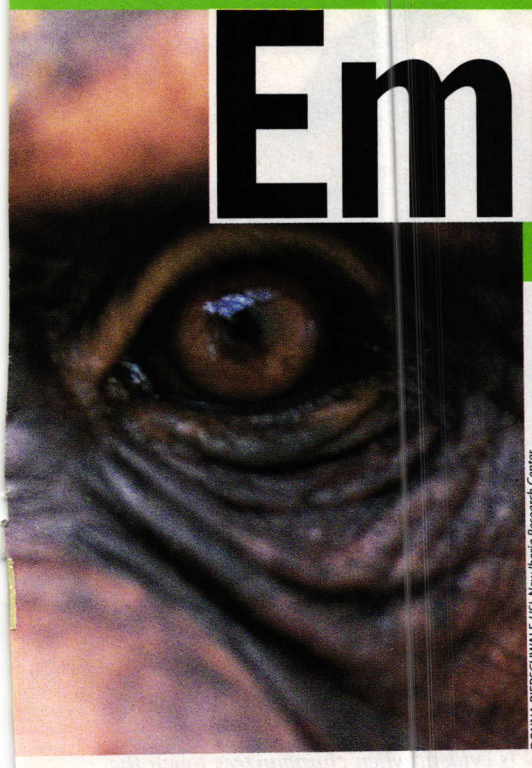
Empathize?



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Maybe not

Even though chimpanzees pass the mirror test, they do not seem to conceive of others'—or even their own—mental states

by Daniel J. Povinelli

Let me begin with a point on which Gordon Gallup, Jr., and I agree: the reactions of chimpanzees when they see themselves in mirrors reveal that these animals possess a self-concept. Furthermore, we agree that this self-concept appears to be restricted to the great apes and humans. Beyond this point, however, our views diverge. Gallup speculates that the capacity for self-recognition may indicate that chimpanzees are aware of their own internal, psychological states and understand that other individuals possess such states as well. I have come to doubt this high-level interpretation of the chimpanzees' reactions to seeing themselves in mirrors. More generally, I question whether chimpanzees possess the deep psychological understanding of behavior that seems so characteristic of our species. In what follows, I describe why I have come to this conclusion, and I offer an explanation of how humans and chimpanzees can behave so similarly and yet understand this behavior in radically different ways.

Knowing That Others See

Consider the simple act of seeing. When we witness other people turning their eyes toward a particular object, we automatically interpret this behavior in terms of their underlying psychological states—what they are attending to, what they are thinking about, what they know or what they intend to do next. These inferences are often solely based on fairly subtle movements of their eyes and heads.

Do chimpanzees understand seeing in this manner? Gallup thinks they do, and at first glance it seems hard to deny it. For example, chimpanzees exhibit a strong interest in the eyes of their fellow apes. Frans B. M. de Waal of the Yerkes Regional Primate Research Center at Emory University has reported that chimpanzees do not appear to trust the reassurance gestures of their former opponents unless such gestures are accompanied by a mutual gaze—that is, unless they stare directly into one another's eyes. Research from our own laboratory has established that chimpanzees follow the gaze of other apes—and of humans as well. If you stand face-to-face with a chimp, lock your gaze with hers and then suddenly look over her shoulder, the ape will reliably turn around, as if trying to determine what you are looking at.

In short, the spontaneous behavior of chimpanzees seems to make a fairly persuasive case that they can reason about the visual perspectives of others. Does this behavior, then, provide confirmation of Gallup's model? Maybe, but maybe not. The problem is that there are other equally plausible interpretations that do not assume that chimpanzees are reasoning about one another's visual experiences. The case of gaze following illustrates the problem quite well. A chimpanzee who follows your gaze leads you to assume that the animal is trying to figure out what you are looking at. But what excludes

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Colleges and I gave a pair of rhesus monkeys, reared together in the same cage, continuous exposure to themselves in a full-length mirror for 17 years (more than 5,000 hours of mirror exposure a year). Despite this extended opportunity to learn about the mirror, neither monkey ever showed any evidence of self-recognition. On the other hand, when I would walk into the room where they were kept and they saw my reflection in the mirror, they would immediately turn to confront me directly. So it was not that they were incapable of learning to interpret mirrored information about other objects correctly.

Experiments have also failed to uncover compelling evidence of self-recognition in gorillas. After pondering those results, Suarez and I decided to give gorillas the benefit of the doubt, reasoning that maybe gorillas do not care about the superimposed marks. We tested this hypothesis at the Yerkes Regional Primate Research Center at Emory University by applying marks to gorillas' wrists as well as to their faces. We discovered that on recovery from anesthesia all the gorillas touched and inspected the marks on their wrists. But despite extensive prior experience with mirrors, none of the gorillas were able to locate comparable marks on their faces that could be seen only in the mirror.

Gorillas naturally avoid making eye contact with one another, so a possible reason for their mirror-test failure is that they avoid eye contact with their reflection and hence never learn to recognize themselves. Daniel J. Shillito and Benjamin B. Beck of the National Zoological Park in Washington, D.C., and I recently tested this hypothesis, relying on a technique developed by James R. Anderson of the University of Stirling in England. It calls for a pair of mirrors placed together at an angle that renders it impossible to make eye contact with the reflection. But none of the gorillas showed evidence of self-recognition, not even one that had more than four years of exposure to mirrors.

We ought to be able to identify animals that can or cannot recognize themselves in mirrors and their empathetic tendencies.

In other tests of learning, problem solving and cognitive functioning, differences in performance among species are typically a matter of degree, not kind. What is to be made of such decisive differences in self-recognition? Maybe the reason most species cannot process mirrored information about themselves stems from an inability to conceive of themselves. Correctly inferring the identity of the reflection presupposes an identity on the part of the organism making that inference.

That conclusion seems reasonable, considering the way members of *Homo sapiens* interpret mirror images. Humans do not begin to show compelling evidence of mirror-guided self-recognition until they reach 18 to 24 months of age—about the same time at which the prefrontal cortex begins to mature in structure and function. Younger infants react to themselves in mirrors as though they were seeing other children, just as most species do. At about the time that children learn to recognize themselves, they begin to show other evidence of self-conception, such as using personal pronouns, smiling after mastering a task and engaging in self-conscious play.

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SELF-RECOGNITION is evident when chimpanzees touch the red dot painted on their faces. Once familiar with the mirrors, they will inspect themselves and make faces.

Before about two years of age, no one has experiences that can be consciously recalled in later life. Consistent with my interpretation, this period of "infant amnesia" stops at about the same time that children begin to show self-recognition. As would be expected, the onset of an autobiographical memory only begins with the emergence of self-conception.

That may terminate prematurely at the other end of the life span if dementia sets in. Disturbances in self-awareness and impaired structure and function of the prefrontal cortex often accompany this condition. Thus, for some, human development may be bounded at both ends by periods of unconsciousness.

Knowing Mental States

Some practical advantages are derived from being able to conceive of the self. I argue that self-awareness, consciousness and mind are an expression of the same underlying process, so that organisms aware of themselves are in a unique position to use their experience as a means of modeling the experience of others. When you see someone in a situation similar to one you have encountered, you automatically assume his or her experience will be similar to yours. Although it is probably true that no two people experience the same event in exactly the same way, as members of the same species we share the same sensory and neurological mechanisms. So there is bound to be considerable overlap between your experience and mine.

POVINELLI *Maybe Not*

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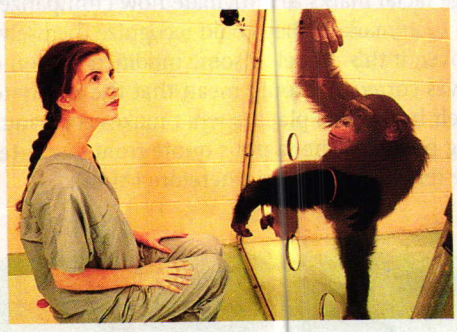
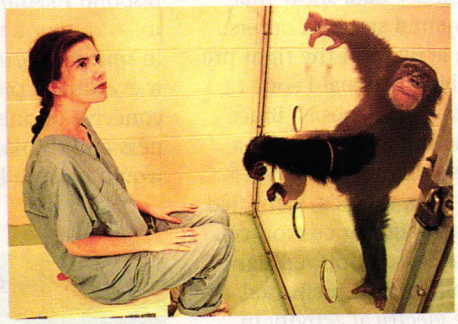
the possibility that evolution has simply produced "mind-blind" mechanisms that lead social primates to look where other animals look, without entertaining any ideas about their visual perspective?

To disentangle these issues, we need to study the behavior of these animals in more revealing experimental situations. One method occurred to us after watching our chimpanzees in their everyday play. They frequently covered their heads with blankets, toy buckets or even their palms and then frolicked around their compound until they bumped into something—or someone. Occasionally they would stop and lift the obstruction from their eyes—to peek, as it were—before continuing their blind strolls. On more than one occasion I made the mistake of imitating these behaviors while playing with the animals, a maneuver that left me vulnerable to a well-timed play attack!

Does this behavior mean that chimpanzees have a concept of seeing? For example, when they play with someone else who covers his or her head, do they know that this person cannot see them, or do they simply learn that this person is unable to respond effectively?



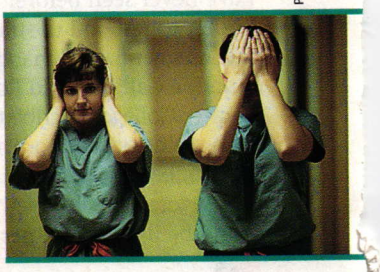


GAZE FOLLOWING is a common behavior among chimpanzees. When the experimenter looks over the chimpanzee's shoulder (left), *the ape looks in the same direction* (right).

To answer these questions, we examined one of our chimpanzees' most common communicative gestures: begging. First, we allowed them to beg for food from an experimenter who was sitting just out of their reach. When they did so, they were handed an apple or banana. Next, we confronted them with two familiar experimenters, one offering a piece of food and the other holding out an undesirable block of wood. As we expected, the chimps had no trouble: after glancing at the two experimenters, they immediately gestured to the one offering the food.

This set the stage for our real objective, which was to provide the apes with a choice between a person who could see them and a person who could not. If the high-level model of chimpanzee understanding were correct, the chimps would gesture only to the person who could see them. We achieved the "seeing/not-seeing" contrast by having the two experimenters adopt different postures. In one test, one experimenter wore a blindfold over her eyes while the other wore a blindfold over her mouth. In the other tests, one of the experimenters wore a bucket over her head, placed her hands over her eyes or sat with her back turned to the chimpanzee. All these postures were modeled after the behaviors we had observed during the chimpanzees' spontaneous play.

The results of this initial experiment were astonishing. In three of the four tests—the ones involving blindfolds, buckets and hands over the eyes—the apes entered the lab and paused but then were just as likely to gesture to the person who could not see them as to the person who could. In several cases, the apes gestured to the person who could not see them and then, when nothing happened, gestured again, as if puzzled by the fact that the experimenter did not respond.



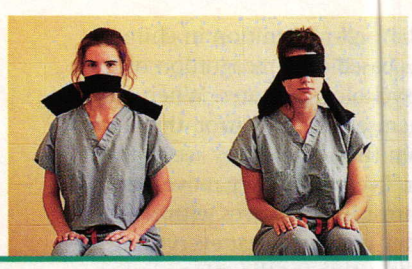
PHOTOGRAPHS BY DONNA BIERSCHWALE

We were not prepared for such findings. Surely our apes understood that only one of the experimenters could see them. Indeed, the apes did perform excellently in one of the tests, where one experimenter sat with her back turned to the chimpanzees. But why only this one? At first we assumed that the back/front test was simply the most obvious or natural contrast between seeing and not seeing. In this test the apes might have been demonstrating their genuine understanding of seeing—an understanding that was obscured by the arguably less natural postures in the other tests.

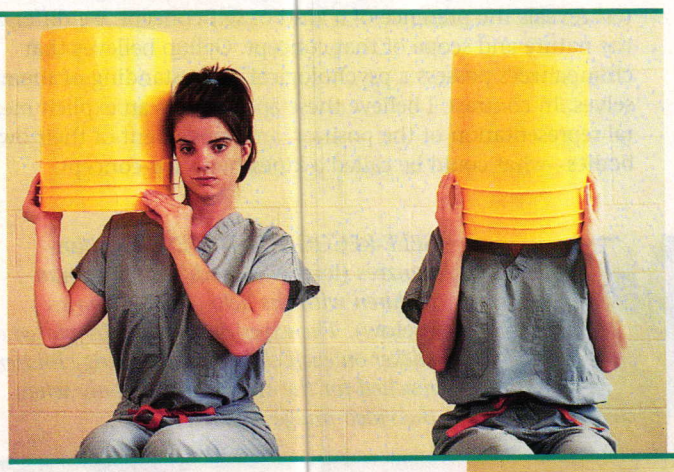
Another idea, however, began to nag at us. Perhaps the apes' excellent performance on the back/front test had nothing to do with their reasoning about who could or could not see them. Maybe they were just doing what we had taught them to do in the first part of the study—gesture to the front of someone who was facing them. Or perhaps the act of gesturing to the front of a social partner is simply a hardwired social inclination among chimpanzees, unconnected to a psychological concept of seeing or attention.

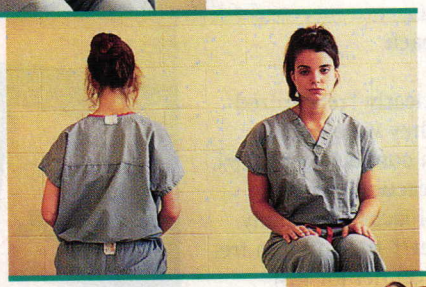
As a first attempt to distinguish among these possibilities, we conducted another test in which both experimenters sat with their backs to the chimpanzees, but one looked over her shoulder at them. This posture was quite familiar to the apes—in their daily interactions, they frequently looked over their shoulders at one another. The high-level model of chimpanzee understanding predicted that the animals would gesture only to the experimenter who could see them. The low-level model predicted that the apes would choose at random because they could not see the front of either experimenter. Their performance turned out to be random—they were just as likely to gesture to either experimenter.

I should point out that what I am describing are the apes' initial reactions to these situations. As you might guess, with enough experience of not being handed a banana after gesturing to someone whose face was not visible, our chimpanzees quickly learned to choose the other option. But what exactly did the apes learn? Did they finally realize what we were asking them—"Oh, I get it! It's about seeing!"—or had they simply learned another rule that could work every time: "Gesture to the person whose face is visible."



We examined this question in an extended series of studies, the results of which were consistent with the low-level model. For example, after the chimpanzees learned not to gesture to an experimenter whose head was obscured by a cardboard disk, we retested the animals using the original conditions (buckets, blindfolds, hands over the eyes and looking over the shoulder). We realized that if the apes had genuinely understood the idea of seeing, they ought to gesture only to the experimenters who could see them in all the other tests as well. But if the chimpanzees had simply learned to gesture to a person whose face was visible, they would still choose randomly in the blindfold test, because the faces of the experimenters were equally visible (one had the blindfold over her eyes; the other had it over her mouth). Just as the low-level model predicted, the chimpanzees were more likely to gesture to the experimenter who could see them in all the tests except one—the blindfold test.





CHIMPANZEE UNDERSTANDING of the concept of seeing was tested in a series of experiments. Confronted with pairs of "seeing" and "not-seeing" experimenters (above), *the chimps were equally likely to gesture to either one. The apes performed better in the back/front test* (right), *but their performance was random in the looking-over-the-shoulder test* (below).

These findings contrast sharply with the development of these abilities in human infants. John H. Flavell and his colleagues at Stanford University have shown that children as young as two or three years seem to understand the concept of seeing. And indeed, when we tested young children using our seeing/not-seeing method, we found that even two-and-a-half-year-old children performed at levels suggesting that they understood that only one of the experimenters could see them.

Growing Up Ape

Let me address one important criticism of our work raised by Gallup concerning the age of our animals. The initial tests were conducted in 1993 and 1994, when the chimpanzees were five to six years old. Although several of our apes were displaying all the traditional evidence of recognizing themselves in mirrors, some of them were still on the cusp of developing this ability. Could it be that older chimpanzees might fare better in the seeing/not-seeing tests?

One year after the initial research—and after our apes had been engaged in many other studies—we assessed their reactions to several of the original seeing/not-seeing tests. Much to our surprise, the chimpanzees initially responded at random, even to the test where one of the experimenters hid her head behind a cardboard disk—a test the apes had learned extremely well a year earlier. Our chimpanzees' performance improved only gradually, after considerable trial and error. Furthermore, after another year had passed and our apes had become young adults, additional tests revealed that they were still relying on rules about the frontal posture, faces and eye movements of the experimenters—not about who could see them. Thus, despite the fact that many of our chimpanzees had displayed evidence of self-recognition for more than four years, we had no evidence that they genuinely understood one of the most basic empathic aspects of human intelligence: the understanding that others *see*.

The Meaning of Self-Recognition

If we knew nothing more about chimpanzees, we might simply conclude that they understand visual perception in a very different manner than we do. Other studies in our laboratory, however, have suggested that chimpanzees may not understand any behavior in a psychological manner. For example, careful tests revealed that our apes do not comprehend pointing gestures as referential actions, nor do they understand the difference between accidental and intentional behavior. Furthermore, recent tests conducted with Daniela K. O'Neill of the University of Waterloo suggest that our original interpretations of our earlier studies on cooperation—which Gallup cites in support of his theory—may have been incorrect. Although our chimpanzees easily learn to cooperate with one another, our new results cast doubt on whether they truly appreciate the differing subjective mind-sets of their partners.

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If chimpanzees do not genuinely reason about mental states in others, what can we say about their understanding of self? Exactly what is revealed by their antics in front of mirrors? And do such reactions to mirror images really indicate

the onset of autobiographical memory—in both apes and humans—as Gallup suggests?

As a first attempt to answer these questions, we shifted our attention to humans—specifically, two-, three- and four-year-old children. In a series of studies, we individually videotaped the children as they played an unusual game with an experimenter.

Self-recognition in chimpanzees and human toddlers is based on a recognition of the self's behavior, not the self's psychological states.

During the game, the experimenter praised the child and used this opportunity to place a large, brightly colored sticker secretly on top of the child's head. Three minutes later the children were shown either a live video image of themselves or the recording we had made several minutes earlier, which clearly depicted the experimenter placing the sticker on the child's head.

These tests revealed that the younger children—the two- and three-year-olds—responded very differently depending on whether they observed the live or delayed images. When confronted with a live image, the vast majority of the two- and three-year-olds reached up and removed the sticker from their heads. When confronted with three-minute-old images, however, only about one third of the younger children reached up for the sticker. Did the others simply not notice the sticker in the delayed video? Hardly. After experimenters drew their attention to the sticker in the video and asked them, "What is that?" the majority of the children responded, "It's a sticker." But this acknowledgment did not cause them to reach up and remove the sticker.

In one sense, of course, the children clearly "recognized themselves" in the delayed video. When they were asked, "Who is that?" even the youngest children confidently replied, "Me!" or stated their proper names. This reaction, however, did not seem to go beyond a recognition of facial and bodily features. When asked, "Where is that sticker?" the children frequently referred to the "other" child: "It's on her [or his] head." It was as if the children were trying to say, "Yes, that looks like me, but that's not *me*—she's not doing what I'm doing right now." One three-year-old girl summarized this psychological conflict quite succinctly: "It's Jennifer," she stated, only to hurriedly add, "but why is she wearing my shirt?"

So when do children come to think of themselves as having a past and a future? Our studies have revealed that by about four years of age, a significant majority of the children began to pass our delayed self-recognition test. Unlike their younger counterparts, most four- and five-year-olds confidently reached up to remove the sticker after they observed the delayed video images of themselves. They no longer referred to "him" or "her" or their proper names when talking about their images. This finding fits nicely with the view of Katherine Nelson of the City University of New York and others, who believe that genuine autobiographical memory appears to emerge in children between 3.5 and 4.5 years old—not at the two-year mark that Gallup favors. Of course, any parent knows that two-year-olds can recall past events, but this is very different from understanding that those memories constitute a genuine "past"—a history of the self leading up to the here and now.

Although it is still too early to rule out Gallup's model altogether, our research suggests that self-recognition in chimpanzees and human toddlers is based on a recognition of the self's behavior, not the self's psychological states. When chimpanzees and orangutans see themselves in a mirror, they form an equivalence relation between the actions they see in the mirror and their own behavior. Every time they move, the mirror image moves with them. They conclude that everything that is true for the mirror image is also true for their own bodies, and vice versa. Thus, these apes can pass the mirror test by correlating colored marks on the mirror image with marks on their own bodies. But the ape does not conclude, "That's me!" Rather the animal concludes, "That's the same as me!"

Thus, although Gallup and I agree that passing the mirror test reveals the presence of a kind of self-concept, we differ on the nature and scope of that concept. Gallup believes that chimpanzees possess a psychological understanding of themselves. In contrast, I believe these apes possess an explicit mental representation of the position and movement of their own bodies—what could be called a kinesthetic self-concept.

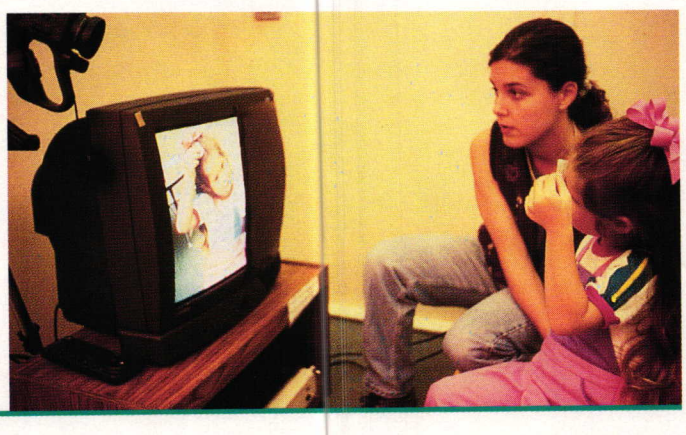
SELF-RECOGNITION TEST for chimpanzees (left) *was modified for human children with the help of video images* (below). *The experimenter secretly placed a sticker on each child's head. Young children reached for the sticker* (right) *only when the video image was live.*

Ironically, this may be close to what Gallup himself had in mind when he originally published his discovery nearly 30 years ago. He noted that self-recognition appears to require the ability to project "kinesthetic feedback onto the reflected visual image so as to coordinate the appropriate visually guided movements via the mirror."

But why do humans, chimpanzees and orangutans possess this kinesthetic self-concept, whereas other nonhuman primates—such as monkeys—do not? One clue may be the large difference in body size between the great apes and other primates. Consider orangutans, which may represent the closest living approximation to the common ancestor of the great apes and humans. Several years ago, John G. H. Cant of the University of Puerto Rico and I spent months in the Sumatran

rain forest observing the orangutan's chaotic blend of slow, carefully planned movements and sudden, breathtaking acrobatics. We concluded that the problems encountered by these 40- to 80-kilogram (90- to 180-pound) animals in bridging the gaps between trees were qualitatively different from the problems faced by the much smaller monkeys and lesser apes. We hypothesized that as the ancestors of the great apes evolved, quadrupling in body size over 10 to 20 million years, they may have needed to evolve a high-level self-representational system dedicated to planning their movements in their arboreal environment. Ultimately, this unprecedented increase in body size for a tree-dwelling mammal may have left a psychological imprint on the great apes: an explicit kinesthetic self-concept. It was this self-concept that Gallup tapped millions of years later in his tests of chimpanzee self-recognition.

A crucial test for our theory is the gorilla, the largest non-



human primate. Although gorillas share the same common ancestor as humans, chimpanzees and orangutans, they have readapted to spending most of their lives on the ground. The surprising absence of self-recognition in this species may reflect the fact that gorillas no longer needed to execute the complex movements that were necessary to transport their enormous body weight across the gaps between trees. Their evolution appears to have focused on aspects that were more relevant to their new terrestrial way of life, including a more rapid physical growth rate than is found in chimpanzees and orangutans. This process may have interfered with the development of a kinesthetic self-concept. Humans, in contrast, slowed down their growth rate, allowing more years for cognitive development.

If self-recognition depends on a kinesthetic rather than a psychological self-concept, it would help explain some puzzling facts. Several studies have found no connection between the ability of 18- to 24-month-old infants to pass the mirror test and their ability to understand that a mirror reflects any object placed in front of it. Our theory explains this result by postulating that the infants do not see their mirror images as representations of themselves. Rather they see their images as a special class of entities that share their behavior and appearance.

Our theory also explains why toddlers often fail the self-recognition test if there is even a minimal disruption of the visual feedback—for example, a two-second delay in the video images of themselves. Although the children continue to recognize their facial and bodily features, the two-second disjunction between their actions and the movements of their images leads them to conclude that the images are not equivalent to themselves. Finally, our theory explains why both toddlers and chimpanzees, after recognizing themselves in the mirror, may nonetheless persist in looking behind the mirror, as if searching for the "other" child or ape.

PHOTOGRAPHS BY DONNA BIERSCHWALE

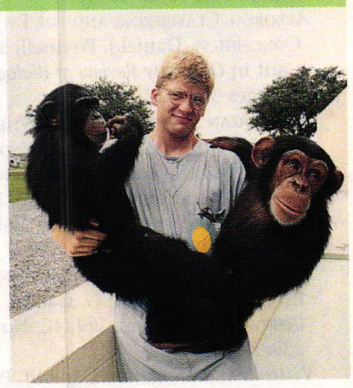
Understanding Minds: A Human Specialization

At this point we are still left with a troubling question: How can humans and chimpanzees share such sophisticated social behaviors but understand them so differently? Why do humans interpret these behaviors in terms of psychological states, but apes do not?

My answer may become more obvious if we imagine our planet 60 million years ago, long before any of the modern primates had evolved. Alison Jolly of Princeton University has speculated that as the solitary lifestyle of the small, early primates gave way to existence in large groups, these animals were forced to cope with increasingly complex social interactions. As a result, Jolly argues, the primates became stunningly adept at reasoning about one another's actions, slowly evolving the rich array of social behaviors now observed among the modern primates: gaze following, deception, appeasement and so on.

But, in my view, none of these behaviors required the early primates to reason about one another's mental states. Our research suggests that only one primate lineage—the human one—evolved the unique cognitive specialization that enables us to represent explicitly our own psychological states and those of others. But in evolving this specialization, we did not discard our array of basic primate behaviors. Our new awareness of the mental dimension of behavior was woven into our existing neural circuitry, forever altering our understanding of our own behavior and the behavior of those around us. Other species, including chimpanzees, may simply be incapable of reasoning about mental states—no matter how much we insist on believing that they do. SA

About the Author



DANIEL J. POVINELLI first became interested in chimpanzee behavior in 1979, when he was 15 years old. While doing research for a high school debate, Povinelli came across an article by Gordon Gallup, Jr., in *American Scientist* describing his mirror tests on chimpanzees. "The elegance and ingenuity of Gallup's tests really struck me," he says. "I thought that here might be a species profoundly similar to our own." Inspired, Povinelli studied primate behavior as an undergraduate at the University of Massachusetts at Amherst and earned his Ph.D. in biological anthropology from Yale University in 1991. He then joined the University of Southwestern Louisiana's New Iberia Research Center, a 150-acre facility that is home to more than 300 chimpanzees. Now an associate professor, Povinelli directs the center's division of behavioral biology, which studies cognitive development in both chimpanzees and young children. Over the years Povinelli has become a friend and colleague of Gallup's, but his view of the chimpanzee's mental abilities has diverged from that of his mentor. "It took a lot of patience on the part of the chimpanzees," he says, "but they've finally taught me that they're not hairy human children."