

ORIGINAL ARTICLE

Basic questions

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This paper argues that a set of questioning attitudes are among the foundations of human and animal minds. While both verbal questioning and states of curiosity are generally explained in terms of metacognitive desires for knowledge or true belief, I argue (following Whitcomb and Friedman) that each is better explained by a prelinguistic *sui generis* type of mental attitude of *questioning*. I review a range of considerations in support of such a proposal and improve on previous characterizations of the nature of these attitudes. I then broaden their explanatory scope to include a number of forms of exploratory search. The paper has three main goals: (a) to characterize the nature of the questioning attitudes, outlining their causal role and type of content; (b) to argue that they are fundamental components of the mind, being widespread among animals and not constructed during ontogeny out of other attitudes; and (c) to suggest that they explain a great deal more behavior (among both humans and animals) than one might think.

KEYWORDS

affect, curiosity, emotion, interest, metacognition, question, search

1 | QUESTIONS, ATTITUDES, AND CURIOSITY

From a common sense perspective, how is the speech-behavior of asking a question to be explained? Suppose Mary asks Jim, “Where are the car keys?” (And let this be a genuine request for information, spoken while Jim is seated elsewhere in the house, and not a disguised request for the keys themselves, spoken commandingly with an outstretched hand.) And suppose someone then asks, “Why did Mary ask that?” What sorts of explanation are available? Some might mention Mary’s belief that Jim knows where the car keys are, or her belief that he had them last; others might mention her need to find the keys in order to get the kids to school. And of course there are the usual pragmatic explanations that might cite Mary’s desire to get Jim to recognize what she is

requesting. But at the most basic level one could also say, “She asked because she *wanted to know* where the car keys are.”

It seems that people ask questions because they want to know things. The behavior of question-asking manifests a desire for knowledge, or a desire for truth, or a desire for information, or something of the sort. Note that all these desires are—directly or indirectly—metacognitive in nature.¹ A desire for knowledge takes a mental state (knowing) as its content. A desire for truth, in this context, is a desire to acquire a true belief. And likewise, to receive information about something is to *be informed* about that thing. So a desire for information, here, is a desire for something that provides reliable evidence for a specific sort of belief.²

Suppose, now, that Jim replies to Mary’s question, “The car keys are in the pocket of my jacket.” And again suppose we ask, “Why did Jim say that?” Various explanations are available here too, which might appeal to Jim’s desire to answer Mary’s question, or his desire to inform her of the keys’ location, and so on. But at the most basic level one might say, “He said they are in his jacket because that is where he thinks they are.” Linguistic assertions express beliefs, we think; and people assert what they do, in general, because that is what they believe. When one makes a statement with the content *P*, that is generally because one has an attitude—a belief—with that same content.

Not all assertions express beliefs, of course. People sometimes lie, and often they have other goals they are trying to satisfy in making the statements they do in addition to expressing belief. But it seems uncontroversial that, in general, people say what they do, at least in part, because they think what they do. And notice that the explanation here is *not* a metacognitive one. It is Jim’s *belief* that causes him to say what he does, not his belief that he has that belief. Only in extraordinary circumstances would anyone explain Jim’s behavior by saying, “Because that is where he thinks he believes they are.” And in this common sense and cognitive science coincide. The standard view in the field of language-production is that assertions begin from a message to be communicated—normally a belief (Levelt, 1989). No one thinks that assertions have to start from meta-awareness of one’s beliefs.

It may be that the common sense contrast between questioning and asserting drawn here is not very deep. Certainly there are nearby cases in which one might explain someone’s question in terms that are not explicitly metacognitive. If Mary had asked something with no presumed instrumental motive, then a simple attitude-explanation (or something that at least *looks* like one) would have been available. Had she asked, “Why does the moon look bigger near the horizon?” then we could have explained her questioning behavior by saying she is *curious*. (“Why did Mary ask that?”—“She was curious.”) It seems that some questions express an attitude of curiosity, just as assertions express an attitude of belief.

In fact, common sense recognizes a number of lexicalized (and so seemingly first-order) attitudes that can underlie and explain verbal questioning. In addition to curiosity, one might cite an attitude of *wondering*, for example. (“Why did Mary ask about the keys?”—“Because she wondered where they were.”) And although the verb “to inquire” (just as the verbs “to ask” and “to wonder”)

¹ Metacognition is cognition that is about cognition, or “thinking about thinking” (Dunlosky & Metcalfe, 2009; Flavell, 1979; Nelson & Narens, 1990). The term is generally restricted to cases where one thinks about one’s own thoughts, rather than the thoughts of other people.

² It might be objected that *information* is an objective property of the world, not a property of mental states. Roughly, one state carries information about another to the extent that the former reliably causally covaries with the latter. Hence if Mary wants information in this sense, her desire is not a metacognitive one. But this can’t be all that Mary wants. Properties that reliably covary with the location of the keys will be useless to her unless she can extract or infer the location of the keys from the information provided. *Mere* information about the location of the keys is of no use. In fact, properties that reliably covary with the location of the keys will not answer her question unless she knows of the existence and nature of the covariance relation. What she must want is information that will enable her to know or truly believe where the keys are. This is a metacognitive desire.

can sometimes refer to a verbal performance rather than an underlying attitude (“What did Mary *say* to Jim?”—“She inquired/asked/wondered where the keys are”), in other contexts it can seemingly designate a mental attitude. (“Why did Mary ask about the moon?”—“She is inquiring into the topic.”) Our primary focus will be on curiosity, however.

When philosophers have addressed the nature of curiosity, they have generally offered some form of metacognitive account. They have claimed that curiosity is either an intrinsic (noninstrumental) desire for true belief (Foley, 1987; Goldman, 1999), or an intrinsic desire for knowledge (Williamson, 2000). Similarly, in the burgeoning recent literature on curiosity in cognitive science, curiosity is defined as a desire to know or experience things (Litman, 2005), an intrinsic motivation to learn (Gruber, Gelman & Ranganath, 2014), a desire for knowledge for its own sake (Golman & Loewenstein, 2015), or a desire or drive-state for information (Blanchard, Hayden & Bromberg-Martin, 2015; Kidd & Hayden, 2015). In each case, curiosity is analyzed in terms of a desire or desire-like state whose content includes a representation of some kind of cognitive state.

Likewise, it is widely assumed in the developmental literature that when children ask questions of their parents and other adults, then this, too, displays metacognitive awareness (Mills et al., 2010; Goupil, Romand-Monnier & Kouider, 2016). The child is assumed to ask her question because she realizes she is *ignorant* of the answer, and *wants to know* it. Now, I have no doubt that young children have the conceptual resources to form such metacognitive beliefs and goals (Carruthers, 2013). But it may be that we do not need to appeal to those resources in order to explain the behavior. It may be that verbal questions express a first-order attitude of *questioning*, and that curiosity is really a form of questioning attitude (as might be inquiring, wondering, and other related attitudes). Building on the work of Whitcomb (2010) and Friedman (2013), this is one of the ideas to be developed here.

If questioning attitudes are basic components of the human mind (as I shall argue), then one can make the following prediction. This is that human children should “get” the idea of asking verbal questions quite early, discovering that question-asking is an effective way of satisfying the underlying questioning attitude. For when children learn language, there will be a ready-made attitude onto which the syntax and communicative role of natural-language questions can be “fast-mapped” (just as the child’s preexisting store of concepts enables fast-mapping of lexical items; Bloom, 2002). And indeed, this seems to be the case. By the age of 12 months, infants use gestures and vocalizations to request information from caregivers (Southgate, van Maanen & Csibra, 2010; Begus & Southgate, 2012; Kovács, Tausin, Téglás, Gergely & Csibra, 2014). And by 2 years of age, well-formed questions constitute a large proportion of the speech of young children when interacting with a caregiver (Chouinard, 2007). At the initial stages, 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 (Harris, 2012).³

The main problem with metacognitive accounts of curiosity is that they make it hard to see how nonhuman animals could ever be curious. For metacognitive theories of curiosity seem to require conceptual resources that the creatures in question likely lack. Indeed, many animals besides humans seem capable of curiosity. Or more neutrally—so as not to beg any questions—many animals

³ In more recent work Harris has argued that 2-year-old children are meta-aware of their own states of knowledge and ignorance (Harris, Ronfard & Bartz, 2017). I do not have space to discuss his arguments here, which are in any case peripheral to the main ideas to be defended in this paper. For I have already acknowledged that what he claims *might* be true of human children. My point is just that this should not be assumed too easily.

engage in forms of behavior that do not seem obviously instrumental, but which seem designed to obtain information. An animal confronted with something unusual might look closer at it, move up to sniff it, walk around it to examine it from the other side, and so on. In humans, this would be recognized as exhibiting curiosity. And in humans, as they generally have metacognitive abilities, it would be possible to analyze the motivation as involving a *desire to learn* what the unfamiliar object is. But it seems implausible that such metacognitive desires are present in all creatures that we might want to describe as manifesting curiosity.

There are three possible responses to this line of thought. The first would be to claim that the animals *are not really curious*. This would be because curiosity is a metacognitive affective state, and some of these animals, at least, are incapable of metacognition. The second would be to maintain that the animals are indeed curious, but to insist that metacognition is just as widespread in the animal kingdom as curiosity is. And the third is the response I propose to defend: that while many species of animal can be curious, curiosity is a form of basic first-order attitude, with no metacognitive components. Since we will see in due course that even bees can be curious (or something sufficiently similar), I take it that the second of the above alternatives is implausible. It seems unlikely that metacognitive capacities are possessed by invertebrates. But what of the first? Might we deny that animals are really curious?

Even if one were to take this route, however, and were to draw a sharp distinction between humans and other animals in respect of capacities for curiosity, that would still leave us needing to find some way of explaining the curiosity-like behavior of nonhuman animals. We would need to appeal to some sort of first-order motivational attitude to explain why the animal approaches a novel object, sniffs it, licks it, walks around it while looking at it, and so on. And once we had characterized such an attitude, it would become a moot point why we could not appeal to that same attitude to explain the curiosity-behavior of humans. In fact, explanatory virtues of simplicity and theoretical unity would suggest that human curiosity should be explained in the same terms. Armed with a first-order account of what motivates curiosity-like behavior in animals, a metacognitive account of human curiosity would become otiose.

This argument assumes, of course, that it is appropriate to ascribe attitudes to nonhuman animals at all. Even if we grant (as we surely should) that behaviorism is false, someone might claim that the representational states of animals, albeit compositionally structured, do not have sufficient combinatorial flexibility to qualify as genuine attitudes composed out of genuine (albeit simple) concepts. That is to say: animal “attitudes” do not satisfy the Generality Constraint on concept possession (Evans, 1982; McDowell, 1994), and so are, at best, *proto*-attitudes (Bermúdez, 2003). I have critiqued this argument elsewhere (Carruthers, 2009). But I do not need to rely on that critique for present purposes. For suppose that animals only have proto-attitudes composed out of proto-concepts. Still, if one of those proto-attitudes can explain the curiosity-like behavior of animals in first-order terms, then it would remain an issue why we should not appeal to attitudes of that same first-order sort to explain human curiosity. The difference would just be that these states would be enriched (in the human case) to qualify as genuine attitude-states because of our greater powers of conceptual recombination.⁴

Perhaps there is a way to accept that curiosity is widespread among animals while insisting on the metacognitive nature of the attitude. For one might claim that animals can have desires for knowledge, or for learning, without representing knowledge or learning *as such*. Perhaps the desire for knowledge is *de re* rather than *de dicto*, in which case possession of a concept of knowledge need not be presupposed. Perhaps what animals want when they are curious is knowledge, but not represented

⁴ Note that the Generality Constraint requires flexible recombination of whatever concepts one happens to possess. No one claims that a creature needs to have metacognitive capacities in order to possess genuine concepts.

as such. And notice that it does seem to be knowledge-acquisition that *extinguishes* curiosity. An animal will be apt to remain curious about a novel entity until it has learned (enough about) what it is.

As Wittgenstein (1953) pointed out long ago, however, what extinguishes a desire is not the same as what satisfies it. A punch in the stomach might well remove my desire for some chocolate cake, but that does not mean I wanted the punch all along. So the question remains of *how* the animal represents states that are coextensive with learning, if it does not represent learning as such. Every desire has *some* representational content, of course, which specifies the conditions for its own satisfaction. If one accepts that curiosity is widespread in the animal kingdom, then one needs some way of specifying the content of the attitude in terms of representations that the animal might actually possess. This is where we go next.

2 | QUESTIONING ATTITUDES: FIRST STEPS

There have been two recent attempts by philosophers to analyze curiosity and other related attitudes in first-order terms (Friedman, 2013; Whitcomb, 2010). Each is motivated, in part, by the need to account for such attitudes in terms of concepts that might be possessed by nonhuman animals. As a result, both agree that the contents of these attitudes are *questions*, generally expressed using first-order concepts. (One *can* be curious about someone else's mental states, of course, and then the content of the question will be metarepresentational. But this is not the normal case and may well be distinctively human.) Grasping these questions will require only concepts that the animal actually possesses (or at least concept-like representations, if one sets the bar for concept-possession especially high). They might include such questions as, *what is that thing?—what is over there?—where is home?—*and so forth.

Our target is a set of questioning *attitudes*, of course, rather than linguistic questions. But it will be instructive to note the distinction linguists commonly draw between *direct* and *indirect* questions. A direct question is a sentence such as, "Where is home from here?" An indirect question is a sentence that reports a direct question, as in, "Joan asked where home is from here." Both have questions as contents, which are *what get asked*. I shall generally use the interrogative clause of an indirect question (such as, *where home is from here*) when referring to the content of a questioning attitude.

Like any other attitude, a questioning attitude will comprise both a content and a causal or functional role. (Compare the way in which one would characterize the nature of belief, *qua* attitude, in terms of its causal role and propositional content.) The *content* component of curiosity and other such attitudes is what is specified by an interrogative clause, using phrases like, "where home is," "what that is," "whether that is dangerous," and so on. The attitude component of curiosity will be the distinctive sort of role that is occupied by the conceptual structures that pick out the contents of the question. A questioning attitude is thus an attitude of a certain functionally characterizable sort toward an interrogative content, or toward a question. Our first task will be to say something substantive about these contents and roles.

As Friedman (2013) points out, questions do not express propositions. They do not have truth conditions, and they do not correspond to states of affairs. Rather, they specify what is needed to *answer* the question (Karttunen, 1977). The question, "Where is home?" specifies that a proposition of the form, *home is at place p* is needed for an answer. (The content of a question can thus be identified with 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.⁵) Likewise, the question,

⁵ It might be possible to draw a distinction between a *literal* answer to a question (which could be any answer that matches the form of the question) and a *relevant* one (which satisfies the concerns that prompted the question). Although intriguing, I shall not pursue this further. In explaining the behavior of an animal motivated by a questioning attitude, what matters are answers that *satisfy* the attitude, of course (making the question go away). For present purposes I shall assume, then, that the content of such an attitude comprises a set of *relevant* answers/satisfiers.

“What is that?” specifies that a proposition of the form, *that is an F* is needed for an answer. And “Is that dangerous?” can be answered by either one of the propositions, *that is dangerous*, or *that is not dangerous*. It does seem plausible that the conceptual (or concept-like) resources necessary for formulating the content of a question (and for appreciating its answer) can be quite minimal, and might be possessed by many kinds of animal.

If the content of a linguistic question can be thought of as a set of possible verbal answers (limited by the form of the question), then what can be said about the content of a questioning attitude? Note that an answer to a question *answers* the question, and should satisfy the questioner unless it somehow gives rise to a further question. If Paul replies to Joan by saying, “Home is 10 miles *that way* [while pointing]” he has answered her question with a proposition. This should satisfy her. (If she follows up with a further question, “Yes, but is that way North or South?” then she is, in effect, clarifying the intent behind the original question. What she really meant to ask was, “Where is home from here expressed in compass-directions?”) One might then say that the content of a questioning *attitude* is the set of propositions or possible states of affairs (the difference between these is not relevant for our purposes) that would satisfy the attitude (normally removing it). If an animal is curious where home is, or what *that* thing is, then its curiosity should be satisfied if it learns or otherwise comes to believe a proposition like, *home is over there* or *that thing is a predator*.

Notice that learning, or belief-acquisition generally, is what *mediates* the relationship between questioning attitudes and their satisfiers. A questioning attitude is satisfied (and ceases to exist) when one comes to believe one of the propositions specified by the question that is the content of the attitude. Neither the properties of *learning* nor *belief* will figure in the content of the attitude itself, however. We, as theorists, have to use those concepts in specifying the sort of content that a questioning attitude has. But they are not parts of that content. So questioning attitudes need not be metacognitive ones. Put differently, we are required to appeal to learning in specifying what the *satisfaction* relationship is between a questioning attitude and its satisfier. It is by learning a proposition of the specified type that a questioning attitude gets satisfied. But the only concepts the animal (or human) needs are the concepts employed in specifying the question that constitutes the content of the attitude, as well as in the propositions that can satisfy that question.

What, then, should be said of the attitude-component of questioning states like curiosity? We have been told that they are attitudes toward contents that have the structure of a question. But *what* attitude is taken toward those contents? What can be said about its nature and causal role? Friedman (2013) says little about the nature of the attitudes one can take toward questions. Indeed, she writes of “questioning attitudes” (plural), and its content just to work with a list that includes curiosity, inquiry, wondering, and more. Whitcomb (2010) confines his discussion to curiosity, saying nothing about the wider set. He claims that curiosity is a *desire* whose content is a question. But this view is problematic when taken at face value. Desires are for things or states of affairs, and involve representations of things or states of affairs. You can want an apple, or you can (more strictly, perhaps) want *to eat an apple*. This is often cashed out by saying that what one wants is the truth of the proposition *I eat an apple*, or the state of affairs of oneself eating an apple. In contrast, you cannot, it seems, desire a question. Indeed, a statement like, “Joan wants: where home is from here” is not even well-formed.

Consider someone who is curious about the contents of a box found in the attic. The person is *curious what the box contains*. But if we identify the attitude taken toward the question *what the box contains* as a desire, then the person would be *wanting what the box contains*. But that is not right at all. That might be the case if the person knows the box contains a necklace and wants the necklace. But our curious person does not know what the box contains. What she wants, rather, is

to *find out* what the box contains. But this is now a metacognitive desire. It turns out that identifying the content of curiosity with a question does not enable us to account for it in first-order terms if we then go on to identify the attitude taken toward that question as a desire.

Perhaps this is not the most charitable reading of Whitcomb (2010). Perhaps all he really means to be saying is that curiosity is a *desire-like* state (i.e., curiosity is both motivating and affective in nature). In that case I agree. It is obvious that curiosity is an affective state. Curiosity can be *felt* more or less intensely; and curiosity motivates us to do things to investigate the object of our curiosity. Our next task will be to characterize the sort of desire-like state curiosity is, before widening our focus to consider other sorts of questioning attitude. As we will see, all these attitudes can be understood as affective states that motivate one to seek answers to the questions that are their contents.

3 | THE NATURE OF CURIOSITY OUTLINED

I will henceforward assume that curiosity is an affective (desire-like or emotion-like) motivational state whose content is a question. Our task is to characterize the distinctive causal role of this and related attitudes; to understand how basic they are to the mind; and to say something about how widely they might extend (both phylogenetically, and across modes of interaction with the world). In this section, I will continue to focus on curiosity in particular. This will form the heart of our discussion. But first I need to say something general about the nature of affect, and about the sense in which a given form of affect can be *basic*.

3.1 | Basic affect

Most cognitive scientists have little use for the common sense distinction between desire and emotion. (At least, this is true of occurrent—or “felt”—desires. The common sense notion of desire can also comprise stored goals, which cognitive science regards as more similar to intentions than to emotions; see Carruthers, 2015.) All are affective states produced by subcortical value systems that appraise the value of a stimulus and produce as output some degree of positive or negative *valence* as well as physiological *arousal*. Moreover, all are states with *content*, and are *about* something. The desire for an apple is about the apple, and represents eating the apple as good; fear caused by a bear on the trail ahead is about the bear, and represents the presence of the bear as bad and threatening; and so on.

Moreover, all affective states can issue in action via either one of two partly separate routes. They can enter into practical decision-making, interacting with one’s perceptions and beliefs to issue in decisions about whether and how to act. But they also give rise to behavioral dispositions *directly*, independently of anything resembling belief-desire practical reasoning. In fact, all affective states tend to activate related motor plans directly, in such a way that these will need to be inhibited if one is *not* to act. Thus desire for an apple automatically activates approach-behavior, but it can also interact with one’s beliefs to issue in actions that are planned and decided on. Or consider the fear caused by the sight of a bear on the trail ahead. This might interact with one’s knowledge that black bears will normally retreat if one is noisy and looks large, leading one to shout and stretch oneself fully upright. But it will also give rise to an immediate and unplanned impulse to run away. This impulse (and the motor-system activation that accompanies it) will need to be *inhibited* if one is to do the sensible thing and stand one’s ground.

The question of the number of basic affective attitudes is much debated among cognitive scientists. Some think that the only true natural kind that exists is the system that issues in the valence

and arousal dimensions of affect in general (Barrett, 2006a, 2006b; Barrett et al., 2007). Others think that there are a smallish number of core affective attitudes, which might include fear, anger, disgust, happiness, sadness, surprise, and a few more (Izard, 2007; LeDoux, 2012; Panksepp & Watt, 2011). These are thought to be basic in the sense that they are constituted by discrete (or partly discrete) neural networks that are phylogenetically ancient and heavily channeled in development, emerging initially in ontogeny without learning. (That is, they are “innate,” although they can subsequently be modified by learning, of course.) On the basis of this core set, other culture-specific affective attitudes can be constructed.

While my sympathies are definitely with the latter multiple-kind position, it would take us too far afield to argue for this here. For the debate is a tangled one. It comprises a number of different strands, and the protagonists are often at cross-purposes with one another. I will be content if I can make a case that there is just as much reason to regard some of the questioning attitudes to be basic affective kinds as there is to believe this of emotions like fear. To do that I will argue that questioning attitudes are phylogenetically very ancient and unlikely to result from any other set of attitudes through affective learning. And for it to be plausible that this is so, of course, it needs to be the case that questioning attitudes can exist and do their work in the absence of any kind of metacognition.

I shall suggest, then, that prelinguistic attitudes of *questioning* are just as basic as are affective states like fear. (Perhaps even more so, since there is little reason to think that invertebrates have fear-like attitudes, whereas there is good reason to think they have curiosity-like ones, as we will see.) Curiosity, in particular, is an affective state that takes a question as content, and that motivates forms of behavior that issue in the acquisition of new beliefs. But curiosity is not *about* beliefs, in the sense of having representations of belief or knowledge embedded within the content of the attitude. Rather, curiosity is about locations (*what is over there?*), things (*what is that?*), events (*what is happening?*), times (*when will the food arrive?*), and so on. In each case, the content of the questioning attitude is a question (*what is over there? what that is? what is happening? when the food will arrive?*). And in each case curiosity is satisfied when one learns a fact of the appropriate form (*an F is over there, that is a G, Øing is happening, the food will arrive at t*)—or at least, when one learns a fact of the right form that is, in addition, sufficiently relevant to the animal given its needs, values, and current context.

3.2 | Curiosity's role: Consequences

Curiosity is sometimes listed among the basic emotions (at least implicitly, included under the broader umbrella of “interest”; see Izard, 2007). Importantly for our purposes, like other emotions it directly activates and motivates action-sequences without requiring guidance from belief or practical decision-making. All basic kinds of emotion can activate emotion-specific actions. Many issue in distinctive facial expressions and bodily postures unless these action-tendencies are repressed through top-down control (Ekman, 1992; Izard, 1977). (There is a fear-face, an anger-face, a surprise-face, a disgust-face, and so on.) And likewise, many emotions activate specific kinds of seemingly instrumental behavior. Thus fear motivates running away, and will issue in running behavior unless the impulse is repressed; anger motivates attack; disgust motivates actions that avoid contact; and so on. Notice, too, that the behavioral repertoire directly motivated by an emotion can expand well beyond an initial innate basis. Anger at a colleague can motivate a *verbal* attack in the same sort of direct way that it might (in other circumstances) motivate striking the person. One might need to inhibit a cutting remark, just as in other circumstances one might need to inhibit an urge to punch.

What I suggest is that curiosity recruits and motivates actions that have been sculpted by evolution and subsequent learning to issue in new knowledge (moving closer to the target of the question, looking at it, sniffing it, and so on). And just as fear can be apt to issue in safety without representing it (rather, safety is the *normal effect* of running away), so curiosity can be apt to issue in new knowledge without representing it. When one is curious about the contents of the box in the attic and moves to open it, looking inside, this is not (or need not be) because one *believes* that looking inside will satisfy one's curiosity. Rather, the connection to looking-behavior is direct and unmediated by decision-making. On the contrary, it will require decision-making to *resist* the impulse to look, just as self-control is needed to resist an impulse to trade insults when angry.

Curiosity, like other emotions, *can* interact with beliefs in processes of practical reasoning to decide on behavior, of course. (Recall the way in which fear of the bear might interact with one's beliefs about the best way to avoid a bear-attack.) If one is curious about the contents of the box in the attic, it *might* be that what guides one toward satisfying one's curiosity is a belief like, *if I open and look in the box I will find out what it contains*. Note that this is a metacognitive belief. So what mediates between curiosity and its satisfaction can sometimes be a metacognitive belief. But it may be that this is distinctively human. The more basic route is for curiosity to activate a set of investigative behaviors directly (moving closer, opening, looking, and so on).

The normal consequence of curiosity is thus exploratory or investigative behavior directed toward answering the question that forms the content of the attitude (subject to competition from other concurrent motivations, of course, and unless inhibited by top-down executive signals). Curiosity about *what that is* will motivate actions that are apt to issue in information about the referent of *that*, and will cease to be active once one comes to believe something relevant of the form, *that is an F*. Curiosity about *where one is* will motivate a pattern of search behavior that terminates when one either recognizes a landmark of some sort, or becomes sufficiently familiar with the area, or both. And so on.

Investigative actions are those that are designed to put agents into a better position for their sense organs to gain information about the states of affairs that constitute an answer to the question. The actions employed will vary by species, of course (flying, running, swimming), and different forms of sensory access will be prioritized in different species. Thus among rats and dogs the primary mode of sensory exploration is smell, but humans hardly use smell at all. We rely especially on sight and sound (the latter because a primary form of exploratory behavior, for us, is to ask someone a verbal question).

3.3 | Curiosity's role: Causes

If the normal consequence of curiosity is exploratory behavior, the normal *cause* of curiosity is ignorance of some kind, but ignorance that is made salient by the context. (Of course, there is no end to the things one is ignorant of, and one is curious about only a few of them.) Failure to recognize what an object is will, if that object is salient in a creature's environment, prompt the questioning attitude, *what is that?* Similarly, failure to recognize where one is will prompt the attitude, *where am I?* or *where is this?* The need for an X, in combination with ignorance of the location of an X, may prompt the attitude, *where is an X?* And so on.

If the normal cause of curiosity is ignorance of some sort, then does that mean curiosity is metacognitive after all? If failure to recognize something prompts one to inquire what that thing is, does this mean one first has to be *aware* that one fails to recognize it? Does one have to be aware of (and metarepresent) one's own state of ignorance? Although this idea is perennially tempting, plainly it is not mandatory. One can readily conceive of a mechanism that triggers a *what is?* attitude when the

normal processes that issue in categorization of a salient stimulus fail to generate an output. The question can be caused by failure without representing failure. Likewise, one can imagine a mechanism that causes a *where am I?* attitude whenever one fails to identify any local landmarks, or otherwise fails to locate oneself on one's mental map of the area.⁶

In support of such a view, note that almost all animals can detect their own ignorance, and will respond differently when in a state of ignorance. As we will see in more detail in section 3.4, this is even true of invertebrates like bees. When a cunning experimenter captures a foraging honey-bee at a feeder and transports it in a black box to a novel location, the bee will initially fly on its habitual solar bearing to where the hive would normally be found. But when it fails to recognize any of the familiar landmarks on the normal route from feeder to hive it breaks off its straight flight. It then goes into a looping exploratory flight pattern until it locates a landmark from which it can compute a direct trajectory to home (Menzel et al., 2005). So ignorance-detection is something almost all animals can do (presumably without metacognition).

3.4 | Curiosity in animals

Many animals will engage in exploratory behavior when placed in a novel environment, of course. Rats placed into a novel maze will spend a while running up and down the various corridors sniffing in all the nooks and crannies, thereby building up a "place map" in the hippocampus that can be used for navigating thereafter (O'Keefe & Dostrovsky, 1971; Wills, Cacucci, Burgess & O'Keefe, 2010). Indeed, even invertebrates like bees spend their first few days outside the nest engaged in exploratory flights around the hive. They do this before they begin paying any attention to the waggle-dances of other bees, and before they begin foraging for themselves. This enables the bees to learn the layout and main landmarks of the surrounding environment, from which (we now know) they construct a map-like representation (Cheeseman et al., 2014; Menzel et al., 2005). For if captured and displaced to a novel spot thereafter, they are capable of making direct flights back to the hive.

Are bees *curious* about their surroundings when they first emerge into the sunlight from the dark of the nest? They are in a state that is at least *curiosity-like*, it seems. For they must have *some* state that motivates them to engage in exploratory flights. And these flights have the effect of enabling the bees to learn. So the state in question is a rough functional equivalent of curiosity, at any rate. And we can then suppose that the bees are motivated by a questioning attitude, thinking, *what is around the hive?* Notice, however, that the questioning-attitude that underlies exploratory search is unspecific in content, and will thus generally not be satisfied by a particular item of information. Rather, the animal presumably sets some criterion of *sufficient familiarity*, such that once its environment seems sufficiently familiar to it, exploration can finish.

Why should we believe that bees think anything at all, however? There are really two questions here. One is why we should believe that bees have compositionally structured representational states that play *attitude-like* roles in selecting and guiding behavior. The other is whether bees *really* think, where that means having attitude states that satisfy the Generality Constraint (Evans, 1982). This

⁶ It might be granted that curiosity (and questioning attitudes more generally) need not be *explicitly* metacognitive. One does not have to represent one's ignorance *as such* in order to be curious. But it might be said that curiosity is *implicitly* metacognitive, nevertheless (Proust, 2014). This is because it requires agents to monitor their own states of knowledge, detecting and responding appropriately to a state of ignorance. You can describe this as a form of metacognition if you like, but it completely trivializes the notion. If bees count as implicitly-metacognitive agents (see the discussion that follows in the main text), then just about every creature does likewise. So what is gained? Why not just allow that most creatures have affective questioning-mechanisms that are triggered by salient states of ignorance? Nothing of value is added by insisting on describing this as an implicit form of metacognition.

latter question is not relevant for our purposes, as I argued earlier. And the answer to the former question is quite straightforward. For there is now compelling evidence that bees build compositionally structured map-like representations of their environment, which interact with goals of various sorts to select and guide behavior, including desires for nectar, pollen, water, nest sites, and (one might think) information (Gould & Gould, 1988; Wei et al., 2002; Carruthers, 2004; Menzel et al., 2005; Cheeseman et al., 2014).

An alternative explanation of the bees' exploratory flights might be possible, however. It could be claimed that they are a *fixed action-pattern*, triggered by first emergence from the hive. Perception of sunlight (or any form of light, since the inside of the hive is almost wholly dark) might activate a fly-around-in-circles motor plan, in something like the way that habitual actions can be directly triggered by perceptual cues (Wood & R nger, 2016). But it counts against this explanation that bees engage in exploratory flights in a range of other circumstances as well (some of them evolutionarily novel). As we noted earlier, if experimenters arrange for them to get lost, they will fly in widening circles to orient themselves before (generally) heading in a direct line back to the hive once they have got their bearings. Moreover, when bees and other foraging insects leave a recently discovered food source they engage in orientation flights while leaving the vicinity of the food. In effect, they "turn back and look" (flying from side to side while facing the food-source) to familiarize themselves with the details of its position in relation to local landmarks (Wei et al., 2002). Instead of postulating three distinct fixed-action-patterns, we can unify these behaviors by supposing that bees are motivated by questions directed at their environment when they find themselves in ignorance of their surroundings, asking questions like, *what is around here?*

Moving on from invertebrates to birds and mammals, we know experimentally that such animals can be motivated to satisfy their curiosity, and will give up other goods to do so. Indeed, it seems that a questioning motivation can compete directly with hunger in certain circumstances. In a paradigm that has now been used with both monkeys and pigeons, animals will opt to give up between 20 and 30% of their eventual reward in order to learn whether the 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 selecting the informative-option is known to 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 these animals respond positively to the prospect of the informative option independently of their responses to the prospect of the food itself (Blanchard et al., 2015).

I suggest, then, that the animals in these experiments should be understood as motivated by a questioning attitude with the content, *whether food is coming this time*. This is an affective, desire-like, state that motivates them to obtain an answer, even when they know full-well that getting an answer will reduce the amount of food-reward they get, if a reward is received at all. (Note that the structure of the experiment is probabilistic. Rewards are only available on some trials.) So in this context, at least, hunger and a curiosity-like motivation are in competition with one another.

3.5 | Curiosity: Summing up

I have argued, then, that curiosity is normally a first-order (non-metacognitive) affective state that is triggered by salient forms of ignorance (without representing ignorance), whose content is a question, and which directly motivates actions that have been shaped by evolution and/or learning to issue in the appropriate sorts of knowledge (i.e., forms of knowledge that match the content of the question,

hence satisfying the initial state of curiosity). We have also seen that curiosity (or curiosity-like) states are extremely widespread in the animal kingdom, being possessed even by invertebrates like bees. Then since these curiosity-like states can be manifested quite early in a creature's life (after just a few days spent in the dark of the hive, in the case of bees), they are presumably not learned, nor constructed out of other even-more-basic attitudes. Indeed, it is hard even to conceive how one might *learn* to be curious (although one can of course learn to be *more* curious, just as one can learn to be more fearful). Therefore, we can conclude that at least one form of questioning attitude (curiosity) is just as basic to human and animal minds as are basic emotions like fear or anger.

In the sections that follow, I will show how questioning attitudes can be called upon to explain a range of other forms of behavior across the animal kingdom, including instrumental search (especially when foraging), attentional search, and memory search. This will strengthen the case for claiming that questioning attitudes are not only basic and widespread, but are fundamental to our understanding of cognition generally. I propose to remain neutral, however, on the issue of whether these questioning attitudes really constitute a plurality, or whether there is just one such attitude that can be manifested in a variety of different ways. Although the term "curiosity" is normally reserved for forms of questioning that are intrinsically motivated rather than instrumental, for example (as we saw in section 1), it may be that this is a mistake if our goal is to pick out the relevant natural-psychological kind. Settling this question would require us to tackle subtle issues relating to kind-individuation and the sorts of functional differences that constitute distinct psychological kinds. I, therefore, propose to set it aside for present purposes.

4 | EXTENDING THE SCOPE (1): FORAGING AND SEEKING

I have suggested that an inference to the simplest and most unifying explanation supports a view of curiosity as non-metacognitive in nature. Indeed, I have suggested that curiosity is really a kind of world-directed questioning attitude, one that is widespread among animals. I will now suggest that there are other forms of the questioning attitude possessed by animals (or alternatively, other behavioral manifestations of the same questioning attitude). As we have just noted, curiosity is generally thought to be an intrinsic (noninstrumental) affective state (in our terms, a state of questioning-for-its-own-sake). But humans and other animals direct questions at the world for instrumental purposes also. We not only explore in order to find our way around a novel environment, but we seek out specific goods in the environment, such as food, water, and mates.⁷

While exploration involves learning for its own sake (or for potential later use when navigating and foraging), many animals engage in instrumental search behavior when foraging, where the goal is to obtain food or other goods. Such behavior seems not to be random, nor is it a fixed-action pattern, but rather involves probabilistic sampling of likely locations in the environment, drawing on innate or learned knowledge of its probabilistic structure (Robinson & Holmes, 1982; Tomasello & Call, 1997). Honey bees, for example, will explore brightly colored objects (normally flowers), and preferentially forage in open meadows rather than forests, while avoiding open water (Gould & Gould, 1988; Tautz et al., 2004). It is as if the animal were motivated by probability-informed questions directed at the environment: *do those colored things have nectar?—what lies in that direction?—what is under that log?* (for a foraging bear)—and so on. Search behavior certainly is not

⁷ I do not deny that there may be forms of questioning attitude that are uniquely human, of course. It can sound odd to describe an animal as *wondering* whether something is the case, for example, or *inquiring into* something. Perhaps animals cannot wonder or inquire. Our topic here, however, is the set of questioning attitudes that are basic to human and animal minds, excluding from consideration any that are human-specific.

mindless. It is not a form of habitual action, for example, with motor programs being guided directly by perceptual input.

I suggest, in fact, that knowledge of the probabilistic structure of the environment influences the questions that an animal asks when engaged in foraging-search, rather than interacting directly with its desires. Animals do not engage in practical reasoning about where and what to search next, guided by a combination of perceptual affordances and knowledge of the probabilistic structure of the environment. Rather, the knowledge that fallen logs often have grubs and other edibles beneath them is among the causes of the question, *what is under that log?* Previous experience of food under logs will be one of the things that makes one's ignorance of what is under the log *salient*, prompting the question. And once asked, the question motivates looking-to-see behavior directly, without any need for executive decision-making. Just as knowledge of the probabilistic structure of the environment can be among the input-conditions for fear (e.g., *bears can be dangerous*), so such knowledge can be among the input conditions for a specific questioning attitude.

How else might we explain foraging search? One possibility would be to insist that the only motivation involved is hunger. This cannot be sufficient by itself, of course. A desire on its own cannot explain search-actions, but only when paired with appropriate action-guiding beliefs. In the case of foraging behavior, the beliefs might concern the likelihood of success of the behavior itself. Hence animals might engage in practical reasoning of the form: I want food; if I move around the environment (especially in likely places), I am likely to find food; so I shall move. And then in explaining any particular search-action (such as looking under a log), the practical reasoning might look like this: I want food; there is food under that log; so I shall lift the log.

Many animals forage when they are not actually hungry, however. Rather, they forage most of the time when awake, using the rule, "When you find it, eat it," and they continue to forage even when they have just eaten. Perhaps hunger is evoked by the sight of food when found; but hunger is not a plausible motivating force throughout. In addition, when food is sparsely distributed in the environment, the probability that food will be found at any particular location searched will be quite low. One might wonder, then, whether a combination of a weak or nonexistent desire to eat with a very low-probability belief would be sufficient to motivate the animal to engage in search.

I can think of two possibilities here. One is that the animal has a metacognitive desire to avoid being hungry in the future. The other is that it routinely uses hugely inflated estimates of the likelihood of food being found at any given location searched. Either one (or both combined) might result in a sufficiently powerful practical syllogism to get the animal searching. But neither proposal seems likely as a general solution to the problem of foraging. The metacognitive-desire route requires foresight (and metarepresentational capacities), and in general, one might think that it would benefit an animal to have veridical beliefs about the probabilistic structure of the environment rather than highly inflated ones. A plausible solution, then, is an intrinsically motivating questioning attitude. The animal is motivated to seek answers to probabilistically salient questions like, *what is over there?—what is behind that tree?—what is under that log?*—and so on.

Notice, too, that the flexibility of search behavior displayed by many species of animal (especially generalist feeders like chimpanzees, bears, and raccoons), suggests that they are addressing particular questions at the environment. For what an animal will do to answer its questions when foraging may vary quite a bit with context. It seems that on a given occasion, an animal might be asking, *what is inside that thing?*—since it attempts to open it. Or it might be asking, *what is behind that thing?*—since it moves around to get into a position to see. And the bear turning over a log is presumably seeking an answer to the question, *what is under that thing?* These behaviors are easy to understand once we accept the existence of questioning attitudes, while being much harder to make sense of without.

The fundamental and widespread existence of such questioning attitudes is further supported by findings from comparative affective neuroscience. In his influential work on affective/motivation systems in mammals, Panksepp (1998) identifies a basic motivational state of *seeking*. (He writes this in capitals—SEEKING—to emphasize that the term is a technical one, and is not intended to correspond to any common sense category of emotion or desire.) Working mostly with rats (but also with cats and some other mammals), he shows that there is a specific subcortical affective network, centered especially on the lateral hypothalamus, whose direct stimulation can elicit full-blown search behavior. This will emerge as a form of generalized exploration in the absence of any other source of motivation, but will manifest as foraging in the presence of hunger, social-seeking in the presence of the smell of a female rat, and so on. Panksepp argues that SEEKING is one of a small number of basic affective–emotional states, alongside rage, fear, social anxiety (mother-separation in infants, grief in pair-bonded adults), and a few others. What the seeking-motivation motivates is behavior designed to secure information in the first instance, and secondarily information about the location and availability of other goods. It is thus plausible that Panksepp’s emotion of SEEKING should be identified with the affective, desire-like, attitude of *questioning*.

I suggest, then, that not only are questioning attitudes widespread among animals that manifest curiosity-like behavior, but similar (or the same) kinds of attitude also explain foraging search and other forms of instrumental search. Section 5 will sketch some reasons—albeit speculative—for thinking that questioning attitudes might also guide *internal* (mental) actions, including attentional search and memory search.

5 | EXTENDING THE SCOPE (2): ATTENTION AND MEMORY SEARCH

Panksepp (1998) reports that when humans have received direct electrical stimulation to putative components of the SEEKING network, the most common introspective report is one of intense *interest*—feelings of alertness, excitement, and the sense that something very interesting is happening or about to happen.⁸ (Recall that Izard (1977, 2007) lists *interest* among the basic emotions.) I suggest that *interest*, in the current framework, can be thought of as a form of stimulus-driven or merely-attentional questioning. In cases where one is interested in something happening in full view, the questioning motivation directs attention (rather than overt action) toward it, asking, *what is going on?—what will happen next?*—and so on.

In fact, we can think of the relationship between curiosity and interest like this: curiosity is how a questioning attitude manifests itself in circumstances where overt action is required to get an answer to the question (such as walking closer to look); interest is how the same (or a similar) questioning attitude manifests itself when the target of questioning is unfolding in full view. In the latter case, the motivational component of questioning is used to direct and hold attention on the target, rather than to initiate overt action (beyond the overt components of attention, such as eye movements, of course).

In order for this suggestion to make sense, one needs to accept that attention is a form of action.⁹ (The action will be a physical one when attention is overt, involving eye movements say, but a

⁸ Moreover (and especially striking in the light of the points about memory to be made below), Panksepp (1998) reports that one patient who repeatedly self-stimulated a particular site in the SEEKING network had a persistent (and quite frustrating) sense that he was on the verge of recalling an elusive memory of some sort. One possibility is that the electrical stimulus produced a sort of generalized questioning directed toward episodic memory, but questioning that was too unspecific in content to evoke an answer.

⁹ Note that this is not the same as saying that attention is *for* action, as some have claimed (Wu, 2014). Indeed, such a view founders precisely on the phenomenon of interest-driven attention. When one is interested in something, one attends to it not because any action is in the offing, but merely *because* it is interesting.

mental action when attention is covert.) This is because the motivational role of questioning attitudes in general is to initiate information-gathering *actions*. There is not space here to defend the idea that both overt and covert forms of attention are kinds of action. (See Carruthers, 2015, for extended discussion.) But there is good reason to think that the top-down attentional network interacts with the same mechanisms in dorsolateral prefrontal cortex and anterior cingulate cortex that are involved in other forms of decision-making, at any rate (Shenhav, Botvinick & Cohen, 2013). Moreover, one could think of the role of the bottom-up “saliency” network (Corbetta, Patel & Shulman, 2008) as motivating question-driven shifts in top-down attention in just the same sort of direct way as curiosity can motivate other forms of action. In any case, Kidd and Hayden (2015), too, suggest that attention should be thought of as a form of informational search, and that *interest* should be treated as a form of curiosity. They also review evidence that the same valuational circuits underlie each. Each time attention shifts, then, one might think of this as motivated by a question directed at the environment.

In addition to searching the environment, of course, many animals engage in targeted searches of long-term memory. Consider food-caching birds, for example, which have remarkably detailed memories for the locations of their caches (Bednekoff & Balda, 1997), as well as for the types of food hidden at those locations and the times of the caching events (Clayton, Yu & Dickinson, 2001, 2003). When such a bird is hungry, what does it do? It consults its memory, of course. And if it has eaten enough of one sort of food, it will search its memory for the location of a different sort of food. It is as if the bird were addressing to its own memory system, not a generalized query like, *where is something to eat?* but a specific question like, *where is a mealworm?* And in order to search its memory, a bird does not have to know that it *has* memories, of course, and nor (surely) does it need a metacognitive desire, like the desire *to remember where a mealworm is*.

Notice, however, that common sense psychology seems to force such a locution on us. If asked to say what the bird is doing, we seemingly have to say something like, “It is *trying to remember*.” But this is not an idea we should take seriously. It would entail, for example, that only creatures that have a *concept* of memory are capable of *having* memories, which seems absurd. Indeed, it is arguably phylogenetically incoherent: surely a *concept* of memory could only emerge among creatures that antecedently *had* memories.

The motivation to search memory might be distinct from the motivation to search the physical environment, of course. But notice that both motivations can be prompted in the same circumstances. A hungry bird might *first* search its memory for the location of a cache and *then* begin foraging-search if it fails to recall one. It is more parsimonious to assume that the two motivations are the same, but can issue in distinct forms of activity (whether mental or physical). And notice, too, that a number of researchers have noted the commonalities between environmental search and memory search, and have postulated that each is underlain by mechanisms that are at least partially shared between them (Hills & Dukas, 2012; Hills, Jones & Todd, 2012). One intriguing possibility, then, is that among the shared mechanisms are a set of questioning attitudes (perhaps a singleton set, remember) that direct searches of both kinds.

6 | CONCLUSION

There is a powerful case for thinking that curiosity and other questioning attitudes are basic components of human and animal minds. In order to make this case, I have followed Whitcomb (2010) and Friedman (2013) in arguing that the contents of such attitudes are normally first-order questions. These attitudes can directly motivate various forms of search behavior, while being prompted by

one's own salient states of ignorance (without representing that ignorance). I have argued that such attitudes are extremely widespread in the animal kingdom, being possessed even by invertebrates. Moreover, not only do they guide investigative and exploratory behavior, but also forms of foraging and instrumental search, as well as perhaps attentional search and memory search. And in humans, of course, they also motivate verbal questioning.

Finally, then, return to the case of Mary and Jim, and consider what might lead her to ask, "Where are the car keys?" Mary is about to drive the kids to school and looks in the bowl by the door where the keys are normally kept, finding it empty. This prompts her to search her memory for their current location. On the account sketched above, this involves entering an affective state whose content is the question, *where the keys are*. This search of memory comes up empty, leading her to formulate her questioning attitude into a speech act directed toward Jim. It may be that she does this because she *believes he knows* where the keys are. Or it may be that her targeting of him is habitual, or by default (since he is the only adult present). But the attitude that *motivates* her question is a first-order one, and may be the same as the questioning attitude that motivated her search of memory. So: why did Mary say what she did? Not (or not necessarily) because *she wanted to know*; but rather: *to express her questioning attitude*.

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