2 Questions in Development

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Introduction: Questioning Attitudes

Everyone will likely acknowledge that attitudes such as *curiosity* and *interest* are vitally important for learning, and that young children ask so many questions because they are intensely curious and interested in the world around them. But the nature of these questioning attitudes themselves is poorly understood. Indeed, many have a mistaken view of them – or so I will claim. In consequence, many are led to give mistaken accounts of the cognitive processes that underlie children's asking and answering of questions, too. This matters, both for our understanding of childhood development generally and for designing interventions that are intended to help children learn.

This chapter has two main goals. One is to offer a fresh set of conceptual resources for those wanting to understand childhood development – specifically, the likely existence from infancy of a set of first-order, non-metacognitive, questioning attitudes. The second is to suggest that the early question-asking and question-answering behavior of infants and toddlers is best understood as expressive of such attitudes, rather than providing evidence of early metacognition.

(Metacognition is defined as cognition that is *about* cognition, or "thinking about thinking," and the term is generally restricted to cases where one thinks about one's own thoughts, rather than the thoughts of other people; see Flavell, 1979; Nelson & Narens, 1990; Dunlosky & Metcalfe, 2009.)

People can ask questions for instrumental reasons ("Where are the car keys?"), but often they are just curious ("Why do birds sing?"). And almost all philosophers and cognitive scientists who have written on the topic of curiosity have addressed it in metacognitive terms – as involving a desire for knowledge or true belief, or as an intrinsic motivation to learn, or something of the sort. (See Foley, 1987; Goldman, 1999; and

Williamson, 2000, among philosophers; and see Litman, 2005; Gruber et al., 2014; Blanchard et al., 2015; and Kidd & Hayden, 2015, among psychologists.) Even Loewenstein's (1994) well-known "information gap" theory of curiosity, which *sounds* as if it might not require metacognition, is actually framed in metacognitive terms. Curiosity is said to arise from "a discrepancy between what one knows and what one wishes to know" (p. 93).

The main problem with metacognitive accounts of curiosity, however, is that they make it hard to understand how animals other than ourselves can be curious. For if any such account is correct, only animals with the concept of knowledge – or something sufficiently close – can be curious. This is because curiosity is said to be *wanting to know* (or *wanting true belief*, or *wanting to learn*, or something similar), and you can only want what you have some conception of (Delton & Sell, 2014). This consideration has motivated a small set of philosophers – just three, to my knowledge – to propose that curiosity should instead be understood as a first-order attitude to a question (Whitcomb, 2010; Friedman, 2013; Carruthers, 2018).

In a previous piece (Carruthers, 2018), I have developed and defended such a view at length. Indeed, I argued 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. Note, however, that I actually remain neutral on the question whether the set of questioning attitudes is a plurality or a singleton. The answer depends on difficult and hard-to-resolve issues concerning the individuation of emotions as psychological kinds. Referring to them in the plural is for convenience only.

In my view, questioning 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*. Moreover, just as other emotions motivate adaptive forms of action directly, without requiring planning or executive selection (fear motivates running, anger motivates attacking, and so on), so too do

questioning attitudes. They directly activate exploratory or investigative behavior of various sorts.

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 have are ones like *what*, *where*, *when*, 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 Carruthers, 2009, for contrasting views on this topic.) Such attitudes are caused by (salient instances of) ignorance without representing ignorance (that is, without 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 and 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.) A curious animal might approach the thing, look at it, sniff it, lick it, and so on.

I propose 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-while-foraging insects like bees. 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.

Note that if this is correct, then one can expect that the questioning attitudes might play an especially important role in human development, given the importance of cultural learning (and information acquisition generally) in human life. Note, too, that no fundamental evolutionary change would need to be postulated in order to account for the extraordinary levels of curiosity found among humans. One can suppose that what happened in the hominin lineage was just a ramping up of the *sensitivity* of the questioning-attitude systems held in common with other animals. No new structures would need to have been added.

I will be assuming in what follows that human infants are successful mind readers, and are capable of attributing at least a limited range of mental states to other people. This is partly because I believe this view to be adequately supported by the evidence, as I have argued elsewhere (Carruthers, 2013, 2016). 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 infants and toddlers 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 thus 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 (Goldman, 2006). I have argued, in contrast (Carruthers, 2011), that the reverse is true: awareness of the mental states of other people emerges first in ontogeny, and is likely to be an adaptation that evolved to undergird human, ape, or primate social life (depending on the distribution of these capacities across primates, which is still a matter of controversy). Self-knowledge, on the other hand, results from turning one's mind-reading abilities on oneself, and relies mostly on a range of indirect (and only partly reliable) attribution-heuristics and sensorily-accessible cues (such as one's own feelings, one's own visual and auditory imagery, and observation of one's own behavior).

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. But our focus will be on infants and toddlers specifically (up to the age of about two). Once children become capable of metacognitive awareness, no doubt their interrogative behavior will not only become more flexible and sophisticated, but may well sometimes reflect metacognitive knowledge of their own ignorance. I will return to this point in the section below entitled Beyond Two.

Questions in Infancy

The present section will focus on infants in the first year of life. It will argue that the existence of the assumed questioning attitudes is at least consistent with what we know about human children of this age. Drawing on the same perspective, it will also propose a novel hypothesis for future exploration, concerning question-based mind reading in infants.

For more than thirty years, researchers have employed *expectancy-violation* paradigms to explore human infants' "core knowledge" of the world around them (Baillargeon et al., 1985; Spelke & Kinzler, 2007). When an infant has had her expectations violated she will look longer at

the object or event than when the latter was expected. Seen in the light of the proposed questioning attitudes, such behavior manifests questions directed at the environment, such as the question *how that happened*. And indeed, infants don't just passively attend to expectancy-violating objects or events, but they preferentially learn from them, and if given the opportunity they will explore them in ways related to the nature of the initial expectation (Stahl & Feigenson, 2015). A ten-month-old infant shown an object apparently passing through a solid wall, for example, will try banging it on a surface when later given an opportunity to handle the object (seemingly asking whether it is solid); whereas the same infant shown an object that seems to remain in the air without support will thereafter repeatedly drop it (as if inquiring whether it can float).

Note that it was initially the same expectancy-violation method that was used to explore the mind-reading abilities of infants and toddlers in the first eighteen months of life, too (Woodward, 1998; Onishi & Baillargeon, 2005; Baillargeon et al., 2010). But similar findings have now been confirmed using a wide variety of different methods. These include anticipatory looking (Southgate et al., 2007), active helping (Buttelmann et al., 2009), mirror-neuron activation (Southgate & Vernetti, 2014), and more.

Even if it is true (as I believe, and as I propose to assume) that core mind-reading 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. The fact that infants are capable of having questioning attitudes themselves from early stages of development doesn't imply that they are capable of attributing such attitudes to others. 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. Young children might thus need to build a conception of curiosity over time out of the concepts of desire and knowledge (or want and think).

(Note that the metacognitive conception of curiosity does appear to be part of our commonsense folk-psychology, at any rate. For it – or something like it – has been endorsed by nearly everyone who has written on the topic, as we saw earlier. So it isn't implausible that children might construct just such a conception over the course of the first few years of life.)

On current evidence it seems likely that concepts such as WANT and THINK would be among the core components of an innately channeled

mind-reading 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. Indeed, notice 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. (And notice 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 able to tell other people what is in it.

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 (and thus question-answering), 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 prelinguistic infants can think. Indeed, when children acquire language, it takes them a few years to sort out the difference in semantics between "think" and "know" (Dudley et al., 2015; Dudley, 2018). 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 innately channeled nature of core mind-reading abilities is taken for granted). My point here is that once we accept that infants are capable of entertaining questions as the contents of their own thoughts (when curious about something or interested in something, for example), then this 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 worthy of investigation by developmental psychologists alongside (and in competition with) the notion of empty belief-files.

Interrogative Behavior

Let me now turn to the interrogative behavior of infants and toddlers, focusing initially on the former. A number of experimenters have shown that by the age of twelve months, infants use gestures and vocalizations in a variety of different ways. One is to provide information intended to benefit those who are ignorant (Liszkowski et al., 2007, 2008). But another is to *request* information from caregivers (Southgate et al., 2010; Begus & Southgate, 2012; Kovács et al., 2014). And from that point onwards, development of questioning behavior is quite swift. Thus Chouinard (2007) shows from a longitudinal discourse-analysis that by two years of age well-formed verbal 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 mind-reading system, enabling children to identify whom best to direct questions toward. (That is, who

knows or is ignorant; who is the most reliable informant; who is a member of one's own social group and is thus the most relevant informant; and so on.) And this, too, appears to be the case (Mills et al., 2010; Harris, 2012; Begus et al., 2016).

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 & 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 the contents of the box, 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 motivate directly (without any need for executive decision-making) forms of action that are designed to alleviate the affective state in question (that is, to extinguish curiosity). 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. Likewise, 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 counterproductive 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 kinds 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 it while looking at it closely, and so on. There is evidence that infants need to *learn* that pointing to an object reliably elicits information from a caregiver; however, in a way that other sorts of gesturing or joint-attention behaviors don't. Thus Lucca & Wilbourn (2016) show that at 18 months, but not at 12 months, infants understand the information-eliciting nature of their own pointing gestures.

Another possibility, however, is that infants' interrogative 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 mind readers (generally the child's caregivers) as manifesting just such attitudes. She may turn her head toward the source of an unusual sound, for example, or look intently at and/or reach toward an unfamiliar object; or she may exhibit 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 (Kishimoto et al., 2007; Wu & Gros-Louis, 2014). One might expect that infants would rapidly learn that by drawing a caregiver's attention to the object of curiosity or interest, they can generally secure just such a reward. And hence we see the emergence of 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 animals (and hence presumably in human infants likewise). 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 & 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 discernible in the orbitofrontal cortex (Blanchard et al., 2015).

Suppose that the hypothesis outlined here is correct, that infants and toddlers learn to engage in interrogative behavior via adult feedback and affective learning. Then we can predict that rates of question-asking among two-year-olds will depend not just on trait-curiosity (insofar as this can be independently measured) but also on earlier adult responsiveness to signs of curiosity in the child (Begus & Southgate, 2018). Children who are frequently rewarded for behavior that is interpreted by adults as expressing curiosity, interest, or puzzlement should acquire interrogative behavior more swiftly and robustly – via the provision of information that satisfies the desire-like states in question.

Verbal Questions

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. However, it is worth noting a couple of features of the present account that suggest that learning the verbal question-form should be especially easy for a developing child. For one thing, the distinctive components of wh-questions ("what," "where," "when," and so on) express 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 have propositions as contents. (However, the contents of linguistic questions may specify sets of possible *answers* – Karttunen, 1977 – rather than sets of possible *satisfiers*, which form the contents of the underlying attitudes.) One might expect, then, that the natural language question-form would be fast-mapped to the questioning attitudes 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 knowledge, 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 made salient by the context) 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 one's curiosity.

To illustrate some of the points made in this section, consider the work of Goupil et al. (2016). They presented twenty-month-old 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 before indicating their choices. 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 whey had. (Both groups of children *pointed* in all conditions when making their choices. But these were points that expressed a forced-choice guess or some degree of belief. These points were not themselves interrogative.)

The experimenters interpret these findings as demonstrating the children's metacognitive awareness of their own states of knowledge and ignorance. But given the existence of questioning attitudes, a better interpretation is 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 of the child's own belief isn't 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, some of 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. (Only a subset of the infants in the experimental group ever asked for help, in fact, so it seems not all of them learned this.) Again, metacognitive awareness isn't needed.

Consider, in contrast, the explanatory burden that needs to be taken on if one insists that the behavior of the toddlers 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 & 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 or 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.

Giving Positive Answers

Toddlers don't just ask questions, of course, they answer them. But as we noted above in the section entitled Verbal Questions, 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, toddlers (like adults) come to interpret verbal questions as manifesting the speaker's desire to know something (or better: as manifesting the desire to think something, since the likely conceptual primitive employed is an undifferentiated thinks concept). 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 think whether P*; *I think P*; *so I can give him what he wants by saying that 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 the toddler's reasoning would go: *He wants to think whether P; P; so I can give him what he wants by saying that P*. Since we are dealing at the moment only with positive answers to questions (negative answers will be considered below in the section entitled Giving Negative Answers), the child in such a case already has the knowledge that *P*. Moreover, it seems plausible that decoding the embedded content of the question asked – namely, *whether P* – should be sufficient to evoke this knowledge into an active state, making it available to guide a verbal response. If this is right, then the

toddler just has to *have* a belief, not be *aware* that she has that belief. While the toddler needs to represent the goals and thoughts of the speaker, she doesn't need to represent her own thoughts in order to construct an appropriate reply.

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. But it might be objected that toddlers, 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 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 awareness. Since children's answers are often metacognitive in form, isn't the simplest conclusion that such answers reflect metacognitive thoughts about the child's own thoughts?

This line of argument is unconvincing, however, because most uses of "I think" are not really attributive, but formulaic. And this is true in adult speech to children as well as in the speech of children themselves (Shatz et al., 1983; Bloom et al., 1989; Diessel & 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. One reason for thinking this might be 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 mind-reading 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 it 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 may 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 own mind-reading abilities, directed at herself), not the starting point.

Giving Negative Answers

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 toddlers 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* 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 toddlers answer a question by saying, "I dunno," then, does this reflect (as it seems to) a prior metacognitive awareness of their own ignorance? It may subsequently cause such awareness, of course. Hearing and understanding their own answers, they may 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 addressing these questions, it will be helpful to note that there are close parallels between question-answering in general and the sorts of word/nonword 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, Dufau 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 buildup 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 frame (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?" then evidence will accumulate 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 dunno." In effect, the message to be communicated is not that one lacks knowledge as such (that would require metacognitive awareness), but rather that 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 dunno" if no name comes to mind.

There are significant differences between a "No" response in a word/nonword task and an "I dunno" 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 LCA 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 dunno" (or by shrugging their shoulders, or other behavior that can be interpreted as an expression of ignorance). This can be the direct output of an LCA 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 dunno" 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 positive 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 & 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 dunno" 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 dunno" responses are so ubiquitous in early childhood discourse (Harris et al., 2017a).

One might wonder whether my proposed interpretation of children's "I dunno" 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 dunno" correctly, in circumstances where they are ignorant of some fact or answer to a question; and that when "know" is 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. Note that the second-personal component of this conclusion is fully consistent with the assumption I adopted at the outset, that even infants possess core mind-reading abilities. The real question for us is whether Harris and colleagues are entitled to conclude that first-personal metacognition is also present.

It is worth noting up front that the children who participated in this study were somewhat older than the infants and toddlers we have been considering: they were in the third year of life. But more importantly, the findings are in any case consistent with the claim defended here, that children's use of "I dunno" doesn't reflect (but at best causes) a metacognitive belief in their own ignorance. The initial production of "I dunno" can still be formulaic, and can still be the default direct response in the LCA process that generates answers to a question (whether that question is explicitly asked by an interlocutor or is tacit in the context of the ongoing conversation).

Beyond Two

My main focus in this chapter has been on the nature of curiosity and other questioning attitudes, and their role in the first two years of life. I have emphasized, especially, that questioning behavior during this time period can be understood as manifesting the influence of such attitudes, rather than as displaying any kind of metacognitive awareness. But it may be worth making a few speculative remarks about the years thereafter before we conclude.

Curiosity and interest remain what they are throughout the lifespan, of course – first-order affective attitudes. And they will continue to motivate forms of behavior – including verbal questions – that one has learned will satisfy those attitudes. Moreover, the motivation involved will be direct, without any need for metacognitive awareness. But the conditions that elicit curiosity and interest will greatly expand with learning, as will the range of the behaviors that are used to satisfy those attitudes. As the child's knowledge expands, this will provide an opportunity for new questions and new forms of curiosity to develop. And once a child learns

that books can both stimulate and satisfy interest, for example, then reading can become intrinsically motivating.

How will questioning behavior interact with children's emerging metacognitive awareness and knowledge, which seem to develop gradually from the age of about three years (Lockl & Schneider, 2007; Ghetti et al., 2013; Lyons & Ghetti, 2013; Destan et al., 2014)? The result will surely be a new set of motives for asking questions. Knowing that you don't know something, but knowing that you *need* to know it to achieve a goal or solve a problem, will provide an instrumental motive for trying to find out – and in many cases that will mean asking a question. But this source of motivation is often a pale shadow of that provided by curiosity, especially when the goals in question are distal ones (like passing a test next week, or doing well in school). This is, of course, why teachers try to make their material interesting: to provide an intrinsic motivation to attend, and to provoke intrinsically motivated forms of questioning.

What matters most for learning, I suggest, is not merely the relevance of the knowledge in question to one's goals, but that the appraisal mechanisms that issue in emotions of curiosity and interest should be sensitive to that relevance. Although I am not aware of any direct evidence on the topic, my guess is that these appraisal mechanisms aren't easily influenced by one's metacognitive knowledge that one lacks knowledge or needs knowledge. If this is right, then the central goal for parents and educators should be to engage curiosity and sustain interest, not to equip children with a set of metacognitive abilities. The latter may help learning at the margins, especially when intrinsic motivation is lacking; and it may well become increasingly important as children progress through the school years. (Everyone has to learn *some* stuff that doesn't interest them!) But the questioning attitudes will surely remain central to successful learning throughout.

Conclusion

Drawing on the work of Whitcomb (2010), Friedman (2013), and myself (Carruthers, 2018), I have suggested that among the building blocks of the human mind – available from early in infancy – are a set of questioning attitudes, encompassing curiosity, interest, and more. These are affective, desire-like, states that take questions rather than propositions as contents. As with other emotional states, they are caused by appraisal systems that are likely sensitive to existing knowledge, current goals, and standing values. They are activated by ignorance, in particular – especially ignorance made salient by features of the context (including one's current goals as well as background values). And also like other emotional states, they directly

motivate adaptive forms of behavior – in this case, behavior that has been sculpted by evolution and individual learning to issue in answers to the embedded questions.

With the existence of such questioning attitudes accepted, a number of new lines of inquiry open up for developmental psychologists. One is whether infants can deploy the distinctive contents of these attitudes (questions) for other purposes, specifically for tracking the unknown beliefs of another agent (see Questions in Infancy). In addition to entertaining thoughts like *He thinks the toy is in the box*, might they also be capable of thoughts such as *He thinks what is in the box*, where the specific content of the person's belief is left unspecified (because unknown to the infant)?

Another possible line of inquiry is to see whether rates of interrogative behavior in infants and toddlers is a function of the frequency with which their questioning attitudes (as manifested in their surprise, puzzlement, evident curiosity, and so on) have been satisfied. For I have suggested that those behaviors will likely have been acquired, in part, through reward-based learning (see Interrogative Behavior).

Our discussion in the remaining sections, however, has turned especially on the fact that the questioning attitudes are hypothesized to be first order in nature. For they take first-order questions as contents. (This is only true for the most part, of course. One can be curious about someone's beliefs or goals as well, and in that case the question will have a second-order content such as *what he thinks* or *what he wants*.) Indeed, the content of such an attitude can be as simple as *what that is* or *where the toy is*. As a result, we can give explanations of the question-asking and question-answering behavior of infants and toddlers that are more parsimonious than standard metacognitive ones. At the very least, one might think that the burden of proof has now been shifted onto those wishing to give metacognitive interpretations of experimental results such as those reported by Goupil et al. (2016).

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