PRIMATOLOGY

New Clues Surface About The Making of the Mind

The origin of the human mind is rooted in our primate past. But sometime during the last 7 million years, our lineage split off from those of the other great apes and went on to develop symbolic systems—language and mathematics—that transformed both ourselves and the world.

Humanity is constantly patting itself on the back for these accomplishments. But how far have we really come? "Every time someone offers an example of a behavior that makes us human, some uppity captive ape appears to master it," says anthropologist Kathleen Gibson of the University of Texas at Houston. The dividing line between human and ape cognition has proven hard to fix. The controversy over the extent of ape language abilities, for instance, has been simmering for 30 years. At a session of the annual meeting of the American Anthropological Association in Washington, D.C. 2 weeks ago, researchers tackled the subject of primate cognition head-on. In the process they provided clues to the forces that might have shaped that cognition in the past and to the cognitive limits that today may separate human beings from other apes.

Food for thought

While a multitude of explanations have been advanced for the evolution of intelligence, in recent years two competing theories have garnered a lot of attention. One holds that the complex social relations among higher primates provided a key driving force; the other holds that it was the complexities involved in obtaining a varied diet.

Now evidence seems to point toward a combination of culinary and social pressures. At the meeting, Richard Byrne of the University of St. Andrews in Scotland, one of the major proponents of the evolutionary importance of social interactions, took a step toward the other camp. He presented new evidence that obtaining food was a challenge so difficult for apes that it became a selective pressure for a clever mind.

Byrne was trying to explain why apes, which include chimpanzees, gorillas, and orangutans and are humans' closest relatives, seem smarter than monkeys. Earlier work, carried out by Byrne and his colleague, Andrew Whiten, in the mid-1980s, led him to believe that the apes' higher intelligence might have been produced by the hurly-burly of their social life. Shifting alliances and changing dominant and subordinate relationships, they found, present apes with social dilemmas best solved by a nimble mind. Indeed, they coined the term "Machiavellian intelligence" to describe apes' startling facility at manipulating one anothers' perceptions and intentions.

The problem, Byrne found, was that the less clever monkeys face similar social challenges. So he began to wonder whether social intelligence really was the answer. One alternative was feeding complexity. Chimps hunt and gather a wide variety of foods; better facility at this has obvious adaptive advantages. Gibson, in fact, had advanced a similar theory in 1979. Unfortunately, the theory ran straight into a problem of its own: the gorillas. "They appear to feed on very simple things, and there's loads of food around," Byrne says. But appearances can be deceiving, and 4 years ago, when Richard Byrne and Jennifer Byrne went to Rwanda to study the feeding habits of mountain gorillas, they found that the gorilla diet was more complex than previously thought.

Evolution by the numbers. Chimps at Ohio State University appear able to use Arabic numbers as humans do: to count.

The complexity wasn't in finding food, however, but in eating it. Much of the gorilla diet consists of plants with nettles, thistle spines, hooks, or thick husks protecting the edible part. Gorillas have intricate procedures for getting to the goodies without getting hurt. This often takes eight or nine steps, in which the animal covers a nettle with leaves, for example, then peels it, and twists it apart. The sequence of those steps varies from plant to plant, suggesting it is a learned rather than a genetically programmed behavior.

Mastering these elaborate table manners provides a selective pressure that, along with social skills, could produce a mind capable of more advanced cognition. Gibson says this work shows that both feeding and interacting with peers could have driven the evolution of intelligence. "It's not one or the other," she says.

Greed is (not) good

Whatever the adaptive pressures that created it, the nonhuman primate mind does appear capable of remarkably advanced cognition—but within some inviolate biological limits. This has been shown in a striking experiment conducted by psychologist Sarah Boysen of Ohio State University.

Boysen has been teaching two chimps, Sarah and Sheba, to use Arabic numerals. She had previously shown that the animals have some ability to do rudimentary addition using a series of plastic Arabic numerals. Then Boysen tried to teach them another numbers game. She gave Sarah a plate with one gumdrop and another plate with seven gumdrops. The chimp was then supposed to point to the plate she wanted to go to Sheba; Sarah would get the remaining plate. In theory, this would show that Sarah could count and reason that her counterpart would get the shorter tally. But in practice, greed got in the way. Sarah always pointed to the plate with more gumdrops, and then got upset when Boysen gave the plate to Sheba. Sheba did no better. "It was the first task in 20 years that I'd failed to teach a chimpanzee," Boysen says.

But the result changed when she replaced the gumdrops with abstractions: plastic numbers. "They got it right away," Boysen says. The first chimp would point to the lower number, and the second chimp would get that meal, while the first would get more. Then Boysen went back to the gumdrops, and again the chimps had problems.

"The chimps understood the rule," Boysen says, "but they couldn't act on it" because of some biological imperative to get more food. Moving into the symbolic realm allowed them to transcend that biology, and exercise a capacity—already present—to use abstractions. Byrne says that this " super finding" implies that during evolution, a species able to take this transcendent step could develop rules for food sharing and other underpinnings of culture. And that species may have been hominids, the first non-ape primates.

–Joshua Fischman