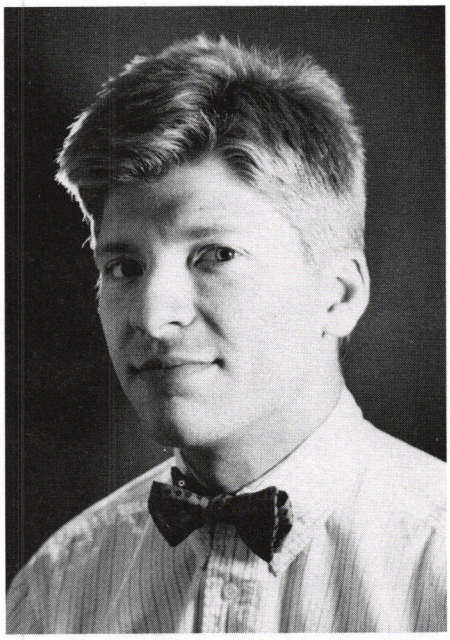
SCIENCE BRIEFS

Chimpanzees, Children, and the Mind of the Eyes

Daniel J. Povinelli, PhD, is Director of the Division of Behavioral Biology at the University of Southwestern Louisiana (USL) New Iberia Research Center, and Director of the USL Center for Child Studies.

Dr. Povinelli's research interests include the evolution and ontogeny of cognition in the context of primate evolution, cognitive development, and primate behavior and ecology. He is the recipient of the APA Distinguished Scientific Award for Early Career Contribution to Psychology and the National Science Foundation Young Investigator Award. Dr. Povinelli received his PhD in physical anthropology from Yale University in 1991.



Daniel J. Povinelli, PhD

Behaviorists spent half a century trying to convince their fellow psychologists that the real explanations for human behavior could never be found by examining the contents of people's minds. The problem, of course, is that regardless of whether the behaviorists were correct, our common sense tells us otherwise.

In cultures around the world, human beings are born into a social world teeming with each other's intentions, desires, hopes, plans, goals, and beliefs. No army of behaviorist-trained, lever-pressing rats could stem the overwhelming tide of this folk psychology of mind, nor convince the academically uninitiated that the thoughts they feel going on inside their heads are simply some kind of illusion, voices and images unconnected to their behavior. In this sense, the behaviorists' project was unsustainable from the outset. For even if mental states really and truly do not determine our behavior (and they may not), our species is forever committed to the belief that they do. Thus, regardless of the merits of the behaviorists' position, this pervasive, unshakable folk psychology demands psychological and evolutionary explanation in its own right. Indeed, perhaps one of the most dramatic questions we can ask about human nature is whether other species also possess this rather astonishing (and almost irrational) belief in the unobservable life of the mind. It is this question that we have attempted to address within the context of an empirical research program centered around comparing the psychological development of preschool children and our nearest living relatives, the chimpanzees.

Although we have examined chimpanzees' understanding of a wide range of mental states, in particular, we have recently focused on trying to determine if they (like us) understand the mentalistic connections between the mind and the eyes. A moment's reflection will reveal that the perceptual act of seeing can be understood as more than just the physical relation between the eyes, on the one hand, and objects and events in the world, on the other. No, our folk psychology accords the eyes with a mind of their own. For example, the eyes play a major role in our understanding of how knowledge and beliefs arise. Indeed, this understanding arises fairly early in life. For example, when 4- and 5-year-old children observe someone lift the lid of a box and look inside, they automatically assume that this other person *knows* what is inside. In contrast, they do not make this assumption when they see the person just touch a box, or just look at the box without lifting the lid. Thus, even though they cannot see information entering the person's eyes, traveling to their brain, and resulting in the mental state of knowing the contents of the box, older preschool children (like us) know that something very much like this has happened: Knowledge and belief can arise from visual perception. Yet if one tries this same task with young 3-year-olds, one will rapidly discover that they interpret what is happening in a very different way. They appear to have no idea that the one who sees, knows, and that the one who does not see is ignorant about the box's contents. They attribute knowledge to themselves and others miraculously, without reference to whether the required perceptual contact has occurred.

These developmental questions are fascinating in their own right, but how can we ask members of a species that does not speak what they understand about the mental connection between seeing and knowing? To begin, we need to find a new way to ask young

children--this time, without using words! One of our solutions was to have 3- and 4- year-old children play a simple game where they look for stickers under cups. One of the experimenters leaves the room, while the other hides a sticker. The child observes the experimenter hiding the sticker, but cannot see under which cup the sticker is hidden. Next, the other experimenter returns, and now both point to a different cup,

Figure 1. Testing a chimpanzee's understanding of the connection between seeing and knowing.

offering the child contradictory advice about where to look. The 4-year-olds reveal that they interpreted the experimenters' behavior in a mentalistic fashion. They correctly choose the experimenter who saw where the sticker was hidden, ignoring the advice of the one who had been outside of the room. In contrast, and just as we predicted from their results on the verbal tests, 3-year-olds choose randomly, sometimes picking the person who was outside, sometimes picking the person who hid the sticker.

Having calibrated our nonverbal and verbal tasks in this manner, we can now ask chimpanzees the same question by devising a similar game for them (see Figure 1). Here the chimpanzees demonstrate that if we give them enough trials, they can learn to pick the person who stays in the room, but that they may not really understand the epistemological significance of the fact that only one person looked under the cups. In general, the chimpanzees behave like 3-year-olds--they choose randomly between the two experimenters.

Does this mean that chimpanzees and 3-year-old children are similar with respect to their understanding of the mind of the eyes? Maybe, but maybe not. Understanding how visual perception creates knowledge is only one of several ways in which seeing can be understood as a mental event. For example, even though 3-year-olds do not seem to understand the seeing-knowing relationship described earlier, they do understand that seeing is 'about' or refers to events or objects in the world. In short, they realize that someone who is looking at something is subjectively connected to that thing through the mental state of attention. For example, many years ago John Flavell and his colleagues showed that 3-year-olds have a solid understanding of whether someone can see something, even though they do not understand how that object appears to the person. For example, sit across a table from a child and show the child a picture of a turtle so that it is right-side-up from the child's perspective, but upside-down from yours. Young 3-year-olds know that you can see the turtle, and if you put your hands over your eyes, they know that you can no longer see it. But they do not understand that, from your perspective, it appears differently--that is, upside-down.

In order to compare chimpanzees and children's understanding of this aspect of seeing, we have devised several nonverbal ways of asking this question. The chimpanzees are taught to approach a plexiglass partition and use their species-typical begging gesture to request food from an experimenter (see Figure 2). In the beginning, there is one experimenter present at every trial, randomly positioned in front of either a hole on the right or left side of the partition. If the chimpanzees beg in front of the experimenter, they are handed a small fruit reward. Once the apes are performing perfectly on this simple task, we probe their understanding of seeing by having them occasionally encounter two experimenters. However, although there is now an experimenter in front of both holes, only one of them can actually see the chimpanzee. For example, in some cases, one of the experimenters has a blindfold covering the eyes, whereas the other has a blindfold covering the mouth. In other cases, one of the experimenters is facing forward, and the other one is facing backward. In still other cases, the choice is between an experimenter with eyes open versus one with eyes closed. The common denominator in all of these situations is that the chimpanzees must decide whether to gesture in front of the person who can see them or the person who cannot see them (see Figure 2). More generally, the question is, do chimpanzees understand the attentional significance of the fact that only one person's eyes are unobstructed? Do they know that the eyes connect one's internal, subjective attentional state to the external world?

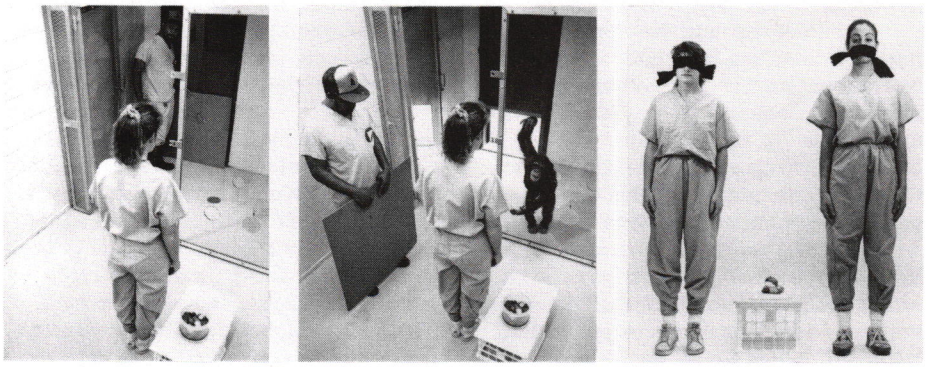


Figure 2. Procedures for testing a chimpanzee's understanding of the attentional aspects of seeing. (a-b) Chimpanzee gestures for reward from a single experimenter. (c) Chimpanzee confronted with two experimenters, one who can see her, and the other who cannot.

We have conducted over two dozen experiments with both preschool children and chimpanzees to explore whether they possess a similar understanding of these attentional aspects of seeing. Although there have been a few

notable exceptions, in general, the chimpanzees have behaved as if they are largely unaware of the role that the eyes play in deploying attention. For example, when choosing between the experimenters with the blindfolds, they choose randomly. In contrast, when given the same test, even older 2-year-old children gesture in front of the experimenter who can see them--and they do so on their very first trial. Thus, although children at this age do not seem to understand the impact that seeing has on the mind, they do understand that only one of the experimenters is attentionally connected to them.

Could the disparity between the performance of the children and chimpanzees simply mean that the apes are not paying attention to the eyes of the experimenters? To the contrary, we have clear evidence that these apes are very sensitive to the eyes of the experimenters. For example, in the context of these same tests, we have repeatedly shown that chimpanzees (possibly like many other social primates) will track the visual gaze of others; that is, if an experimenter suddenly looks behind the chimpanzee, the chimpanzee, too, will turn and look there.

There are at least three possible explanations for why our chimpanzees have consistently replied "no" when we ask them whether they understand seeing in mentalistic terms. First, our subjects have usually been fairly young --between 5 and 7 years of age. It is possible that older apes might understand seeing in a manner more similar to young children. Second, it is possible that chimpanzees do, in fact, understand the mental state of attention, but they simply do not understand the role that the specific sensory modalities (such as vision, audition, and olfaction) play in deploying attention. For example, when chimpanzees confront two people facing them, one with eyes open and one with eyes closed, they may assume that, based on their similar proximity and orientation, both of the experimenters are attending. Of course, there is a final and more sobering possibility that, despite their sophisticated intelligence, chimpanzees and other nonhuman primates simply do not possess a theory of mind. It may be that a subjective understanding of others--so ingrained and automatic in us--is alien to them. One of the hallmarks of human evolution may have been the emergence of a radically new psychology, a psychology that does not merely learn about behavior, but interprets it in a rich and mentalistic way. ■

Talented Undergraduates Sought for Summer Institute

Do you know a talented undergraduate who might profit from spending a week with the best psychological scientists around? "The Nature of Research in Psychology" will be the theme for APA's Summer Science Institute, designed to attract such students to scientific psychology. The Institute is part of the Special Science Initiative that was funded by APA to promote the science of psychology.

The Institute will introduce and build on the concept of the scientific method in psychology. It will then feature content sessions that cover some of the major subfields of scientific psychology, such as social, cognitive, developmental, and biopsychology.

The Institute will also feature a field trip to the National Institutes of Health, where students will have the opportunity to speak with several distinguished psychologists and observe research conducted in their laboratories. In addition, students will meet with current graduate students and will be given up-to-date career-planning information.

Two sessions, each with 30 students, will be held at the University of Maryland, College Park. Students, whose expenses will be fully paid, will be able to choose between sessions occurring June 10-16 and July 8-14. Lest this become an "all work and no play" week, students will have a few "Washington, DC" opportunities, including an evening tour of the monuments on the mall.

Ludy T. Benjamin, Jr., PhD, will serve as the Institute leader for both sessions. Dr. Benjamin, of Texas A&M University, has led high school psychology-teacher summer institutes for many years and is well-known for his innovative teaching methods.

"We are really excited about Ludy's taking on this assignment. He is clearly the best qualified person to lead the Institute, and we are just delighted that he will be at the helm," said William C. Howell, PhD, APA Executive Director for Science. "Ludy is a master at grabbing the attention of students and drawing them into the subject matter."

The following are applicant requirements:

1. Students should be college freshmen or sophomores.

2. Applicants should have completed at least one of the following as preparation: a college introductory course in psychology; Advanced Placement psychology at the high school level; independent study by reading one or more psychology textbooks outside of course requirements; or supervised field or laboratory experience in psychology.

William C. Howell, PhD, APA Executive Director for Science, meets with Ludy T. Benjamin, Jr., PhD, Summer Science Institute leader.

3. Students must complete application materials, including references from faculty members, and submit them by February 1, 1996.

Selection decisions will be made by late February.

The Institute has been advertised in a variety of ways, including posters on campuses, announcements on student e-mail lists, and letters to department chairs and many faculty members.

To obtain application materials, please request the "Summer Science Institute application packet" from the Science Directorate. Contact staff at (202) 336-6000; FAX: (202) 336-5953; or e-mail: science@APA.org. ■