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BABOONS CAN THINK ABSTRACTLY, IN THE FIRST STUDY TO SHOW THAT A NON-HUMAN, NON-APE ANIMAL SHARES A CENTRAL ASPECT OF HUMAN INTELLIGENCE

Two baboons successfully used analogous thinking to match symbol arrays that were the "same but different"

WASHINGTON - More non-human animals may be capable of abstract thought than previously known, with profound implications for the evolution of human intelligence and the stuff that separates homo sapiens from other animals. A trans-Atlantic team of psychologists has found evidence of abstract thought in baboons, significant because baboons are "old world monkeys," part of a different primate "super family" that -- some 30 million years ago -- split from the family that gave rise to apes and then humans. Chimpanzees, in the ape family, already have demonstrated abstract thought. Now, two trained baboons successfully determined that two differently detailed displays were fundamentally the same in their overall design. Figuring this out required analogical (*this* is to *this* as *that* is to *that*) reasoning, which many theorists view as the foundation of human reasoning and intelligence.

The study is reported in the October issue of the *Journal of Experimental Psychology: Animal Behavior Processes,* published by the American Psychological Association (APA).

In a series of five experiments, Joël Fagot, Ph.D., of the Center for Research in Cognitive Neuroscience in Marseille, France; Edward A. Wasserman, Ph.D., of both the Center for Research in Cognitive Neuroscience and the University of Iowa; and Michael E. Young, Ph.D., of the University of Iowa trained two adult baboons, one male and one female, to use a personal computer and joystick to look at and select grids that had varying collections of little pictures.

In the foundation experiment, researchers familiarized the baboons with a screen display of 16 different little pictures (four rows of four across), such as the sun, an arrow, a light bulb, a train, and a house, OR with a display of the same little picture repeated 16 times (for example, all telephones). Researchers then presented the baboons with a series of choices of two new displays. In each choice, one display was a 4x4 grid with 16 different icons (for example, a clock, a brain, a hand, a triangle...); the other was the 4x4 grid with 16 identical icons (for example, all flowers). Researchers rewarded the baboons for selecting, from two choices, the array that showed the same relationships among pictures as the sample.

Researchers wanted to see whether the baboons could learn this principle. Could the baboons perceive "sameness" even when its cues were subtle and abstract?

The baboons did indeed learn to match the "different icons" test grids to sample grids at a rate greater than chance. They also learned to match "same icons" test grids to "same icons" sample grids at a rate greater than chance. It took thousands of trials for them to learn the "relation between relations" required by the task, but they did it. Say the authors, "Although discriminating the relation between relations may not be an intellectual forte of baboons, it is nevertheless within their ken."

In the primary and subsequent four experiments, Fagot et al. also tested two humans to assess baboon versus human performance. In experiments 2-5, the researchers shrunk the numbers of items in the grid to see whether a lessening in variability (the "different" grids became closer to the "same" grids, a lessening in entropy) affected the baboons' choices. Both baboons and humans learned the basic task (although the

humans learned far faster), and transferred it to novel sample displays, but humans were far more accurate at matching grids when the number of icons was reduced.

The baboons and humans seemed to have different cutoff points for discerning same vs. different, with humans being more sensitive to entropy. The authors speculate that language may play a role, because our verbal expression for "same" makes the idea of "same" more restrictive -- in other words, things really have to be identical to qualify. To baboons, the authors suggest, the concept of "same" might be fuzzier and more inclusive.

The baboons' ability to abstract opens the door to other species' cognitive potential. Fagot et al. state that additional research of non-human animals is necessary before theorists attempt to limit the capability for abstraction only to certain species. They state, "Analogical thinking and its possible precursors may very well be found in non-human animals -- if only we assiduously look for them."

Article: "Discriminating the Relation Between Relations: The Role of Entropy in Abstract Conceptualization by Baboons (Papio papio) and Humans (Homo sapiens)," Joël Fagot, Center for Research in Cognitive Neurosciences of the National Center for Scientific Research in Marseille, France; Edward A. Wasserman, Center for Research in Cognitive Neurosciences (as above) and the University of Iowa, Iowa City; and Michael E. Young, University of Iowa, Iowa City; *Journal of Experimental Psychology - Animal Behavior Processes,* Vol 27. No.4.

Joël Fagot can be reached by phone at (33) 04-91-16-43-06. Edward A. Wasserman can be reached by phone at 319-335-2445. For more information about this author and the study, go to http://www.psychology.uiowa.edu/news/pr_wasserman.html.

Full text of the article is available from the APA Public Affairs Office and at http://www.apa.org/journals/releases/xan274316.pdf.

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