

COMMENT

AQ: 1 **Metacognition Does Not Imply Self-Reflection, but It Does Imply Function**AQ: au
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Is self-reflection necessary for metacognition to occur? Like Kornell (this volume), we struggle with this question. If humans metacognition is not always self-reflective, why should we expect animals to be so? We suggest that one way to pursue metacognition in animals is to examine its ecological and evolutionary relevance.

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Kornell (this volume) defines metacognition in terms of self-reflective behaviors, and wonders whether any of the many animal studies on metacognition reach this criterion. We applaud his insight and his integration of theory in human metacognition with research on animal metacognition. We also agree with his emphasis that it is time to look at the mechanisms that underlie animal metacognition. Indeed, his review comes at an opportune time, as Kornell introduces concerns and issues that are not only relevant to the study of metacognition across species, but are applicable to comparative psychology in a more general sense. His argument is a straightforward one—humans are not always self-reflective in their metacognitive judgments and often use inferential mechanisms in making metacognitive judgments, so we should not assume that our nonhuman counterparts are self-reflecting concerning their own knowledge states, and we should examine whether inferential process could be mediating their judgments.

Our commentary acknowledges a problem that emerges frequently in the comparative psychology of cognition—as humans, it is easy to view our own behavior and cognitive processes as the most sophisticated among animals. After all, we discuss Shakespeare, take trigonometry tests, and fix carburetors, all abilities that are well beyond our nonhuman kin. However, the bias in comparative psychology as seeing humans as the gold standard is problematic because it can lead us to discount situations in which humans behave in a less than optimal manner and situations in which animals may outperform us (Matsuzawa, 2013). When it comes to thinking about metacognitive judgments, we tend to think of situations in which humans behave at their best, making accu-

rate judgments of their own ability and skill level. What we do not tend to think of are the many situations in which humans make inaccurate judgments, such as those described by Kornell, let alone those decisions which may result in negative consequences to themselves or others (e.g., “I still have time to go through that red light”). This bias may also explain why we discount situations in which humans make metacognitive judgments without much self-reflection. Moreover, we agree with Kornell that it would be most interesting to explore the inferential mechanisms by which rhesus macaques or other species guide their decisions about their cognitive processes.

However, Kornell introduces consciousness as an important part of what it means to be metacognitive, but in comparative research, the concept of consciousness must always be grounded in an operational definition (see Mulcahy & Call, 2006). Because nonhumans do not have language, we will always be at the mercy of Nagel’s bats—no matter how much we know about their behavior, we do not know whether nonhumans experience the same feelings of consciousness as we do because they cannot describe them (Nagel, 1974). For example, even if we show that the same area of a language-trained chimpanzee’s brain is active when it is hesitating between pointing to one symbol or another as a human’s is when she is experiencing a tip-of-the-tongue state, we cannot be sure that they are experiencing the same internal conscious state. This does not mean pursuing animal consciousness is always a dead end. Rather, as Kornell emphasizes, we will learn more about metacognition if we focus on the mechanism that allows animals to make judgments and to guide their behavior.

We suggest another tack in the study of animal metacognition, and that is to pursue more ecologically valid approaches. If a species possesses metacognition, it may have evolved for a particular adaptive function in that species. What kinds of metacognitive tasks are appropriate given the ecological niche and neurological capacities of a particular animal? This tack has been successful in studies of memory in nonhuman species, some of which have used tasks that conform to the feeding ecology of the particular species being studied (e.g., food-caching birds in Clayton & Dickinson, 2001; rats in Eacott & Norman, 2004; chimpan-

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zees in Menzel, 2005). How does this apply to metacognition? According to Nelson and Narens (1990), metacognition evolved for feedback and control at many levels, and that any level of this feedback loop may be “meta” to another level. For example, a cat’s feedback from his motor cortex causes him to hesitate before making a long jump. We can say that the cat is “uncertain” about an important behavior. If this feedback loop stops the cat from making a risky jump, then the control system works (he has not broken his leg), regardless of whether the cat can “reflect” on this decision. The inhibition feedback that prevents the risky jump is certainly “meta” to the jump itself and therefore would qualify as metacognition according to some definitions (e.g., Nelson & Narens, 1990; Reder, 1996).

The fact that an implicit metacognitive judgment may be adequate for survival of other species leads to the question of whether it is ultimately necessary for humans’ metacognition to be self-reflective. The self-reflective experience we have when evaluating our own knowledge could be influenced by our ability to speak and the emphasis we have put on reflecting and sharing our own experiences. Indeed, it may also be that being self-reflective derives partially from our education and culture as humans. Consider the amount of time educated Westerners spend reflecting on past experiences, thinking about what we know, comparing our abilities to other individuals, and so forth. Does this verbal self-reflection then influence other nonverbal metacognition? We do not know. But the fossil record presents an interesting paradox. By and large, humans have been anatomically consistent for the past 100,000 years, but most self-reflective and symbolic behaviors (cave painting, jewelry, and sculptures) appear in the fossil record relatively recently, between 10,000 and 35,000 years ago (Nowell, 2006). What happened then was not physiological but likely something cultural—perhaps a cultural emphasis on self-reflection led to this revolution.

Even though it may be difficult, if not impossible, to resolve empirically whether animals have conscious experience, the question of whether other species are consciously aware is a captivating question. Kornell discusses the famous mirror-mark-test that has been used to examine self-awareness in other species. We argue that a significant drawback to this procedure is that it equates physical recognition with a sense of self-awareness. Although an animal may fail to recognize itself in a mirror, it does not mean that the animal lacks knowledge of itself. Despite our emphasis on the mirror-mark-test in comparative psychology, children from some non-Western, rural areas do not spontaneously engage in exploratory behaviors in response to the mirror mark test (Broesch et al., 2011) indicating that the mirror test is not an appropriate test of self-awareness, as these individuals are obviously self-aware, but are not exploring themselves with the mirror. Certainly, we should continue to look for ways to assess self-awareness in other species through behavioral tests, but this particular test does not seem well suited to the task.

In conclusion, metacognition does not need to be thought of as a self-reflective process, although humans may experience such self-reflection in some specific circumstances that encourage such direct evaluation of one’s knowledge. As Kornell notes, there is no reason to assume that other animals are being self-reflective in their judgments, just as humans are often not reflective in theirs.

That being said, questions related to self-reflection in animals (such as self-awareness) will continue to be an interesting question, and we should not abandon the quest to understand self-awareness in other species just because it is a challenging task—though we always need clear operational definitions before we wade into this territory. However, when doing this we should ask whether we are creating an unfair comparison by overstating our own ability as a species. Although we pride ourselves on being aware of ourselves and others, in many cases we fall short—often not realizing how we are being perceived by others or how our behavior affects others around us. Kornell emphasizes the importance of examining situations in which we behave in less-than-optimal ways; not only does it provide a more accurate portrayal of our own abilities, but it may help us in other ways. We agree and advance that metacognition needs to have a functional purpose to be of use to nonhumans. Thus, we must also seek the adaptive nature of metacognition on a species-by-species basis. As Kornell acknowledged, it is often useful to examine whether another species falls prey to the same biases and errors that we make as humans and we cannot do this if we are not aware of these situations.

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