Ape-Language Controversy Flares Up

Although apes may learn extensive vocabularies of signs, there is still dispute about whether they are capable of true language

. . . it is a great baboon, but so much like man in most things. . . . I do believe it already understands much English; and I am of the mind it might be taught to speak or make signs.—Entry in Samuel Pepys' *Diary*, August 1661

Are the apes capable of using language or aren't they? Samuel Pepys suggested that they might be, on the basis of impressions gained when he first encountered a baboon. Over the years several investigators tried to teach apes, usually chimpanzees, to speak, but with little success, possibly because the animals are physiologically incapable of producing the sounds needed for vocal speech.

Then in the late 1960's reports began to appear suggesting that apes are capable of using language, such as American Sign Language (Ameslan, the sign language used by the deaf in North America), that does not require vocalization. This did not settle the issue of apes and language, however. More than 300 years after Pepys' observation, debate on the issue rages on—often with as much heat as light—at meetings and in a variety of learned and not so learned journals.

Herbert Terrace* of Columbia University revived the controversy late last year when he described the results† of an effort to teach Ameslan to a young chimpanzee named Nim Chimpsky. Although the initial analysis of Nim's signing suggested that he was using language the way humans do, after a closer look Terrace concluded that he really was not.

The investigator noted several ways in which the chimp's utterances differed from the developing language of human children. For example, Nim, unlike children, rarely signed spontaneously, usually signing only in response to prompting by the trainer. In fact, as much as 40 percent of the time Nim merely repeated the signs made by the trainer without adding any new ones of his own. In other words, the chimp was not actually creating sentences of his own. Instead, he was behaving more or less like a trained dog—albeit a very clever one.

Even when Nim did expand on his trainer's utterances, says Terrace, he tended to use signs, such as *Nim, me, you,* and *eat* that did not add any new information. A good illustration of this phenomenon is Nim's 16-sign utterance: *give orange me give eat orange me eat orange give me eat orange give me you.*

Terrace's conclusions flew in the face of those reached by other investigators who have been teaching Ameslan to great apes, including chimpanzees and gorillas. These investigators have all concluded that apes are capable of true language. Not surprisingly, they view Terrace's work with disfavor. Says R. Allen Gardner of the University of Nevada, who with his wife Beatrice Gardner trained Washoe, the first chimp to become proficient at producing signs, "It is the shoddiest piece of work I have ever seen in this area."

Also taking issue with Terrace are Roger Fouts, who originally worked with the Gardners and is now at the University of Oklahoma, and Francine (Penny) Patterson of the Gorilla Foundation near Stanford, California. Patterson has been training the female gorilla Koko since 1972.

The current controversy is perhaps the most spectacular eruption in a long-simmering debate over apes and language. Part of the debate is philosophical. It concerns nothing less than the nature of man. This facet of the controversy revolves around the question of whether man is unique in his ability to use language. Noam Chomsky, the noted linguist from the Massachusetts Institute of Technology, is among those who say that he is. In fact, Terrace named Nim in recognition of Chomsky's prominence in defending the linguistic uniqueness of human beings. The investigator, who was originally disposed to believe that apes might be capable of true language, thought it would be ironic if Nim were to ultimately prove Chomsky wrong.

In addition, the debate is linguistic, concerning the nature of language. The fact that there is no general agreement about what does or does not constitute a language complicates all the issues.

And still a third issue centers on the methods used to assess the language capabilities of the apes. There is no way to know what an ape is thinking when it uses a sign or some other symbol intended by the researchers to act as a word. As David Premack of the University of Pennsylvania puts it, "You cannot interrogate them; that would be quite nonsensical."

Two general ways of confronting the problem have developed. On the one hand are investigators who use Ameslan with their animals. They raise the gorillas or chimps in an highly social, family-like environment where the animals are exposed to Ameslan in much the same way as human infants are exposed to language. The underlying assumption, says Fouts, is "that language is a social behavior, developing out of the mother-infant bond." The apes' linguistic capabilities are then assessed by comparing their language development with that of human children. Using this method, the Gardners and Fouts concluded that language developed in Washoe and, more recently, in several other chimps just as it does in humans. And according to Patterson, Koko is at least as accomplished in this regard as are the chimpanzees.

On the other hand are investigators who have developed artificial languages for testing the communicative abilities of chimpanzees. They include Premack and Duane Rumbaugh of Georgia State University and the Yerkes Regional Primate Research Center of Emory University and Sue Savage-Rumbaugh, who is also at the Yerkes center.

Premack uses a set of plastic chips of various sizes, shapes, and colors to represent words. The Rumbaughs have developed a system of geometrical symbols

*Collaborating with Terrace on Project Nim were Laura Pettito, currently at Harvard University, and Richard Sanders and Thomas Bever, who are both at Columbia University.

†The results were described in a book, *Nim: A Chimpanzee Who Learned Sign Language* (Knopf, New York, 1979), and also in articles in *Science* (23 November 1979, p. 891) and *Psychology Today* (November 1979, p. 65).

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that they call lexigrams, which are displayed on the keyboard of a computer. The computer can record every use of the lexigrams by the chimps. In general, these investigators take a less optimistic view of apes' language capabilities than do those who use sign language, with the exception, of course, of Terrace.

The investigators who use sign language criticize the methods of the others as being too artifical, lacking the freedom and spontaneity of normal communication. They do not think that true language can develop under these conditions, a circumstance that would account for the failure of Premack and the Rumbaughs to find it in their animals.

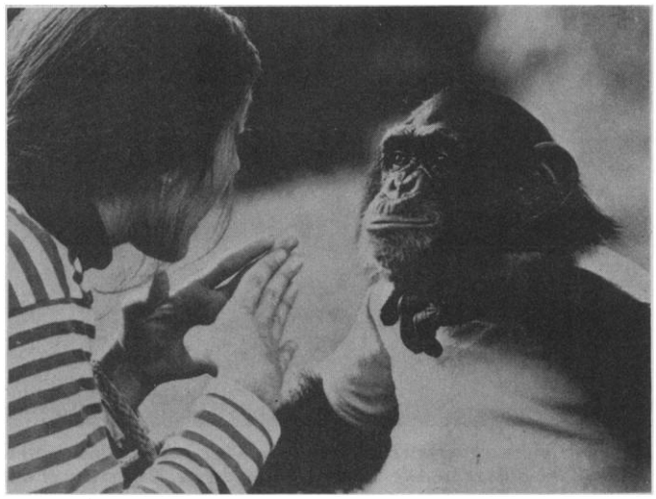
Premack and the Rumbaughs, in turn, criticize the sign methods as being uncontrolled and the results anecdotal, a criticism echoed by Terrace. Paradoxically, each group maintains that the methods of the other are flawed because they are subject to cuing of the animals' responses by the investigator. They cite Clever Hans as an example of how cuing can lead to erroneous conclusions about an animal's talents.

Clever Hans was a horse who lived around the turn of the century and was credited for a time with being able to solve arithmetic problems. He would stamp out the answers with his hoof. Close examination showed, however, that Clever Hans really did not know that two plus two equals four. He was instead picking up subtle cues from his trainer—who was himself unaware of what he was doing—that told the horse when to stop stamping.

Now Terrace is basically saying that what appeared to be sentences produced by Nim were, in fact, examples of the Clever Hans effect. The chimp was responding to prompting by his trainers and the trainers were unaware of the mimicry.

If Nim was not producing sentences, says Terrace, then he was not capable of true language. Despite the lack of agreement about what constitutes a language, most linguists concur that two elements are necessary, if not sufficient. One is that the words or signs be symbols for something and be recognized as such by the user. And the other is that the words be combined with one another to form novel phrases or sentences that are nonetheless understandable by others. This requires that the combinations follow grammatical rules of some kind.

By Terrace's account, the Columbia group's overall approach with Nim was similar to that of the other investigators who use sign language. As Nim began learning Ameslan, they recorded his vocabulary and also attempted to record all of the word combinations he eventually began to produce.



Nim signs "dirty" during training session with Joyce Butler, who is asking him if he wants to go into the house. Nim would sign "dirty" when he needed to use the toilet—and also when he was bored or wished to avoid some unpleasant task. He had learned that the sign would elicit a quick response from the trainer. [*Photograph by Herbert Terrace from the book,* Nim, *reprinted with permission from Alfred A. Knopf, Inc.*]

When the Columbia researchers first examined the patterns in Nim's sign combinations, they concluded that Nim might have been following grammatical rules of some kind. But when Terrace looked more closely at Nim's performance, particularly in $3^1/_2$ hours of videotape recordings, he began to be troubled by the differences between the way language develops in children and the way Nim was using signs. "You do not have a sentence," he points out, "just because you have a sequence of signs."

Not only were Nim's utterances imitative and lacking in spontaneity, but their average length remained stuck at around 1.5 signs during the last 2 years of the 4 years he underwent training. In contrast, the phrases spoken by children increase in both length and complexity as they grow older. All in all, Terrace concluded that Nim showed little evidence of the spontaneous production of sentences characteristic of human language.

Fouts, the Gardners, and Patterson all object to this conclusion on several grounds. They are especially critical of the manner in which Nim was trained, maintaining that the training was unnatural because it was carried out in a classroom and used techniques unlikely to elicit spontaneous behavior.

Fouts points out that Terrace was a student of B. F. Skinner of Harvard University. He suggests that Terrace relied on the Skinnerian technique of operant conditioning while training Nim. An animal undergoing operant conditioning learns to produce a response in order to receive a reward, usually something to eat. Fouts maintains that this kind of conditioning will produce a passive animal whose behavior is largely imitative and lacking spontaneity—in other words, precisely the kind of language behavior Terrace observed in Nim, but not at all like that of the animals trained by himself and the Gardners.

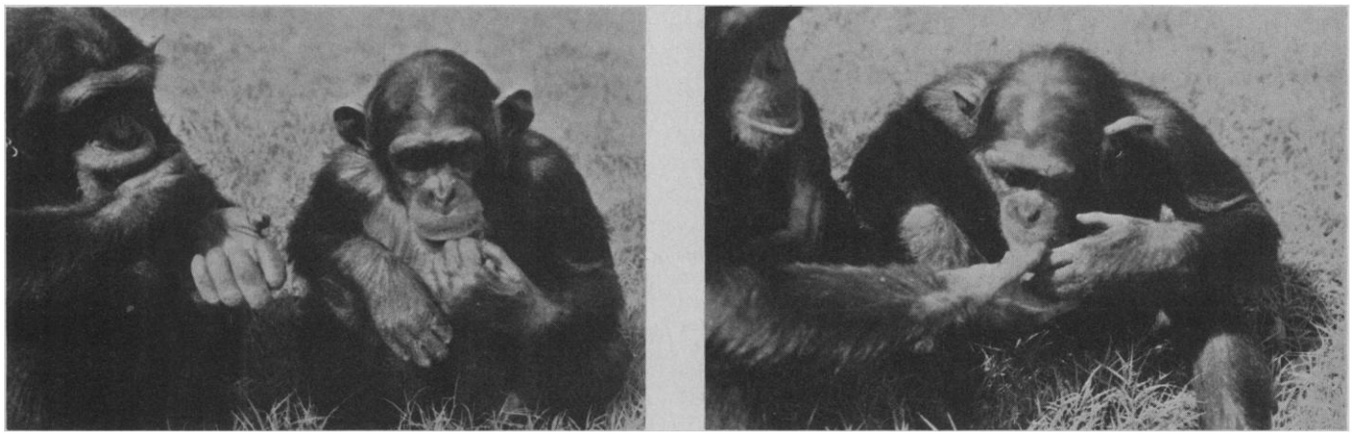
Says Allen Gardner, "We can show that you can turn it [imitation] on and off, depending on the type of training you give." The Gardners recently made a videotape of a chimp, the first two-thirds of which shows little or no imitation in the animal's signing. In the remaining third, in which operant conditioning is used, most—about 70 percent—of the chimp's signing is imitative.

As further evidence of spontaneity in chimpanzees' use of Ameslan, Gardner and Fouts point to several occasions on which Washoe was observed signing to herself or in which one chimp was observed signing to another.

While operant conditioning might possibly explain the high degree of imitation observed in Nim's signing, Terrace maintains that he did not use the technique for training the chimp. He also points out that videotapes of Nim's signing in the less structured environment of the chimp's home gave the same results as those made in the classroom.

Another criticism of Terrace's research is that approximately 60 trainers, many of them poorly trained in Ameslan, participated in the study during its 4-year duration. Says Fouts, "Communication is the binder of a relationship. By having so many changes, Terrace de-emphasized the relationship necessary for language to develop." Other investigators, including the Rumbaughs, have also noted that changes in personnel inevitably led to deterioration of a chimp's performance.

Terrace has always conceded that having so many people involved in Nim's



Example of one chimpanzee signing to another. Ally (on the right) signs "feed" to Bruno, who is eating an orange. Bruno responds by giving some of the orange to Ally. [Source: Roger Fouts, University of Oklahoma]

training made for a less than ideal situation. It was necessary, however, because for much of the study lack of funds forced him to rely on volunteers, many of whom found it difficult to cope for long with an energetic young chimp.

According to Terrace, first impressions counted with Nim, and the neophyte teacher often paid for a failure with a bite, scratch, or torn clothes. Once a teacher failed to establish dominance over Nim, the situation was usually hopeless and a permanent retreat the only solution. The chimp's regular teachers also paid for these encounters because the chimp would be aggressive and difficult to handle for some time afterward.

Despite these problems, Terrace points out that there was a core group of about six people who did most of Nim's training and of whom Nim was quite fond. This core group is about the same size as the groups who have worked with Washoe and the other apes.

Given the disagreements already surrounding ape-language studies, the results of Project Nim, which have been highly publicized, were bound to raise some hackles, even if Terrace had restricted himself to reporting only the conclusions obtained by studying Nim. But Terrace did something more.

Expecting criticism and not wanting to answer at the level of "my chimp is better than yours" or "my teachers were better than yours," Terrace decided to look at data from some of the other projects to see if they supported his conclusions about Nim. He proceeded to use two films, one produced by Nova for television and called *The First Signs of Washoe*, the other produced by the Gardners and called *Teaching Sign Language to the Chimpanzee: Washoe*. Analyzing these films, Terrace came to the same conclusions about Washoe and Koko (who appeared briefly in the Nova film) as he had about Nim—that is, they were being cued by their trainers.

This direct criticism of the work of the other investigators who use sign language has done nothing to calm any tempers. The Gardners, for example, have adamantly denied Terrace permission to reproduce photographically any of the frames of their film in his publications. They maintain that viewing isolated single frames misrepresents and distorts the filmed conversations between Washoe and her trainers in several ways.

For one, eliminating movement can cause one sign to be misinterpreted as another because motion is one of the distinguishing features of signs. For another, they point out that the average duration of a sign is 8 frames, with the final signs of questions being held for up to 12 frames more. As a consequence, choosing widely spaced frames means that much information about when a given sign has started or stopped will be lost. In a letter to the managing editor of *Science*, Beatrice Gardner states, "Slowing down the motion leads to distortion in the same way that slowing down audio tapes distorts speech to the point where all intelligibility is lost." As a result, the Gardners contend, only this loss of information makes it possible for Terrace to claim that Washoe is being prompted by her trainers, a claim, they believe, that is not supported by the film itself. Terrace replies that he used single frames as a space-saving device in illustrating the conclusions, but that the conclusions are based on a frame-by-frame analysis of the film.

Nevertheless, the Gardners are extremely perturbed because Terrace published in his *Science* article tracings of frames from their film. They regard this as an infringement of their copyright on the material and are currently threatening to sue Terrace if he continues to use the tracings in his publications or lectures. Terrace in turn contends that he is merely making scholarly use of the Gardners' scientific data, as happens when one investigator replots the data acquired by another.

Finally, the Gardners have accused Terrace of applying a "rubber ruler"—that is, using different criteria to evaluate the utterances of children and chimps. For example, they maintain that he was not consistent in the methods that he used to decide on the meanings of the utterances of the two species. For children, they say, he used the method of "rich interpretation," in which the full context of the situation in which the utterance is made is taken into account when deciding on its meaning. But the Gardners say he did not use the same method for interpreting such chimp utterances as Washoe's signing of "water bird" when she saw a swan. The Gardners have long cited this usage as an example of the creative use of language by chimpanzees, a conclusion with which Terrace disagrees. He suggests that Washoe merely signed "water" because she saw water and "bird" because she saw the swan, not that she produced a new name appropriate for the swan.

Furthermore, Terrace maintains that he did indeed use rich interpretation with both children's and chimps' utterances. He just found such "an impoverished use of language by the chimpanzees compared to children" that he had to conclude that there was a qualitative difference between the ways the two species use language.

The investigators who use artificial language with their chimps are less distressed by Terrace's conclusions than

those who use sign language. Nevertheless, the former do not see the Columbia results as the final answer on the apes' linguistic abilities, at least partially because of their view that teaching sign language is an inadequate way to assess those capabilities. Says Premack regarding Project Nim, "It is a repetition of a nonoptimal experiment." And Rumbaugh suggests that the problem might be that Nim lacked a grasp of the meaning of words—and thus could not construct a sentence—because of deficiencies in the training procedure.

Despite the controversy over whether or not apes can produce sentences, there seems to be agreement that they use words the way we do—that is, as symbols representing some object that can be used to convey information to another individual. The methodological split is in evidence here, however, as each investigator tends to believe that his or her methods are adequate to show word use, but not necessarily that any of the others are. Rumbaugh, who has lost some of his initial optimism about the apes' linguistic talents, goes so far as to conclude that even his own earlier methods were not up to the task. He does not reject the possibility that apes use language but maintains that this ability has not yet been demonstrated.

In a more recent series of experiments the Rumbaughs devised a method to test the ability of chimpanzees to communicate with one another by means of symbols—and the chimps passed the test. In one of the experiments, the chimpanzees Sherman and Austin were put in separate rooms, both of which were equipped with the computer terminals with which the animals communicate. Food was then placed in Sherman's room in such a way that he needed one of six tools to retrieve it. Although Sherman knew the location of the food, only Austin, who did not see where it was hidden, had access to the tools. In order for Sherman to get at the food, he had to ask Austin for the right tool. The animals had previously been trained in the use of the tools, which included a key for unlocking a box and a stick for pushing food out of a long, narrow tube, and had learned the symbols for them.

After a few false starts, in which Sherman unsuccessfully asked the human experimenter for the tool, he caught on to the fact that he had to ask Austin. When asked for a tool, Austin would pick out the right one and give it to Sherman, who would retrieve the food and then share it with his buddy.

The animals learned this process very quickly, Rumbaugh says, and completed the task successfully 97 percent of the time if the computer terminals were turned on. When they were switched off, however, Sherman and Austin managed to obtain the food only about 10 percent of the time. The Rumbaughs conclude that the lexigrams are needed for one chimp to convey information to the other, and that the chimps use the lexigrams, their "words," just as we use ours.

Premack, who concluded some time ago that chimps are capable of some aspects of human language, such as symbol use, but not all, has gone on to investigate some of the other capacities of the chimp mind. "The interesting part," he remarks, "is that they perceive many of the basic things we perceive, such as causality and intentionality."

Premack tested chimpanzees' knowledge of causality by presenting them with a series of pairs of items, in which one item was in its initial state (a whole apple, for example) and the other was changed in some way (a cut apple). The chimps were supposed to match the item pairs with the tool that had effected the change (such as a knife for the apples). "The question to be answered is, how do you get from X to Y," says Premack. Since the chimps did not see the alterations made, they would have to hold a representation of the action in their mind. He says the animals were very good at selecting the right tools and performed just as well with pairs of items that they had not encountered before as with those they had. All in all, he concludes, they are capable of recognizing the relationship between cause and effect.

To test whether chimpanzees could recognize intention, Premack showed Sarah, an adult chimp, a series of videotapes, each of which portrayed a human actor with a problem. Some of the problems were simple—the actor straining to grasp a bunch of bananas suspended out of his reach, for example. Others were more difficult, as when the actor was unable to play a phonograph because it was unplugged.

After viewing each videotape, Sarah was shown a series of pictures, one of which showed the solution to the actor's problem. According to Premack, the chimps were very good at picking out the right solution, even better than children of the same age. What this means, he says, is that the animal was able to recognize that the tape presented a problem for the actor to solve and that the actor had a purpose, or an intention, in mind. In other words, Sarah was able to impute a mental state to another being.

Now some people may wonder what the point is of all this research on the apes' linguistic and intellectual capabilities. The question has occurred to, among others, Senator William Proxmire (D-Wis.), who has become famous—or infamous, depending on your point of view—for his "Golden Fleece" awards for government spending on projects he considers frivolous or wasteful. Proxmire at one time was highly critical of the National Science Foundation's funding of Premack's research. (Premack did not receive the Golden Fleece; Proxmire had not instituted it at the time he questioned the ape-language studies.)

At least one practical benefit has come out of the chimpanzee work—the development of methods for teaching severely mentally retarded human beings. Many severely retarded persons cannot speak, and as Rumbaugh points out, "Without communicative abilities, these people can do nothing."

In one project, at the Georgia State Retardation Center, Savage-Rumbaugh is working with six individuals, who range in age from 12 to 20 years. These patients have IQ's of about 20 to 40 and had little training before entering the project. Savage-Rumbaugh and her colleagues are using both the computer technology and the methods the Georgia group developed for training chimpanzees. She says, "What works with the chimps, works with the human." Savage-Rumbaugh emphasizes, however, that despite their severe behavioral and linguistic problems, the people are still much easier to teach than the chimps. Other investigators around the country are also successfully applying the lessons gleaned from the work with apes to the mentally retarded.

—JEAN L. MARX

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