Bonobo demonstrates the cognitive ability to imagine “make believe” objects

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In a major contribution to our understanding of the evolution of human cognition, a bonobo (a.k.a. pygmy chimpanzee) has demonstrated the ability to create mental images of pretend scenarios. This suggests that the common ancestor of humans, chimpanzees and bonobos (a separate species but closely related to chimpanzees), possessed a precursor to abstract symbolic thought. That common ancestor is thought to have lived 6 to 9 million years ago.

The new research, “Evidence for representation of pretend objects by Kanzi, a language-trained bonobo,” was published in the journal *Science*.

The male bonobo, known as Kanzi, who had long resided at a research center in Iowa, was already famous for having shown a remarkable ability to learn and communicate with human researchers using sign language and a specialized keyboard. In a recent series of three experiments, Kanzi was able to distinguish between pretend and real objects, demonstrating that he could hold an abstract representation of external phenomena in his mind even when the original configuration had changed.

The three experiments were:

1) The first was a make-believe tea party in which the researcher pretended to pour a liquid from an empty pitcher into two empty glasses and then “pour” one of the empty glasses back into the pitcher, replacing the “empty” glass next to the “full” one. Kanzi was then prompted to point to the glass which still contained the pretend liquid. He picked the correct one more than two thirds of the time, much more frequently than by chance.

2) As a control, the researchers conducted another experiment in which there were two glasses, one filled with juice and the other empty. The researcher then pretended to fill each glass from an empty pitcher. Kanzi picked the glass containing the real juice more than three quarters of the time, demonstrating an understanding of the difference between real and imaginary.

3) As an additional control, using two transparent cups, the researcher placed a grape into one of the cups and replicated the motions pretending to place a grape into the second cup. Kanzi selected the cup with the grape more than two thirds of the time.

The authors explain the significance of the experiment’s result:

> In pretense contexts, individuals must form a secondary representation, which is an imagined or simulated state (“there is pretend tea in one cup”) that is decoupled from their representation of reality (“both cups are empty”), so as to avoid confusing the two. The situation therefore becomes linked to two simultaneous representations: a primary representation of the state of the world as it is, and a secondary representation of an alternative state. Secondary representations are therefore thought to require a cognitive decoupling, or quarantining, of the imagined mental model from that of the opposing reality that the mind has directly perceived.

This, the authors contend, demonstrates a fundamental basis of human cognition.

Although the cognitive mechanisms enabling secondary representations remain poorly understood, they serve as a foundational prerequisite not only for pretense but also for several other abilities proposed to be uniquely human, such as reasoning about mutually exclusive possibilities, imagining possible futures, making causal inferences, and tracking others’ mental states (e.g., beliefs).

It has long been known that apes can plan ahead and consider the beliefs of other individuals, but no reproducible evidence has shown an ape’s ability to

engage with make-believe objects.

According to the authors, previous observations suggesting that apes had some capacity to distinguish pretend and reality, such as adults holding sticks as if they were infants or dragging imaginary blocks across the floor or seeming to eat blueberries off of a printed photograph, were open to alternate interpretation, such as simple replication of learned behavior. They believe that the new controlled experiments provide a more solid basis for their conclusions.

They also consider the possibility that captive apes who have undergone communication training (sign language and use of keyboard symbols) have developed enhanced skills not found in wild populations. The researchers conclude that further investigation comparing wild populations to “enculturated” individuals is needed. Even if the training was a factor, it is significant that the potential for such behavior exists, if only in rudimentary form in the wild. This raises the question of what selective advantage would have been gained by wild populations with such latent capacities.

The authors propose, “Secondary representations underlie many other complex cognitive capacities, such as imagining future possibilities and mental state attribution.” These, in turn, form the foundation for the development of abstract symbolic thought—the foundation of human culture.

Abstract symbolic thought marks a decisive qualitative leap in the evolution of human cognition. It is the capacity to form and manipulate symbols—patterns, sounds, marks or gestures—that stand for objects, relations or ideas not immediately present. This capacity underlies language, technology, art and social organization; it is thus central to the emergence of culture, cooperative labor and the collective understanding necessary for conscious political action.