

# How to Interpret Infant Socio-Cognitive Competence

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**Abstract** I review recent evidence that very young, pre-verbal infants attribute belief-like states when anticipating the behavior of others. This evidence is drawn from infant performance on non-verbal false belief tasks. I argue that, contrary to typical interpretations, such evidence does not show that infants attribute belief-like states. Rather, it shows that infants apply an enhanced version of what Gergely (2011) calls the “teleological stance” to brief bouts of behavior. This requires them to parse behavioral sequences into goals and rationally/informationally-constrained means of achieving them; however, it does not require the attribution of unobservable mental states, like beliefs, that are causally responsible for behavior.

## 1 Introduction

A growing body of data in recent developmental psychology appears to imply that human infants attribute belief-like states at a remarkably early age—perhaps as early as 13 months (Onishi and Baillargeon 2005; Surian, et al. 2007; Song et al. 2008; Buttelmann et al. 2009; Scott and Baillargeon 2009). The evidence comes from non-verbal versions of the so-called “false belief task” (NVFBTs). Although no theorist takes this evidence to show *full-blown* mastery of the belief concept, many describe infant competence in ways that suggest that infants have mastered the central core of the concept: it is routinely claimed that infants attribute potentially non-veridical mental states that combine inferentially with other mental states to causally influence behavior. This evidence has potentially “paradigm-busting” implications. It appears to undermine the prior consensus among developmental psychologists that the capacity to attribute such belief-like states is not present until roughly four years of age (Wellman et al. 2001). Furthermore, it threatens highly influential theories of human socio-cognitive development (Gopnik 1996, 2004), as well as influential philosophical

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arguments for the claim that mastery of the belief concept presupposes linguistic competence (Bermudez 2003, 2009; Hutto 2008).

The new data are indeed groundbreaking. However, as I argue in what follows, it does not show that pre-linguistic infants attribute mental states with the core properties of beliefs mentioned above. Instead, it suggests that pre-linguistic infants apply an enhanced version of what Gergely (2011) calls the “teleological stance” to bouts of behavior. The teleological stance is a capacity to parse bouts of behavior into goals and rationally constrained means of achieving them. Infants appear capable of this long before mastering NVFBTs: as early as 6.5 months of age (Csibra 2008). In the following, I argue that success at NVFBTs is best interpreted as showing that pre-linguistic infants adopt an enhanced version of the teleological stance, which incorporates behavioral cues of information access, like direction of gaze. Information access is not a mentalistic notion—it involves no attribution of unobservable, potentially reality incongruent mental states that combine inferentially with other mental states to cause behavior. Hence, if my interpretation is correct, these experimental studies do *not* demonstrate that pre-linguistic infants can attribute belief-like states.

The following proceeds as follows. The goal of Section 3 is to highlight the inadequacy of both NVFBTs and the older, standard false belief tasks (SFBTs) as tests of full-blown mastery of the belief concept. Since many interpret infant performance on NVFBTs as indicating a capacity to attribute mental states with some of the core properties of beliefs, it is important to clarify just which components of the belief concept success on NVFBTs is supposed to require. I argue that neither NVFBTs nor SFBTs *can* test for *full* mastery of the belief concept, for entirely general reasons having to do with what such mastery involves. I illustrate this point with a careful analysis of a specific NVFBT, employed in Scott and Baillargeon’s (2009) study, showing that the infant socio-cognitive competencies it reveals are not aptly characterized in terms of a mastery of the concept of belief. I then propose a characterization of the belief-like states that NVFBTs *might* show infants attribute. However, in Section 3, I argue for an alternative interpretation of infant performance in Scott & Baillargeon’s study, as well as in another recent study, Buttelmann et al. (2009). Rather than revealing a capacity to attribute belief-like states, the data are better interpreted as showing that infants adopt the enhanced version of Gergely’s teleological stance described above. I conclude in Section 4.

## 2 Performance on False Belief Tasks Cannot Show Mastery of the Belief Concept

### 2.1 Historical Background

Until about 2005, most developmental psychologists assumed that passing SFBTs was the most important milestone in the development of human socio-cognitive competence. SFBTs come in a variety of versions. An early and influential version confronted children with two dolls, Sally and Anne. The child subject sees Sally handle an object she likes, like a toy or a piece of candy, in the presence of Anne. Sally then places the object in some location that all can see, like a drawer, and

leaves the scene. With Sally gone, Anne takes the object and hides it in some other location, like a cupboard in another part of the room. Sally returns, and the child is asked where she will look for the object. The correct answer is that Sally will look for the object where she believes it to be, i.e., the drawer in which she left it. However, children provide this answer reliably only after the age of four. Prior to this, most children answer that Sally will look for the object where it actually is, i.e., where they saw Anne put it: the cupboard.

Other versions of the SFBT show similar results. For example, a child is shown a box of a well-known brand of candy from the outside and asked what is in it; the child responds with the name of the candy. However, unbeknownst to the child, the candy has actually been replaced with crayons. The box is then opened and the crayons are shown to the child. The child is then asked what some other child, who has not seen inside the box, will think is in the box. Prior to the age of four, children tend to assume others will know the truth behind the appearance—that the box contains crayons, not candy.<sup>1</sup> After four, children are more likely to predict others' responses based on their likely false beliefs.<sup>2</sup>

There are several reasons why the different versions of the SFBT were taken for such a long time to indicate a milestone in human socio-cognitive development. First, many developmental psychologists assumed that the central feature of the concept of belief is that it is a potentially non-veridical mental state. Second, inspired by centuries of philosophy, many also assumed that the attribution of beliefs and desires was the most important component of human socio-cognitive competence. Passing SFBTs appeared to show an appreciation of non-veridical mental states, and hence, mastery of a central feature of the concept of belief; so, passing SFBTs was plausibly interpreted as *the* central milestone in human socio-cognitive development. In addition, there is convergent evidence from psychopathology: most individuals with autism, known to have severe deficits in social cognition (Baron-Cohen 1995), never pass SFBTs.

In recent years, this consensus about the significance of passing SFBTs has been rapidly eroding. Since 2005, there has been a steady stream of data that appear to undermine the assumption that passing SFBTs is the earliest indicator of competence at belief attribution. Drawing on various methods for gauging the expectations of pre-verbal and non-verbal subjects, Onishi and Baillargeon (2005) ran the first NVFBT. The basic measure such tasks employ is looking time. It is widely held that pre-verbal infants look longer at stimuli that violate their expectations. This makes possible a way of testing for the understanding of false belief in pre-verbal infants. One need only run two versions of the Sally-Anne task with different endings, and see which triggers longer looking time. In one version, Sally returns to look for her

<sup>1</sup> They also make the same judgment of their past selves, denying that they thought the box contained candy prior to opening it, even though this is exactly what they said.

<sup>2</sup> The meta-analysis by Wellman et al. (2001) reviews a wide range of studies that support this timeline in the development of SFBT mastery. This meta-analysis has come under considerable criticism (see Yazdi et al. 2006 for a recent discussion). Also, there is considerable variation in the ages at which children show competence at SFBTs, with some showing such competence long before 4 years of age (Clements and Perner 1994; Carpenter et al. 2002; Happé and Loth 2002). My arguments in what follows are independent of these empirical details.

toy or candy and goes directly to where it is. In another version, Sally returns to look for her toy or candy and goes directly to where she left it. Onishi and Baillargeon (2005) found that 15-month-old infants look longer when Sally goes directly to where the toy or candy is than when Sally goes directly to where she left it.<sup>3</sup> If longer looking time indicates violation of expectations, then 15-month-old infants expect Sally to go to where she should think the toy or candy is, not to where it actually is. In other words, 15-month-old infants appear to understand that Sally has a false belief about the location of the object she seeks.<sup>4</sup> Numerous investigators have found congenial results since Onishi and Baillargeon's initial study (Surian et al. 2007; Song et al. 2008; Buttelmann et al. 2009; Scott and Baillargeon 2009). Passing SFBTs does not appear to be the earliest indicator of competence at belief attribution, nor does this capacity appear to require discursive competence.

## 2.2 Limits to What False Belief Tasks Show

I do not agree with this interpretation of infant performance on NVFBTs. I think such data can be reinterpreted in a way that makes clear that infants who pass versions of the NVFBT are not capable of belief attribution. But before I turn to this, I want to draw attention to an unjustified inference that is common in this literature, and that can be traced to the original interpretations of performance on SFBTs. It is tempting to conclude from the newer data that infants master the concept of belief long before they show any mastery of complex language. After all, they expect agents to behave in certain ways depending on whether or not they have false beliefs; what more could there be to mastering the concept of belief? This line of reasoning inherits from the original interpretations of SFBT performance the assumptions that potential non-veridicality is the central property of the concept of belief, and that mastering the concept of belief is the key accomplishment in the ontogeny of human socio-cognitive competence. Although these assumptions seemed innocuous when the evidence showed that expectations sensitive to false belief did not develop until relatively late, the earlier one pushes such competence, the less plausible such assumptions seem. Can it really be that 15-month-olds possess the full-blown concept of belief, and hence have cleared the most important hurdle on the road to mature socio-cognitive competence?<sup>5</sup>

<sup>3</sup> The scenario with which Onishi and Baillargeon (2005) presented the infants was not precisely the same as in the original Sally-Anne task; I describe it this way only for ease of exposition. The fundamental structure of the scenario was the same, and nothing turns on the differences in details.

<sup>4</sup> Onishi & Baillargeon also ran a true belief version of the task, to make sure that infants do not just look longer, by default, at scenarios where Sally goes to the new toy/candy location. If Sally *sees* the toy/candy moved, the pattern of results is reversed: they look longer if she subsequently goes to where she left the toy/candy than if she goes to the new location, indicating that they understand that Sally has a true belief about the new location in this condition.

<sup>5</sup> Of course, when it is put this baldly, most researchers impressed with the NVFBT results would adamantly deny this interpretation. However, as I show below, their interpretations of infant performance on NVFBTs often explicitly attribute the capacity to reason about the beliefs, desires and bouts of practical reasoning that animate interpretive targets. Furthermore, all these researchers claim parity between what the SFBTs and the NVFBTs show about understanding belief. So, if one thinks passing SFBTs is the most important milestone in the acquisition of the belief concept, then either one should reject this assumption (as I urge), or one must accept that passing NVFBTs is the most important milestone in the acquisition of the belief concept.

This is clearly an overly rich interpretation of the NVFBT data. There is much more to the concept of belief than merely potential non-veridicality. First of all, mental states that are far less sophisticated than beliefs can be non-veridical, e.g., perceptions. There is evidence that even chimpanzees can appreciate non-veridical perceptions (Krachun et al. 2009), even though it is widely acknowledged that they have no capacity to attribute false beliefs, and hence, no concept of belief (Call and Tomasello 2008). So, clearly, an appreciation that an agent might be guided by a non-veridical mental state is not sufficient for a mastery of the concept of belief.

Secondly, one of the central properties of belief, at least as philosophers have understood the concept, is its intensionality. The truth of a belief attribution depends on how the content of the belief is characterized. For example, someone may believe that Mark Twain authored *Huckleberry Finn* without believing that Samuel Clemens authored *Huckleberry Finn*, even though Mark Twain and Samuel Clemens were the same person. To know how to attribute beliefs, one must be able to take into account not just what one's interpretive targets know, but also how they represent what they know. At best, passing NVFBTs or even SFBTs requires sensitivity to what one's interpretive targets know. But it requires no appreciation of how they represent what they know. So, passing these tests does not show mastery of the concept of belief (Apperly 2011, 16–17, 42–45, 150). In fact, as Apperly argues, there is evidence that children who can pass SFBTs are not sensitive to the intensionality of belief, i.e., the fact that different individuals can represent the same facts under different modes of presentation. For example, after using an eraser that looks like a die, even 5- and 6-year old children judge that a puppet with only visual access to the die/eraser (and hence, presumably, no awareness that it is actually an eraser) would treat it as an eraser (2011, 17).<sup>6</sup>

Thirdly, the intensionality of belief is closely related to another central property of the propositional attitudes: their tenuous, holistically mediated relations to observable behavior and circumstances (Morton 1996, 2003; Bermudez 2003, 2009). The belief with which an interpretive target responds to a stimulus depends on indefinitely many other propositional attitudes she tokens. I see a picture of an astronaut planting a flag on the moon and I come to believe that human beings have set foot on the moon. A conspiracy theorist, on the other hand, comes to believe that Hollywood designed a particularly realistic set on orders from the United States government. Similarly, the behavior that a belief causes in an interpretive target depends on indefinitely many other propositional attitudes she tokens. My belief that I have been offered a bowl of ice cream causes me to refuse, because I also believe that I am lactose intolerant. Your belief that you have been offered a bowl of ice cream causes you to accept, because you do not believe that you are lactose intolerant.<sup>7</sup> The holism of beliefs and other

<sup>6</sup> Apperly notes that “in a variety of studies using stories or real objects and using verbal or behavioural judgments, including scenarios where false belief and dual identity problems are very closely matched ... the consistent pattern is that children who pass false belief tasks do not necessarily pass such Oedipus problems” (2011, 17). This is in direct conflict with Scott and Baillargeon's (2009) claim that 18-month-old infants appreciate that others can represent an object—a toy penguin—under a different mode of presentation (as 1-piece rather than 2-piece). I argue below that this is a gross over-interpretation.

<sup>7</sup> I realize that, in one sense, these are not tokens of the same belief type, since my belief is about me and your belief is about you. However, there are other ways of individuating beliefs that are more relevant to action explanation (Perry 1979). The beliefs are of the same type in the sense that they're both about the agent who tokens them.

propositional attitudes is closely related to their intensionality because how an agent represents the content of her propositional attitudes can be identified with how they combine with other propositional attitudes, i.e., how other propositional attitudes mediate their tokening in response to stimuli or how other propositional attitudes mediate their influence on behavioral response.

Neither SFBTs nor NVFBTs test for an appreciation of holism (Apperly 2011, 118–119). Even if Sally searches for her candy where she left it, this does not mean that she believes it is there. Perhaps she is searching for something else. Perhaps she believes Anne moved the candy but forgets this, absentmindedly, in the moment. Perhaps she believes Anne moved the candy to the cupboard, but also knows that she is part of an experiment testing whether a child can pass the false belief task and so pretends that she does not believe this. The possibilities are limitless. Until a child shows some appreciation of the many-to-many mapping between observable circumstances/behaviors and mental states, she has not mastered the full-blown concept of belief.<sup>8</sup> For this reason, neither SFBTs nor NVFBTs *can* test for mastery of the concept of belief. Such tests presume that there is a straightforward correlation between tokening a belief and behaving in a certain way.

### 2.3 What NVFBTs Show: A Case Study

Despite occasional wariness, experimenters investigating infant performance on NVFBTs often *seem* to attribute full-blown mastery of the belief concept to infants younger than 2 years of age. Given what I have said above, such mastery must include understanding that beliefs are potentially non-veridical, unobservable mental states, that can represent worldly objects and states of affairs under varying modes of presentation, and combine inferentially with other mental states, to exert tenuous, holistically mediated causal influence on behavior. Scott and Baillargeon's (2009) certainly come close to interpreting their infant subjects in this way. First, they claim infant performance on their NVFBTs shows an appreciation that interpretive targets can represent an object under a different mode of presentation than the infant interpreters do: targets represent as 1-piece a toy penguin infants know to be 2-piece (Scott and Baillargeon 2009, 1186). Furthermore, they claim that these infants appreciate that the behavior of interpretive targets is causally determined by inferential interactions among multiple mental states, some of which are reality-incongruent:

the infants ... had to reason that ... the agent[‘s] ... inference would lead the agent to form ... [a] false belief that the penguin visible under the transparent cover was the 1-piece penguin [which] ... would in turn lead the agent to falsely believe that the 2-piece penguin was hidden under the opaque cover. Success in the false-belief conditions thus required the attribution of a complex, interlocking set of motivational states, reality-congruent informational states, and reality-incongruent informational states. (1192)

<sup>8</sup> Accordingly, an appropriate test for mastery of the belief concept would require children to show some hesitation when attributing beliefs based on limited evidence, and perhaps attempts to find more evidence to rule out competing interpretations.

I think a close analysis of Scott and Baillargeon's study shows that such rich interpretations of infant socio-cognitive capacities are unwarranted.

In Scott and Baillargeon's study, 18-month-old infants were initially familiarized with the following scenario. On a table in front of the subject, there are two toy penguins, one of which is hollow and split in two, like a Russian "Matryoshka doll". The other is in one piece. Each penguin is in front of a shallow, open box. An adult faces the infant from across the table. A gloved hand reaches out from a draped opening to the side and places the two pieces of the split penguin in the box behind them, and the 1-piece penguin in the box behind it. All penguin pieces remain visible because the boxes are shallow. The adult facing the infant from the other side of the table reveals a key in one hand. She places the key in the bottom part of the 2-piece penguin, and then assembles the doll, fitting the top piece snugly onto the bottom piece. When assembled, the 2-piece penguin is indistinguishable from the 1-piece penguin.

After this familiarization phase, the infants are ready for the test phase. There are two test scenarios: the false belief and the true belief scenarios. The false belief scenario begins with the adult absent. On the table, in front of the infant are the disassembled 2-piece penguin on one side and the 1-piece penguin on the other. Instead of shallow boxes, each penguin has a solid cover behind it—of the kind you might place over a cake. The cover behind the 2-piece penguin is transparent, while the cover behind the 1-piece penguin is opaque. The gloved hand reaches out from the draped opening to the side, assembles the 2-piece penguin so that it is indistinguishable from the 1-piece penguin, and then places the penguins under their respective covers—the assembled 2-piece penguin under the transparent cover and the 1-piece penguin under the opaque cover. There are then two test conditions in which the adult from the familiarization phase returns, holding her key, apparently looking for the 2-piece penguin in which to put it. In one condition, the adult reaches for the transparent cover. In the other condition, the adult reaches for the opaque cover. Infant subjects tend to look longer in the former condition. That is, on the standard interpretation of looking time, they expect the adult to reach for the opaque cover, concealing the 1-piece penguin, rather than for the transparent cover, under which the 2-piece penguin, assembled to *look* like the 1-piece penguin, is visible. The results are reversed when the adult *witnesses* the manipulations of the gloved hand. In this true belief scenario, infants expect the adult to reach for the transparent rather than for the opaque cover.

Here is how Scott and Baillargeon interpret these results (2009, 1192). The infants attribute to the adult a bout of practical reasoning in order to form expectations about how she will behave. The adult wants to place her key in the 2-piece penguin. In the false belief condition, she falsely believes that the penguin under the transparent cover is *not* the 2-piece penguin. This is because the adult is not present when the infants witness the gloved hand assemble the 2-piece penguin to look like the 1-piece penguin and place it under the transparent cover. Hence, the infants conclude that the adult will first look under the opaque cover in an attempt to locate the 2-piece penguin. This is why they look longer when the adult first reaches for the transparent cover: their expectations are violated.

Scott and Baillargeon's (2009) results clearly show that 18-month-old infants know how failing to witness specific information will affect agents' behavior differently in different conditions. Still, the results show, equally clearly, that these infants are *not*



operating with the full-blown concept of belief. The reason is that, given their knowledge of what the adult witnessed *in the familiarization phase*, the infants have no grounds to conclude, in the false belief scenario of the test phase, that she falsely believes the 1-piece penguin to be under the transparent cover. In the familiarization phase, both the infants and the adult witness the 2-piece penguin being assembled to look like the 1-piece penguin. In fact, not only does the adult witness this; the adult actually assembles the 2-piece penguin to look like the 1-piece penguin after placing the key in the bottom half. Given that the adult knows that the 2-piece penguin can be assembled to look like the 1-piece penguin, why would she come to believe, in the false belief scenario of the test phase, that the penguin under the transparent cover is *not* the 2-piece penguin? When she confronts the scene, consisting of the assembled 2-piece penguin under the transparent cover and an opaque cover, what she should believe is that the 2-piece penguin might be under either of the covers. Furthermore, the infant subjects should know this because they see the adult assemble the 2-piece penguin to look like the 1-piece penguin during the familiarization phase.

This problem illustrates how the concept of belief requires an appreciation of the tenuous, holistically mediated connection between beliefs and observable circumstances or behavior. The adult's not having witnessed, in the false belief scenario of the test phase, the 2-piece penguin assembled to look like the 1-piece penguin is *not* sufficient grounds to attribute to the adult the *belief* that the penguin under the transparent cover is *not* the 2-piece penguin. The reason is that the adult may have background information that defeats the inference from seeing only the assembled penguin under the transparent cover to believing that it is not the 2-piece penguin. In fact, the adult does have such background information from the familiarization trial, in which the adult herself assembles the 2-piece penguin to look like the 1-piece penguin. And the infant subjects witness this during the familiarization trial. However, they appear to miss the relevance of this when forming expectations about how the adult will behave in the test phase. This suggests that they are not really attributing *beliefs*: if they are attributing a kind of mental state, it is not one with only tenuous, holistically mediated links to observable behavior.

Furthermore, there is no need to interpret the infants as appreciating that their interpretive target *misidentifies* the 2-piece penguin as the 1-piece penguin. This would imply that infants appreciate the intensionality of belief attribution: the fact that two individuals can represent the same object under different modes of presentation. It would also contradict evidence that even 5-6-year-olds do not appreciate this (Apperly 2011, 17). However, Scott and Baillargeon's (2009) evidence is entirely compatible with a simpler interpretation: infants may interpret their adult target as looking for *a* penguin that comes apart, and falsely believing that the penguin under the transparent cover is *not* one that comes apart. Looking time data in this experiment does not distinguish between the possibility that infants attribute to the adult the misidentification of a *particular* penguin, and the possibility that infants attribute to the adult simply a false belief about whether or not a penguin they happen to see comes in 2 pieces. Hence, the experiment does not show infant appreciation of the intensionality of belief attribution, i.e., knowledge that different individuals can represent the same object under different modes of presentation.

The fact that Scott & Baillargeon's infants show neither an appreciation of holism nor an appreciation of intensionality means that they are not operating with the full-blown



concept of belief. But how else can we interpret infant performance? After all, they do distinguish between cases where the adult does and does not witness the 2-piece penguin assembled to look like the 1-piece penguin immediately before making her selection. This clearly shows that infants have some understanding of how access to information can affect behavior. Furthermore, Scott and Baillargeon (2009, 1188–1191) performed experiments that confute the most deflationary interpretation of this understanding: that infants distinguish between ignorant and knowledgeable individuals, and assume that the former will always perform incorrectly while the latter will always perform correctly.<sup>9</sup>

But there are alternatives both to such deflationary interpretations and to the claim that infants attribute full-blown beliefs. If infants attribute belief-like states, there is *no* evidence that infants think of these attributions as intensional, i.e., as attributing individually variable modes of representing the same objects, and there *is* evidence that infants do *not* think of these states as holistically related to observable behavior. At best then, Scott & Baillargeon's evidence shows that infants engage in what Apperly calls "low-level" mindreading (2011, 144). In other words, they can track potentially non-veridical mental states that are capable of limited, inferential integration with other mental states, leading to the causation of behavior, yet which do not represent the world under varying modes of presentation, and hence, do not qualify as propositional attitudes. In my view, this is still overly generous. It is implausible that 18-month-old infants have *any* understanding of such difficult and abstract concepts as "inference" and "causation" and "unobservable state". Perhaps they can be *sensitive* to such states, but it is implausible to assume that they represent unobservable, inferentially active and causally potent states *as such*. In the next section I argue for a different interpretation: Scott & Baillargeon's infants adopt an enhanced version of Gergely's teleological stance.

### 3 Infants Adopt an Enhanced Version of the Teleological Stance

#### 3.1 Overview of the Teleological Stance: Original and Enhanced Versions

In a series of studies over the past fifteen years, Gergely Csibra, Gyorgy Gergely and colleagues have amassed data showing that infants from as young as 6.5 months of age operate with a "*teleological action representation and interpretation system* (the 'naïve theory of rational action' or the 'teleological stance') ... guided by the principle of rational action ... according to which instrumental agents are expected to perform the most efficient means-ends action available to them within their situational constraints to bring about the goal state" (Gergely 2011, 79). Much of this

<sup>9</sup> This does not require the attribution of false beliefs; it is merely a behavioral generalization: if an agent hasn't witnessed an event relevant to her projects she is not likely to succeed at those projects. Scott & Baillargeon rule this possibility out by running versions of the false belief condition where the penguins are *both* placed under transparent covers or opaque covers. If infants assume only that ignorant interpretive targets will fail at the task, then this should not affect the results: infants should expect ignorant interpretive targets to select the wrong penguin, even if both are visible or both are invisible. However, this is not what occurs: infants have no expectation that the ignorant interpretive target will select the wrong penguin when both penguins are visible or invisible (Scott and Baillargeon 2009, 1188–1191).

evidence consists in looking time studies that gauge infant expectations about the behavior of agents. For example, infants are familiarized with a computer-animated agent jumping over an obstacle to reach some goal. They are then shown the same agent approaching the goal with the obstacle removed. In one condition, the agent jumps over where the obstacle had been, while in the other, the agent goes directly to the goal. Infants look longer in the former than in the latter condition, indicating that they expect agents to pursue their goals by the most efficient means possible.

Csibra, Gergely and colleagues have run numerous variants on this experimental paradigm. These experiments reveal a number of striking facts about infant social cognition. First, infants are extremely liberal in their attributions of agency: “young infants are ready to interpret unfamiliar entities such as inanimate objects, abstract 2D figures, humanoid robots, unfamiliar human actions, and even biomechanically impossible hand actions ... as goal-directed” (Gergely 2011, 87). Second, “what seems to be criterial for attributing intentionality and goal-directedness is evidence indicating the ability for *rational choice* among the accessible action alternatives by reliably performing the most efficient action available to bring about the goal state across changing environmental constraints” (Ibid, original emphasis). Third, the behavior of paradigmatic agents, like human beings, is not even *sufficient* to trigger attributions of agency. Even a human hand grasping an object “is *not* interpreted as goal-directed ... if this outcome ... is achieved as the end result of unnecessary and therefore unjustifiable and inefficient preceding actions, as when a hand first opens a transparent empty box before grasping the target object that is *in front of the box*” (Ibid, original emphasis). Fourth, as shown by Gergely et al.’s (2002) update of Meltzoff’s (1988) imitation experiment, older infants spontaneously reinterpret apparently non-rational behavior as aiming at a non-obvious goal that rationalizes the behavior. Meltzoff found that 14-month-olds imitate an adult who lights a “light panel” on a table in front of her, by leaning over and pressing it with her forehead, despite the fact that lighting it by hand is easier. Gergely et al. showed that this effect depends on whether or not the adult’s hands are otherwise occupied. If they are not, infants interpret the forehead touch as the whole point of the demonstration, and hence imitate that, as in Meltzoff’s original experiment. However, if the adult’s hands are otherwise occupied, e.g., wrapped in a blanket, infants interpret the forehead touch as the most efficient available means of lighting the light box, and so assume *that* to be the whole point of the demonstration; hence, in this condition, they light the light box using the most efficient means available to them: by hand.

This evidence that very young infants adopt the teleological stance in their social cognition is not necessarily at odds with the claim that they learn to attribute belief-like states several months later, yet long before mastering language. In fact, Gergely himself (2011, 88) accepts interpretations of infant performance on NVFBTs according to which infants as young as 13 months attribute false beliefs. It is entirely possible that infants begin their socio-cognitive careers employing the teleological stance and then, in their second year, acquire concepts of belief and other mental states, thereby enhancing their socio-cognitive powers. However, I think a more parsimonious interpretation of the data is possible: infants who succeed on NVFBTs adopt an enhanced version of the teleological stance. It is enhanced in the following way. Among the “situational constraints” (Gergely 2011, 79) relative to which infants make judgments of means-ends rationality, older infants include *information access*. That is, using entirely behavioral

cues, like gaze direction, older infants keep track of the information to which their interpretive targets have access, and incorporate this information into the situational constraints on judgments of means-ends rationality. This, and not the attribution of unobservable, mental causes, like belief-like states, is why Scott & Baillargeon's infants distinguish between interpretive targets who have and have not witnessed the assembly of the 2-piece penguin immediately before making their selections.

### 3.2 The Enhanced Teleological Stance and NVFBTs

Scott & Baillargeon's infants are clearly sensitive to what is rationally appropriate given the goal of placing the key in a 2-piece penguin and information that is immediately available at the time. When the adult witnesses a 2-piece penguin assembled to look like a 1-piece penguin *immediately before* she must select a penguin in which to place the key, the infants expect her to pick that penguin. Given the adult's goal and the information to which she has immediate access, that is the most rational choice. However, when the adult does not witness a 2-piece penguin assembled to look like a 1-piece penguin *immediately before* she must select a penguin in which to place the key, infants do not expect her to pick that penguin. Relative to the goal of placing the key in a 2-piece penguin, and the only information to which the adult has *immediate* access in *this* condition, i.e., a penguin that looks to be in one piece under a transparent cover and an opaque cover, it is no longer rational to pick the visible penguin. Instead, it is rational to look for the 2-piece penguin under the opaque cover.

None of this requires attributing to the adult unobservable mental states with causal influence over behavior. It requires only an appreciation of what is rational relative to the goals of one's interpretive target, and the information to which she has immediate or very recent access. In fact, infants are *better* interpreted as deploying an enhanced version of the teleological stance to relatively brief bouts of behavior. This makes more sense of the fact, noted above, that they do not take into account potentially relevant evidence from the familiarization phase. If infants were attributing enduring, belief-like mental states, then we would expect them to treat as relevant the fact that their interpretive target assembled the 2-piece penguin to look like the 1-piece penguin during familiarization: this seems to imply that the interpretive target believes that a 2-piece penguin can be made to look like a 1-piece penguin, which should defeat the inference from her not witnessing this in the test condition, to the attribution of the false belief that the penguin under the transparent cover is 1-piece. If, on the other hand, we interpret the infants as employing the enhanced version of the teleological stance to brief bouts of behavior, then this insensitivity to relevant, not-so-recent information is entirely unsurprising. On this interpretation, infants do not treat their interpretive targets as animated by enduring mental states with causal influence on behavior; rather, they treat bouts of their behavior as aiming at goals, under rational and informational constraints specific to the immediate situation. If the interpretive target is informed, immediately prior to her decision, of the fact that the penguin under the transparent cover is the 2-piece penguin assembled to look like the 1-piece penguin, it is rational to select it; otherwise, it is not. So, Scott and Baillargeon's (2009) results show only that infants expect agents to act rationally relative to their goals and immediately available

information. This is not the same as attributing belief-like states with causal relations to observable circumstances and behavior.

It is true that these infants appear to show a limited capacity to keep track of *differences* in the information to which they and other agents have access. Presumably, if an infant subject were required to place the key in the 2-piece penguin, she would know to reach for the assembled 2-piece penguin, even when the adult did not. However, this is not equivalent to attributing a belief-like state. Such tracking of information differentials seems entirely limited to the here-and-now, e.g., whether or not interpreter and interpretive target witness the same event immediately prior to task performance. I think this is more usefully characterized as an imaginative ability to keep track of different perspectives (Hutto 2008, 194–5) than as an ability to attribute belief-like states.

This understanding of Scott & Baillargeon's results—as an application of an enhanced version of the teleological stance to brief bouts of behavior—makes great sense of another recent result involving pre-verbal infants. Buttelmann et al. (2009) showed that 18-month-olds take into account information differentials when deciding how best to help an adult achieve a goal. The experiment takes advantage of the well-documented fact that infants of this age are spontaneously cooperative: they grasp goals of others' behavior, and actively try to help accomplish those goals. The experiment begins with an adult displaying a favorable attitude toward an object she is handling while she sits between two boxes. In front of the adult is a key that can be used to lock the boxes, and the infant knows this from earlier familiarization. The adult places the object in one of the boxes. After this, there are two conditions, as usual in NVFBTs. In the true belief condition, the adult witnesses a second adult move the object from the box in which she placed it to the other box. While the first adult briefly looks away, the second adult locks both boxes with the key. The first adult then tries to open the box in which she originally placed the object, but she struggles with this, as the box has been locked. At this point, the infant is allowed or encouraged to help the adult. In the false belief condition, everything proceeds in exactly the same manner, except the first adult leaves the scene before the object is moved to the second box and the boxes are locked. After this, she returns to the scene, and tries to open the box in which she initially placed the object, as in the true belief condition. In the true belief condition, most infants try to help the first adult open the box she is trying to open, i.e., the box in which she originally placed the object. In the false belief condition, most infants immediately go to the second box, in which, unbeknownst to the adult, her object has been locked, unlock the box, and retrieve the object for the adult.

It is tempting to attribute to these infants a sophisticated understanding of practical reasoning, according to which the infants know what the adults *believe* about the location of the object, and how these beliefs constrain their *desires*, given their observable behavior. Thus, in the true belief condition, because the adult believes the object has been moved, yet still tries to open the box in which she had put it, she must desire something other than retrieving the object. In contrast, in the false belief condition, because the adult believes the object has not been moved, her attempt to open the box in which she placed it indicates the desire to retrieve the object. However, a simpler interpretation is possible. The infants may be attributing to both adults, by default, the goal of retrieving the object, based on the favorable attitude they show it prior to the manipulations. So, by default, the infants assume

the adults' goal is to retrieve the object, and intend to help in this endeavor. However, when the first adult witnesses the object moved to the other box yet persists in trying to open the first box, the only way to *rationalize* this behavior is by assuming the adult's goal has changed: she now wants to open the first box not to retrieve the object, but for some other reason, and so the infant helps with this. This interpretation of the infants' behavior does not require attributing to them the concept of belief. We can explain their behavior entirely in terms of an understanding of perceptions and goals. Agents pursue goals in which they have previously indicated interest unless they witness information that *should* lead them to adjust the means by which they pursue those goals yet they fail to do so. The best way to rationalize such anomalies is to attribute to agents new goals.

On this view, the fact that the adult in the false belief condition has a false belief about the location of the object is irrelevant to the infant's response. The adult's goal in this condition is assumed not to have changed from the familiarization stage: her goal is, as before, to retrieve the object, and the infant immediately obliges by retrieving it from the second box. The harder case is the true belief condition. Here, given the goal of retrieving the object, the adult's behavior appears irrational, because she persists in trying to open the first box when she has witnessed the object moved to the second box. Applying the enhanced teleological stance, infants immediately try to rationalize this anomalous behavior by attributing a different goal to the adult, i.e., opening the first box for some other reason.

There is a wealth of evidence that infants automatically seek to rationalize agent behavior when attributing goals to it. For example, consider Gergely et al.'s (2002) imitation experiment described above. Fourteen-month-old infants imitate an apparently inefficient way of lighting a light panel (with one's head) only if this is the best way to rationalize the observed behavior. If an adult model lights the panel with her head while her hands are otherwise occupied, the infants take lighting the panel by the most efficient means available to be the goal, and hence, use their own hands to light the panel. Buttelmann et al.'s (2009) experiment seems to involve exactly the same kind of reasoning. In the so-called true belief condition, the adult witnesses her favored object moved, yet persists in trying to access its original location. Infants automatically rationalize this behavior by attributing a different goal to the adult, just as infants in Gergely et al.'s (2002) experiment rationalized the apparently inefficient forehead touch as the whole point of the demonstration. In both experiments, what is shown is not a capacity to attribute belief-like states, i.e., unobservable mental states with holistically mediated, causal influence on behavior, but, rather, a capacity to apply the enhanced teleological stance, i.e., an attempt to rationalize behavior relative to potential goals and information to which the interpretive target ought to have access. Rather than sophisticated mindreaders, infants are highly sensitive detectors of rationally appropriate patterns of behavior.

#### 4 Conclusion

Although recent results in developmental psychology involving infant performance on non-verbal versions of the false belief task are indeed groundbreaking, they fail to show what many experimenters claim, i.e., that very young, pre-verbal infants

attribute beliefs or even belief-like states. I have discussed, in detail, three ways of interpreting infant performance on NVFBTs: (1) it is evidence of a capacity to attribute full-blown beliefs; (2) it is evidence of a capacity to attribute mental states that are like beliefs because they are potentially non-veridical and interact inferentially with other mental states to causally influence behavior, yet unlike beliefs because they do not involve individually variable modes of presentation or holistically mediated influence on behavior; (3) it is evidence of a capacity to adopt an enhanced version of Gergely's teleological stance.

The first option is a non-starter because, as I argued in Sections 2.1 and 2.3, neither non-verbal nor standard false belief tasks *can* indicate a capacity to attribute full-blown beliefs, because they presume direct, simple links between observable behaviors and beliefs. But beliefs do not bear such simple links to observable behavior; their connections to observable circumstances and behaviors are holistically mediated. Also, as I argued in Section 2.3, infant performance on NVFBTs provides no evidence that they appreciate the intensionality of belief attribution, i.e., the fact that interpretive targets represent the contents of their beliefs under individually variable modes of presentation.

It is more difficult to choose among the second and third options. One reason in favor of the third option is that, on the face of it, it seems implausible to attribute to pre-linguistic infants concepts of unobservable mental states with inferential links to each other and causal links to behavior. Furthermore, as I argued in Section 3.2, the third option makes better sense of the fact that, in Scott and Baillargeon's (2009) study, infants do not take into account relevant information from the familiarization phase when forming expectations about the behavior of interpretive targets in the test phase; they seem to take into account only information to which targets have access immediately before making their decisions. Finally, the enhanced teleological stance provides a framework in which we can understand the ontogeny of socio-cognitive competence in terms of gradual, incremental improvement. Infants begin, around 6.5 months of age, with the rationality assumption: behavior is assumed to constitute the most efficient means of achieving some goal. This gives rise to expectations that are sometimes confuted. The response is reinterpretation that attempts to rationalize the anomalous behavior. For example, as in the forehead-touch experiment, the interpreter might search for a different goal that would make the behavior turn out rational. Or the interpreter might search for situational constraints she has overlooked. Or, ultimately, the interpreter might hit upon the idea of differences in information access. The principle that behavior constitutes rationally constrained means of achieving some goal can thus explain ontogenetic milestones as discoveries of factors that excuse apparently counter-normative, irrational behavior, allowing reinterpretations that make it come out rational. In this regard, the teleological stance hypothesis is more parsimonious than alternatives that see dramatic discontinuities in the ontogeny of social cognition. Instead, it explains these phenomena in terms of the gradual, incremental development of one basic idea: that agents pursue their goals in the most rational way possible given certain constraints. The ontogeny of social cognition is explained entirely in terms of increasing sensitivity to the variety and complexity of such constraints, including differential access to information, disparate goals, and, eventually, false beliefs.

A number of theorists have argued that the socio-cognitive competence revealed by NVFBTs is not the same as full-blown, adult socio-cognitive competence.



Apperly (2011) and Apperly and Butterfill (2009) argue that there are in fact two mindreading systems, the first involved in fast, unconscious, automatic and innately determined social cognition, of the kind shared by infants, some non-human animals, and adults under severe time and resource constraints, and the second involved in conscious, deliberate and possibly language-based reasoning about other minds. Here, I have given reasons to doubt that the former system is aptly characterized as a kind of mindreading. What Apperly (2011) calls “low-level” mindreading, is better conceived of as an enhanced version of Gergely’s teleological stance.

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