

# Déjà Vu All Over Again: Chimp-Language Wars

*Studies of apes using language were decimated once, but diehards are fighting back*

A DECADE AGO SOME RESEARCHERS THOUGHT they had taught chimps to form full-blown sentences. That finding was revolutionary in several ways. First, it suggested that language is not a uniquely human capacity. In addition, it raised the possibility that apes and human beings share a common ancestor who had linguistic capacity—threatening to overturn the established view that language evolved long after human ancestors and apes diverged.

Unfortunately for those holding this revolutionary view, the findings on chimp language were thoroughly demolished by Columbia University psychologist Herbert Terrace in 1979. Publishing in *Science*, Terrace showed convincingly that the chimps were simply imitating their human keepers—and not inventing sentences. He also pointed out major methodological flaws in all the ape-language studies. Terrace's article devastated the budding field. Funds dried up and researchers were discouraged from studying language in apes.

Now, a tiny band of researchers is back with new and (they claim) better controlled data. Two of them, Sue Savage-Rumbaugh of Georgia State University and Patricia Marks Greenfield of the University of California at Los Angeles, claim a pygmy chimp named Kanzi can create sentences as grammatical as those of a 2-year-old child—and even invent new syntactical rules. It would seem that the debate whether language is uniquely human is about to be opened up again.

This time around some former critics, having successfully cratered the previous generation of ape-language studies, don't want to revisit the issue. "It's no longer interesting to me," says Terrace abruptly. One of his coauthors on the 1979 *Science* paper, University of Rochester psychologist Thomas Bever, calls teaching chimps to use language "stunts" that don't add anything to our ability to understand human evolution or what apes do in the wild.

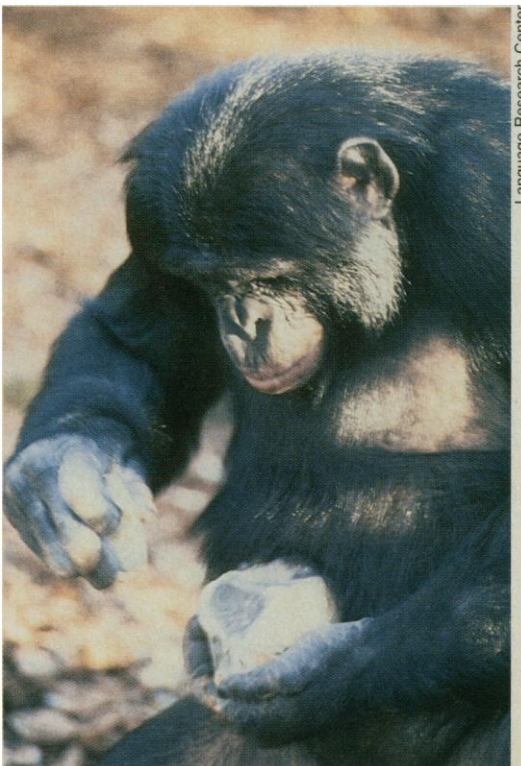
Far too little of the new data has been published for a consensus to have emerged, but some in the field believe the new studies are better than the old ones. Greenfield and Savage-Rumbaugh's work suggests that apes do have "rudimentary

syntax," says Dorothy Chaney, a primate behaviorist at the University of Pennsylvania who has seen the new results. "If true," adds Chaney, "this would be very important, because syntax is supposed to be one of the linchpins of human language."

Savage-Rumbaugh and her husband and colleague, Duane Rumbaugh, are veterans of the ape-language disputes of the 1970s. Rather than giving up when the roof fell in, they changed their methods. To begin, they chose a new subject: *Pan paniscus*, the pygmy chimp, whose behavior is thought to be more like that of humans than the behavior of the more widely studied common chimpanzee, *Pan troglodytes*.

Savage-Rumbaugh also tried to eliminate data derived from situations where Kanzi was imitating his keeper—retaining only data showing the chimp was using symbols on his own. Furthermore, she works in a 55-acre forest outside Atlanta (the Language Research Center, funded by Yerkes Regional Primate Research Center and Georgia State University), which she claims makes her work more representative of what happens in the wild.

**Big talker.** Pygmy chimp Kanzi fashions a stone tool.



These efforts have won plaudits from some researchers, including Herbert Roitblat, an expert in animal cognition at the University of Hawaii. He says Savage-Rumbaugh has "made every effort to ensure it's solid and reliable data." Roitblat adds that Savage-Rumbaugh's previous publications have convinced many workers in this field that whether Kanzi can exploit syntax or not, he does have a remarkable comprehension of spoken English.

The second round of ape-language work got under way in earnest 4 years ago, when Kanzi was 5½. A team of researchers worked with the pygmy chimp intensively for 5 months, recording more than 13,000 "utterances." Kanzi communicated by gesturing and touching lexigrams—200 geometric symbols on a keyboard.

After watching Kanzi use his keyboard and make gestures many times, Savage-Rumbaugh and Greenfield inferred that the chimp has skills showing the beginning of a capacity for grammar and syntax. For example, Kanzi uses changes in the order of words to signal a change in meaning. When his mother, Matata, was grabbed by a trainer, Kanzi used symbols in the order: "Grab Matata." But when Matata was biting someone, he would select Matata's name first—and then the symbol for "bite."

The researchers also cite cases in which Kanzi used linguistic rules. For instance, when he used gestures and keyboard symbols together, he seemed to have a rule requiring him to make the gesture after pointing to the symbol. When he wanted to see the lab's dog, he would point to the symbol for dog, then make a gesture for "go." A rule Kanzi apparently invented was that when he gave an order combining two symbols for action—such as "chase" and "hide"—it was important to him that the first action—"chase"—be done first.

These findings were published last year in a volume of essays by Cambridge University Press; some are in press in the journal *Advances in Infancy Research*. Those results, says Greenfield, "provide evidence that pygmy chimpanzees can learn a simple grammar, but more interesting and more important, they can invent new protogrammatical rules—rules never demonstrated by any human or animal in the chimpanzees' social environment."

The researchers extrapolate from these data to suggest the capacity for the earliest stage of language originated at least 5 million years ago in an ape-like ancestor common to chimps and humans. Rather than emerging for the first time in humans, that capacity merely became

more sophisticated in an incremental way as human beings evolved.

Savage-Rumbaugh and Greenfield's conclusions are only now reaching investigators concerned with language and evolution. But even at this early stage it is clear they have some sympathizers. UC Berkeley linguist William S. Wang, an expert in the evolution of language who wasn't a participant in the earlier battles, is keeping an open mind. If the findings with Kanzi are proven true, he says, it would suggest that many of the components we think are crucial to speech and that separate human speech from animal communication are quite old.

At the other extreme is MIT linguist Noam Chomsky, who was a severe critic the first time around and now thinks the issue is settled. Chomsky admits he hasn't seen the new data—and doesn't care to see it—but ridicules the notion that any species would have a capacity highly advantageous to survival but not use it until a researcher taught them to. "It would be a biological miracle if humans had the capacity for flight and never thought of using it," Chomsky says.

Other Round 1 critics, including Terrace coauthors Bever and McGill University psy-

chologist Laura Petitto, aren't as harsh as Chomsky. But they have specific objections to the latest round of Kanzi findings. Those findings are difficult to reproduce, they say, since it is nearly impossible to obtain pygmy chimps (an endangered species) for studies in the United States. Furthermore, they say, the criteria Greenfield and Savage-Rumbaugh used to define grammar are too lenient. Bever and Petitto remain unconvinced that Kanzi is using—much less inventing—grammar.

"Kanzi's behavior differs from children's use of language in systematic ways," Petitto wrote in a review of Savage-Rumbaugh's work with Kanzi on language comprehension in an article in the *Journal of Experimental Psychology, General* (Vol. 116, No. 3, 279). "It is not controversial that many [nonhuman] species communicate," wrote Petitto. "What is controversial is whether any species other than humans possess the capacity to acquire language."

But some of those who are attracted by the new studies don't dismiss the idea that pygmy chimps could comprehend English—and perhaps even use rudimentary grammar. "I think most people would say they're dignifying it to call it grammar—it's proto-

grammar," says Wang. "But they're headed in the right direction."

One of the directions these studies might take is suggested by work done by paleoanthropologist Nicholas Toth of the University of Indiana. Toth, who is interested in the interrelation between tool use and language in evolution, showed Kanzi how to strike flints from a stone and use them as simple tools. Toth is now interested in finding out whether Kanzi will teach other chimps to make stone tools, yielding an animal "community" of toolmakers that might mirror early hominid toolmakers, further diminishing the putative uniqueness of *Homo sapiens*.

Beyond Toth's work, say many researchers, what is needed are studies of pygmy chimps in other labs to see if the work with Kanzi can be reproduced. Also needed are studies of the same species in the wild to analyze more precisely differences between human and chimp symbolic behavior. One researcher—University of Michigan anthropologist John Mitani—has just begun studies of vocal communication among wild pygmy chimps in Zaire. What he finds may settle the question: Have the chimps really mastered their grammar? ■ ANN GIBBONS

## Rising Chemical "Stars" Could Play Many Roles

*Enormous polymers that grow from a tiny core might be used in drug delivery, filtering, catalysis—even artificial cells*

IF *TIME* MAGAZINE COULD name the computer its "Man of the Year" in 1983, Nature deserves consideration from the Nobel jury for the prize in chemistry. In fact, no chemistry Nobel has matched Nature's command of the periodic table in turning out enormous polymers—be they hemoglobin or chromosome 12—with precisely identical molecules.

Recently, however, several research teams have begun giving Nature a run for its money. "We have, for the first time, made a large molecule that is precisely defined spatially," says Jean J. M. Fréchet, professor of chemistry at Cornell University, one of those who



**Starmaker.** Donald Tomalia of Midland Molecular Institute.

Midland Molecular Institute

are at the forefront of this work. "Now, we have the opportunity to design some pretty sophisticated molecules with very useful properties."

Among the useful roles these heavyweights (some have molecular weights of 350,000 and diameters of 100 angstroms) could ultimately play is serving as vehicles for intercellular drug delivery. "Imagine having a molecule that is large enough to carry hundreds of molecules of drug, yet small enough, at 100 angstroms, to pass through a biological

membrane," says Fréchet.

Beyond drug delivery, firms such as Kodak, DuPont, IBM, and Allied-Signal are studying how uniform molecules can be used to im-

prove microelectronics processing, selective filtering, catalysis, and advanced materials design. Other companies, afraid of being left behind, are scrambling to get a foot into this new area of polymer research, but the field is so new and small that expertise in making the polymers is in short supply. An indication of just how hot the field has become is the fact that few investigators were willing to disclose details of their work for fear of jeopardizing patent applications.

The new, uniform polymers are called by various names, including hyperbranched dendrimers, starburst dendrimers, arborols, and fractal polymers. Whatever the name, they have the same structure: three or more highly branched polymer chains sprouting from a tiny core. By carefully choosing the conditions under which the chains grow, it is possible to make the chains identical.

The key to obtaining the identical molecules is a sudden change in the growth process. Although the dendrimers begin growing as two-dimensional, fanlike shapes, at a certain point they take on a ball-like form and stop growing, leaving all the molecules with the same shape and mass. "When these molecules reach a certain size, the chains of each molecule undergo a reorganization and pack together to form a tight skin surrounding a largely hollow interior," explains Donald Tomalia, senior scientist at the Midland (Michigan) Molecular Institute (MMI), a state-funded research insti-