Do Animals Read Minds, Tell Lies?

A survey of primatologists reveals that apparent deception is widespread among monkeys and apes; but a major problem is how researchers can determine what is real deception

"One of the female baboons at Gilgil grew particularly fond of meat, although the males do most hunting," said Shirley Strum of the University of California, San Diego. "A male, one who does not willingly share, caught an antelope. The female edged up to him and groomed him until he lolled back under her attentions. She then snatched the antelope carcass and ran."

This incident is one of many similar examples of apparent animal deception collected in a recent survey by Richard Byrne and Andrew Whiten of the University of St. Andrews, Scotland. Their survey reads like a catalogue of low cunning, animals seemingly outsmarting each other in pursuit of food, sex, and power—or simply avoiding being beaten up.

"We decided to conduct the survey after observing examples of what could be interpreted as various kinds of deception among baboons," Byrne told *Science*. Their study had been on baboon feeding ecology, not on social behavior. But after noticing various apparently manipulative social tricks indulged in by the animals, Byrne and Whiten decided to search the literature for formal reports of such behavior.

"It is not unusual for chimpanzee deception to be discussed in the literature," conclude Byrne and Whiten, "whereas in our experience, deception in other primates is seriously discussed informally by primatologists but has seldom found its way into the respectability of scientific publications." But Byrne and Whiten wanted to get a much broader picture, and so they therefore sent questionnaires to some 115 primatologists, asking for observations on what they call "tactical deception" among apes, monkeys, and prosimians (such as bush babies).

The territory into which they were venturing is beset with snares, including as it does the question of "mind" and "intentionality" and how best one might detect such phenomena among animals. The first issue addresses an animal's behavior: Is it governed by simple trial and error, or conditioning? Or is it guided by an understanding of the effect its own behavior will have on that of another animal? In other words, as Tufts University researcher Nicholas Humphrey has put it, are animals "nature's psychologists," seeing their own actions from another's point of view? The second issue concerns how best this might be decided: by field observations or lab experiments.

Roger Lewin

Hazards of the social whorl. *Baboons live a complex social life, with measured interactions between individuals being revealed by detailed studies. Such complexity is conducive to deception by one individual of another, if it has the wit to do it.*

What Byrne and Whiten are interested in is "tactical deception," which they define as follows: "an individual's capacity to use an 'honest act' from his normal repertoire in a different context, such that even familiar individuals are misled."

The case of the female baboon that grooms the male until it relaxes, and then snatches the dead antelope, certainly gives the impression of tactical deception. But a behaviorist might legitimately argue that the female has learned that, in order to get a share of meat from this particular male, she must groom him. This "conditioning" explanation is different from the intentionality explanation, in which the female knows that if she grooms the male—as she probably often does on many different occasions—he will become relaxed enough so that she can make off with the meat.

One of the incidents that set Byrne and Whiten off on their survey also involved baboons in pursuit of food. In this case a young male approached and watched an adult female digging rhizomes from the bone-dry earth. He looked around, and, with no other animals in sight, screamed as if he had been attacked. His mother came running, as she always would to such a call, and chased away the "offending" female, over which she was dominant. The juvenile then proceeded to eat the rhizome that had just been dug up.

Again, this incident is redolent of deception. But it may have been a trick learned fortuitously, not involving the line of thought that "a scream will bring mother to the rescue, who will chase off the female, leaving the food for me."

Byrne acknowledges that behaviorist interpretations can be convincingly advanced in almost all cases of field observations, not least because one simply does not know in sufficient detail the history of the animals involved. If an animal had learned over a period of time that a certain social trick was a useful habit, then one would probably have no way of knowing that: hence the argument for laboratory experimentation, an approach vigorously promoted by David Premack of the University of Pennsylvania.

Laboratory experimentation may indeed have a degree of purity unattainable in the

field, but, warns Daniel Dennett of Tufts University, it also carries the danger of training, which might also be misleading. "But the major problem with studying deception is that evidence for it will always be close to the level of chance, even when it is true," says Dennett. The reason is that, for deception to work, it must be extremely subtle and probably infrequent: the boy who cried wolf discovered that. "What we really need," says Humphrey, "is evidence of creative deception, a situation in which there was no possibility of past learning. That will be difficult to achieve."

Philosophers have long acknowledged that, with the advent of the capacity to communicate also came the ability to deceive. But, creative deception requires not only a certain level of intelligence, but also opportunity and motive. "Whether we will see tactical deception in nonhuman primates will depend to some extent on their social organization," explains Byrne. "Monogamous species, for instance, or groupings in which individuals must regularly help each other for maintenance, are not going to be conducive to deception. Nor are species in which groups are highly cohesive."

Chimpanzees are clearly intelligent, and their fluid social structure of group fission and fusion offers the required opportunity. However, neither the harem structure of gorillas nor the more solitary social system of orangutans is particularly fertile ground for social deception. According to Byrne and Whiten's survey, not much is seen. To be fair, however, the relevant data are few.

Monkeys, such as baboons, score in every category of apparent deception in the survey, but they are the most intensively studied of primates, which may bias the data. Bush babies and their like have not been reported to deceive each other.

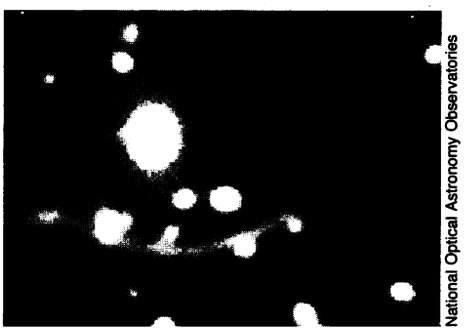
If baboons were found to be intentionally deceptive, it would be something of a surpise, as they fail to score at all on certain tests of "self-consciousness." In fact, on such tests, only chimpanzees and orangutans appear to have a concept of self. And without a concept of self it is surely impossible to be able to read the mind of another individual.

Byrne and Whiten's survey was not meant to answer the question of how extensive self awareness is among primates, partly because, as they acknowledge, anecdotes by themselves probably always will remain insufficient evidence. Nevertheless, they plan to collect more cases by survey, and hope to reach some agreement on "some fundamental questions concerning the way behavioral scientists should approach phenomena that are so elusive yet critical to our understanding of the evolution of social cognition." ■ **ROGER LEWIN**

The Giant Arcs Are Gravitational Mirages

The arcs appear to be highly magnified and highly distorted images of far-distant galaxies; as such they could offer new insight into galactic evolution and a unique probe of cosmic dark matter

LAST January, when astronomers C. Roger Lynds of the Kitt Peak National Observatory and Vahe Petrosian of Stanford University announced that they had found giant luminous arcs lying in at least two massive clusters of galaxies—with each arc being far larger than any single galaxy—the phenomenon seemed as mysterious as it was bizarre. Now, however, the mystery appears to have been solved: Lynds and Petrosian believe they have proof that the clusters are acting as gravitational lenses, and that the arcs are far-distant galaxies whose images have been magnified and distorted beyond recognition.



National Optical Astronomy Observatories

Abell 370. *The arc is centered on a giant elliptical galaxy, presumably the lensing mass.*

"All the facts I know of support that explanation," says Lynds. "It's about as good as it can look."

The gravitational lens hypothesis has always been an attractive one, the researchers say, especially since each of the arcs is roughly centered on a huge elliptical galaxy that provides an obvious candidate for the lensing mass. On the other hand, it was also possible that the arcs were real physical structures embedded in the clusters themselves. One model, for example, assumed that the two giant ellipticals were moving very rapidly through their clusters in a direction perpendicular to our line of sight, and were therefore producing "bow shocks" in the clusters' tenuous intergalactic gas; the arcs were just the bow shocks as viewed from the side. Granted that no one had ever seen such a thing, no one could rule it out, either.

The resolution had to wait until September, when Lynds and Petrosian were finally able to obtain spectra of the arcs at the Mayall 4-meter telescope on Kitt Peak. Their results from the brighter arc, located in the cluster Abell 370, were particularly intriguing: the spectrum showed a single strong emission line. "We've spent most of our time since September trying to identify that line," says Lynds.

That effort quickly led Lynds and Petrosian to rule out a cluster origin for the arcs. After subtracting Abell 370's overall redshift of 37%, they did find that the emission line corresponded quite closely to the 4686-angstrom line of doubly ionized helium, an element that is second only to hydrogen in cosmic abundance. However, they also knew that the helium line almost never occurs in isolation. If the arc emission were really helium then its spectrum ought to include lines from ionized oxygen and neon, as well as from the hydrogen Balmer series. "We just don't see them," says Lynds. Furthermore, the helium line requires a very high excitation energy, which means that it only occurs under correspondingly rare physical conditions. It is typically found in the spectra of Wolf-Rayert stars, for example. These objects are massive, fiercely hot stars that have recently shed their outer layers of hydrogen and that are on the verge of going supernova. "But to expect to see a whole system of Wolf-Rayert stars is pretty preposterous," says Lynds.

In short, the helium identification was unworkable. The natural alternative was then the 3727-angstrom line of singly ionized oxygen, which is one of the standard signposts of spectroscopy. As Petrosian points out, "anytime an astronomer sees *one* strong emission line, he assumes that it's 3727."

With this identification the gravitational lens model became mandatory: the required redshift works out to 72%, which puts the source of the observed line almost twice as far away as Abell 370 itself. At the same time, however, everything else about the spectrum falls into place. For example, Lynds and Petrosian were able to identify