Dispatch

Animal consciousness: Should a new behavioral correlate in monkeys persuade agnostics?

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After human subjects learn to look away from visible cues, their attention can still be captured by cues so brief that they cause no conscious perception. A new study has found evidence that this behavior also occurs in monkeys. Is this further evidence for consciousness in a nonhuman animal?

When my dog yelps, I become concerned. I am not only concerned that she might damage her body, I am also concerned that she might have had a bad experience. Most of us believe, or at least think it is important to admit the possibility, that some nonhuman animals have conscious experiences. We think the conscious state of suffering is more important than mere physical damage and we act to protect our pets from it.

Admitting the possibility that other animals are sometimes conscious is ethically important, but it provides little guidance about how and why consciousness occurs. If we are uncertain about the extent to which other animals are conscious, but believe that inflicting suffering on conscious entities is a moral hazard, it is appropriate to apply liberal standards of evidence and to act *as if* other animals are conscious. If a dog yelps something like a human

might cry out in pain, the ethically conservative choice is to act to reduce the yelping. But when we seek to understand consciousness scientifically, more stringent standards should apply.

Scientific and moral reasoning about consciousness often come in unnecessary conflict. Scientists and philosophers who question the quality or interpretation of evidence 'for' consciousness can be accused of denying the existence of consciousness. Yet all of those same scientists and philosophers who question the evidence of nonhuman consciousness would nonetheless find operating on unanesthetized animals unacceptable. One can act to avoid the moral hazard at the same time they seek better evidence about how and why consciousness occurs.

Questions about how and why consciousness comes to be, and in which entities, are among the most intriguing and challenging in science and philosophy. If consciousness is an epiphenomenon, having no causal role in behavior, we may never be able to detect it in any entity other than our personal selves. How can we detect it if it has no consequences in behavior? But if consciousness has a causal role in a class of behaviors — if there are behaviors that cannot occur without consciousness — then we can infer consciousness whenever we observe behaviors upon which it depends causally. The great difficulty is in describing a causal role for consciousness when we are so able to imagine unconscious 'zombie' machines that could show almost any pattern of behavior associated with consciousness in humans[1].

Into this challenging field of the science of consciousness step Ben-Haim, *et al.*[2] with their recent paper '*Disentangling perceptual awareness from nonconscious processing in rhesus monkeys (Macaca mulatta)*'. Using an elegant and simple visual counter-cuing task (Figure 1) these authors found a striking similarity in the behavior of humans and monkeys. The task requires that subjects shift their gaze away from a visual cue and fixate a rewarded target. When

the cue is shown for 250 ms, both species readily move their eyes away from the cue. In contrast, when the cue is presented so briefly that humans report not seeing it, subjects of both species fail to learn to look away and behavior changes in the opposite direction. The cue captures attention, slightly increasing the time taken for subjects to look to the rewarded location opposite the cue. Ben-Haim, *et al.*[2] argue that monkeys have both conscious and unconscious modes of visual perception based on this similarity in eye movements between humans and monkeys.

The form of the argument developed by Ben-Haim, *et al.*[2] is a familiar gloss for inferring consciousness from behavior[3,4]. We observe some behavior about which humans report conscious experience. Upon observing that same behavior in another species, some investigators — let's call them *inclusivists* — declare the discovery of consciousness in another species[5,6]. The behavioral basis of this inclusive inference has ranged from animals moving away from potentially harmful stimuli, to some kinds of learning, to demonstrations of flexibility or complexity in behavior.

In contrast to inclusivists, *consciousness agnostics* are more cautious about invoking consciousness simply on the basis of an animal behaving in some way similar to conscious humans. Agnostics might ask, for example, why a cockroach would have to be consciously afraid in order to move away from an approaching shoe. Is it not a mechanistically sufficient account to describe how detection of the direction from which the shoe approaches activates neural ganglia that cause locomotion in the opposite direction? Agnostics remind us that complex and flexible behavior sometimes occurs in humans without consciousness[7], and that conscious rationalization may follow, rather than cause, behavior.

Despite the claim of Ben-Haim, *et al.*[2] that they have departed "from all previous attempts to study consciousness", their experiments closely parallel many others, some of which

they cite, and their reasoning follows the familiar *inclusionist* pattern. For example, it has long been known that damage to the temporal lobes causes both monkeys and humans to lose kinds of memory that in humans are experienced consciously. In contrast, damage to the basal ganglia impairs kinds of memory that are often not conscious[8]. Similar double dissociations in memory have been found by others in both monkeys, and other animals[9-11]. Inclusionists infer from these findings that monkeys have both conscious and unconscious memories. Agnostics recognize the shared behavior and neurobiology, but seek independent evidence that monkeys are aware of some, but not other, memories[12].

Strong evidence of parallels in visual perception between humans and other animals that suggest the distinction between conscious and unconscious vision already exist. Studies of 'blindsight' are the most similar precedents for the work by Ben-Haim, *et al.*[2]. Humans with damage to primary visual cortex report being blind in the part of the visual field affected by the damage. These people do not report seeing anything in this area, but they nonetheless guess accurately where an image appears or in which direction it is moving[13]. Monkeys with primary visual cortex damage show remarkably similar behavior, failing to report the occurrence of a stimulus, but nonetheless reporting where it occurred[14]. Intact monkeys and humans show a similar distinction between detection and localization with appropriate manipulations of visual displays[15,16].

The fact that the claim of novelty by Ben-Haim, *et al.*[2] are somewhat overstated does not mean that this work makes no contribution to the study of cognition and even consciousness. The experiments are clever, well-conducted, and thoroughly analysed. They contribute yet another parallel between the behavior of conscious humans and the behavior of other animals.

Inclusivists see these parallels as a mountain of evidence in favor of the existence of consciousness in other animals.

Agnostics hold that more of the same correlational evidence, however elegantly collected and analysed, will not revolutionize our understanding of consciousness. We need a theory that stipulates what consciousness does for cognition [1] (see Dennett[17] for a different position). In the context of the Ben-Haim, *et al.*[2] study, this theory of consciousness would describe why it is that the visual system responds to both very brief and much longer duration visual cues, but can only learn to saccade away from a longer duration cue. Ben-Haim, *et al.*[2] could explicitly argue, for example, that automatic bottom-up perceptual process can only be counter-acted, or inhibited, by conscious cognition. But such an explanation must provide some indication of why people can learn grammar and complex motor skills unconsciously[7,18], yet we need consciousness simply to look away from a star! Only when we describe the causal role of consciousness can we say whether a given behavior does or does not force the inference of consciousness in other animals. We will know it is present because the animal behaves in a way that requires it.

On a more technical point, Ben-Haim, *et al.*[2] argue that one of the strengths of their findings is that they have established a double-dissociation of perception in monkeys. Double dissociations are important because they are often considered the strongest evidence of independent cognitive systems. Establishing a double dissociation requires two manipulations that have complementary effects on two behavioral outcomes[19]. The findings Ben-Haim, *et al.*[2] report do not meet these criteria: the authors manipulate one variable, cue duration, and they have just a single task — the counter-cueing test.

The new findings from Ben-Haim *et al.*[2] establish another strong parallel between cognition in humans and monkeys, and provide a tantalizing hint of a distinction between

conscious and unconscious vision in monkeys. Unfortunately this work does not take us much further down the road from cognition to consciousness[5]. We still don't know what consciousness does to facilitate behavior, nor how to reliably detect it. Let's hope the Ben-Haim, *et al.*[2] findings will nevertheless inspire some novel theorizing.

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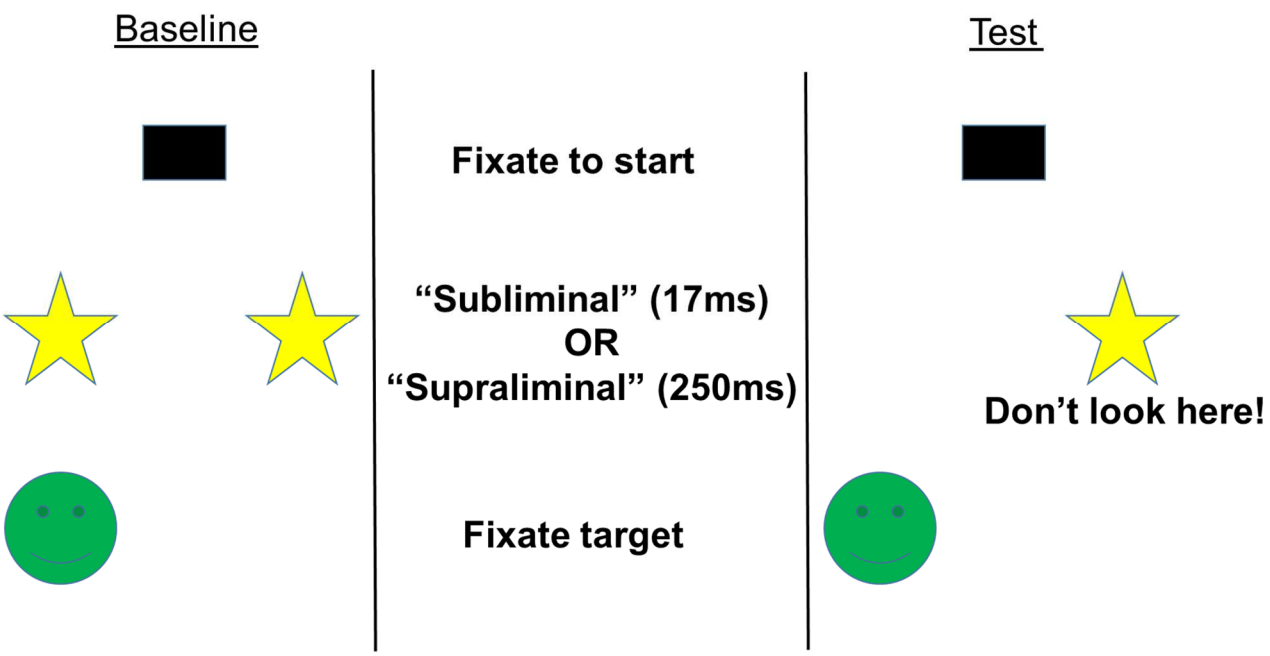
Figure 1. Counter-cuing task performed by humans and monkeys.

Each row in the figure depicts what subjects saw on a computer screen at a given point in time. Trials began with a central cue that required subjects to fixate a neutral central position. The stars appeared either so briefly that humans do not report seeing them (17 or 33ms) or for 250ms, which most people report seeing. In the Baseline condition, the two stars were uninformative. In the Test condition the rewarded location was always opposite the location in which the single star appeared. Both humans and monkeys learned to quickly look away from a star that was presented for 250ms, but not a star that was presented briefly. Critically, both species were slower to look at the rewarded location on “subliminal” trials than on Baseline trials, showing that even though the very brief presentations did not support learning, they did engage visual processing. The display viewed by subjects did not include “Don’t look here!”


Baseline
Test
Fixate to start
“Subliminal” (17ms)
OR
“Supraliminal” (250ms)
Don’t look here!
Fixate target