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Pragmatic development explains the Theory-of-Mind Scale

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ABSTRACT

Henry Wellman and colleagues have provided evidence of a robust developmental progression in theory-of-mind (or as we will say, "mindreading") abilities, using verbal tasks. Understanding diverse desires is said to be easier than understanding diverse beliefs, which is easier than understanding that lack of perceptual access issues in ignorance, which is easier than understanding false belief, which is easier than understanding that people can hide their true emotions. These findings present a challenge to nativists about mindreading, and are said to support a social-constructivist account of mindreading development instead. This article takes up the challenge on behalf of nativism. Our goal is to show that the mindreading-scale findings fail to support constructivism because well-motivated alternative hypotheses have not yet been controlled for and ruled out. These have to do with the pragmatic demands of verbal tasks.

1. The nativist–constructivist debate

Humans are hyper-social. This much is widely agreed. It is also generally agreed that human social *cognition*—involving a capacity to attribute mental states to other people and to anticipate their likely actions—is essential to human uniqueness (Tomasello, 2009), even if it isn't the ultimate source of that uniqueness (Piantadosi & Kidd, 2016). Accordingly, a great deal of effort has been expended over more than 30 years in an attempt to understand the development of human mindreading capacities (Wimmer & Perner, 1983). For most of this period there was a widespread consensus that such capacities are constructed gradually over the course of the preschool years, relying on linguistic and cultural input together with general-learning and theorizing abilities (Gopnik & Meltzoff, 1997; Wellman, 1990; Wellman, Cross, & Watson, 2001). While there were always some in the field who claimed that basic mindreading abilities are innate, and that the appearance of development reflects failures of performance (Leslie, 1994; Scholl & Leslie, 1999), this was decidedly a minority position.

In the past 10 years, however, the field has changed dramatically. There are now dozens of studies of infants aged 6–18 months using a variety of non-verbal methods (including expectancy-violation looking, anticipatory looking, active helping, and more) suggesting that infants understand the goals and beliefs of other agents, and can anticipate actions accordingly. (For example, see: Buttelmann, Carpenter, & Tomasello, 2009; Buttelmann, Over, Carpenter, & Tomasello, 2014; Buttelmann, Suhrke, & Buttelman, 2015; He, Bolz, & Baillargeon, 2012; Kovács, Téglás, & Endress, 2010; Onishi & Baillargeon, 2005; Southgate, Senju, & Csibra, 2010; Southgate & Vernetti, 2014.) It is now widely agreed that these findings reflect an underlying social-cognitive competence of some sort (although see Heyes, 2014, for a dissenting view). What is disputed is how these early abilities relate to those that underlie performance in more traditional verbal tasks. Nativists have seized on the new findings to claim that core mindreading abilities are present throughout infancy, and that early failures on verbal tasks reflect performance difficulties of some sort (Baillargeon, Scott, & He, 2010; Carruthers, 2013). Constructivists, in contrast, have mostly converged on some form of two-systems view, according to which there is an early-developing, implicit, limited-flexibility system that is later supplemented by a slowly-acquired, flexible and explicit, theory of mind (Apperly, 2011; Wellman, 2014).

There are broadly two lines of support for this new constructivist position. One consists of evidence that both implicit and explicit systems exist alongside one another in adults, and that the implicit system operative in infancy has signature limits (Apperly, 2011; Low, Drummond, Walmsley, & Wang, 2014; Low & Watts, 2013; Schneider, Bayliss, Becker, & Dux, 2012; Schneider, Nott, & Dux, 2014). This evidence has been systematically criticized elsewhere (Carruthers, 2016a, 2016b; Christensen & Michael, 2015; Thompson, 2014; Westra, 2016a). The other line of support derives from evidence of an orderly and systematic progression in toddlers' verbally-manifested mindreading abilities,

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which is suggestive of genuine conceptual development. This is most clearly demonstrated by Wellman and colleagues who have created and validated across cultures the *mindreading scale*. This will be our main focus here. Our goal is to show that the data provided by the mindreading scale fail to support constructivism. This is because there are plausible alternative explanations—mostly pragmatic in nature—that have not yet been controlled for and excluded.

2. The mindreading scale

Wellman and Liu (2004) undertook two studies. The first was a meta-analysis of investigations of mindreading development in which children's understandings of different types of mental state were pitted against one another using otherwise-matched tasks. (All of the studies reviewed involved verbal presentations and required the children to give verbal answers.) Their analysis showed that the first milestone children pass is understanding that different people can have different desires, and that these differences will lead them to act differently. These tasks are reliably easier than ones in which children are required to understand that different people can have different beliefs. The latter tasks are in turn easier than ones in which children are required to understand that someone can be ignorant of a fact by virtue of lacking perceptual access to it. Finally, understanding ignorance is reliably easier than understanding that people can have, and act on, beliefs that are false.

Inspired by these meta-analytic findings, Wellman and Liu (2004) constructed a sequence of matched tasks, extended to include a test of children's ability to understand that someone can act in a way incongruent with her true feelings.[1] They included a diverse-desires task (DD), a diverse-beliefs task (DB), a knowledge/perceptual-access task (KA), a false-belief task (FB), and a hidden-emotions task (HE). They tested 75 children aged 3–5 on all of these tasks, finding evidence of a robust developmental progression that matched the meta-analytic findings, with an understanding that people can hide their true emotions being hardest of all. In fact, a large majority of the children performed in a manner consistent with the following order of ease of passing: DD > DB > KA > FB > HE. Since Wellman & Liu's initial study, over 80% of some 500 children tested in the USA, Canada, Australia, and Germany have displayed abilities consistent with this pattern (Kristen, Thoermer, Hofer, Aschersleben, & Sodian, 2006; Peterson, Wellman, & Liu, 2005). Moreover, congenitally deaf children born of hearing parents (who are introduced to full-blown sign-languages much later in childhood than normal) follow the same developmental progression, only significantly delayed (Peterson & Wellman, 2009; Peterson et al., 2005).

Wellman and colleagues have also found that this developmental sequence is cross-culturally robust, with one intriguing exception: preschool children from "collectivist" cultures (specifically, China and Iran) tend to find the knowledge-access (KA) task easier than the diverse beliefs (DB) one, thus exhibiting the sequence DD > KA > DB > FB > HE (Duh et al., 2016; Shahaeian, Peterson, Slaughter, & Wellman, 2011; Wellman, Fang, Liu, Zhu, & Liu, 2006). This is thought to reflect a cultural emphasis on differences of opinion in "individualist" countries such as the USA, and a correspondingly greater emphasis on education, knowledge, and the importance of learning from those in authority in "collectivist" ones.

In addition, Rhodes and Wellman (2013) combined use of the mindreading-scale tasks with microgenetic measures (a form of longitudinal study in which behavior is sampled very frequently, which effectively amounts to a form of training). Children in the study were pre-tested on the mindreading scale, and those in the experimental condition then underwent a number of regular microgenetic training sessions over the course of six weeks. In each of these sessions children had to complete two new false-belief prediction tasks. They were then shown the correct outcome of the scenario, and were asked to explain the character's action. Consistent with previous intervention studies (Amsterlaw & Wellman, 2006; Lohmann & Tomasello, 2003), training on false-belief tasks tended to have a positive effect on performance at post-test. More interestingly, it was also found that children's scores on the mindreading scale at pre-test predicted the effectiveness of the training. Children who could already pass the knowledge-access task at pre-test were more likely to pass the false-belief task at post-test than children who could only pass the diverse-beliefs task at pre-test. Using similar methods, Wellman and Peterson (2013) obtained comparable training effects for older late-signing deaf children.

Wellman (2012, 2014) argues that this overall body of data supports a constructivist account of mindreading development, and is correspondingly problematic for nativist theories. Children are said to be constructing a causal framework for understanding the operations of the mind, drawing on their own experiences and their observations of others. Some aspects of the developing theory (particularly the idea that the mind contains states that *represent* aspects of reality, needed for an understanding of false belief) are said to be intrinsically harder to construct than others. But construction of the theory also depends on cultural input. Those who are on the cusp of constructing a full-blown representational theory of mind are most likely to transform intensive conceptually-relevant forms of social experience into full false-belief competence, but such experience still benefits children at an earlier stage in the mindreading-scale progression. In contrast, if mindreading capacities are innate, then it is said to be very unclear why performance should exhibit these regularities, or why cultural differences and individual training-experiences should make any difference.

Wellman draws a false contrast here, however. For nativism is consistent with cultural learning. What is innate, it can be said, is a domain-specific learning mechanism. (Compare what nativists say about the innateness of the language-faculty, which is obviously designed for learning.) Specifically, a nativist can claim that infants are innately endowed with certain core concepts (perhaps desire, belief, pretense, happy, sad, see, and tell) and certain basic principles of attribution (such as "seeing leads to believing"). Thereafter novel concepts can be acquired, and new principles of attribution learned, relying both on individual experiences and cultural input. So from this perspective it isn't surprising that culture might make a difference, nor that training might help performance. Moreover, it may be that the kind of learning that actually contributes to passing the tests making up the mindreading scale doesn't require enrichment of the target mental-state concepts at all. Rather, as we will see, it may be a matter of learning to recognize cues that signal the current topic of conversation or the most likely intent behind a question.

In addition, it is far from obvious that Wellman's own constructivist framework is internally coherent. Specifically, it is unclear that the delay between an ability to pass diverse-belief tasks and a capacity to pass false-belief tasks makes theoretical sense, from a constructivist perspective. This is because both tasks require a grasp of the representational nature of mind. In order to understand that two people can have different beliefs about the same subject matter, one needs to understand that the subject matter in question can be represented differently. But this is the *same* understanding as has often been thought to underlie grasp of the possibility of false belief, together with the ability to pass (verbal)

[1] Some of the tasks included in Wellman and Liu's (2004) initial battery of tests were dropped from follow-up studies, and will not be discussed here.

false-belief tests. Moreover, since the two beliefs in a diverse-belief scenario conflict with one another, at least one of them must be false.

Of course it is true that in some versions of diverse-belief test the child only guesses at the location of the item, rather than seeing it for herself. But at the very least we can say that the diverse-belief test requires the child to reason about what someone will do who has a belief that conflicts with what the child has just *said* she thinks is the case. Why should this be any easier *conceptually* than reasoning about what someone will do who has a belief that conflicts with what the child has just been *told* is the case (which is what happens in the mindreading-scale version of the false-belief test)? Of course, if guesses give rise to beliefs of lesser strength than testimony from an adult, it may be that the pre-potent response (the "lure of the real") in a false-belief task is correspondingly stronger. But this would then suggest that the differential in performance reflects differences in executive function, rather than differing understandings of the mind. So there is still a problem, here, for Wellman's preferred conceptual-development interpretation of the mindreading scale.

From the fact that Wellman's constructivist framework is problematic it doesn't follow that a nativist account is correct, of course. Indeed, the problem for nativists arising from the mindreading-scale data is that the very experiments with infants that are thought to support nativism suggest that infants already possess the concepts and attribution-principles tested by most of the items on the scale (Baillargeon et al., 2010; Buttelmann et al., 2014; Luo & Baillargeon, 2005). Moreover, although the infancy-data seemed initially to suggest that the development of infant competence might mirror two major stages of the mindreading scale (specifically, that desires are understood earlier than beliefs), recent data puts infant capacities to track and reason about false beliefs as early as 7 or 8 months, or even 6 months of age (Kampis, Parise, Csibra, & Kovács, 2015; Kovács et al., 2010; Southgate & Vernetti, 2014). So there is little scope, here, for arguing that mindreading-scale performance merely lags behind true mindreading development, requiring monotonic growth in executive-function capacities or linguistic abilities for example. The challenge for nativism, then, is to explain why the mindreading scale should be so robust if all the conceptual resources necessary to succeed in the tests are available some two years earlier than children actually begin passing its easiest items.

Not all tasks in the mindreading scale contribute to this challenge for nativism, however. Specifically, the final "hidden emotion" (HE) item is rather different in character from the rest. This is so for two reasons. The first is that the story presented to children is more complex than gets used with the other measures in the scale, and more memory-check questions get asked prior to the target question. So the task is likely to be significantly harder for reasons extraneous to mindreading. Second, the HE task tests an appreciation of how mental states, on the one hand, and behavior that would normally manifest such states, on the other, can be in conflict, whereas the belief and desire tasks are about how the states of different *people* can conflict. It may be that it takes a while to acquire the knowledge that people aren't always feeling what they appear to be feeling. And crucially for our purposes, there is no evidence that infants have any sort of appreciation of this point. So there is no initial puzzle here for nativists to answer.

Accordingly, in what follows we will consider just the first four items of the mindreading scale (diverse-desire, diverse-belief, knowledge-access, and false-belief). We will first focus on explaining the sequence DD > DB > FB, before turning to a separate discussion of KA. Our goals are (a) to provide well-motivated alternative explanations of the reliability of the sequence DD > DB > FB, together with (b) the influence of culture on the order in which children pass DB and KA, as well as (c) the boost that false-belief training can give children who perform at intermediate levels in the sequence. Our goal is not to demonstrate that our alternative explanations are correct, however. That would require a whole raft of new experiments. Rather, it is to show that they are independently plausible, thereby undercutting any support for constructivism from the mindreading-scale data in the absence of such experiments.

3. Existing accounts of verbal-task performance failures

Since nativists are committed to claiming that the conceptual–theoretical competence for passing all the main components of the mindreading scale are present from infancy onwards, they must explain the mindreading-scale findings in terms of differential demands on performance. What resources are available for constructing such an explanation? We will first consider what nativists might say about the failures of children younger than four to pass verbal false-belief tasks, despite passing non-verbal versions of the same tasks from as early as the latter half of the first year of life.

One possibility often mentioned in the literature concerns executive-function abilities. It has been said, for example, that capacities to pass verbal false-belief tasks depend on late-maturing fronto-parietal pathways, connecting executive function in the frontal lobes with major components of the mindreading network (Baillargeon et al., 2010). In support of such a view, executive function is known to correlate with age of passing verbal false-belief tasks (Carlson, Moses, & Breton, 2002; Carlson, Moses, & Claxton, 2004; Kloo & Perner, 2003). Moreover, reduced demands on executive function are thought to explain why removal of the target object from the scene in a change-of-location false-belief task makes the task somewhat easier (Southgate et al., 2010; Wellman et al., 2001).

While executive function abilities are no doubt part of the story, they can by no means provide the whole explanation. There are a number of reasons for this. One is that the correlation between executive function and false belief is small after controlling for age and verbal ability (only 0.22; see Devine & Hughes, 2014). Another is that the active-helping false-belief tasks passed by 18-month-old infants surely require executive decision making (Buttelmann et al., 2009, 2014, 2015). Moreover, although Chinese children are known to be more advanced than US children in their executive-function abilities, they perform no better in false-belief tasks (Sabbagh, Xu, Carlson, Moses, & Lee, 2006; Wellman et al., 2001). And in addition, it is hard to see how an appeal to executive function can explain the increasing difficulty of the tasks that make up the mindreading scale, which are generally well-matched in terms of their executive demands. Nevertheless, executive function will surely assist with learning and managing the pragmatic aspect of verbal mindreading tasks, which we emphasize below.

Another factor known to correlate with age of passing false-belief tasks is general language ability. A number of constructivist accounts have proposed that the acquisition of language plays an important, perhaps necessary, role in the development of mindreading. However, there is substantial disagreement about which aspects of language play this role. Some authors have suggested that it is complementation syntax (De Villiers & Pyers, 2002), others have emphasized mental state vocabulary (Montgomery, 2005), and yet others stress the social experience that comes from linguistic interactions (Dunn & Brophy, 2005; Harris, de Rosnay, & Pons, 2005; Tomasello & Rakoczy, 2003). But in their meta-analysis Milligan, Astington, and Dack (2007) were unable to identify a special role for any single aspect of language independent of general language ability. And in all, after controlling for age, they determined that linguistic factors correlated only moderately with min-

dreading ability (0.31), and accounted for only 10% of the variance in the latter. Moreover, general language ability is often controlled for in testing the validity of the mindreading scale (Wellman & Peterson, 2013). It is therefore unclear how a simple appeal to language ability could explain the sequential progressions in mindreading performance described earlier. What is surely correct, however, is that what makes verbal false-belief tasks hard has *something* to do with the fact that they are verbal (or at least communicative) in nature. The proposal we make below will build on this idea.

Yet another suggestion that has been made in the literature is that verbal false-belief tasks are, in effect, *triple*-mindreading tasks (Carruthers, 2013). This is because both language comprehension and communicative production are inevitably pragmatic in nature, and because it is widely acknowledged that mindreading is implicated in pragmatic aspects of speech. The child in a verbal false-belief task has to figure out what the experimenter is trying to communicate while computing, remembering, and accessing at the relevant time the mental states of the target agent. The child then has to figure out and select a verbal (or other communicative) response to have the intended effect on the mind of the questioner. A verbal false-belief task will thus involve a complex interplay between executive decision making, the language faculty, and mindreading. It seems plausible that the relevant connections (and the efficiency of the mindreading system itself) might not have matured sufficiently in younger children for them to pass. Although promising, however, this suggestion is not specific enough to explain the comparative difficulty of the tasks that make up the mindreading scale.

Pragmatic accounts of young children's failures in verbal false-belief tasks are not new. Siegal and Beattie (1991), for example, hypothesized that children might be misinterpreting the test question to mean, "Where *should* she look for her ball?" They found that by altering the question slightly to, "Where will she look *first* for her ball" they were able to shift the average age of passing a few months earlier. (The latter question doesn't remove the ambiguity altogether, of course. It can still be heard as asking, "Where *should* she look first for her ball [in order to get it right away]?") Surian and Leslie (1999) later replicated this finding, while also showing that the "look first" manipulation has no effect on children with autism (suggesting that the difficulties these children experience with false-belief tasks are not merely pragmatic). More recently, Helming, Strickland, and Jacob (2014, 2016) have proposed a more elaborate form of pragmatic account, which we briefly discuss here before developing our own view in Section 4.

Helming et al. argue that young children have problems with the false-belief task because it requires them to adopt two different perspectives simultaneously. In order to pass, a child must adopt a third-person—"spectatorial"—perspective on the protagonist's instrumental action, while simultaneously adopting a second-person—communicative, and hence cooperative—perspective with the experimenter and when answering the latter's question. Engaging with the experimenter in a communicative interaction is said to disrupt the child's third-personal tracking of the protagonist's beliefs. The child's subsequent response is then the product of two pragmatic biases: one referential, one cooperative.

The referential bias is triggered when the experimenter asks a question about the target object. It can be triggered by the test question itself (e.g. "Where will she look for her ball?"), or by a prior control question about the actual location of the target object (e.g. "Where is the ball now?") (Rubio-Fernández & Geurts, 2015). Such questions have two primary effects: first, mentioning the object primes the child to think about its true location. Second, involvement in a second-person interaction with the experimenter causes the child to focus on their shared epistemic perspective (specifically, their shared knowledge of the object's true location). This disrupts the child's ability to track the protagonist's false belief from a third-person perspective. Together, these two factors cause the child to focus on the true location of the object, and ignore the agent's false belief.

The cooperative bias is said to arise from the fact that children are motivated to help the mistaken agent. This leads them to adopt a second-person perspective toward the protagonist in the narrative, rather than a third-person spectatorial one. The bias arises because children at this age are chronically helpful, and will go out of their way to help an unknown adult even when it takes effort to do so and they are engrossed in an activity of their own (Warneken, 2015; Warneken & Tomasello, 2007, 2009, 2013). Indeed, even somewhat younger children will point out information to help an ignorant adult who is searching for something, or to prevent an adult from making a mistake (Knudsen & Liszkowski, 2012; Liszkowski, Carpenter, & Tomasello, 2008). Thus when younger children see that the protagonist in the false-belief task is mistaken about the location of her ball, they are motivated to help her find it. This, in combination with the referential bias towards the true location of the ball, leads the child to misinterpret the experimenter's predictive question, "Where will she look for her ball?" as a normative one ("Where *should* she look for her ball?")

We agree with much in these suggestions, so far as they go.[2] But while these two biases may help to explain why younger children initially *fail* the false-belief task, they do not explain how older children eventually come to *pass* it. Here, Helming and colleagues appeal to children's developing executive abilities (which presumably help children inhibit the two biases).[3] But for the reasons that we have just mentioned, executive development cannot be the whole story. Moreover, Helming and colleagues' account is silent about the ordered difficulty of the tasks that make up the mindreading scale. In Section 4 we will construct a more elaborate pragmatic account of false-belief failures that incorporates this one, building on the work of Westra (2016b).

4. A pragmatic account of false-belief performance

We should stress at the outset that all communication is inevitably partly pragmatic in nature. A communicator produces a performance of some sort (a speech act, a gesture) and the audience has to figure out the intent behind that performance (Sperber & Wilson, 1995, 2002). Moreover, recent models of speech comprehension suggest that it takes place competitively and in parallel, with syntax, semantics, and pragmatics being processed interactively, generally with multiple hypotheses in play at each level (Hickok & Poeppel, 2007). In production, too, it seems that speakers make a selection from among a number of candidate utterances suggested by the context (Novick, Trueswell, & Thompson-Schill, 2010; Nozari, Dell, & Schwartz, 2011). We should expect, then, that a child participating in a verbal false-belief task will be no differ-

[2] Helming et al. (2014, 2016) stress that these two biases are generated by the demands of simultaneously adopting second- and third-person perspectives on the actions of the experimenter and the agent. But we are doubtful whether this framework is really doing any work in their account. The referential bias seems to be generated primarily by the fact that the hidden object has been mentioned, while the cooperative bias is the product of children's disposition to engage in helping behavior. It isn't obvious what pointing out the contrast between second- and third-person perspectives adds to explanation. Therefore, although we agree with the substance of Helming et al.'s account, we do not follow them in adopting this terminology.

[3] While they largely endorse an executive-functioning account in their paper, Helming and colleagues do note that the existence of the two biases doesn't logically entail acceptance of an executive-functioning account. This, they acknowledge, might make their pragmatic analysis of the task compatible with some form of constructivism. By the same token, it also makes their view compatible with our pragmatic-development proposal.

ent. A number of candidate interpretations of the experimenter's question are likely to be entertained and evaluated for likelihood (albeit swiftly and unconsciously), with a selection from among candidate answers being made accordingly.

How a child interprets the experimenter's questions in a false-belief experiment will depend, in part, on her construal of the nature of the communicative exchange: that is to say, its topic and purpose. As Helming et al. (2014, 2016) rightly point out, one aspect of the false-belief scenario that will seem highly salient to children of this age is the fact that the agent is in need of help (because she has a false belief). If nativism is assumed, then the child will be aware that the protagonist *needs* help, and may thus anticipate being invited to offer such help. This will, in turn, increase the salience of a normative interpretation of the test question, taking it to mean, "Where *should* she look for her ball?" Even more simply, the child might infer that the experimenter is inviting her to help Sally find her ball, and interpret the test question to mean, "Can you show Sally where to look for her ball?" We will refer to this as the "helpfulness-interpretation" of a false-belief (or other mindreading-related) question.

Another salient construal of the communicative exchange with the experimenter is that it serves a pedagogic purpose of some sort. Hence the false-belief question is a request for the child to show what she has learned from the exchange; she is being asked to exhibit that she has acquired some target item of knowledge (whatever that is). We will refer to this as the "knowledge-exhibiting-interpretation" of the question. In fact, children are quite likely to assume that the interaction with the experimenter may have a pedagogic intent. This is because the normal cues to pedagogy (shared attention, eye-contact between adult and child at the outset of the exchange) will almost always be present in a normal false-belief experiment. Note that in other contexts such cues have been found to serve as reliable signals to young children that knowledge transmission of some sort is about to take place (Csibra & Gergely, 2009; Gergely & Csibra, 2013).

Now notice that intended interpretation of the false-belief question is, indeed, a knowledge-exhibiting one: the experimenter wants the child to exhibit her knowledge of the psychological states of the protagonist in the story and/or their likely effects on behavior. And this will be the interpretation most directly suggested by the syntax and literal semantics of the question ("Where does she think it is?"/"Where will she go?") But this interpretation requires the child to take the topic of conversation to involve the protagonist's cognitive states of knowledge or belief. This may strike the child as unlikely, for reasons we will explain shortly. Moreover, there is normally nothing in the setup of a false-belief experiment to suggest to the child that she is supposed to be learning something about the cognitive states of the protagonist (although manipulations that make cognitive states more salient do have the effect of reducing the age at which children first pass the false-belief task; see Wellman et al., 2001).

In contrast, what will seem most immediately salient about the false-belief scenario is that it involves displacement and concealment of an object (in a change-of-location false-belief task), or that a container has contents other than one might expect (in an unexpected-contents version of the task). If pedagogic intent is assumed, then these will seem like probable targets for learning: the experimenter wants the child to learn about the true location of the object or the contents of the container. The child is then likely at least to entertain the hypothesis that the question is inviting her to exhibit her knowledge of the worldly events that have just unfolded—that is, the actual location of the object, or the actual contents of the container. As a result, in false-belief experiments there will generally be two knowledge-exhibiting interpretations in play, in addition to the helpfulness-interpretation discussed earlier. The child's task is to figure out which of the three is the most likely.[4]

When a child in a false-belief experiment is asked where the protagonist will look for her ball, then, we suggest that there will generally be three interpretations of the question that are activated, competing to control the answer. One is that the child is being invited to be helpful toward the protagonist. Another is that she is being asked to exhibit her knowledge of the events that have unfolded in the story. And the third is that she is supposed to exhibit her knowledge of the way in which the protagonist's beliefs will issue in action. Notice that although this third interpretation is the one intended by the experimenter, each of the others will push in the direction of the same (incorrect) answer: both will incline the child to reply by stating the actual, current, location of the ball. One might expect, then, that in a three-way competition among possible interpretations, the odd one out would face an uphill battle to control behavior. Put differently: the child has *two* reasons to name the actual location of the ball, and only one reason to name the location believed-in by the story protagonist.

This account enables us to offer a deeper explanation of the referential bias postulated by Helming et al. (2014, 2016), which was discussed in Section 3. The reason why control-questions or false-belief questions that mention the actual location of the target object are more likely to lead to erroneous answers is that they raise the probability of the two competing interpretations of the intent behind the question. When the experimenter refers to the target object she thereby draws attention to its actual location. This will make that location seem relevant to the communicative exchange, hence increasing the likelihood that she is inviting the child to be helpful by pointing out that location to the protagonist; and by the same token, it will also make it seem more likely that the child is being invited to exhibit her knowledge of the actual location, rather than her knowledge of the protagonist's beliefs. We diverge from Helming et al., however, in that we do not view the referential bias as *disrupting* or *interfering with* the third-person mindreading process. On our account, the child continuously represents the agent's false belief throughout the task. However, children don't use this information when interpreting the experimenter's question, because they are drawn instead to more salient, alternative interpretations.

We noted earlier that there is a systematic reason why it may strike the child as unlikely that the topic of conversation in a false-belief task is the protagonist's mental states and resulting actions, or that the protagonist's beliefs are conversationally relevant. This is that, in the child's experience, cognitive states are rarely talked about (Westra, 2016b). One reason for this is that our ordinary explanations and descriptions of behavior generally leave beliefs implicit. Instead, we simply refer to an agent's desires, leaving it to our interlocutors to infer the relevant belief-factors (Papafragou, Cassidy, & Gleitman, 2007; see also Steglich-Petersen & Michael, 2015). Indeed, Papafragou et al. (2007) found that participants would only spontaneously mention beliefs when describing behavior in cases of deception or false belief, or when provided with particular syntactic cues. While mature speakers will recognize that these exchanges contain implicit references to beliefs, a novice speaker unfamiliar with the pragmatics of belief discourse will likely come to regard references to beliefs as

[4] Consistent with this suggestion, Howard, Mayeux, and Naigles (2008) found that the most consistent predictor of false-belief performance in their corpus data was the frequency of child-directed questions. Likewise, Hughes et al. (2014) found in a study employing false-belief tasks with slightly older children from England, Italy, and Japan that the only systematic predictor of differential success across groups was the age at which children in their respective countries begin formal schooling. (This is a year earlier in England than in Italy and Japan, and the English children performed significantly better.) For of course school-teachers frequently ask children knowledge-exhibiting questions.

relatively rare events. Moreover, such a pattern of omission is reflected in child-directed speech, where "think" gets used only half as frequently as "want" (MacWhinney, 2014; Taumoepeau & Ruffman, 2006).

In addition, we often use verbs like "think" in a manner that isn't really about beliefs at all (Lewis, Hacquard, & Lidz, 2012; Simons, 2007). Rather, "think" is frequently used as a way of indirectly asserting its complement. Thus if one says, "I think it will rain this afternoon," one's primary speech act is to make a hedged assertion about the weather, not to attribute a belief about the weather to oneself. Third-person uses of these terms often perform a similar role. If one responds to someone's query about the upcoming weather by saying, "John thinks it will rain this afternoon", mention of John's beliefs is introduced in an evidential role, and the result is still something resembling an indirect assertion that it will rain. The topic is still the weather, not John's mental states.

Studies of corpus-data collected from children's conversations with adults show that such indirect-assertion uses of "think" make up a large proportion of children's conversational experience with such terms, both in child-directed adult speech and in children's own speech production (Bloom, Rispoli, Gartner, & Hafitz, 1989; Diessel & Tomasello, 2001; Shatz, Wellman, & Silber, 1983). Sentences of the form, "S thinks that P" are more likely to serve as a way of indirectly asserting, "P" than to attribute a belief to the subject. This has led some linguists to argue that children interpret "think" as indirect by default, and only draw on the attributive sense when the indirect interpretation is clearly implausible (Dudley, Orita, Hacquard, & Lidz, 2015; Hacquard, 2014; Lewis et al., 2012).

Thus, while many of our actual thoughts about the beliefs others are left implicit, many of our explicit uses of belief-verbs tend not to be about beliefs at all. All this will lead a novice speaker to assume that conversations about beliefs are quite infrequent. So even when an utterance might be plausibly interpreted as being about beliefs (e.g. "What will she think is in the box?"), these interpretations will be assigned a low prior probability. Consequently, such interpretations are unlikely to be selected when more probable alternatives exist.

It might be objected that not all forms of false-belief task use the term "think", either in describing the false-belief scenario or in the test question. Rather, the child might merely be told where the protagonist has placed her desired object and that it has been moved in her absence, before being asked, "Where will she look for it when she returns?" This objection misses the point of the proposal, however. The idea is that infrequent talk about cognitive states combined with indirect-assertion uses of terms like "think" and "know" lowers the prior probability of the hypothesis that cognitive states are relevant to the topic of conversation. This remains true even in conversations where those terms are not themselves used.

5. Pragmatic reasoning in FB

With the components of our pragmatic account now outlined, consider the version of false-belief task used in the mindreading scale, drawn from Wellman and Liu (2004):

> Children see a toy figure of a boy, together with a sheet of paper with a backpack and a closet drawn on it. The experimenter says, "Here's Scott. Scott wants to find his mittens. His mittens might be in his backpack or they might be in the closet. Really, Scott's mittens are in his backpack. But Scott thinks his mittens are in the closet." – "So, where will Scott look for his mittens? In his backpack or in the closet?" (the target question) – "Where are Scott's mittens really? In his backpack or in the closet?" (the reality question). To be correct the child must answer the target question "closet" and the reality question "backpack."

We suggest that children will likely entertain three main hypotheses about the intent behind the target question. One is the helpfulness-interpretation: *she wants me to help Scott find his mittens*. A second is a knowledge-exhibiting interpretation whose topic is the world (rather than Scott's psychology): *she wants me to show that I know where the mittens really are*. And the third is the intended psychological-knowledge-exhibiting interpretation: *she wants me to show that I know that Scott will look for his mittens where he thinks they are*. On the one hand, the syntax of the question favors the third hypothesis. But the child is alert for opportunities to be helpful, and will be aware that Scott won't find his mittens unless he looks in the right place. And in addition, as we pointed out above, people's cognitive states are rarely directly relevant to the topic of conversation in the child's previous experience. These factors may render the intended interpretation the least plausible of the three. And even if they don't, since the other two alternatives motivate the same reality-oriented answer, when combined they may lead the child to answer accordingly.

While our account can explain why children fail change-of-location false-belief tasks, it might seem that it is less well placed to explain failures in unexpected-contents versions of the task. For in such cases there is no overt goal. The child is merely asked what someone else (or her previous self) will think is in the Smarties tube (having just discovered for herself that the tube contains pencils and not candies).[5] And in the self-directed version of the task, especially, it may seem unlikely to the child that she is being invited to offer help to her own past self when she is asked, "What *did* you think was in there?" A world-directed knowledge-exhibiting interpretation will be especially salient in unexpected-contents forms of false-belief task, however. For consider what has taken place from the child's perspective. She begins by presuming likely pedagogic intent following initial eye-contact with the experimenter and/or the use of child-directed speech. She is then shown something surprising about a Smarties-tube (that it contains pencils). She might reasonably infer that this is what she is supposed to have learned, and thus exhibit her knowledge of the actual contents of the container when asked.

Moreover, recall that "think" is generally used in statements to indirectly assert the complement clause. In second-person questions, likewise, the topic is the complement clause: if you ask me, "Do you think it will rain this afternoon?", the most likely situation is one in which you are asking me about the weather, not my beliefs. This may combine with the saliency of the surprising fact the child has just learned to make it seem likely that she is being asked to exhibit her knowledge of the contents of the container, rather than her own prior beliefs.

Notice that our proposed account of young children's failures in verbal false-belief tasks comports quite nicely with many of the known predictors of false-belief performance. It makes sense, for example, that both executive function and general verbal ability should correlate with false-belief performance. For in order to pass, a child needs not only to decipher the experimenter's query correctly, but also to inhibit answers suggested by alternative interpretations. Likewise, one might expect that verbal ability would depend partly on greater conversational experience, leading to an appreciation that the syntax of the question ("Where will she look?" or "What does she think?") increases the likelihood that the questioner's pragmatic intent has to do with the cognitive states of the story protagonist.

It also makes good sense that false-belief performance should correlate with the extent to which mental-state terms are used in the child's home and with the frequency of child-directed ques-

[5] Nevertheless, a goal may often be tacitly presumed. The child might reasonably assume that everyone likes smarties, and hence be motivated to prevent the target agent from being disappointed to discover that the box contains pencils.

tions (Howard et al., 2008), and that it should likewise correlate with the number of the child's siblings (McAlister & Peterson, 2013; Perner, Ruffman, & Leekam, 1994)—at least, on the assumption that multiplying perspectives in the home is likely to lead to more talk about mental states. The same point holds for the finding that deaf children of hearing parents, who are delayed in their exposure to language, should also be delayed in verbal false-belief performance (Peterson & Wellman, 2009), and that it should be increased exposure to mental-state terms in particular that predicts subsequent success (Pyers & Senghas, 2009).

In addition, our pragmatic proposal can explain why some variations in task-parameters can reliably shift the age of passing false-belief tasks forward by a few months (Wellman et al., 2001). One factor is whether the target object remains present when the child is asked the test question, or has been removed from the scene. This is generally explained in terms of reduced demands on executive function. And this may well be partly correct. But it can also be explained in pragmatic terms. For if the true location of the target object is unknown to the child, then that will lower the probability that the experimenter is inviting the child to be helpful to the agent in the story, as well as lowering the probability that she is being asked to display knowledge of the actual location; and it will correspondingly increase the probability that the experimenter is inviting the child to display her knowledge of the protagonist's psychology.

If the context is a deceptive one, too, then it is correspondingly less likely that the adult is inviting the child to be helpful. Of course this isn't ruled out. Sometimes tricks are intended just to elicit surprise ("Look where your ball is now!") rather than consternation ("My ball has gone!"). But given an intent to deceive the target agent about the location or nature of an object, it is significantly less likely that the adult will at the same time invite the child to *undeceive* (be helpful to) the agent. A similar point holds if the child herself participates in the experimental transformation. If the child was encouraged to put the pencils in the Smarties container, then that should lower the likelihood that the adult is now asking the child to be helpful in informing the target agent of this fact. For why would she encourage the child to make the change and then invite the child to helpfully inform the agent of the result? Indeed, this factor may merge with the previous one. That the child is asked to make the move suggests some sort of deceit, or game of hide-and-seek. And then telling about it would spoil the game.

Finally, it also makes sense, of course, that making the protagonist's cognitive states more salient during the setup of a false-belief task should make it easier for children to pass, as we noted earlier (Wellman et al., 2001). For this will help them to see that such states are directly relevant to the topic of conversation, hence raising the likelihood of the psychological-knowledge-exhibiting interpretation.

Our approach also provides an alternative explanation for some recent results that have been thought to support an executive-function account of children's difficulties with standard false-belief tasks. Thus Scott, He, Baillargeon, and Cummins (2012) show in an expectancy-violation looking-paradigm that 2.5-year-olds can pass when they passively watch an adult participating in a verbal false-belief task. They look longer when the adult gives the incorrect (reality-based) answer. But since the infant is just an observer in these circumstances, there will be no pedagogic cues; and one might expect that the helpfulness-interpretation would be less salient because the infant herself is not involved in the task, and has no opportunity to help. Likewise, He et al. (2012) show using anticipatory looking that 2.5-year-olds pass a false-belief task when the question, "I wonder where she will look for her scissors?" is self-addressed by the experimenter while gazing at the ceiling, while they fail when the same words are directed at them. For there is a pedagogic cue (eye-contact) in the latter case but not the former; and only in the former it is plain that the child is not being invited to help.

One might wonder whether the finding that 3-year-olds can pass a verbal false-belief task when prompted with the question, "What happens next?" (Rubio-Fernández & Geurts, 2013) presents a problem for our account. For why shouldn't children be motivated to help the Duplo character in the narrative, just as they are in a regular change-of-location false-belief task? This would lead them to guide the Duplo character to the actual location of the bananas she wants, rather than the believed location (which is what they actually do). But in fact the experimental procedure makes clear to participants that they are being invited to continue the story. They are invited to pick up the Duplo character and act-out the conclusion. This should induce the child to access her model of the character's psychology, adopting it as her own in pretend-mode, and then acting-out what one should do when occupying that perspective. (One should go to the empty location to retrieve the bananas, of course, because that is where one thinks they are.) In effect, the procedure lowers the probability of a helpfulness-interpretation of the question, substituting in its place an invitation to pretend to *be* the character in the narrative (Westra, 2016b).

We propose, then, that our pragmatic account can offer a well-motivated alternative explanation of the difficulties young children have with verbal false-belief tasks. We suggest, in fact, that the explanation is no less plausible than that offered by constructivists about mindreading, who think that children's failures manifest a conceptual deficit. In what follows we will apply our framework (together with other factors) to show that one can similarly explain the order of difficulty of the main components of the mindreading scale.

6. Why DB is easier than FB

With our account of the false-belief task in place, we are now in a position to explain children's performance on the other items on the mindreading scale. We begin with why diverse-belief tasks should be easier for young children than false-belief tasks. Here is a description of a diverse-belief task, drawn from Wellman and Liu (2004), to be compared with the description of the false-belief task given in Section 5.

> Children see a toy figure of a girl, together with a sheet of paper with bushes and a garage drawn on it. The experimenter says, "Here's Linda. Linda wants to find her cat. Her cat might be hiding in the bushes or it might be hiding in the garage. Where do you think the cat is? In the bushes or in the garage?" This is the own-belief question. If the child chooses the bushes: "Well, that's a good idea, but Linda thinks her cat is in the garage. She thinks her cat is in the garage." (Or, if the child chooses the garage, she is told Linda thinks her cat is in the bushes.) Then the child is asked the target question: "So where will Linda look for her cat? In the bushes or in the garage?" To be correct the child must answer the target question opposite from her answer to the own-belief question.

In contrast with the false-belief task (where the child is told where the target object really is), in the diverse-belief task the child is initially asked what *she* thinks. From the child's perspective this would normally be interpreted as a question about the world, rather than about her beliefs as such. It therefore seems likely (given the pragmatic framework articulated in Section 4) that the child will interpret the experimenter's subsequent assertion, "Linda thinks the cat is in the garage" as also an implicit statement about where the cat really is. In effect, she takes the experimenter

to be offering evidence of where the cat is actually located. As a result, she is likely to prioritize the experimenter's belief over her own guess, and thus forms the belief that the cat is in the garage.

Now, consider the hypotheses that the child entertains when interpreting the experimenter's query in this task. The intended interpretation will be, *she wants me to show that I know that Linda will look for her cat where she thinks it is.* The worldly-knowledge-exhibiting interpretation will be, *she wants me to show that I know where the cat is*. The helpfulness interpretation will be, *she wants me to help Linda find her cat*. We think it likely that in this task, as in the false-belief task, younger children will favor one of the alternative hypotheses over the intended one. But in contrast to the false-belief task, this misunderstanding makes no difference to children's performance. Since the child has inferred, based on the experimenter's indirect speech act, that the cat is in the garage, all three interpretations will issue in the same answer, namely, the garage. Thus in contrast to the false-belief task, where the differing interpretations yield different responses, here all three interpretations yield the same (correct) response.

If this account is accurate, then the only way for a child to *fail* a diverse-belief task (besides mere confusion, which is more likely in younger children, of course) is if she ignores or fails to pick up on the indirect assertion of the experimenter, and goes on believing her own guess. Believing that the cat is in the bushes, the helpful thing to tell Linda is that this is where the cat is, which would then get scored as incorrect.[6] (The worldly-knowledge-exhibiting interpretation, in contrast, will seem implausible in this case. For it was not the experimenter who taught her the location of the cat.)

7. Why DD is easier than DB

Having explained from a nativist perspective why the diverse-belief task may be pragmatically easier than the false-belief task, we now turn to explain why the diverse-desire task should be easier still. Here is a canonical description of the task, drawn from Wellman and Liu (2004).

> Children see a toy figure of an adult, together with a sheet of paper with a carrot and a cookie drawn on it. The experimenter says, "Here is Mr. Jones. It's snack time, so Mr. Jones wants a snack to eat. Here are two different snacks: a carrot and a cookie. Which snack would you like best? Would you like a carrot or a cookie best?" This is the own-desire question. If the child chooses the carrot: "Well, that's a good choice, but Mr. Jones really likes cookies. He doesn't like carrots. What he likes best are cookies." (Or, if the child chooses the cookie, she is told that Mr. Jones likes carrots.) Then the child is asked the target question: "So, now it's time to eat. Mr. Jones can only choose one snack, just one. Which snack will Mr. Jones choose? A carrot or a cookie?" To be scored as correct, the child must answer the target question opposite from her answer to the own-desire question.

This task is pragmatically easy for children for two related reasons. The first is that we know from corpus-data that young children have plenty of experience with conversations in which talk of people's desires takes place, and are the topic of conversation, as well as with conversations in which there is encouragement for children to tell others what they want (MacWhinney, 2014; see also Taumoepeau & Ruffman, 2006).

[6] Why would children ever *believe* a mere guess? One possibility is that children (and especially young children) are chronically poor at source monitoring (Bruck & Ceci, 1999). Having guessed an answer (or indeed, having merely been asked to imagine a particular state of affairs), children are apt thereafter to speak and behave as if they really believe it.

Further, while "think" is most often used in an indirect manner, the same is unlikely to be true of "want." Even though "want" *can* be used as an indirect way of communicating an imperative (e.g. "Do you want to be quiet?" can mean, "Be quiet!"), our suspicion is that such uses are comparatively rare. In fact children's desires, unlike their other thoughts, are frequent topics of conversation in child-directed speech: primary caregivers continuously monitor and manage their children's needs, so it makes sense to ask them what they want on a regular basis. Children's beliefs, in contrast, are less vital to the caregiving process. Thus, desire-talk in general, and the verb "want" in particular, is much less likely to pose pragmatic challenges for a novice speaker than does talk of cognitive states like belief and knowledge. Hence the conversation initiated with the child in a diverse-desire task is comparatively unambiguous. Most young children can easily figure out that they are being told what Mr. Jones wants, and can predict what he will choose accordingly.

In fact the only way a child can fail the diverse-desire task (aside from being completely confused, mishearing the question, and so on) is if she thinks that everybody shares her desires, and refuses to accept the statement that Mr. Jones likes carrots. If she believes that Mr. Jones (like everyone) prefers cookies to carrots, then she will answer, "Cookies" when asked what Mr. Jones will choose. There is some evidence that children might reason egocentrically like this at an early age. Repacholi and Gopnik (1997) show this pattern of response at 14 months, but not 18 months. However, although children are fairly adept at giving and helping by this age (Warneken & Tomasello, 2007), the test question in this experiment was pragmatically demanding. In the pre-test phase, the experimenter expressed a preference for either broccoli or crackers. Then in the test phase, bowls of broccoli and crackers were placed between the child and the experimenter. The experimenter then asked, "Can you give me some?" and the child had to interpret the nature of the request. ("Some *what*?" she might wonder.) When 14-month-olds failed, this was interpreted as egocentrism. However, it could just be that they found the unusual nature of the request confusing—especially when, for them, the crackers are the most salient option (Baillargeon et al., 2015). In fact, even at much earlier ages children already show an understanding of goals and preferences, and are surprised when agents act contrary to their preferences (e.g. Luo & Baillargeon, 2005; Woodward, 1998). We argue, then, that there is no age at which infants are truly egocentric about desires.

Indeed, we predict that it might be easier still for young children to pass a version of the diverse-desire test if it were to involve two protagonists, especially if the desired items were affectively-neutral for the child (or even better: novel). Children could be introduced to Mr. Jones and Mr. Smith. They are told that Jones likes daxes, whereas Smith likes blickets, while being shown some of each. They could then be asked: "Which will Mr. Jones choose?" Here there would be no opportunity for the child's response to be biased by her own preferences.

8. Knowledge-access

We turn now to the knowledge-access task, and the way in which performance on the task is influenced by cultural background. Here is a canonical statement of the task, drawn from Wellman and Liu (2004).

> Children see a nondescript plastic box with a closed drawer (which contains a small plastic toy dog inside). The experimenter says, "Here's a drawer. What do you think is inside the drawer?" (The child can give any answer she likes, or indicate that she does not know). Next, the drawer is opened and the child is shown the contents of the drawer. The experimenter

says, "Let's see ... it's really a dog inside!" The drawer is then closed: "Okay, what is in the drawer?" Then a toy figure of a girl is produced: "Polly has never ever seen inside this drawer. Now here comes Polly. So, does Polly know what is in the drawer?" (the target question) "Did Polly see inside this drawer?" (the memory question). To be correct the child must answer the target question "no" and the memory control question "No."

Why is this task easier than the false-belief task? In contrast with the latter, there is nothing in the task to suggest that Polly has the goal of finding the toy dog. So an interpretation of the test question as inviting the child to be helpful to Polly is correspondingly less likely. One of the main factors that pushes children toward incorrect answers in a false-belief task is therefore absent. However, children might still assume that the most salient fact they have learned about the situation is that the drawer contains a toy dog. They might therefore hear the test question as an invitation to show what they have learned. Moreover, the intended-interpretation of the test question still makes cognitive states a topic of conversation, which is something that children at this age would regard as unusual. So there are still factors (albeit fewer factors) biasing young children toward an incorrect answer, thus explaining why the knowledge-access task is harder than the diverse-desire task.

Is this the only reason why the knowledge-access task is harder than the diverse-desire task (and, for Western subjects, the diverse-belief task)? In fact there is good reason to think that at least part of the difficulty results from an experimental artifact. For the knowledge-access task (alone among tests in the mindreading scale) requires children to give yes/no answers.[7] (Both answers need to be negative for the child to be scored as correct.) Yet we know that children of this age are strongly biased to answer all yes/no questions positively (Fritzley & Lee, 2003; Okanda & Itakura, 2008). The yes-bias is especially strong in younger children, but begins to weaken through the fourth year of life (at about the time children begin passing the knowledge-access task). So one reason why young children pass the diverse-desire task before they pass the knowledge-access task is likely to be this: the latter, but not the former, involves yes/no questions that require a negative answer. Moreover, a general capacity to inhibit the yes-bias is strongly predicted by both verbal ability and executive (specifically inhibitory) control, even after controlling for age (Moriguchi, Okanda, & Itakura, 2008), both of which will be developing during this period.

If these explanations of the difficulty of the knowledge-access task in comparison to the diverse-desire and false-belief tasks are correct, then that leaves us with the question of cross-cultural differences in the relative ease of the diverse-belief and knowledge-access tasks. Why do children in countries like America and Australia find the former easier than the latter, whereas in countries like China and Iran the reverse is true? One part of the explanation turns on the role of the yes-bias in the knowledge-access task. For we know that children in "collectivist" cultures tend to perform better on measures of inhibitory control (Lan, Legare, Ponitz, Li, & Morrison, 2011; Oh & Lewis, 2008; Sabbagh et al., 2006), and that inhibitory control is strongly predictive of children's ability to overcome the yes-bias (Moriguchi et al., 2008). So one component of the explanation is simply that children from such cultures are able to overcome the yes-bias earlier than do children from "individualist" ones.

In addition, we can also adopt Wellman's own proposal, but giving it a pragmatic rather than a constructivist twist. He points out that in "collectivist" cultures there is much greater emphasis on the importance of knowledge, the importance of respecting those who have knowledge, and so on (Shahaeian et al., 2011; Wellman et al., 2006). As a result, we suggest, children in these cultures will be better positioned to recognize the conversational importance of the "seeing leads to knowing" principle that is at stake in the knowledge-access task. This raises the likelihood that the child will interpret the experimenter's question as asking about Polly's state of knowledge rather than the location of the dog, leading her to answer correctly.

Why should there be no difference between "collectivist" and "individualist" cultures in the age at which children pass verbal false-belief tasks, however (Wellman et al., 2001), given that the former have more advanced executive function abilities, and given that executive function predicts some of the individual variance in false-belief, as we noted earlier? Here, too, we can appeal to Wellman's own proposals for an explanation. While the increased executive-function abilities of "collectivist" children should give them a boost in false-belief tasks, at the same time the greater emphasis placed on differences of opinion and conflicts of belief distinctive of "individualist" cultures should provide additional help to Western children in figuring out the intent behind the false-belief question. So the two factors may cancel one another out.

9. The benefits of training

We have suggested explanations of the relative ordering of the main components of the mindreading-scale, and have sketched an account of cultural variation in the scale's intermediate components. We now turn to consider the impact of training on false-belief performance.

Rhodes and Wellman (2013) undertook a training study with American children, who normally find diverse-belief tasks significantly easier (and pass them 3–6 months earlier) than knowledge-access tasks. They found that children who are already capable of passing both forms of task, while still failing false-belief tasks, are more likely to benefit from training in the latter. Significantly more of these children transition from failing to passing false-belief tasks following training. Children who are only capable of passing diverse-belief tasks, in contrast (who prior to training fail both knowledge-access and false-belief), are less likely to benefit. Wellman (2014) argues that this finding supports a constructivist position. Children who are further along the mindreading scale are on the cusp of genuinely understanding the nature of false beliefs, and can benefit from training that targets that understanding, whereas those earlier along the scale are not, and do not.

From our nativist perspective, in contrast, the difference between diverse-belief tasks and false-belief tasks is one of pragmatic difficulty, not conceptual understanding (see Sections 5 and 6). In particular, the same pragmatic misunderstanding that leads children to fail a false-belief task (interpreting the question in one or other reality-oriented way) will lead children to answer in a manner that is scored as passing a diverse-belief task. But it normally takes 6–12 months for children to transition from passing the diverse-belief task to passing the false-belief task. During this time they have more and more experience, both of conversations in which cognitive states are the main topic of conversation and of questions that are intended to elicit statements of what they know, and they learn to discriminate some of the cues that will enable them to tell when these things are so. For instance, children will start to see that facts about beliefs become especially noteworthy and relevant in false-belief scenarios, and that explicit talk about beliefs is associated with particular syntactic frames, such as complementation syntax (Papafragou et al., 2007). They will also start to realize that we often make implicit reference to beliefs. In

[7] The same form of yes/no question was also used in the studies cited in Wellman and Liu (2004), on which the knowledge-access task was based. See Flavell, Flavell, Green, and Moses (1990), Surian and Leslie (1999), and Fabricius and Khalil (2003).

addition, children will develop more general pragmatic competence during this period. This will help them to develop more refined expectations about how various question-types (such as knowledge-exhibiting questions and invitations to be helpful) tend to be asked. All of these experiences will lead them to gradually update their priors about the conversational relevance of cognitive states, and help them to successfully apply their knowledge of beliefs in conversation.

In contrast, children who have recently become capable of passing the knowledge-access task are only 3–6 months away from being able to pass the false-belief task (Rhodes & Wellman, 2013). It makes sense, then, that they will already have accumulated much of the necessary conversational experience and sensitivity. As a result, they are better positioned to respond to training in false-belief tasks. They improve (whereas children who fail knowledge-access tasks do not), not because the training induces a conceptual understanding of false belief, but simply because the training makes talk of mental states more salient to them—thereby increasing the prior probability of the interpretation intended by the experimenter. In children who do not yet pass knowledge-access tasks, in contrast, the lure of the helpfulness and real-world knowledge-exhibiting interpretations is still too strong for them to show any improvement.

At this point, defenders of the conceptual development account might point out that, on their view, the benefits of training should generalize to a wide range of situations. The conceptual-change account should predict that the benefits of training will extend to mindreading tasks employing quite different questions and materials, involving different experimenters, and taking place in entirely different contexts. Our view, in contrast, might predict that the benefits of training will be quite local and context-specific, and not generalize to new testing situations. What is learned in just a few training episodes (as opposed to months of communicative experience) is more likely to be that in conversations with *these* people taking place in *this* context cognitive states are relevant to the interpretation of *these sorts of questions*.[8] While these predictions have not been directly tested, there are some results in the literature that might seem to support the conceptual-change account. We will discuss these briefly here.

Lecce, Bianco, Demicheli, and Cavallini (2014), Lecce, Bottiroli, Bianco, Rosi, and Cavallini (2015) show that training both children and aging adults on false-belief tasks not only improves false-belief performance, but also benefits later performance on metamemory tasks, enabling them to exhibit greater knowledge of such facts as that it is easier to learn a short list than a long one, or that it is easier to learn in the absence of distractions. But the transfer, here, is quite unlikely to be conceptual. For how could training on false-belief tasks lead people to acquire explicit knowledge of these sorts, and to do so in just a couple of days? Rather, we suggest that the training increases the saliency of mental-state talk in general. Consistent with this interpretation, Lecce, Bottiroli, Bianco, Rosi, and Cavallini (2015) found that false-belief training significantly *decreases* performance on physical-causality tasks. It is surely more likely that false-belief training decreases the saliency of physical-causal talk than that it causes some sort of physical-causality forgetting, or results in some kind of conceptual loss.

In addition, there is the recent finding that false-belief training helps children in a game of deceive-the-experimenter, where to win they have to tell the experimenter the opposite of what they know to be true (Ding, Wellman, Wang, Fu, & Lee, 2015). But this, too, is explicable in terms of a kind of pragmatic saliency-priming. For repeated exposure to false-belief tasks should make other people's cognitive states more salient when engaging in verbal interactions with the experimenters, making it easier for them to adopt the false-belief-causing response. And it should also make clear to children that a helpfulness response (telling the experimenter where the target really is, thereby enabling him to win) is not what is being looked for in the interaction (any more than it is in false-belief tasks).

[8] This will depend on the nature of the training, of course. If the training takes place across many different contexts, then it may succeed in raising the probability that cognitive states are a topic of conversation across the board.

10. Conclusion

Our goal in this paper has been to show that the mindreading-scale data do not presently support constructivism over nativism. This is because there are plausible and empirically well-motivated alternative explanations of those results that are consistent with nativism about mindreading, mostly of a pragmatic sort. Our main proposal has been that it takes children a while to figure out that cognitive states can be a topic of conversation and to develop the pragmatic skills to discern when this is so. They have to learn that sometimes questions are really invitations for them to display their psychological knowledge rather than requests to be helpful or to display their knowledge of the worldly facts. And we have suggested that the various components of the mindreading scale differ in their pragmatic demands rather than their conceptual difficulty. But we have, of course, done nothing to *support* the truth of nativism here. That is a task for another occasion. Our goal has merely been to show that the robustness of the mindreading scale (and children's late-emerging performance in verbal false-belief tasks, in particular) provides inadequate reason to *reject* a nativist account.

Nevertheless, our pragmatic account is surely ripe for experimental testing. For it makes numerous predictions for interventions that should impact children's performance in these tasks that would distinguish it from constructivist approaches. Here we will mention just one. Manipulations that draw children's attention to cognitive states as the topic of conversation should improve performance. For instance, one should be able to "prime" children who are on the cusp of passing false-belief tasks into succeeding, by engaging them in conversations in which cognitive states of belief or knowledge are the topic. Whether those conversations concern false beliefs in particular, or provide feedback that could be construed as evidence for a representational theory of mind, should be irrelevant. The same effect could also be achieved through task designs that highlight the salience of cognitive states—for instance, by making them highly relevant to children's goals (e.g. Dudley et al., 2015).

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