2.4

False-Belief Understanding and Why it Matters

The Social-Acting Hypothesis

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From a very early age, infants attempt to make sense of the world around them. This causal reasoning appears to be carried out by a small number of special-purpose reasoning systems; each system operates without explicit awareness and is triggered whenever infants attend to events, or aspects of events, that fall within the purview of the system. Thus, the physical-reasoning system deals with the interactions of objects and other physical entities; the psychological-reasoning system deals with the intentional actions of agents; and the sociomoral-reasoning system deals with the interactions of individuals within and across social groups. Each reasoning system has at its core a distinct explanatory framework that enables infants to form specific expectations about events. Because each framework is at best skeletal, early expectations tend to be highly abstract and lacking in all mechanistic detail; nevertheless, they play a critical role in determining how infants respond to and learn about events. To a remarkable degree, all reasoning systems are able to operate jointly: Thus, when infants watch a complex event with salient physical, psychological, and social components, the relevant reasoning systems work together seamlessly to yield a causally coherent interpretation of the event.

In this chapter, we focus primarily on the psychological-reasoning system. We first briefly describe its two subsystems and then discuss the long-standing and controversial question of when the second subsystem—the one responsible for our uniquely human ability to understand that others may hold and act on false beliefs—becomes operational in development. Finally, we propose that, beyond false-belief understanding, this second subsystem (when recruited by the sociomoral-reasoning system) allows individuals to decouple what they think and feel from what they choose to communicate to others in everyday social interactions. We speculate that the primary function of social acting—in the form of white lies, tactful omissions, feigned interest, hidden disappointments, false cheer, and the like—is that of maintaining positivity within social groups, thereby supporting in-group loyalty (for related ideas, see, e.g., DePaulo & Bell, 1996; Lakoff, 1973; Lee & Ross, 1997; Sweetser, 1987).

THE PSYCHOLOGICAL-REASONING SYSTEM

When infants identify an entity—whether human or nonhuman—as an agent and attend to its actions, their psychological-reasoning system enables them to infer some of the likely mental states underlying the agent's actions. Two subsystems are assumed to be involved in the attribution of mental states, subsystem-1 (SS1) and subsystem-2 (SS2) (e.g., Leslie, 1995; Scott & Baillargeon, 2009).

When infants watch an agent act in a scene, SS1 enables them to attribute at least two kinds of mental states to the agent: motivational states, which specify the agent's motivation in the scene (e.g., goals, dispositions), and epistemic states, which specify what the agent knows and what the agent does not know about the scene. When an agent is ignorant about some aspect of a scene (e.g., the agent cannot see an object, or a portion of an object, that the infant sees), a masking mechanism blocks the information that is unavailable to the agent, enabling the infant to predict and interpret the agent's actions in terms of the remaining, shared information (e.g., Luo & Beck, 2010).

SS2 extends SS1 and enables infants to attribute counterfactual states to agents; these states include false and pretend beliefs. When an agent holds information about a scene that is incompatible with the information available to the infant (e.g., the agent believes a toy is in location-A, but the infant knows the toy has been moved to location-B; the agent pretends to be riding a horse, but the infant knows the horse is really a broom), SS2 allows the infant to represent these divergent beliefs. A decoupling mechanism enables the infant to create a separate representation of the scene that incorporates the agent's false or pretend beliefs but otherwise functions as expected, making it possible for the infant to predict and interpret the agent's actions (e.g., Leslie, 1994).

Why Two Subsystems?

There are at least four reasons for positing two separate subsystems in infants' psychological-reasoning system. First, the masking mechanism of SS1 seems intuitively very different from the decoupling mechanism of SS2; masking or blocking out the portion of reality that is unavailable to an agent seems computationally far simpler than creating a second, alternative version of reality that incorporates an agent's false or pretend beliefs (e.g., Scott & Baillargeon, 2009). Second, recent evidence from neuroscience suggests that the brain regions associated with SS1 and SS2 tasks do not fully overlap (e.g., Yang & Pelphrey, in press; Young & Saxe, 2009). Third, although there is extensive evidence that nonhuman primates possess psychological-reasoning abilities akin to those carried out by SS1, there is currently no robust evidence that they can either attribute false beliefs or comprehend pretense (e.g., Call & Tomasello, 2008). Finally, children and adults living with autism appear to have specific difficulties with false-belief and pretense tasks (e.g., Senju, Southgate, White, & Frith, 2009). Together, these results suggest that the decoupling mechanism of SS2 emerged late in evolution, is relatively fragile, and is somewhat impaired or deficient in individuals living with autism.

WHEN DOES SUBSYSTEM-2 BECOME OPERATIONAL?

SS1 is operational early in life: There is considerable evidence that young infants can attribute simple goals and dispositions to agents and that they hold different expectations for the actions of knowledgeable and ignorant agents (e.g., Luo & Baillargeon, 2010). The question of when SS2 becomes operational has been far more controversial.

Elicited-Response False-Belief Tasks

Beginning with the seminal work of Wimmer and Perner (1983), much of the research on early psychological reasoning has focused on the question of when children become able to attribute false beliefs to others. Initial investigations used elicited-response tasks in which children answer a direct question about the likely behavior of an agent who holds a false belief about a scene. In a classic task (Baron-Cohen, Leslie, & Frith, 1985), children listen to a story enacted with props: Sally hides a marble in a basket and then leaves; in her absence, Anne moves the marble to a nearby box; Sally then returns, and children are asked where she will look for her marble. Beginning at about age 4, children typically answer correctly and point to the basket (where Sally falsely believes the marble is); in contrast, most 3-year-olds point to the box (where the marble actually is), suggesting that they do not yet understand that Sally holds a false belief about the marble's location. This developmental pattern was subsequently confirmed with elicited-response tasks testing different false beliefs and with children from different countries (e.g., Liu, Wellman, Tardif, & Sabbagh, 2008).

Broadly speaking, two very different accounts were proposed for these findings. In the dominant (late-emergence) account, researchers suggested that false-belief understanding did not emerge until the preschool years, as a result of conceptual, executive-function, or linguistic advances (e.g., Carlson & Moses, 2001; Wimmer & Perner, 1983). The other (early-emergence) account argued that (1) SS2 had to be operational much earlier, since the same decoupling mechanism underlies pretense and false-belief reasoning and infants in the second year of life already engage in pretense, and therefore (2) preschoolers' failures at elicited-response false-belief tasks had to reflect performance limitations, such as inhibition difficulties (e.g., Leslie, 1994; Leslie & Polizzi, 1998). In line with the early-emergence account, 3-year-olds performed somewhat better at elicited-response false-belief tasks when inhibition demands were reduced through various means; however, children's performance was typically no better than chance, providing only weak support for the account (e.g., Kovács, 2009; Yazdi, German, Defeyter, & Siegal, 2006).

A critical new research direction began with the discovery that 3-year-olds gave evidence of

false-belief understanding when the experimenter delivered the standard test question (e.g., "Where will Sally look for her marble?") as a self-addressed prompt, rather than as a direct question: Upon hearing the prompt, children spontaneously looked at the marble's original location, thus correctly anticipating where Sally's false belief would lead her to search (e.g., Clements & Perner, 1994). These positive results gave rise to the possibility that children younger than age 3 might also demonstrate false-belief understanding in tasks designed to measure their spontaneous—instead of their elicited—responses to test scenes.

Spontaneous-Response False-Belief Tasks

Beginning with the work of Onishi and Baillargeon (2005), several different spontaneous-response false-belief tasks have been developed for use with infants and toddlers. Positive results have now been obtained with children ages 7 months to 2.5 years, indicating that SS2 is already operational in the first year of life and as such supporting the early-emergence account (e.g., Baillargeon, Scott, & He, 2010; He, Bolz, & Baillargeon, 2011; Kovács, Téglés, & Endress, 2010; Scott, Baillargeon, Song, & Leslie, 2010). To illustrate false-belief reasoning in young infants, we next describe a recent violation-of-expectation experiment with 11-month-olds (He & Baillargeon, 2012); this experiment was based on prior physical-reasoning findings that, by about 7.5 months, infants realize that a tall object can be hidden in a tall but not a short container (e.g., Hespos & Baillargeon, 2006).

Infants were assigned to a false-belief, a knowledge, or an ignorance condition. In the false-belief condition, infants first received four familiarization trials (see Fig. 2.4.1). In each trial, a female agent sat at a window in the back wall of a puppet-stage apparatus, and a female experimenter knelt at

FIGURE 2.4.1: Familiarization and test events shown in the false-belief condition of He and Baillargeon (2012).

a window in the right wall; on the apparatus floor were two short open containers and a tall toy dog. The agent played with the dog briefly, returned it to the apparatus floor, and then hid herself by lifting a large cloth that filled her window. The experimenter placed the dog in one of the containers and then signaled the agent to return ("Ok!"). At that point, the agent lowered her cloth, grasped the dog's head, and paused until the trial ended. Across trials, different containers were used, and the dog was placed in the left or the right container (order was counterbalanced); the familiarization trials thus served to establish that the agent wanted the dog and reached for it wherever the experimenter happened to place it. Next, infants received two test trials involving a tall and a short container, each closed with a lid; the dog was taller than the short but not the tall container. As before, the agent played with the dog and then hid behind her cloth. Next, the experimenter shortened the dog (its body was a rigid cylinder that could be collapsed by pressing firmly on its head) and placed it in the short container. When the agent returned, she grasped the lid of either the tall container (tall-container event) or the short container (short-container event), and then she paused until the trial ended. If infants reasoned that the agent (1) should falsely believe that the dog was still tall and hence (2) should falsely infer that it was hidden in the tall container (since tall objects cannot be hidden in short containers), then they should expect the agent to reach for the tall container and they should look reliably longer when she reached for the short container instead. Infants in the knowledge condition (see Fig. 2.4.2) saw similar test events except that the agent watched all of the

FIGURE 2.4.2: Test events shown in the knowledge and ignorance conditions of He and Baillargeon (2012). Infants in these conditions saw the same familiarization events as in the false-belief condition, with one exception: In the knowledge condition, the agent's cloth had a large hole that enabled her to watch the experimenter's actions.

experimenter's actions through a large hole in her cloth and hence knew where the dog was hidden. Infants in this condition should thus expect the agent to reach for the short container, and they should look reliably longer when she reached for the tall container instead. Finally, infants in the ignorance condition again saw test events similar to those in the false-belief condition except that, before the agent hid behind her cloth, she saw the experimenter shorten the dog. Because the shortened dog could be hidden in either container, infants should expect the agent to reach randomly for the tall or the short container, and they should thus look about equally at the two events.

As predicted, infants in the false-belief condition looked reliably longer at the short- than at the tall-container event, infants in the knowledge condition showed the reverse looking pattern, and infants in the ignorance condition looked about equally at the two events. Together, these results indicate that, by 11 months of age, infants can already attribute false beliefs to others.

Why Are Elicited-Response False-Belief Tasks Difficult for Young Children?

If children succeed at spontaneous-response false-belief tasks before they reach their first birthday, why do they fail at elicited-response false-belief tasks until about age 4? According to our processing-load account, elicited-response tasks not only require children to represent the agent's false belief but also involve at least two executive-function processes (e.g., Scott, He, Baillargeon, & Cummins, 2012). One is an inhibition process: When children are asked the test question (and thus shift from merely observing the test scene to engaging in a verbal interaction about it), their own perspective on the scene naturally becomes prominent and must be inhibited to allow them to adopt the agent's perspective. The other process is a response-selection process: Children must select a response to the test question. The inhibition and response-selection processes are both important. In low-demand false-belief tasks where little inhibition is required (e.g., where Anne, instead of moving the marble to the box, takes it away to an undisclosed location), 2.5-year-olds typically perform at chance, because the simultaneous activation of the false-belief-representation and response-selection processes overwhelms their limited information-processing resources; children do succeed, however, if first given practice trials designed to reduce response-selection demands (Setoh, Scott, & Baillargeon, 2011). In more typical high-demand false-belief tasks (e.g., where Anne moves the marble to the box), young children fail even if given response-selection practice trials because their inhibitory skills are too immature to enable them to inhibit their own, prominent perspective on the scene.

According to the processing-load account, spontaneous-response false-belief tasks are thus easier because (1) children observe the false-belief scene as bystanders so that their own perspective is less salient, leaving them free to reason about the scene from the agent's perspective, and (2) children respond spontaneously, so that the response-selection process is not engaged.

WHY DOES SUBSYSTEM-2 MATTER?

We have reviewed evidence that SS2 is typically operational in the first year of life, is impaired in individuals living with autism, and is absent in nonhuman primates. Why does SS2 matter? As alluded to in the Introduction, we suspect that, beyond false-belief understanding, an intact SS2 enables individuals to engage in everyday social acting. Whether one is pretending to ride a horse or pretending to adore the latest inspirational window ornament offered by Great-Aunt Petunia, one is still pretending.

In-Group Support, Positivity, and Social Acting

One of the principles guiding sociomoral reasoning in adults and children is that of in-group support (Baillargeon et al., in press). Like adults, young children tend to prefer members of their own groups, to help in-group members in need of assistance, to display in-group favoritism when distributing resources, and so on (e.g., Brewer, 1999; Kinzler, Dupoux, & Spelke, 2007; Olson & Spelke, 2008; Over & Carpenter, 2009; Sloane, Baillargeon, & Premack, 2010; Warneken & Tomasello, 2006). Recent evidence from our laboratory suggests that infants also expect individuals from the same social group to maintain positivity; for example, mild negative actions (e.g., throwing someone's toy on the floor), when produced without provocation, are viewed as unexpected or impermissible if directed at in-group members, but not if directed at out-group members or at individuals whose group membership is unspecified (e.g., He & Baillargeon, 2011). From an evolutionary standpoint, it does not seem implausible that, during the millions of years our ancestors lived in small bands of hunter-gatherers, selective pressures supported the acquisition of various pro-group biases, including positivity; after

all, positivity would facilitate cooperation within a group and as such would contribute to the group's long-term prosperity and survival.

Our findings concerning early positivity led us to the hypothesis—termed the social-acting hypothesis—that one ubiquitous advantage conferred by an intact SS2 is that it allows individuals to engage in social acting with in-group members for the specific purpose of maintaining positivity: preventing aggressive confrontations, avoiding hurt or embarrassed feelings, smoothing over awkward situations, bolstering feelings of trust, and so on.

The brilliant actor Marlon Brando insisted that acting is something all of us do every day. When interviewed on *The Dick Cavett Show* in 1973, Mr. Brando said: "We couldn't survive a second if we weren't able to act. Acting is a survival mechanism. It's a social unguent and it's a lubricant.... People lie constantly every day by not saying something that they think, or [by] saying something that they didn't think" (as reported by Susan Stamberg on Morning Edition, National Public Radio, November 9, 2010). Judith Martin, in her essential *Miss Manners' Guide to Excruciatingly Correct Behavior* (1983), lobbied for more acting. When asked the question "You wouldn't want me to pretend to something I don't really feel, would you?" Miss Manners answered, "Why, yes. Please." She went on to explain that she was forever "trying to persuade people to fake such feelings as delight upon receiving useless presents, curiosity about the welfare of the terminally boring, [and] pleasure in the success of competitors" (p. 243).

According to the social-acting hypothesis, SS2 is one of the critical structures that enable us to decouple what we privately think and feel from what we display outwardly in everyday interactions. As Mr. Brando and Ms. Martin aptly observed, we do not, and should not, speak our minds at every turn; instead, we convey more or less than we believe, we exaggerate some sentiments while suppressing others, we embellish, we equivocate, we feign interest and approval, all in a constant and semi-successful effort to limit aggression and to "lubricate" everyday encounters with members of our social groups (e.g., DePaulo & Bell, 1996; DePaulo & Kashy, 1998). Of course, SS2 also helps us understand that others, too, engage in social acting, allowing us to respond appropriately (Yang & Baillargeon, in press).

From a developmental perspective, the social-acting hypothesis views skillful, nuanced, and context-sensitive social acting as a staggering accomplishment, not fully achieved until late in development, and profoundly shaped by familial, social, and cultural practices (e.g., Broomfield, Robinson, & Robinson, 2002; Heyman & Sweet, 2009; Ma, Xu, Heyman, & Lee, 2011; Xu, Bao, Fu, Talwar, & Lee, 2010). By comparison, demonstrating an understanding of false belief, deception, or pretense in a laboratory experiment seems like an easy feat.

Testing the Social-Acting Hypothesis

The social-acting hypothesis makes several interesting predictions, which we are beginning to test. For example, in an ongoing violation-of-expectation experiment by Setoh, He, and Baillargeon, 2.5- to 3-year-old toddlers watch an individual pretend to eat and to enjoy a food she does not like; the experiment tests whether children view the individual's pretense and deception as expected when she is interacting with an in-group member (i.e., the individual is engaging in social acting), but as unexpected when she is interacting with an out-group member. The two social groups used in the experiment are novel, arbitrary groups identified by nonsense labels.

Children are assigned to an in-group or an out-group condition. In the in-group condition, children first receive two category-induction trials. In each trial, three female individuals sit on the three sides of a puppet-stage apparatus (the child sits at the front) and label themselves: the individual on the right (R) says, "I am a lumi!"; the individual at the back (B) says, "I am a lumi, too!"; and the individual on the left (L) says, "I am a tarfen!" R and B thus belong to the same social group, and L to a different group. In the next, familiarization trial, B is alone; R' and L's positions are closed with curtains. B finds a distinctive cracker, eats it, and expresses disgust ("Yucky!"). In the test trials, L is again absent, and B watches as R opens her window and brings in a box of the same crackers. R eats two crackers with obvious enjoyment, places a third cracker in front of B, and then leaves briefly. While R is gone, B looks at the cracker with distaste ("Eww!") and drops it on the room floor. When R returns, B pretends to be chewing and smiles at R as though enjoying the cracker ("Yummy!"); R and B then pause until the trial ends. Children in the out-group condition see identical events except that in the category-induction trials B states that she is a tarfen, making her a member of the same group as L rather than R. Test results indicate that children in the out-group condition look reliably longer than those in the in-group condition, suggesting that children can make sense of B's pretense and deception when

she belongs to the same social group as R (i.e., B's actions serve to maintain in-group positivity), but not when she belongs to a different social group than R. Results from control conditions support this interpretation.

CONCLUDING REMARKS

Until recently, it was generally assumed that the achievement of false-belief understanding marked a critical milestone in the development of children's "Theory of Mind." In this article, we have argued that false-belief understanding can in fact be demonstrated in the first year of life, as long as one uses spontaneous-response tasks; that preschoolers' difficulties with traditional, elicited-response tasks stem primarily from immature executive-function processes; and that the psychological-reasoning system's decoupling subsystem (SS2), which enables infants to understand false beliefs, deception, and pretense, is also used by the sociomoral-reasoning system for the purpose of comprehending and performing social acting. According to the hypothesis proposed here, social acting serves the principle of in-group support: Maintaining a modicum of positivity within a group limits the number of aggressive or negative interactions and facilitates cooperation, thereby supporting the group's long-term prosperity and survival. In line with this hypothesis, we presented evidence that toddlers expect social acting between members of the same social group, but not between members of different social groups; future research will examine whether infants share the same expectation.

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NAVIGATING THE SOCIAL WORLD

What Infants, Children, and Other Species Can Teach Us

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