

Questions in development

Abstract: The main goal of this article is to defend non-metacognitive interpretations of both the question-asking and question-answering behavior of young children. Rather than manifesting awareness of their own states of knowledge or ignorance (as many in the field assume), such behavior is best seen as dependent upon a set of first-order (non-metacognitive) questioning attitudes, such as curiosity. In addition, the role of such attitudes in other aspects of development is briefly considered.

Keywords: curiosity, desire, emotion, metacognition, mindreading, question

1. Introduction: questioning attitudes

Author (date) argues that questioning attitudes constitute basic and *sui generis* forms of affective state, while arguing that such states are widespread throughout the animal kingdom. Curiosity is one instance of a questioning attitude. Others are manifested in instrumental and exploratory search, as well as in mere attentional search (that is to say, where the emotion of *interest* is directed toward something) and memory search.¹ These attitudes are desire-like or emotion-like states, but states that take questions rather than propositions as contents. A cat that is curious about the identity of a novel object is motivated to explore the object by a state whose content is, *what that is*. Curiosity is satisfied — and the question is answered — when the animal acquires a belief of the form, *that is an F*. Likewise, a monkey that is interested in a conflict between two males in the troupe is motivated to attend to the fight by a state with the content, *who will win*. And interest is satisfied when the animal observes the outcome, coming to believe a proposition of the type, *monkey X won*.

Note that on the proposed account, questioning attitudes are first-order states with first-order (potentially quite simple) contents. The only concepts that an animal needs to possess are ones like *what*, *where*, and *who*, together with concepts for kinds and for individuals. (Of course, these might only qualify as “proto-concepts” if one places especially stringent demands on concept-possession, as many philosophers do; see Bermúdez, 2003, and Author, date, for contrasting views on this topic.) Such attitudes are caused by (salient instances of) ignorance without representing ignorance (that is, without

¹ Author (date) remains neutral on the question whether the set of questioning attitudes is a singleton or a plurality. The answer depends on difficult and hard-to-resolve issues concerning the individuation of psychological kinds. Referring to them in the plural is for convenience only.

the organism being aware of its own ignorance as such). And their functional role is to directly motivate forms of action that have been sculpted by evolution or individual learning to issue in the acquisition of the relevant kinds of information. (Compare the way in which the role of fear is to directly motivate forms of escape or avoidance behavior.)

For present purposes I propose to take for granted that questioning attitudes are among the foundational components of human and animal minds. They are possessed by all mammals, and likely by most vertebrates. Indeed, they may even be possessed by navigating insects like bees and wasps. In fact, any animal that needs to acquire targeted information — as opposed to just hoovering up information through some sort of random walk through the environment — is likely to have motivational states that embed questions as contents, which can serve to direct its search.

Given this assumption, we can assume that human infants, too, possess questioning attitudes. An infant that is curious about a novel toy, or that is interested in the events unfolding on an experimenter's screen, is motivated to investigate and attend, respectively, by questioning attitudes with contents such as, *what that is*, and, *what will happen next*. Indeed, such attitudes will surely be among the foundations of childhood learning and development.

For present purposes I also propose to take for granted that infants are successful mindreaders, and are capable of attributing mental states to other people. This is partly because I believe this assumption to be true, as I have argued elsewhere (Author, date, date). But it is also because I aim to show that even if the conceptual resources necessary for attributing states of knowledge and ignorance to oneself are fully available (employed in attributing such states to others), it is nevertheless more plausible to interpret the interrogative behavior of young children as manifesting first-order questioning attitudes, rather than metacognitive awareness of their own states (which is what many in the field assume).

The present project is part of a larger agenda, and is motivated, in part, by a broader set of considerations. The agenda is to oppose neo-Cartesian accounts of our knowledge of mental states. Many still assume that knowledge of one's own mental states is somehow primary, with knowledge of the mental states of other people emerging later (in both phylogeny and ontogeny), dependent on one's awareness of one's own mental life. Author (date) argues, in contrast, that the reverse is true: awareness of the mental states of other people emerges first in ontogeny, and is likely be an adaptation that evolved to undergird humans' hyper-sociality. Self-knowledge, on the other hand, results from turning our mindreading abilities on ourselves, and relies mostly on a range of indirect (and only partly reliable) sensorily-accessible cues. Neo-Cartesian assumptions continue to underpin a number of

research programs in psychology. One such program, as we will see, concerns the nature and explanation of young children's interrogative behavior, which is thought to manifest metacognitive awareness of the child's own ignorance. I will argue, in contrast, that it is better explained in terms of a set of first-order questioning attitudes.

The main goal of this paper is to explore the role and importance of the proposed questioning attitudes in our understanding of the interrogative behavior of toddlers and young children, both verbal and non-verbal. First, however, I want to look even earlier, considering the role that questions might play at some of the earliest stages in development, in the third-person mindreading of infants in their first year of life, in particular.

2. Attributing questions to others

The fact that infants are capable of having questioning attitudes from early stages of development doesn't imply, of course, that they are capable of attributing such attitudes to others. Even if it is true (as I believe, and as I propose to assume there) that core mindreading abilities are innately channeled, and emerge with little or no learning early in development, it doesn't follow, of course, that attributions of curiosity or interest are among the components of that core system. It may well be that the behavioral cues that indicate the presence of such states need to be learned, and/or that concepts for the relevant attitudes need to be constructed out of others. For example, curiosity might come to be understood as a *desire to know* something — incorrectly, in my view, since I claim that curiosity is a first-order desire-like questioning attitude, not a metacognitive one that embeds the concept KNOW within its content. Children's conception of curiosity might thus need to be built up over time out of the concepts of desire and knowledge.

Note that the metacognitive conception of curiosity does appear to be part of our common-sense folk-psychology, since it — or something like it — is endorsed by almost all philosophers and cognitive scientists who have written on the topic. (See Foley, 1987; Goldman, 1999; and Williamson, 2000, among philosophers; and see Litman, 2005; Gruber et al., 2014; Golman & Loewenstein, 2015; Blanchard et al., 2015; and Kidd & Hayden, 2015, among scientists.) But such an account makes it hard to understand how animals other than ourselves could be curious. For if the account is correct, only animals with the concept KNOWLEDGE — or something sufficiently close — could be curious, since curiosity is said to be *wanting to know*, and you can only want what you have some conception of. This consideration has motivated a small set of philosophers — just three, to my knowledge — to propose an account of curiosity as a first-order attitude to a question, instead (Whitcomb, 2010; Friedman, 2013;

Author, date).

It seems likely that concepts such as WANT and THINK would be among the core components of an innate mindreading system. And a reasonable working assumption would be that infants can (given appropriate evidence) attribute to others as the embedded contents of such concepts any proposition that they themselves can think. Thus an infant who can think a thought like, *the ball is in the box*, and who sees the ball placed inside the box in the presence of another agent, may form a belief with the content, *he thinks that the ball is in the box*. In contrast, if an infant as yet lacks the concept IDENTITY, then she will be incapable of forming a belief with the content, *he thinks that Peter is the firefighter*.

What is an infant to think, however, on seeing another agent look into the box, when the infant herself is ignorant of the contents of the box? In order to explain such cases, Kovács (2016) postulates the existence of what she calls “empty belief files”. Supposing that belief-attributions normally possess the structure, {AGENT THINKS: PROPOSITION}, she suggests that in such cases the infant will form a belief whose content has the structure, {AGENT THINKS: —}, where the content-slot in the belief-attribution is left empty. This is possible, of course, but quite unnatural. And it would leave one floundering to explain how an incomplete belief-attribution of this sort could give rise to determinate expectations — for example, an expectation that the agent should be capable of reporting on the contents of the box to another person. (Note that if the content-slot of the belief-file is left truly empty, then there is nothing even to indicate that the person’s belief concerns the box or its contents.)

If infants are capable of questioning attitudes like curiosity, however, then they can think thoughts that embed questions as well as propositions as contents. And in that case there should be nothing to stand in the way of attributing such a content to another person. On seeing the person look into the box, for example, an infant might form a belief whose content has the structure, {AGENT THINKS: WHAT IS IN THE BOX}, where what is embedded in the belief-attribution is not a proposition but a question. This would be an entirely natural attribution to make, since on seeing the adult look into the box, the infant herself is likely to be at least mildly curious what is in the box. (Note that the content of her curiosity is then the very same as the content of the belief attributed to the agent.) This proposal seemingly avoids all the difficulties that attend the notion of empty belief files. In particular, if the agent knows what is in the box, then she should be able to tell other people what is in the box.

One wrinkle in this suggestion, however, is that in English (and most other languages, I believe) one cannot attribute belief in a question. One can say, “John *knows* what is in the box” but not, “John *thinks* what is in the box” nor, “John *believes* what is in the box.” Why this should be so is itself an interesting question. It may have something to do with the central role of knowledge-reports in

information-transmission, whereas belief-reports are more commonly employed in psychological explanation. But in any case, there seems no reason to expect that there should be similar restrictions on what pre-linguistic infants can think. Indeed, when children acquire language, it takes them a while to sort out the difference in semantics between “think” and “know” (Dudley, 2017). So it makes sense that their initial concept THINKS might incorporate aspects of each; and in particular, that it might permit completion by an embedded question. Note that this would enable infants to represent and draw inferences from cases where someone has a false belief about the contents of the box (even when the infant herself is ignorant of the truth; for example, where the box the agent was seen looking into has been switched for another while the agent was absent).

This issue is an empirical one, of course (even if the innateness of core mindreading abilities is taken for granted). My only point here, is that once we accept that infants are capable of entertaining questions as the contents of their own thoughts (when curious about or interested in something, for example), then it opens up the possibility that they might be capable of attributing questions to others as the content of a THINKS-attitude. At the very least, the idea seems worth investigating alongside (and in competition with) the notion of empty-belief-files.

3. Learning to ask

Let me now turn to the interrogative behavior of slightly older infants and young children. A number of experimenters have shown that by the age of 12 months infants use gestures and vocalizations to request information from caregivers (Southgate *et al.*, 2010; Bergen and Southgate, 2012; Kovács *et al.*, 2014). And Chouinard (2007) shows from a longitudinal discourse-analysis that by two years of age well-formed questions constitute a large proportion of the speech of young children when interacting with a caregiver. Furthermore, at the initial stages of development one might expect that question-asking would be an indiscriminate strategy, but would rapidly begin to interact with the output of the mindreading system, enabling children to identify whom best to direct questions toward (who knows or is ignorant; who is the most reliable informant; and so on). And this, too, appears to be the case (Mills *et al.*, 2010; Harris, 2012).

Given the standard metacognitive construal of curiosity, the interrogative behavior of infants and toddlers can be interpreted as manifesting both *awareness* of their own ignorance and a corresponding desire *to acquire knowledge*. And this is just the interpretation that is often given in the empirical literature. The child is assumed to ask her question because she realizes she is *ignorant* of the answer, and *wants to know* it (Balcomb and Gerken, 2008; Mills *et al.*, 2010; Goupil *et al.*, 2016). But this

interpretation is by no means mandatory. We could view the child's interrogative behavior as an expression of a (non-metacognitive) questioning attitude instead. The child can be said to ask what the box contains, for example, because she is curious what the box contains, not because she wants to know what the box contains. In such cases the child's curiosity can be caused by her ignorance of what the box contains, given its salience in the current context, without her being aware of her ignorance as such (that is, in the absence of metacognition).

Suppose that curiosity is an affective attitude to a question. Then we can suppose that curiosity, like other affective attitudes such as fear and anger, is apt to activate directly (without any requirement for practical reasoning) forms of action that are designed to alleviate (that is, remove) the affective state in question. Consider how this works in the case of fear and anger. Fear motivates forms of escape or defensive behavior that are likely to render one safe; anger motivates forms of aggression that are likely to deter or punish those who have harmed one; and so on for other affective attitudes. And note, too, that the behavior in question is motivated *directly*, independently of one's beliefs. On meeting an aggressive-looking black bear in the forest, for example, and feeling fear, one will likely experience an urge to run away, even though one knows full-well that the best strategy is to make oneself look as large as possible while making a lot of noise; and on becoming angry with a colleague at a meeting one may experience an urge to make a cutting remark, even though one knows it would be counter-productive to do so. Still, even given the general assumption that curiosity should directly cause forms of behavior that are likely to remove (that is, satisfy) one's curiosity, one might wonder *how*, exactly, curiosity comes to cause the forms of interrogative behavior that we observe in infants.

One possibility is that the connection is innate, and is part of the hyper-social endowment characteristic of all normal humans. That is, states of curiosity in humans might be directly wired (or "innately channeled") to issue in behavior such as pointing at the unfamiliar object while looking quizzically toward an adult carer, just as curiosity in a cat seems to be directly wired to cause it to approach an unfamiliar object, sniff it, walk around the object looking at it more closely, and so on. Another possibility, however, is that the behavior might be shaped through normal processes of affective, reward-based, learning. What follows is a sketch of how that story might go.

When an infant is curious about or interested in something, she will attend to it, and will engage in behavior that is easily interpreted by surrounding mindreaders (generally the child's caregivers) as manifesting just such attitudes — turning her head toward the source of an unusual sound, looking intently at and/or reaching toward an unfamiliar object, exhibiting a surprised facial expression when something unexpected happens, and so on. In such circumstances, the infant's caregivers will often

provide information that satisfies or partially satisfies the attitude, and which is thus experienced as rewarding — by naming the source of the sound or the unfamiliar object, for example, or by explaining the event that has just happened. One might expect that infants would rapidly learn that by drawing a caregiver’s attention to the object of curiosity or interest, they can often secure just such a reward. And hence we see the emergence behavior that is readily interpreted by adults as interrogative. Note that on this account the infant doesn’t have to be aware of her own ignorance in order to engage in interrogative behavior. She just has to be curious, and to have learned a set of social behaviors that are apt to satisfy her curiosity.

Consistent with this account, we know that curiosity-satisfaction *is* directly rewarding. In an experimental paradigm that has now been used with both monkeys and pigeons, animals will opt to give up between 20 and 30 percent of their eventual food-reward in order to learn whether that reward is, or is not, coming (Bromberg-Martin and Hikosaka, 2009; Gipson *et al.*, 2009). Animals will choose an option that reliably signals whether or not a food-reward is coming a few seconds later, even though this choice has no impact on the likelihood of the reward, and even though the animal knows that selecting the informative-option will reduce the size of the eventual reward, if it comes. (Compare how one might pay a premium to learn whether or not one has won a lottery of some sort via express mail rather than regular mail.) Moreover, we know that the reward-systems in the brains of monkeys respond positively to the prospect of the informative option independently of their responses to the prospect of the food itself, with distinct neural signatures discernable in orbitofrontal cortex (Blanchard *et al.*, 2015).

How young children learn to ask *verbal* questions is a more complicated issue, one that is entangled with the development of linguistic ability more generally. This cannot be addressed here. But it is worth noting a couple of features of the present account which suggest that learning to ask questions should be especially easy for a developing child. For one thing, the distinctive components of wh-questions (“what ...?”, “where ...?”, “when ...?”, and so on) are concepts that the language-learning child already possesses. This is because, by hypothesis, even infants have attitudes to questions such as what that thing is, where Mother is, when she will return, and so on. So the concepts will already be there for the linguistic wh-terms to be fast-mapped to (in the sense of Bloom, 2002).

Second, recall that questioning attitudes are attitudes whose content is a question, just as truth-directed attitudes like belief are attitudes whose content is a proposition. But linguistic questions, too,

have questions as contents, just as assertions encode propositions.² One might expect, then, that the natural-language question-form would be fast-mapped to the questioning attitudes that it can be used to express, just as children readily grasp that the assertoric form can be used to express propositional attitudes like belief. And note, by the way, that no one would claim that children need to be aware of their own beliefs in order to assert them. Standard models of speech production start from a message to be communicated — in the case of assertion, normally a belief — not from any kind of metacognitive awareness, such as awareness of one's own belief (Levelt, 1989). Nor too, I claim, should anyone think that children need to be aware of their own ignorance, or their own curiosity, in order to ask questions. Rather, ignorance (when salient) results in a state of curiosity with a question as its content, and curiosity directly motivates the behavior of *asking* a question with that content — behavior that has previously been found to be rewarding, since question-asking is apt to lead to responses that *satisfy* curiosity.

To illustrate some of the points made in this section, consider the work of Goupil *et al.* (2016). They presented toddlers with memory-based choices ranging from easy to impossible. The children either observed, or did not observe, a toy being placed under one of two boxes. They then had to point to the correct box after a short or a long delay to be rewarded with the toy. The experimental group, however, were shown during a warm-up phase that they could turn to their caregivers for help instead of indicating their own choice. These children were more likely to ask for help after a long delay (when their own memory was more likely to have faded) than after a short one; similarly, they were more likely to ask for help when they hadn't observed the hiding event (and so were ignorant of the toy's location) than when they had.

The experimenters interpret these findings as demonstrating the children's metacognitive awareness of their own states of knowledge and ignorance. But simpler (and better) interpretations are available. In cases where the child knows and remembers the location of the toy, simple (first-order) practical reasoning is sufficient to explain the child's behavior. The child can reason: *To get the toy I need to point to where it is; the toy is in that box; so I'll point to that box.* Metacognitive awareness isn't

² The contents of questioning attitudes and verbal questions may be related but non-identical. The content of a verbal question is generally said to be a set of possible *answers*, where the latter are determined by the form of the question itself, and perhaps also by the person's background needs and interests (Karttunen, 1977). The content of curiosity, in contrast, will be a set of possible *satisfiers* (that is, a set of states of affairs), learning of which would remove the state of curiosity.

needed. Likewise, in cases where the child is ignorant of the toy's location, we can suppose that ignorance, in this context, will give rise to a desire-like questioning attitude with the content, *where the toy is*. Moreover, the children will have learned through the warm-up training that turning to their caregiver for help is an effective way of satisfying this attitude, and subsequently receiving the toy. Again, metacognitive awareness isn't needed.

Consider, in contrast, the explanatory burden that needs to be taken on if one insists that the infants' behavior in these experiments manifests metacognitive awareness of their own ignorance. As Goupil *et al.* (2016) themselves note, similar behavior has been experimentally elicited from many species of animal, including invertebrates like honey bees (Perry and Barron, 2013). Almost all animals will act to secure information when ignorant; and likewise many species of animal will make choices that differ depending on their confidence in the outcome. Goupil and colleagues are sanguine in asserting that all such creatures are capable of metacognitive awareness. But for this to be true, creatures like bees must possess mental-state concepts such as KNOWS and BELIEVES. (To be aware of one's own ignorance, one needs to have the concept IGNORANT, or the concept DOESN'T KNOW.) And this means they must possess some idea of the causal structure of their own minds. This is possible, but seems quite unlikely. We should surely prefer simpler, less demanding, explanations if available. That is what I have attempted to provide in this section.

4. Is answering metacognitive?

Of course, young children don't just ask questions, they answer them. But as we noted in Section 3, the issue of how children come to understand the significance of the verbal question-form is beyond the scope of the present discussion. Yet plausibly, children (like adults) come to interpret verbal questions as manifesting the speaker's desire to know something. Note that this is a metacognitive desire. And one might then wonder how it could rationally issue in a question-answering response unless the child's reasoning is mediated by a metacognitive premise. It might seem, that is, that the child's reasoning would have to take the form: *He wants to know whether P; I know whether P; so I can give him what he wants by saying whether P*. If this is right, then question-answering behavior manifests metacognitive knowledge, specifically the knowledge that one knows (or has a belief about) the answer.

There is an alternative — weaker and more plausible — account of the rational basis of question-answering, however. This is that understanding someone to be asking a question prompts a cooperative hearer to adopt a mirroring questioning attitude. That is, the hearer comes to share the *actual* (non-metacognitive) attitude of the speaker (rather than the misleading folk-psychological

reconstruction of that attitude), and acquires a first-order desire-like state whose content is *whether P*. This questioning attitude then initiates a search of memory which results in memory-retrieval of the content *P*, or the content *not P* (provided the hearer knows or has a belief about the answer to the question). The resulting proposition is then used as input to the language-production process (becoming the “message to be communicated”), leading the hearer to answer “*P*” or “*not P*”. On this account, then, question-answering doesn’t require speakers to have metacognitive awareness of their own states of knowledge. It just requires them to *have* states of knowledge (or belief).

This pared-down account of the cognitive processes involved in question-answering parallels, and receives some indirect support from, what is surely the most plausible theory of how one normally acquires beliefs from the assertions of other people. Consider what happens when someone asserts a proposition *P*. On a standard Gricean construal, one will recognize that the speaker intends that one should believe that *P* as a result of recognizing his intention. How does this lead one, in the normal case, to come to believe that *P*? One possibility is metacognitive, paralleling the metacognitive account of question-answering. The hearer would start from the premise, *he wants me to believe that P*; then this, combined with the hearer’s cooperative goal of helping the speaker to fulfill his goals, would lead the hearer to have a desire *to believe that P*. And then this desire would (somehow) lead the hearer to believe that *P*.

This sort of metacognitive account seems quite implausible, and the final step is mysterious: how is wanting to believe supposed to lead directly to belief? (Indeed, there is a long tradition in philosophy that claims it to be impossible for one to believe things at will like this; see Williams, 1970; Pojman, 1985; Bennett, 1990; Scott-Kakures, 1994.) It seems much more likely that when one hears someone as asserting that *P* (and appraises him to be sincere and reliable), the content *P* becomes the content of one’s own belief directly, unmediated by further reasoning.³ On this simple view, then, in the normal case expressions of belief give rise to belief in the same propositional content directly, without the hearer needing to form a metacognitive desire. My suggestion is that when answering a question, likewise, hearing someone as asking whether *P* gives rise to a questioning attitude in oneself with the content *whether P* without mediation by metacognitive reasoning. When one hears a question one makes that question one’s own, as it were, and one searches memory (or the world) for an answer accordingly.

³ Indeed, Mandelbaum (2014; Mandelbaum and Quilty-Dunn, 2015) argues that people have a tendency to acquire some degree of belief in any proposition that they entertain, whether asserted by a reliable informant or not.

To be clear, I don't intend these suggestions to amount to a denial of Gricean accounts of communication. It may well be the case that to recognize an utterance as an assertion involves recognizing that the speaker intends that one should form a belief as a result of one's awareness of that intention. And likewise, recognizing an utterance to be a question might involve recognizing that the speaker intends one to respond with a true answer to the question as a result of one's awareness of his intention. But in each case, the move from recognition of the speech-act to the formation of one's own attitude can be direct and non-metacognitive in nature (and plausibly is). Recognizing something to be an assertion with the content *P* will lead one to believe that *P* directly by default (provided the speaker is appraised to be trustworthy and so forth). And likewise, recognizing something to be a question with the content *whether P* will lead one to form a questioning attitude with the content *whether P* by default. It is this first-order questioning attitude that directs the search for an answer.

I have argued, then, that we have no need to attribute to young children metacognitive awareness of their own thoughts in order to explain their capacity to provide (positive) answers to questions. (Negative answers — especially of the form “I don't know” — will be discussed in Section 5.) But it might be objected that children, like adults, will often answer a question with an assertion of the form, “I think that *P*” (less commonly, of the form, “I know that *P*”; see Harris *et al.*, 2017a). Since the thought that they are expressing, here, is that they *think* or *believe* *P* to be the case, it might be said that such statements are evidence of metacognitive thought. Since children's answers are often metacognitive in form, isn't the simplest conclusion that such answers reflect metacognitive awareness of the child's own thoughts?

This line of argument is unconvincing, because most uses of “I think” (in adult speech to children as well as in the speech of children themselves) are not really attributive, but formulaic (Shatz *et al.*, 1983; Bloom *et al.*, 1989; Diessel and Tomasello, 2001; Simons, 2007; Lewis *et al.* 2012). Prefacing a statement with “I think” serves to weaken it somewhat, but it doesn't usually change the topic. If one asserts, “There will be a storm this evening”, then plainly the topic is the weather, and the message to be communicated concerns the likelihood of rain and/or wind (depending on the context). But if one says instead, “I think there will be a storm this evening”, the topic is unchanged: one is still talking about the weather, but perhaps expressing less than complete confidence in one's prediction. The topic is not (as the form of the sentence might suggest) oneself and one's beliefs. The topic remains the weather, not one's own psychology. Even if the literal semantic content of the sentence makes reference to the speaker's beliefs, the message to be communicated doesn't. As a result, when children communicate answers to questions using an “I think” sentence-form, one cannot presume that the message they are

communicating concerns their beliefs, or that they are expressing a metacognitive thought. Indeed, one *shouldn't* presume this, given the prevalence of indirect uses of “I think” in speech generally.

It is possible that a child who responds to a question from an adult by saying, “I think the box is empty”, and hears her own reply, *thereafter* comes to have metacognitive awareness that she believes the box to be empty. For there is some reason to think that young children are poor pragmatists (Westra, 2016). That is, hearing her own reply and extracting its literal semantic content rather than the intended message-to-be-communicated, the child may *subsequently* arrive at a metacognitive belief. But if so, this is metacognition that is indirect, dependent on the child’s mindreading and interpretive abilities, rather than resulting from introspective awareness of her own beliefs. The process that initially generated the statement in question is most likely to have begun with the proposition *the box is empty* as the message-to-be-communicated, with the modifier “I think” being added during the course of speech-production given its prevalence in ordinary discourse.

In fact, however, it is unlikely that young children interpret themselves to be describing their own psychological states when hearing themselves say something of the form, “I think that P”. For indirect-assertion, merely-modifying, uses of “think” are *so* prevalent in ordinary discourse that some linguists have claimed that children interpret “think” in general (whether in the first, second, or third person) as indirect by default, and only draw on the attributive (psychological) sense when the indirect interpretation is clearly implausible (Lewis et al. 2012; Hacquard 2014; Dudley et al., 2015). So when the child hears herself say, “I think the box is empty”, she will likely discount the semantic contribution of “I think” and interpret herself (correctly) as asserting that the box is empty. Nevertheless, the end-state is likely to be the same. Since people generally only assert what they believe, the child will interpret her own assertion that the box is empty as a manifestation of the belief that the box is empty. But as already noted, this means that metacognitive awareness is the outcome of question-answering behavior (and depends on the child’s mindreading abilities, directed at herself), not the starting point.

5. Are negative answers metacognitive?

I have argued that we need not — and should not — interpret young children’s interrogative behavior as manifesting metacognitive awareness. Nor should we regard young children’s positive answers to questions as displaying metacognitive awareness of their own beliefs, even when their answers take the form, “I think that P” or “I believe that P”. For such answers are generally just indirect assertions of the content *P*. Negative answers, however, might seem like another matter. For young children don’t merely fail to answer, or answer irrelevantly, when they don’t know the answer to a question (although they do

sometimes do each of these things). On the contrary, they frequently respond by *saying* that they don't know. This is a metacognitive statement, which can only bear a metacognitive interpretation. In contrast with "I think that P", which is often just an indirect way of asserting "P", "I don't know [whether P]" can only mean just that: that the speaker is ignorant of the answer. Since the message-to-be-communicated is that one is ignorant, it would seem that it has to start from a metacognitive thought: it is because the child *believes* she is ignorant of the answer that she *says* she is ignorant of the answer.

When children answer a question by saying, "I don't know", then, does this reflect (as it seems to) a prior metacognitive awareness of their own ignorance? It will subsequently cause such awareness, of course. Hearing and understanding their own answer, they will become aware of their own ignorance. For there is, as we have just noted, no other way in which the content of such an assertion can be understood. But do children possess such awareness at the outset, in formulating the message-to-be-communicated? Do such metacognitive statements reflect prior metacognitive thoughts?

In answering these questions, it will be helpful to note that there are close parallels between question-answering in general and the sorts of word/non-word decision tasks that have been widely used in psychology. In such tasks one is presented with a string of letters and required either to respond "Yes" if it is a word or "No" if it is a pseudo-word or impossible word. So a "Yes" response is warranted if one recognizes the stimulus as a word, whereas a "No" response reflects ignorance of (that is, failure to recognize) a word. By parity of reasoning, then, one might think that people in these experiments would need to be metacognitively aware of their own ignorance of a word whenever they answer "No". But no one in the field would make such a claim.

For example, Defau et al. (2012) use a leaky competitive accumulator model (LCA) to explain performance in these tasks, following Usher & McClelland (2001). Such models are widely employed in psychology, and are thought to be neurologically realistic, reflecting a gradual build-up of activity in the relevant neural populations. On such an account, then, evidence accumulates over time for a "Yes" answer (with some leakage). A "No" answer, in contrast, is determined by a fixed value minus the evidence for "Yes" (meaning that a "No" answer is the default), with the two answers competing with one another. In effect, then, if one isn't sufficiently inclined to answer "Yes" within some fixed time (fixed by one's goals or the task instructions – e.g. for accuracy versus speed or vice versa), then one answers "No" instead.

It is easy to see how this model can be extended to explain question-answering behavior in general. If a child is asked, "What is that thing called?", evidence accumulates in parallel for a number of possible names. If one of them exceeds threshold swiftly enough given the context, the child responds

positively (e.g. by saying “cow”). But if no word makes it to threshold during that time, the child responds by saying, “I don’t know”. In effect, the message to be communicated is not that one lacks knowledge as such (that would require metacognitive awareness), but rather one doesn’t have a positive answer. And then this same model can easily be extended to account for cases where the child is asked, “Do you know what that thing is called?”, rather than being asked for the name directly. Exactly the same strategy can be followed: replying, “No” or “I don’t know” if no name comes to mind.

There are significant differences between a “No” response in a word/nonword task and an “I don’t know” response to a question, of course. Most salient is that the contextually-expanded content of one’s answer in the former case is that the stimulus is not a word, whereas the only available content in the latter is that one is ignorant of the answer. The former answer is first-order whereas the latter answer has a metacognitive content. Nevertheless, essentially the same leaky-competitive-accumulator process can underlie each. In word/nonword tasks people are instructed to respond “No” if they don’t recognize the stimulus as a word. (Notice, however, that they *could* be instructed to say, “I don’t recognize it”, giving a semantically metacognitive answer instead. Arguably the process that would generate such an answer would remain exactly the same.) Presumably children learn that the appropriate way to respond to questions they can’t answer is by saying, “I don’t know” (or by shrugging their shoulders, or other behavior that can be interpreted as an expression of ignorance). This can be the direct output of a leaky-competitive-accumulator process, only subsequently interpreted by the child (as well as the hearer) in metacognitive terms.

Consider, for contrast, what a metacognitive account of the production of an “I don’t know” response would have to look like. Supposing that such utterances reflect the prior formation of a belief with the content, *I don’t know*, what would be the cues that could give rise to such a belief? Only one serious contender is available: the cue would be one’s *failure* to produce a verbal answer within some specified time. No one who studies metacognition thinks that people have direct introspective access to their memory systems or beliefs (Dunlosky and Metcalfe, 2009). Rather, people are reliant upon various kinds of indirect cue, such as feelings of fluency or disfluency, failure to produce an answer, and so forth. So, in effect, the cue for formation of a metacognitive belief is the very same as that postulated above to underlie production of the “I don’t know” response directly — it is one’s failure to produce a substantive answer. The latter direct account is therefore simpler and more parsimonious — especially since “I don’t know” responses are so ubiquitous in early childhood discourse (Harris *et al.*, 2017a).

I should stress that my proposed interpretation of children’s “I don’t know” responses is consistent with the main conclusions drawn by Harris *et al.* (2017b) from their longitudinal discourse-

analysis of the speech of three young children. They note that children generally use, “I don’t know” correctly, in circumstances where they are ignorant of some fact or answer to a question; and that when used in the second-person it mostly figures in the context of a question or request for information (“Do you know?”). More generally, Harris and colleagues conclude that two-year-olds have a working conception of knowledge and ignorance that they make appropriate use of in the context of communication with an interlocutor. This is fully consistent with the assumption I adopted at the outset, that even infants possess core mindreading abilities. More importantly, it is also consistent with the claim defended here, that children’s use of “I don’t know” doesn’t reflect (but rather causes) a metacognitive belief in their own ignorance. The initial production of “I don’t know” can still be formulaic, and can still be the default direct response in the leaky-competitive-accumulator process that generates answers to a question (whether that question is explicitly asked by an interlocutor or tacit in the context of the on-going conversation).

6. Conclusion

If first-order (non-metacognitive) questioning attitudes are available from infancy, then data that are often interpreted as displaying metacognitive awareness in young children — such as asking a question of a caregiver when ignorant of the subject matter, answering a question with the correct answer when knowledgeable, and answering a question with “I don’t know” when ignorant — are better seen as manifestations of questioning attitudes together with other first-order processes. Moreover, if infants possess questioning attitudes, and are competent mindreaders, then they should be capable of attributing question-contents to other people. As a result, a number of potential new avenues for future research are opened up.

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