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## Metacognition is prior

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**Abstract:** We agree with Carruthers that evidence for metacognition in species lacking mindreading provides dramatic evidence in favor of the *metacognition-is-prior* account and against the *mindreading-is-prior* account. We discuss this existing evidence and explain why an evolutionary perspective favors the former account and poses serious problems for the latter account.

Carruthers acknowledges that evidence for metacognition in species lacking mindreading would provide dramatic evidence for the *metacognition-is-prior* view and against the *mindreading-is-prior* view, and he asserts that the existing evidence can be explained using a first-order system of belief and desire *strengths* (target article, sect. 5.2; see also Carruthers 2008b). We evaluated similar response strategies using formal modeling (Smith et al. 2008) and found indeed that some animal metacognition findings could be explained using first-order strategies. Yet Carruthers' use here of the field's earliest paradigms and oldest data to make his argument is unfortunately selective. More recent paradigms often do not support his first-order argument and description.

Smith et al. (2006) dissociated monkeys' uncertainty responding from any reinforcement and stimulus cues that could have organized Carruthers' gradients of first-order beliefs and response tendencies. It was clear in that study that monkeys' uncertainty-response strategies were adjudicated cognitively and decisionally, not using first-order cues. They followed the animal's subjective decisional construal of the task. Couchman et al. (submitted) extended this dissociation to situations of broader task transfer in which animals had to establish functional regions of judged difficulty and uncertainty even when forced to self-organize their task performance.

Recent cross-species research on uncertainty monitoring also speaks against first-order interpretations of uncertainty-monitoring performances. Beran et al. (in press) gave capuchin monkeys a Sparse-Uncertainty-Dense task that was matched to a Sparse-Middle-Dense task. Capuchins used the middle (first-order) response easily and naturally. They almost never used the uncertainty response, despite having the reinforcement history needed to do so. Likewise, elegant research by Shettleworth and her colleagues (Inman & Shettleworth 1999) has shown that pigeons also do not express an uncertainty-responding capability, even when there are strong first-order reasons for them to do so. It is an important implication from these cross-species results that the organizing psychology underlying uncertainty responding is not first-order, because adept first-order animals such as capuchins and pigeons cannot find and use that psychology.

In other writings, Carruthers (2008b) also acknowledges that first-order beliefs and desires will not explain the wide-ranging empirical findings of uncertainty monitoring and information seeking by animals. He devises a secondary mental construct to explain why an animal uses the uncertainty response in too-close-to-call situations. He suggests that some species have a gate-keeping "mechanism . . . which when confronted with conflicting plans that are too close to one another in strength will refrain from acting on the one that happens to be strongest at that moment, and will initiate alternative information-gathering behavior instead" (p. 66 ).

The gatekeeper mechanism operates on first-order cognition's outputs to assess their ability to produce a correct response. It meets the definition of a second-order controlled cognitive process. It produces a qualitative change in behavior and cognitive strategy (information seeking, uncertainty responses, etc.). It typifies the metacognitive utility that all theorists have envisioned. Even in Carruthers' own description of animals' cognitive self-regulation, it seems, metacognition is prior.

Another analytic problem in the target article concerns the different standard of evidence that is applied to studies of animal metacognition and studies of animal mindreading. It seems highly unlikely, and it goes completely undefended in the target article (sect. 5, para. 2) that all the metacognition paradigms fall prey to behaviorist explanations, but that all the mindreading paradigms are veridical. They clearly are not (Heyes 1998).

Carruthers makes a valid suggestion that, if metacognition is prior, one should be able to explore the evolutionary pressures that produced a free-standing metacognitive utility. Fortunately, James (1890/1952), Dewey (1934/1980), Tolman (1938), and many others have provided this evolutionary narrative (see also Smith et al. 2003). Animals often encounter doubtful and uncertain situations in which their habitual stimulus-response associations do not clearly indicate a safe and adaptive response. They would benefit enormously in those situations from having an online cognitive utility that will let them assemble the relevant facts and recollections and choose an adaptive course of action. Metacognition provides exactly this utility.

It is also a remarkable phylogenetic fact that there appear to be no species that show mindreading ability but fail to show metacognitive ability. This could be used to support more than one of the possibilities discussed in the target article. However, it clearly supports least of all the *mindreading-is-prior* account.

Finally, we believe that an evolutionary perspective on this issue raises a serious problem for the *mindreading-is-prior* account. The author's account may, in principle, explain the development of metacognition ontogenetically, especially if one assumes a parent is constantly informing you of the intentions of others. Your mother may tell you, "Johnny wants a cookie" while you see Johnny reaching for the cookie jar, and the next time you find yourself reaching for the cookie jar, you may well apply "wants a cookie" to yourself. This works only because humans communicate their knowledge of concepts and intentions from one generation to the next.

The first mindreading animal would have no basis for which to make an attribution of a mental state. How would it be possible or beneficial to attribute "wants a cookie" to Johnny, if the attributer has no known experience with "wanting," no understanding of "what it is like to want" and no idea that it has ever "wanted"? The *mindreading-is-prior* account must explain how, from nothing but observed physical behavior, and with no reason to ever attribute anything but cause-and-effect mechanical processes, animals came to attribute subjective belief and desire states to others. This would be equivalent to knowing there is something "that it is like" to be a bat (Nagel 1974) prior to knowing that there is anything "that it is like" to be you!

Indeed, exactly the opposite seems to be true. We have great access to and a rich understanding of our own mental states and only a very limited understanding of the mental states of others. We first knew what it was like to know, and then assumed that others might be having an analogous experience. This process of extending mental concepts outward is surely a more plausible and tractable evolutionary narrative. Within that narrative, metacognition is prior.

## Introspection, confabulation, and dual-process theory

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**Abstract:** This excellent target article helps to resolve a problem for dual-process theories of higher cognition. Theorists posit two systems, one of