If we could talk to the animals

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Abstract: The thesis of discontinuity between humans and nonhumans requires evidence from formal reasoning tasks that rules out solutions based on associative strategies. However, insightful problem solving can be often credited through talking to humans, but not to nonhumans. We note the paradox of assuming that reasoning is orthogonal to language and enculturation while employing the criterion of using language to compare what humans and nonhumans know.

According to Penn et al., there is substantial evidence for discontinuity between human and nonhuman minds. They claim that "a distinctively human, modular system for approximating a LoT [language of thought] – that is, one that subserves higher-order, role-governed relational representations in a systematic and domain-general fashion – has evolved on top of and

reinterprets the output of the *proto-symbolic* systems we still share with other animals" (sect. 11, para. 9, emphasis in original). A good part of their article aims to show that research pointing to nonhuman symbolic functioning in areas such as the ability to make transitive inferences or to demonstrate theory of mind reasoning can be best interpreted in terms of associative rule learning rather than evidence for insightful understanding similar to that of humans. The problem, though, is that their only apparent criterion by which nonhumans could be credited with higher cognition is through language. This criterion creates a paradoxical circularity in their argument, one that is not restricted to comparative psychology but has been long noted to be present in research on human cognitive development.

In this sense, the circularity of Penn et al.'s position resembles that in Piaget's theory (see Lourenço & Machado 1996; Siegal 1999; 2008). In Piaget's clinical method, thinking is assessed through language even though thinking is held to be genetically prior to language. According to this account, children who cannot justify their answers on measures such as those involving transitive inferences cannot be credited with having the necessary knowledge that the premises, if A > B and B > C, must lead to the conclusion that A > C, and that this conclusion is a logical one which is independent of empirical verification. This standard of evidence means that children need to demonstrate proficiency in verbal ability to be counted as having the ability to respond correctly. So support for Piaget's theory has often been subject to the criticism that it is riddled with false negative results, of demonstrating that children lack logic and symbolic functioning when they often do show it in their everyday behavior. Similarly, adults in developing cultures may also appear to demonstrate a lack of competence on some formal tests that does not correspond to their highly adaptive intelligence.

Penn et al. describe evidence based on experiments and observations of nonhumans that would seem to be consistent with Darwin's continuity thesis. For example, crows, pigeons, and fish all show behavior that would seem to indicate a grasp of transitive inferences. However, Penn et al. prefer to dismiss this evidence in terms of training, reinforcement history, and low-level associational learning mechanisms that are independent of an understanding of logical relations. But on this basis, we could not credit the ability to perform transitive inferences to many humans. In common with crows, pigeons, and fish, children at an early age very clearly do show behavior that would seem to indicate a grasp of transitive inferences. However, they do not have the means to justify this behavior. Instead, they may order objects "logically" based on spatial imagery strategies and without the explicit use of logic (Pears & Bryant 1990). Although Penn et al. and Piagetians may not be ready to credit children and many adults with the abilities to solve transitive inference tasks unless they can verbalize a rationale to the effect of "because A is greater (or taller or longer) than B and B is greater than C, then A *must* be greater than C," it is seems entirely acceptable that the use of spatial imagery is a valid way to solve such tasks. It amounts to an alternative adaptive solution that serves the organism very well in a range of domains.

Similarly, birds such as scrub-jays and certain nonhuman primates show behavior that would seem to indicate a theory of mind reasoning in the form of understanding how conspecifics can be misled after having been imbued with false beliefs about the location of food. However, Penn et al. dismiss this evidence as falling short of their criterion for genuine theory of mind reasoning: requiring a demonstration that the animal can attribute mental state content to other agents and use this content in a "theory-like fashion" to predict behavior based on agents' mental states. Without providing a way for animals without language to demonstrate the possession of this theory, Penn et al. again prefer to interpret evidence for theory of mind (ToM) in nonhumans as evidence for a pattern of behavior created through training and reinforcement instead of based on insightful reasoning. This interpretation is close to that provided by Perner and Ruffman (2005) in dismissing the depth of nonverbal infants' ToM understanding as shown through patterns of visual attention devoted to the unexpected behavior shown by an agent with a false belief (Onishi & Baillargeon 2005).

Despite all this, it is abundantly clear that human infants have a substantial understanding of reality and the phenomenal world of reality as through the rational imitation of an agents' behavior (Gergely et al. 2002) – an ability shared to some substantial extent by chimpanzees (Buttelmann et al. 2007). Penn et al.'s proposal that humans are likely to undergo some sort of radical restructuring in their thinking and reasoning that does not occur in nonhumans needs to be reassessed. There are many other possibilities. For example, both humans and nonhumans could instead undergo some sort of "executive functioning" (EF) development. At a certain point, they now attend to the correct response – but humans, unlike nonhumans, can give verbal justifications to an experimenter for why this response is correct. It may of course be that humans undergo a more sophisticated EF development than do nonhumans. They also have access to language that alerts them to the pragmatic nature of the inferential reasoning that is required for task success. Ultimately, advances in brain scanning and eye-tracking techniques, as well as in the use of miniaturized video cameras for studying undisturbed behavior in natural surroundings (Rutz et al. 2007), may substantiate further both what young children and nonhumans know. In the meantime, Penn et al.'s verdict, "nonhuman animals didn't (and still don't) get it" (sect. 11.2, para. 4) is clearly premature.

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