or why Xing might be a good thing to do, or when to X and when not to X. All such an agent needs is a good Xing mechanism. Such an agent (and the agent's many other subsystems) is the beneficiary of all this timely Xing without anybody needing to be the wiser. In short (in philosophese), you can X without having the *concept* of Xing. You do need *something like* a concept; you need a designed mechanism that tracks, at least semi-reliably, the relevant phenomena. (A hand calculator almost perfectly tracks arithmetic, without having a (proper) concept of multiplication and division: after all, ten divided by three, times three, equals ten, not - as the calculator would have it - 9.99999999E.)

Do even articulate adults have *the* concept of communication, of intention, of belief? Probably only accomplished Griceans (and their critics), skilled novelists and playwrights, reflective con artists ... and a few other *virtuosi* would perform well on sophisticated tests of their knowledge of the conditions. We can imagine a challenging multiple-choice exam on the finer points of theory on which many adults would fall down rather badly. ("When X raised his eyebrows just then, what was he intending to do? A: acknowledge that he had understood y's request but was refusing it. B: let Z know that y's request betrayed y's ignorance of the situation. C: cause Y to infer that X knew that Y wasn't serious in his request. D: none of the above.") A low grade on the test would hardly show that a person had not been communicating competently for years.

The mechanisms in the service of providing reasons need not be the same as those involved in predicting simple actions. All animals are in the business of behavioral prediction, but only humans are in the business of articulating reasons (Brandom, 2000). Only humans trade them. Being able to do so no doubt has more than a little to do with language and conceptual development. Young children are hit and miss with their reason ascriptions. In false-belief scenarios, children who fail the task are sometimes able to provide excellent (post-hoc) explanations that refer to mistaken beliefs, but even children who pass are not necessarily privy to their reasoning (for example, "He looked in the white box because that's his favorite color," to take one real-world case) (Bartsch, 1998). Coming up with reasons post hoc is probably easier than using them for prediction for a couple of reasons; (1) the action to be explained has already transpired, so the outcome is a given, and (2) there is simply more time to come up with a reasonable story.

Children not only need to find reasons for other people's actions, but they need to do the same for themselves. Infants may have reasons for acting, but they are not yet their own reasons; they are the reasons that are presupposed by the design of the mechanisms that they are blessed with, "free floating rationales" (Dennett, 1995, 1996) that are not represented anywhere but are nevertheless discernible in the efficiency and effectiveness of their behavior. When we ascribe these reasons to them, this tends to create the illusion of more clear-cut content than actually exists. This overinterpretation can be useful as scaffolding, however, helping the child to come to be able to *distinguish* and then *adopt* such articulated mental states as his or her own (McGeer, 2004). It encourages a form of *approximating confabulation,* much like settling for the nearest miss in a poorly designed multiple-choice exam, when "none of the above" is not an option. We help children along in the dynamic process of composition ("Is *this* what you want?"), endorsement ("Thank you, that's exactly what I wanted!"), and revision ("No thank you. I'm not hungry right now") inherent in the refinement of reason-giving explanations. As their inferential abilities increase, so too will what follows from the reasons they give others and themselves, making them easier and easier to characterize as higher-order intentional systems, and making it easier for them to characterize us in the same way.

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