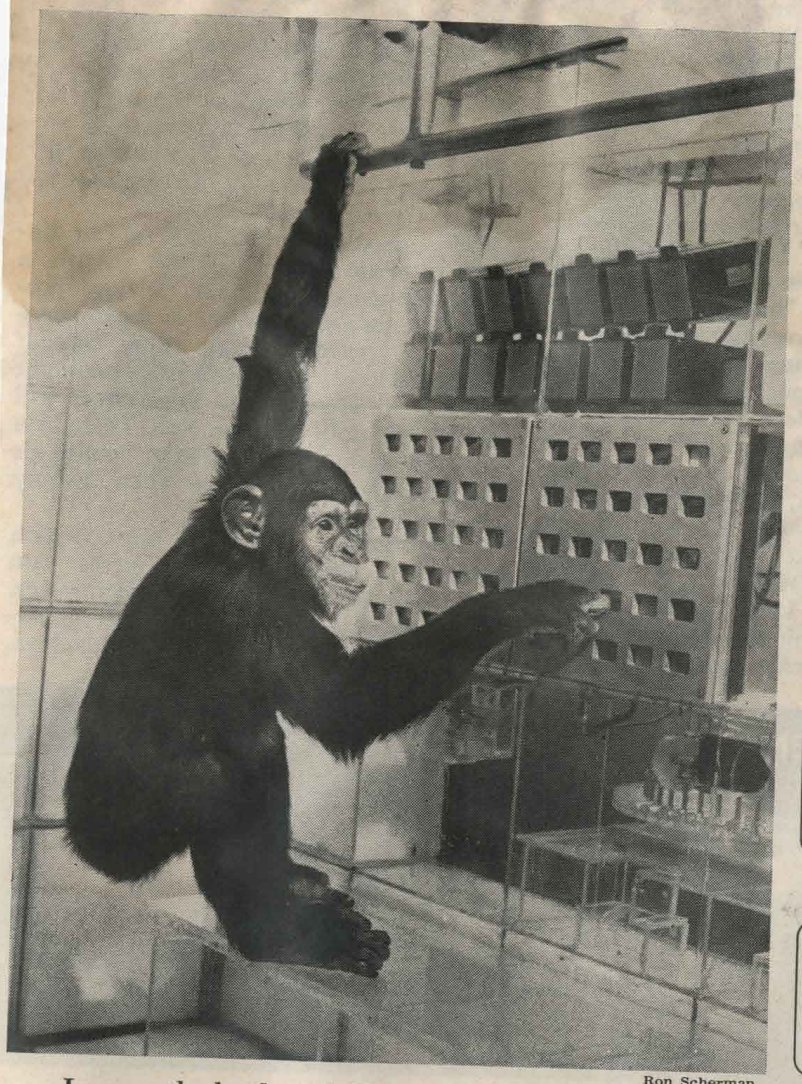
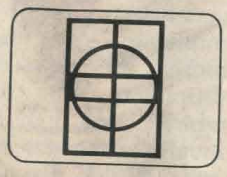
Internationale Presseberichte über das LANA Projekt
International Press Reports on the LANA Project



Ron Scherman

Lana at the keyboard: Punch and you shall receive



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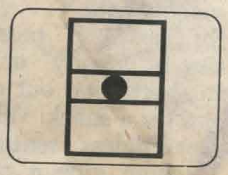

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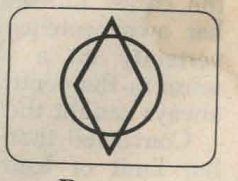

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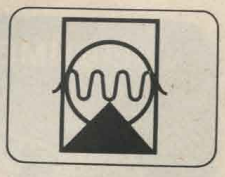

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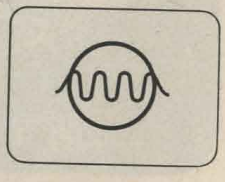


Water

The Syntactical Chimp

Over the last few years several researchers have demonstrated that chimpanzees can learn rudimentary language. At the University of Nevada, a six-year-old chimp named Washoe acquired a 140-word sign-language vocabulary and was taught to engage in complex sentence dialogue with humans. Bruno and Booee, two five-year-old males at the University of Oklahoma, used their sign language to converse with one another, actually preferring it to their natural means of communicating, which is a combination of chirps and gestures. Now, another remarkable demonstration of simian intelligence has been achieved. Researchers at the Yerkes Regional Primate Center in Atlanta, Ga., have taught a chimp named Lana to read and write simple but complete sentences in perfect syntax, and even to punctuate them accurately.

Lana writes her sentences, which convey her desires for food, movies or human affection, by punching plastic keys on a computer console. Each key of her large typewriter has a hieroglyphic-like symbol on it which stands for a word. The researchers say that there is no trick to what Lana does, as there is in teaching a dog to bark for a bone. "She understands the machine," says psychologist Duane M. Rumbaugh, "and she is very flexible in its use. Lana knows exactly what she is doing."

Lana's training began about two years ago when she was taught simple noun symbols such as apple, movie, drink and window. After she knew that pushing the picture key with the proper symbol—in this case a circle with two parallel lines in the center—would cause the computer to produce an apple, she was taught such verbs as give, make, open and tickle. But up to this point Lana's learning was merely rote association, similar to that of a human infant who learns that crying will get parental attention.

The breakthrough came about a year ago when Lana began using her 50-word vocabulary to make her own sentences, and to punctuate declarative ones with a period and interrogative ones with a question mark. To make sure that Lana had not become accustomed to a particular arrangement of the buttons on the computer console, the researchers scrambled the positions every day—the equivalent of randomly rearranging the keys on a secretary's typewriter. But

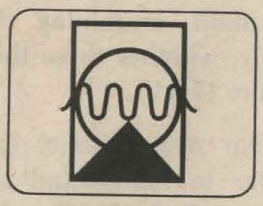
Newsweek

Mind Over Matter Page 73

Eastern mysticism appeals mostly to long-hairs in America, but now a mind-soothing discipline called Transcendental Meditation is winning legions of quite conventional converts. Religion editor Kenneth L. Woodward, himself an initiate, reports on the TM phenomenon.

Chimp Talk Page 75

Research on the ability of chimpanzees to communicate has made great progress in recent years. Now scientists at the Yerkes Primate Center have actually taught chimps to use computers to formulate —and even to punctuate—complete sentences.



January 7, 1974

wart Alsop is off this week.)

Chimp learning to talk to humans

By MIRIAM PACE

A three-year-old chimpanzee named Lana is learning to "talk" to humans as a result of a unique computer communications system designed by Ernst von Glasersfeld, assistant professor of psychology at the University.

Von Glaserfeld, along with Pier Pisani, a systems analyst at the University's computer center, developed the system for a project researching non-human primate communication. Dr. Duane Rumbaugh of Gerogia State is helping to conduct the project along with officials from the University and Emory.

Lana is not actually using word sounds when speaking to the researchers at Yerkes Primate Center in Atlanta where she lives, but communicates in "Yerkish," a computer language created especially for her by von Glasersfeld

..**THE LANGUAGE** is built from nine geometric figures that appear on a special keyboard linked to a computer. These figures, when superimposed on each other, form symbols which stand for various concepts or words. By punching out the proper symbols in the proper sequence, Lana is able to "talk."

After almost a year of experimentation, Lana has quickly adapted to her new language, and is able to read and answer over 60 symbols and grammatically correct sentences.

One example of her communication is "Please machine give piece of banana," on which a dispenser attached to the computer answers her request. Lana may also ask for other food, toys, music and movies.

A recent development shows that chimpanzee is also capable of answering simple questions, and creating original sentences.

Von Glasersfeld recalled an incident where Lana demonstrated her intelligence. One morning, the graduate student who takes care of Lana inadvertantly popped a piece of banana in his mouth that was intended for her breakfast. Upon seeing this, Lana became very distressed, ran to the computer keyboard in her cage, and began to repeatedly punch the symbol for "no."

Using a computer to record Lana's progress provides a definite advantage over previous man-ape communication experiments. The computer records accurate, concrete evidence of the results and observations and leaves little room for human error, according to von Glasersfeld.

THE PURPOSE of the project, said von Glasersfeld, is two fold. First, the researchers want to determine if apes are capable of conveying a simple request, for which they would be rewarded with material gains. Secondly, they hope to discover more about the abstract ideas and thinking processes of apes, and possible even converse on an ape-to-man level with the animals, without having to supply a material reward.

The project may also accomplish some long range goals. Von Glasersfeld explained that there are certain blocks in a chimpanzee that cause difficulty in learning language. These same learning blocks may be what is causing the difficulties of speech in retarded and deaf children, he said.

By extensively studying Lana's learning process, the researchers hope their findings may eventually be used in designing remedial programs for children who have problems in acquiring language skills.

..**VON GLASERSFELD** feels that chimpanzees and other apes are capable of learning much more than was previously believed. "Their intellectual limits are not as low as people have thought. They do communicate quite extensively. They have not developed as complicated a language as we have because their environment did not push them to do so."

Von Glasersfeld and his associates have received international attention on their studies with Lana. Many scientists have expressed interest in the project, and Lana will be included in an upcoming National Educational Television special dealing with non-human primate communication.

Researchers at Yerkes are now in the process of analyzing all of the data on Lana presently recorded in the computer. The project is scheduled to continue for at least three more years, and von Glasersfeld plans to work in greater depth with Lana, as well as possibly conducting similar experiments in teaching other apes to "talk."

Photo by BOB NELLANS

UNIVERSITY PROFESSOR HAS HELPED CHIMP TO "TALK"
Lana speaks by punching out symbols on a computer

WEDNESDAY, JANUARY 30, 1974

Red and the Black Jan 30 1974

Watch Out, This 'Tot' Will Make a Monkey Out of You

By KATHLEEN GALLAGHER

It's pretty unusual for a 3-year-old to learn how to read, especially when that "tot" is a chimpanzee.

But Lana the Chimp, an inmate of the Yerkes Primate Center in Atlanta, can make sentences using combinations of 50 different word-symbols.

HER INSTRUCTOR Prof. Ernst von Glasersfeld, was at the Nashville Linguistic Circle meeting at Vanderbilt University yesterday to explain the progress of his bright pupil.

"Chimpanzees can do more than people ever thought," he said.

To back up this statement, the professor showed films of Lana obtaining banana slices candy, glimpses through her favorite window and affectionate tickling — all by punching a coded series of symbols on a 50-key computer keyboard.

The amazing part of her performance is that she is not just trained to punch buttons for her needs, but that she knows how to form complete sentences to explain exactly what she wants.

WHEN SHE hangs from a rod above the computer with one hand and with the other punches buttons for "please, machine, give me a slice of banana," and then finishes the sentence off with a period, she has performed a complex task.

First, she has turned on the machine with the pressure of her hand against the bar. The word "please" indicates she is asking a favor. She has to ask for a slice of banana, not just a banana, or the automatic feeder will not obey her request. Finally, the period at the end indicates she has finished her message.

Out comes the slice of banana. If she wants another piece she has to repeat the process.

Glasersfeld said the process also is rigged so that Lana can request her little window to open, but it opens for only 30 seconds at a time. If she likes what she sees, she has to punch the sequence of symbols over again, to have another look.

Glasersfeld said scientists long have been interested in communicating with animals. Repeated experimentation has proved that nonhuman primates are not capable of complex spoken language. The computer-based language of symbols, he said, seemed the most effective way to teach chimpanzees to communicate with humans.

He said the seven-member team of professionals from different disciplines who worked on the project decided a symbolic language would eliminate many of the ambiguities of the written English language where one word may have several unrelated meanings or two totally unrelated words may be spelled alike.

Sometimes the chimps learn faster than the professors think they can, Glasersfeld said. Lana knew the words "yes" and "no" only from identifying objects with their written symbols.

ONE DAY when a keeper came to her room to replenish the banana slices in her feeding chute, he absently put a slice in his own mouth. The chimp bristled and made chimpanzee gestures of displeasure.

When the keeper failed to respond as another chimpanzee would, Lana hustled on over to the computer and conveyed her protest in human terms by repeatedly pushing the "no" button.

Science News

Thank you!

— UPI photos

— D. M. Rumbaugh, T.V. Gill, Emory Univ.; E. C. Von Glaserfeld, U. of Georgia, in *Science* Nov. 16, 1973

For years scientists have taught chimpanzees to do all sorts of things. Now scientists have taught a three-year-old chimp named Lana (far right) to read and write.

Scientists Find Lana a Star Student

Chimp Makes Thoughts Known

Atlanta, Ga.—For years scientists have taught chimpanzees to do all sorts of things. Some scientists have even tried to teach chimps to speak.

Spoken words are one way people have of exchanging ideas. Written words are another way. Each written word is like a sign for something that's real. By putting these signs in order, people can make their thoughts known.

Can chimps make their thoughts known this way? Can chimps learn to read and write?

One Chimp Can

Scientists at the Yerkes Regional Primate Research Center here in Atlanta think at least one chimp can. The scientists say they've taught a three-year-old chimp named Lana to read and write.

First Lana had to learn signs just as people learn words. Then she learned what each stood for.

People learn to write with a pencil and paper. Lana learned on a special typewriter. (See photo at right above.) The typewriter had 50 keys. Each key had its own sign that stood for a word.

Lana's job was to make a message by pressing the right keys. If her message made sense, she got a banana for a reward.

In this way Lana learned to form sentences. She was able to ask for food or drink or music or movies or people to play with.

The scientists found that Lana was a star student. In one set of tests, the chimp was given several groups of words. Lana had to read each word group and decide whether or not it made sense.

If the words made sense, Lana had to turn them into a sentence by adding more words. If the words didn't make sense, her job was to push a key that erased them.

Lana Learns Well

Lana read and wrote very well. She even got a 90 on her final exam. So this chimp is a champ when it comes to learning!

Quiz of the Week

UGA research project focus of international attention

A psychology professor and a computer technician at the university have key roles in a research project on a "talking" chimpanzee which is receiving widespread attention from scientists and the news media.

Inquiries and requests for information about the project, which involves a three-year-old chimp named Lana, a computer and a special language called "Yerkish," have come from as far away as the Soviet Union, Africa and India. Reports on the work have been carried by newspapers, magazines, television stations and in professional magazines.

University personnel associated with the study are Dr. Ernst Von Glasersfeld, assistant professor of psychology, and Pier S. Pisani, a systems analyst at the computer center.

Lana, who lives at the Yerkes Regional Primate Research Center at Emory University, has been taught to "read" Yerkish. The language, which was created for this project, is built from nine simple geometrical figures that are superimposed on each other to form different symbols, or lexigrams, that stand for various concepts or words. There are symbols, for example, for such concepts as give, come and make, and for such words as banana, juice, milk and music.

The lexigrams appear on a special keyboard attached to a computer. Lana has learned more than 60 symbols and can punch them in the proper sequence to form grammatically correct requests, which the computer will automatically grant. The sentence structure she uses is "Please machine give piece of banana," or orange, candy, raisin or other foods. She can also ask for music, a short movie, a toy and for a window to be opened.

The purpose of the project, said Von Glasersfeld, is to determine if chimps, gorillas and orangutans can be taught, in a controlled environment, to use a language-like system for their own purposes. If the apes can learn to communicate without the promise of material rewards – to describe something or "talk" about something they do not necessarily want – then conceivably they could learn to ask questions and perhaps even to use the language to "converse," on a simple level, with humans.

The research may also reveal important information about problems children have in learning their language, the psychologist said.

Von Glasersfeld was instrumental in designing the Yerkish language and Pisani helped program the computer to handle the language and perform other functions involved in the study. Both men have key roles in compiling and analyzing the data growing out of the study.

The entire project is under the direction of Dr. Duane M. Rumbaugh, head of the psychology department at Georgia State University. Other members of the research team are Dr. Josephine Brown, professor of psychology at Georgia State; Harold Warner, a biomedical engineer at Yerkes; and graduate students Charles Bell and Timothy Gill at the Yerkes Center.

Last spring, the university's public relations office released a news story on the project which was carried in Georgia newspapers and picked up by a wire service and distributed across the country.

The story appeared as an article in the July, 1973, issue of *Computers and Automation*, along with a more technical explanation of the work written by Von Glasersfeld and his colleagues. The public relations office has since filled 95 requests for reprints of the two articles. The requests have come from scientists throughout the United States and from institutions in the Soviet Union, South Africa, Tanzania, India, Pakistan, Japan, Brazil, France, Hungary, Germany, Switzerland, England, the Netherlands, Canada and Israel.

The news release prompted an Atlanta television station to film a report on the project which was later aired nationwide on a network news program. Von Glasersfeld, Rumbaugh and the other scientists wrote a paper on the project that was published in the November, 1973, issue of *Science*. That article caught the attention of *Newsweek*, which carried a report on the research in its Jan. 7, 1973 issue.

The work has been reported in both the Yerkes center's newsletter and the *Bulldog Byte*, newsletter of the University of Georgia's office of computing activities.

The New York correspondent of Springer Verlag, a large German publishing house which publishes a number of daily and weekly newspapers and magazines, interviewed Von Glasersfeld for more than an hour over the telephone for an article.

Lana will be featured in an hour-long television program being prepared by a Boston firm that makes films for educational television. The show, which deals with the whole subject of communication with non-human primates, will include interviews with Von Glasersfeld, Rumbaugh and Pisani and shots of Lana using her keyboard.

Von Glasersfeld said friends have told him a report on Lana was carried in a news program on the Italian state television network.

Von Glasersfeld last year described the work in a speech at the University of Michigan and has been invited to speak at Michigan State University and Vanderbilt University. Rumbaugh has also received several speaking invitations.

Rumbaugh and a primatologist from New York State University are editing a special issue of the *International Journal of Anthropology*, a prestigious professional magazine, to be published later this year. The issue will include a chapter on Lana and an introductory article by Von Glasersfeld on the topic of inter-species communication.

Von Glasersfeld described interest in the project as "quite enormous. This is due mainly to the picturesqueness of the subject," he said. Funding for the project is assured for two more years, and the scientists hope to continue the work long after that if financing is available.

"We hope to use more non-human subjects," Von Glasersfeld said. "We also hope to learn some things that are relevant to the linguistic education of deaf and retarded children. We're very serious about that."

Works by Mason, Hamilton on display

Exhibitions of works by pioneer abstractionist Alice Trumbull Mason and pop artist Richard Hamilton are on display through Feb. 20 at the Georgia Museum of Art.

The 19 works by Mason, who studied with painter Arshile Gorky and was associated with Ilya Bolotowsky, were completed during the 1930's, when the abstractionist style was least popular. Originally, her paintings were of a biomorphic style – shapes derived or associated with natural motifs. Over the years she shifted to a style closer to geometric art.

Mason died in 1971, at the age of 67, largely forgotten by her contemporaries and unnoticed by the art public. This exhibition was selected from a larger exhibition shown at the Whitney Museum of American Art last year.

The 50 prints by Hamilton were done between 1949 and 1973 and trace the artist's movement from abstract imagery to pop art. Hamilton was a founder of the British "pop art" movement, which uses images that revolve around, and derive from, advertising, popular culture and technology.

He implemented the "Man, Machine and Motion" exhibition, a pioneering pop art show, and was included in the "This Is Tomorrow" exhibition in London, one of the most important shows in the Britist pop movement.

His media range from hand-tinted photographic prints to etchings and aquatint. He has described his purpose in art as "a search for what is epic in everyday objects and everyday attitudes."

campus capsules

■ The university's Faculty Woodwind Quintet will present a program of original wind music on Thursday, Jan. 24, at 8 p.m. in the university chapel. Quintet members are Ronald Waln, flute; John Corina, oboe; Theodore Jahn, clarinet; Warren Gref, horn; and James Burton, bassoon. The quintet will be joined by Valerie Suchor, piano, for a performance of Roussel's *Divertissement, Opus 6* for piano and woodwind quartet. Friday night at 8, also in the chapel, Betty Bennett, flute, will present her graduate recital.

■ University representatives will be on hand at Holiday Inns in Waycross and Statesboro this week to talk to high school students interested in the University of Georgia. Waycross students and their parents are invited to come by and visit Jan. 21 from 4-8 p.m.; representatives will be in Statesboro Jan. 23 from 4-8 p.m.

■ Dr. Calvin S. Brown, Alumni Foundation Distinguished Professor of Comparative Literature, has had published a detailed study of William Faulkner's novel, *Sanctuary*, in the current issue of *Mosaic: A Journal for the Comparative Study of Literature and Ideas*, published by the University of Manitoba. Devoted entirely to invitational critical studies by Faulkner scholars, this special issue will be published also as a hard-cover book. A chapter of Brown's *Music and Literature* (University of Georgia Press, 1948) has just been reprinted in a collection of critical essays, *Die amerikanische Lyrik von Edgar Allan Poe bis Wallace Stevens*, published in Darmstadt, Germany.

■ Dr. Edward Krickel, associate professor of English and acting editor of the *Georgia Review*, has contributed an essay to a recently-published book, *The Form Discovered: Essays on the Achievement of Andrew Lytle* (University and College Press of Mississippi, 1973). The book, edited by M. E. Bradford of the University of Dallas, contains essays by several distinguished critics on Lytle's fiction. Krickel's essay is entitled "The Whole and the Parts: Initiation in 'The Mahogany Frame.'"

columns

Volume I, Number 15

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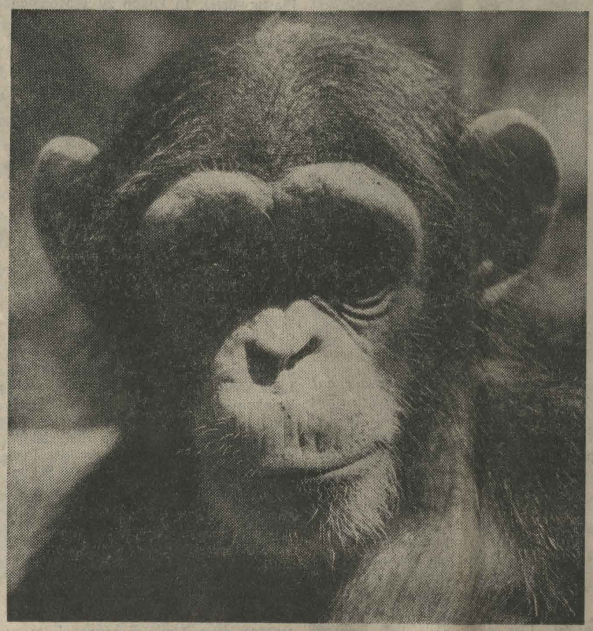
WELTWOCHE MAGAZIN

Verständigung mit Schimpansen

Ein Jahr Spracherziehung für Lana / Von Ernst von Glasersfeld

Ist eine sprachliche Verständigung mit Tieren möglich? Auf diese uralte Frage suchen mehrere Forschungsprogramme in den USA eine endgültige Antwort. Einer der daran direkt beteiligten Wissenschaftler, Prof. Ernst von Glasersfeld (Abteilung für Psychologie an der University of Georgia in Athens, USA), fasst in seinem Exklusivbericht den Stand der Dinge zusammen.

Der Mensch hat immer schon davon geträumt, mit den Tieren zu sprechen. Praktisch wissen wir freilich nur von Schäfern, die sich tagein, tagaus darauf verlassen, dass ihr Hund ein Dutzend oder mehr verschiedene Pfiffe «versteht», und von Dompteuren, die einem abgerichteten Affen, Seelöwen oder Tiger eine ganze Reihe von jeweils richtig befolgten Befehlen geben. In all diesen Fällen jedoch ist die Verständigung eine Art Einbahnstrasse. Der Schäferhund kann dem Schäfer nichts zupfeifen. Angenommen, er möchte seinem Herrn mitteilen, dass da noch zwei, drei Schafe in einer Mulde grasen, die der Herr nicht sieht; er kann dies nur tun, indem er dem Pfiffbefehl, die Herde weiterzutreiben, nicht gehorcht und auf eigene Faust die zurückgebliebenen Schafe einholt.



Zu einer gesprochenen Sprache sind die Schimpansen (der hier abgebildete lebt im Zoo Basel) zwar nicht befähigt, aber . . . (Foto: Hans Bertolf)

Der Schäfer hat freilich längst gelernt, sich auf den gelegentlichen Ungehorsam des Hundes ebenso zu verlassen wie auf die übliche genaue Ausführung der gepfiffenen Anweisungen. Mit dem abgerichteten Zirkustier ist es nicht anders. Der Tiger kann dem Dompteur auf viele und zum Teil recht überzeugende Weisen *zeigen*, dass er diesen oder jenen Befehl nicht ausführen will, aber er kann dies nicht innerhalb des Zeichensystems tun, das der Dompteur ihm gegenüber verwendet.

Diese Begrenzung auf eine Mitteilungsrichtung ist einer der Gründe, weswegen wir Zeichensysteme, wie sie von Schäfern, Dompteuren — oder etwa der Strassenverwaltung in Form von Verkehrssignalen — entwickelt worden sind, nicht «Sprache» nennen wollen.

Ein zweiter, theoretisch wichtigerer Grund für die scharfe Trennung zwischen Zeichen- und Sprachsystemen ist, dass die Bedeutung eines Zeichens — sei es Pfiff, Geste, Schrei, Trommelschlag, graphisches Symbol oder Verkehrslicht — vom Empfänger stets als Aufforderung zu einer bestimmten Handlung verstanden wird. Ein Pfiff des Schäfers heisst z. B. für den Hund «Lauf nach rechts!», ein anderer «Lauf nach links!», ein dritter «Komm zurück!». Der Schäfer kann dem Hund weder eine Frage noch eine bedingte Anweisung zupfeifen (z. B. «Wenn in der Mulde rechts noch ein Schaf ist, bring es ein!»). Er kann nur unbedingte Befehle geben. In einer «Sprache» hingegen können wir Sachverhalte mitteilen, *ohne* eine umgehende Handlung zu bewirken; wir können Fragen stellen und beantworten, und wir können Dinge und Vorgänge beschreiben, auch wenn sie nichts mit der umittelbaren Gegenwart unseres Handelns zu tun haben.

Einzigartige Adoption

Ein dritter, nicht weniger unerlässlicher Aspekt unterscheidet «Sprachen» von Zeichen- und Signalsystemen: Sprachen haben eine Grammatik, d. h. eine Reihe von Regeln, die es gestatten, mehrere Zeichen oder «Wörter» auf bestimmte Weisen zu einer Zeichenreihe oder einem «Satz» zu verbinden, so dass die Bedeutung der Reihe anders oder mehr ist als die Bedeutung der einzelnen Zeichen. Diese dritte theoretische Erwägung ist wichtig, wenn es sich um die Verständigung mit Tieren handelt; denn wir haben wohl alle die Bekanntschaft eines Papageis gemacht, der uns mit einem vollkommen richtigen sprachlichen Ausdruck oder Satz erstaunte. Aber selbst wenn wir einen Papagei sehen, der eine ganze Reihe von Sätzen sprechen kann, zögern wir, ihm eine echte Sprachfähigkeit zuzugestehen. Wir haben das Gefühl, dass ein kleines Kind, auch wenn es nur die Hälfte der Wörter kennt, die der Papagei verwendet, doch schon mehr von der Sprache weiss als der Vogel.

Unser Misstrauen ist gut begründet. Der Papagei lernt seine Sätze als feste unveränderliche Wortfolge und wird nie einen Teil oder ein Wort aus einem gelernten Satz in einen neuen ungelernten übertragen. Das Kind hingegen macht, lange bevor es die Grammatik seiner Sprache beherrscht, ganz spontan Versuche, Wörter auf neue Art zu verbinden und auf diese Weise den Ausdrucksbereich seiner Sprache zu erweitern.

Wie steht es nun mit der sprachlichen Verständigung mit Tieren? Der Wissenschaftler, dessen Definition des Begriffs «Sprache» den drei erwähnten Punkten Rechnung trägt, ist verständlicherweise skeptisch, wenn er hört, das eine oder andere Tier sei im Begriff, eine «Sprache» zu erlernen oder, was in der Vergangenheit öfter der Fall war, die eine oder andere Tierart verwende ein Sprachsystem zur Verständigung. Vor mehr als 50 Jahren beobachtete und beschrieb *Karl von Frisch* die «Sprache der Bienen». Obschon sie unsere drei Kriterien zumindest minimal zu befriedigen scheint, gibt es heute noch einige Linguisten, die bezweifeln, dass diese Verständigungsmethode wirklich die Bezeichnung «Sprache» verdient.

In den letzten zwei Jahrzehnten hörte man von Zeit zu Zeit Gerüchte über die «Sprache der Delphine». Die verhältnismässig wenigen verlässlichen Angaben, die bisher veröffentlicht worden sind, zeugen für die erstaunliche Intelligenz dieser Tiere, reichen aber noch lange nicht aus, um ein verfechtbares Urteil über ihre Verständigungsmethoden zu fällen.

Weit zugänglicher und reicher sind die Daten, die wir heute über die anthropoiden Affen und vor allem über Schimpansen haben. Die ersten Versuche, einem Schimpansenkind eine menschliche Sprache beizubringen, schlugen fehl. *Keith Hayes* und seine Frau adoptierten ein drei Tage altes weibliches Schimpansenkind und erzogen es etwa sechs Jahre lang in ihrem Haus. Soweit es möglich war, versuchten sie, Umwelt und Erziehung so zu gestalten, als hätten sie es mit einem menschlichen Kind zu tun. Ihre Studie ist eine der interessantesten, die jemals von Tierpsychologen durchgeführt wurde, und lieferte einen beinahe unerschöpflichen Reichtum von Material. Unter anderem belegt sie, dass ein Schimpanse nicht imstande ist, eine *gesprochene* Sprache zu erlernen. In den zwanzig Jahren, die seither vergangen sind, hat man sowohl anatomische als auch neurologische Gründe für diese Unfähigkeit gefunden: der Kehlkopf des Schimpansen (sowie der anderen anthropoiden Affen) hat weder die Form noch die nötige Anzahl von Nervenfasern, um die Lautmodulationen ausführen zu können, die unsere menschlichen Sprachen erfordern.

Bedeutung für den Menschen

Die Einsicht, dass eine gesprochene Sprache ausgeschlossen ist, führte zu Versuchen mit Sprachen, die sich nicht akustischer, sondern visueller Zeichen bedienen. Damit war das erste grosse Hindernis überwunden. *Allen* und *Beatrice Gardner* an der Universität von Nevada gelang es innerhalb weniger Monate, einem jungen Schimpansenmädchen einige Zeichen der amerikanischen Taubstummensprache beizubringen. Das war 1966. Washoe, die zeichensprechende Schimpansin, ist inzwischen weltberühmt geworden. Sie hat einen «Wortschatz» von weit über 300 Zeichen (Stellungen und Bewegungen von Fingern, Armen und Kopf) und kombiniert diese zuweilen zu «Sätzen» aus bis zu sieben oder acht Zeichen. Streng überwachte Tests haben erwiesen, dass Washoe die Bedeutungen dieser Zeichen sehr gut weiss. Man kann ihr Dutzende von Gegenständen zeigen — oder sogar Fotografien von Gegenständen —, und sie wird in mehr als 80 Prozent der Fälle jeden beim richtigen Zeichen nennen.

Was die Zeichenkombinationen betrifft, die Washoe spontan von sich gibt, so sind sie meistens nicht nur dem menschlichen Zeichensprecher verständlich, sondern auch für die Situation zutreffend, in der sie gemacht werden. Wie immer man Washoes Fertigkeit betrachtet, man kann nicht mehr daran zweifeln, dass es sich bei ihr tatsächlich um *Verständigung* handelt. Dennoch sind viele Psychologen, Linguistiker und Primatologen noch nicht davon überzeugt, dass diese Verständigung «sprachlich» genannt werden kann.

Der Hauptgrund dafür ist die Tatsache, dass die Syntax (d. h. die Regeln, nach denen Wörter zu Sätzen verbunden werden können) der Zeichensprache recht locker ist. Ein Zeichensprecher kann in vielen Fällen aus drei oder vier Zeichen einen «Satz» zusammenstellen, und die Bedeutung des «Satzes» bleibt unverändert, auch wenn die Reihenfolge der Zeichen nicht immer die gleiche ist. In den menschlichen Sprachen ist das meistens ausgeschlossen. Darum lässt sich das Argument, der Begriff der Sprache sei von einer strengen Syntax abhängig, trotz Washoes erfolgreichen Verständigungen nicht leicht widerlegen.

Auf den ersten Blick mag das als rein theoretische Frage erscheinen. Schürft man ein wenig tiefer, so beginnt man jedoch das Unternehmen in einem anderen Licht zu sehen. Bei weitem das grösste, keineswegs rein theoretische Interesse an Experimenten in dieser Richtung hat die Sprachpsychologie. Die Massenanwendung von Tests in Kindergärten, Volksschulen und sogar in Mittelschulen in den Vereinigten Staaten hat mit erschreckender Deutlichkeit erwiesen, dass die Zahl der durch mangelnde Sprachfähigkeiten behinderten Kinder weit grösser ist, als die düstersten Erziehungspessimisten je angenommen hatten.

Trotz allgemeiner Schulpflicht hat das Erlernen der Sprache (d. h. die Aneignung jenes Grades an sprachlicher Kompetenz, der zur Ausübung der meisten Berufe unerlässlich ist) einen guten Teil seiner Selbstverständlichkeit verloren. Die Schulmethoden scheinen unzulänglich zu sein, und weder Sprachpädagogen noch Sprachpsychologen sind in der Lage, wirklich wirksame Neuerungen vorzuschlagen. Der traurige Grund dafür ist, dass wir herzlich wenig über die eigentlichen Vorgänge wissen, dank derer ein Kind seine Sprache erlernt. Selbst wenn wir annehmen, dass *Jean Piaget* eine solide theoretische Grundlage geschaffen hat, müssen wir doch eingestehen, dass wir (vor allem in den Vereinigten Staaten) hinsichtlich der praktischen Auswertung kaum die ersten Schritte gemacht haben.

Von diesem Gesichtspunkt aus gewinnen Sprachexperimente mit Schimpansen und anderen «intelligenten» Lebewesen eine unerwartete Bedeutung. Erstens kann man mit Versuchstieren eine Unmenge von langwierigen Studien ausführen, die mit Kindern ausgeschlossen wären, weil Kinder ja nicht nur zum Lernen und zu Lehrversuchen auf der Welt sind. Zweitens darf man mit einigem Recht annehmen, dass die praktischen Probleme, die sich im «Sprachunterricht» für Schimpansen als besonders schwierig erweisen, im grossen und ganzen eine gewisse Aehnlichkeit mit jenen haben dürften, auf die ein Kind stösst, das aus irgendeinem Grund ein wenig zurückgeblieben ist.

In dieser Hinsicht ist es selbstverständlich von grösster Wichtigkeit, dass die Sprache, die der Schimpanse lernt, nicht zu verschieden ist von der Sprache, die das Kind meistern muss. Der praktische Wert der grossangelegten Studie der Gardners, die mit Washoe begann und heute schon auf ein halbes Dutzend Schimpansen ausgedehnt ist, liegt also vor allem darin, dass sie neue Mittel und Wege aufweist, die in der Erziehung von taubstummen Kindern zur Zeichensprache mehr oder weniger unmittelbar verwendet werden können.

Manche der Beobachtungen werden sicher auch in der Bewältigung von Problemen wertvoll sein, auf die normale Kinder am Anfang ihrer Sprachentwicklung stossen. Wo es sich jedoch um Schwierigkeiten handelt, die prinzipiell mit syntaktischen oder Satzbauregeln zusammenhängen, können die Versuche mit Zeichensprache, deren Syntax wenig anspruchsvoll ist, nicht viel beitragen.

Diese Ueberlegung war einer der Beweggründe, die uns dazu führten, vor drei Jahren, in Zusammenarbeit mit dem *Yerkes-Institut für Primatologie* in Atlanta, ein neuartiges Forschungsprojekt zu starten. Der Grundgedanke des Unternehmens entsprang einer zufälligen Unterhaltung mit *Ray Carpenter*,

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ENAIP in Nöten

VON ROGER MÜLLER

49 von insgesamt 59 Lehrern und der Direktor des italienischen Berufsbildungszentrums ENAIP in Zürich sind auf den 31. März von ihrem Amt zurückgetreten. Die Schule, an der zur Zeit rund 600 ungelernte ausländische Arbeiter in Abendkursen für einen Berufsfähigkeitsausweis büffeln, wird durch den Massenrücktritt von einem Tag auf den anderen lahmgelegt. Grund für den spektakulären Entschluss des Lehrkörpers: der Zentralsitz der ENAIP (Ausbildungsorganisation der von Papst Pius XII. gegründeten katholischen Gewerkschaft ACLI) in Rom hat sich zwar verbal immer für den Zürcher Ableger stark gemacht und finanziell Garantien versprochen, in letzter Zeit aber die Zahlungen, trotz harten Verhandlungen, stetig gekürzt. Resultat des italienischen Geizes: die Schule kann nicht in der geplanten Art weitergeführt werden, weil an allen Ecken und Enden das (versprochene) Geld fehlt.

Dass sich das Lehrerkollegium derart vehement gegen den Geldmangel wehrt, hat seinen guten Grund. Denn die Lehrer, etwa ein Drittel sind Schweizer, haben in den letzten anderthalb Jahren mit Fachkenntnis und mit einem ungeheuren Einsatz an unbezahlten Ueberstunden das ENAIP-Berufszentrum total umgekrempelt. Lehrplan und Einrichtungen wurden in Zusammenarbeit mit dem Zürcher Berufsbildungsamt geplant, und die ENAIP wurde schon bald als subventionswürdig erachtet. So zahlten 1973 der Kanton Zürich 35 und der Bund 24 Prozent an Lehrerbesoldung, Raummiete und Lehrmittel. Dass diese Staatsbeiträge «gut angelegt» seien, daran liess Berufsinspektor Fritz Niederhauser keinen Zweifel. An der Schule sei «eine grosse Entwicklungsarbeit» geleistet worden, schrieb er zuhanden der Volkswirtschaftsdirektion; sie sei ferner «erstaunlich gut eingerichtet», und auch im gebotenen Stoff sei «die Leistung enorm verbessert» worden.

Der Massenrücktritt, mit dem Rom unter Druck gesetzt werden soll, wird gerade von jenen Schülern unterstützt, die die Schule kannten, wie sie früher war. «Wenn die Schule nicht so weitergeführt werden kann wie bisher, dann lieber keine Schule», erklärt ein Kursteilnehmer, der in einem halben Jahr die vierjährige Ausbildung abschliessen will und dem der Lehrerrücktritt vielleicht das Zeugnis kosten wird.

Unklarheit herrscht über die Zugeknöpftheit des ENAIP-Zentralpräsidenten Alberto Valentini. Möglicherweise ging ihm der selbstbewusste Kurs der Zürcher ENAIP zu schnell, und er glaubt, den Brotkorb höher hängen zu müssen.

Die Schweizer Behörden dürften in diesem Fall allerdings auch noch ein Wort mitreden, denn sie haben sich, von der Notwendigkeit des Unternehmens überzeugt, finanziell in der ENAIP-Berufsausbildung engagiert, soweit es die gesetzlichen Grundlagen erlauben. Kommentarlos dürften sie den Rückzieher der Italiener nicht akzeptieren. Erste Anzeichen dafür gibt es schon. So erklärte Dr. Markus Hefti, Sekretär des Zürcher Volkswirtschaftsdepartementes: «Es ist zu erwarten, dass sich die Volkswirtschaftsdirektion beim italienischen Konsulat im Interesse dieser Schule als beruflichem Bildungsinstitut verwenden wird.»

Verständigung mit Schimpansen

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einem der Begründer der modernen Primatologie. Man sprach über die Schwierigkeit, in der Studie mit Washoe die sprachliche Tätigkeit des Versuchstieres auch nur einigermassen vollständig zu registrieren. Wer jeweils mit Washoe zusammen war, musste eine Doppelrolle spielen: einerseits als Gesprächspartner und anderseits als Beobachter, der jedes Zeichen Washoes sowie die Umstände, unter denen es gemacht wird, so genau wie möglich notiert. «Wieviel einfacher wäre das alles», sagte Carpenter, «wenn man da einen Computer verwenden könnte.»

Die Idee war unmittelbar überzeugend. *Duane Rumbaugh*, der damalige Vizedirektor des Yerkes-Instituts (zur Zeit Leiter der Psychologischen Abteilung der Georgia State University in Atlanta), erkannte sofort die experimentellen Möglichkeiten einer derartig «automatisierten» Anlage. Mein Freund und Mitarbeiter *Piero Pisani* und ich wussten, dass wir ein vollautomatisches Programm für die syntaktische und inhaltliche Analyse einer Zeichensprache ohne allzu grosse Schwierigkeiten entwickeln konnten — wir hatten bereits sieben Jahre, teils in Mailand, teils an der University of Georgia in Athens (USA) mit gutem Erfolg an der automatischen Analyse englischer Sätze gearbeitet.

Gemeinsam arbeiteten wir nun einen Forschungsvorschlag aus. Der Bioingenieur des Yerkes-Instituts *Harold Warner* übernahm die Konstruktion der mechanischen und elektrotechnischen Apparaturen, und die Kinderpsychologin *Josephine Brown* vervollständigte das Team. Ende 1972 bekamen wir die Nachricht, dass das *National Institute for Child Health and Development* bereit sei, die Kosten des Projekts (mit einigen Kürzungen) auf vier Jahre zu übernehmen.

Ein Affe lernt Yerkisch

Das erste Jahr verging mit der Konstruktion der Versuchsanlage. Da war zunächst der Raum. Er sollte durchsichtig sein, so dass man von aussen zu jeder Zeit sehen konnte, was das Versuchstier machte. Glas, das dem Ansturm eines Schimpansen standhalten könnte, war bei unserem bescheidenen Budget unerschwinglich (die grossen anthropoiden Affen haben schon im zarten Kindesalter die Muskelkraft eines Schwergewichtlers!). Wir wählten ein durchsichtiges Plastikmaterial, das aussen durch breite Rippen verstärkt werden konnte. Auf der einen Seite ist eine schwere Schiebetür, gegenüber der Ausblick durch das Fenster des Zimmers, und in die rechte Seitenwand sind die unterschiedlichen Apparate eingebaut, auf denen das Kommunikationsexperiment beruht. Der Plastikraum ist ein Würfel von zweieinhalb Meter Seitenlänge. Anschliessend daran ist ein kleiner Raum für den Computer, die Schaltbretter usw.

Die Schimpansin Lana arbeitet am ersten Teilstück der «yerkischen» Tastatur, auf dem 25 Lexigramme vertreten sind. Zur Zeit hat sie 3 solche Tastaturplatten mit insgesamt 75 Lexigrammen (die Apparatur erlaubt eine Ausweitung bis zu 250 Lexigrammen). Sie setzt soeben den «Punkt» hinter den Satz: «Bitte Maschine gib Stück Banane». In den Projektoren über der Tastatur erscheinen die Lexigramme in der linearen Satzfolge. (Foto: Frank Kierman, Atlanta)

Die Zeichensprache «Yerkisch» — zum Andenken an Robert Yerkes, der in den zwanziger Jahren das Versuchsinstitut gründete — besteht aus kleinen geometrischen Figuren, die je ein Wort darstellen und die wir «Lexigramme» nennen. An der Innenwand des Plastikwürfels ist eine Tastatur angebracht. Jede Taste trägt ein Lexigramm, und wenn man sie niederdrückt, erhält der Computer die Nachricht, dass eben dieses Lexigramm «ausgesprochen» worden ist. Eine Folge von Lexigrammen wird vom Computer als «Satz» betrachtet, wenn sie mit einem Anfangssignal beginnt und mit einem «Schlusspunkt» endet. Das Anfangssignal wird dadurch vermittelt, dass der «Sprecher» sich mit einer Hand an eine kräftige Stange hängt, die oberhalb der Tastatur horizontal angebracht ist und bei minimalem Herabziehen einen Kontakt schliesst.

Der Computer wertet einen Satz als korrekt, wenn die Folge von Lexigrammen genau den Regeln entspricht, die in der vorprogrammierten Grammatik festgelegt worden sind. Es gibt da keinerlei Zweifel: ein Satz ist entweder vollkommen richtig oder er ist falsch. Die Satzbauregeln der Yerkischen Sprache sind eindeutig und unerbittlich und gestatten keine Abweichungen — und darum freilich auch keine dichterische Freiheit (vorläufig wollen wir ja auch nicht die intuitiven oder künstlerischen Fähigkeiten unseres Schimpansenweibchens Lana prüfen, sondern nur ihre grammatikalischen!).

Wenn der «Sprecher» eine Taste drückt, so erscheint das Lexigramm, das auf der Taste steht, in dem ersten der kleinen Projektoren, die in einer Reihe direkt oberhalb der Tastatur angebracht sind. Das Lexigramm der nächsten niedergedrückten Taste erscheint im zweiten Projektor und so fort, bis der ganze Satz als lineare Folge wiedergegeben ist. Der Computer meldet dann seinen Befund: ist der Satz korrekt, so folgt ein Glockenton, ist er falsch, so verschwinden die Lexigramme in den Projektoren, und ein neuer Satzversuch kann beginnen.

Naturfilm auf Bestellung

Diesen «Auswischmechanismus» hat Lana sehr schnell auf eigene Faust entdeckt und ausgenützt. Wenn sie einen «Tippfehler» macht, versucht sie gar nicht erst den Satz zu Ende zu tippen, sondern drückt gleich die Punkttaste, worauf der Computer den «Input» als falsch wertet, die Projektoren löscht und das System zu einem neuen Beginn freigibt. Lana erspart sich also unnötiges Tastendrücken!

Die technische Anlage erlaubt — und das ist eine der wichtigen Neuerungen — eine ganze Reihe von automatischen Antworten. Lana kann jederzeit etwas zu essen oder trinken «bestellen», vorausgesetzt sie formuliert den Satz so, dass er grammatikalisch korrekt ist. Wenn sie z. B. auf der Tastatur schreibt: *Bitte Maschine gib* (ein) *Stück Banane*, so lässt ein Automat umgehend eine Bananenscheibe in eine kleine Nische in der Wand fallen, wo Lana sie erreichen kann. Ebenso kann Lana Apfelstücke, Rosinen, Brot, Nüsse, «M&M» (das sind ganz besonders beliebte Erdnussbonbons mit Schokolade), «Monkey Chow» (eine Art Hundekuchen, der die wichtigsten Nährstoffe und Vitamine für Affen enthält) und 4 verschiedene Getränke (Wasser, Milch, Fruchtsaft und, selbstverständlich, Coca-Cola) verlangen.

Lana übersiedelte Anfang 1973 in den Plastikwürfel. In knapp zwei Monaten lernte sie sich selbst zu ernähren. Seit März des vergangenen Jahres ist sie nur in den kurzen Unterbrechungen gefüttert worden, wenn der Computer nicht funktionierte. Interessant ist, dass sie sich eine völlig angemessene Kost zusammenstellt, obschon sie die Schokoladebonbons allen anderen Möglichkeiten vorzieht. (Die sogenannten «Cafeteria»-Experimente haben freilich gezeigt, dass auch menschliche Kleinkinder die Fähigkeit haben, sich, trotz der «Versuchung» unbegrenzt erreichbarer Leckerbissen, angemessen zu ernähren.)

Eine der Grundideen der Anlage ist, Lanas Umwelt so zu gestalten, dass ihr so viele Gelegenheiten zur Verständigung geboten werden wie möglich und dass ihre sprachlich formulierten Forderungen, soweit es sich machen liess, automatisch gewährt werden können. Lana kann also nicht nur um Essen und Trinken bitten. Sie kann etwa tippen: *Bitte Maschine mach* (das) *Fenster auf*. Der Computer lässt dann den elektrischen Vorhang aufrollen, der das Fenster verdeckt, und Lana kann 30 Sekunden lang hinausschauen. Will sie länger in die Aussenwelt schauen, so muss sie die Forderung jede halbe Minute wiederholen.

Lana kann auch einen Film verlangen, woraufhin ein 16-mm-Film-Projektor 30 Sekunden lang läuft; zur Zeit ist es ein Naturfilm, der Affen in der Wildnis zeigt. Um den ganzen Film zu sehen, muss Lana die Forderung achtundzwanzigmal auf der Tastatur tippen. Ebenso kann sie die Projektion von Diapositiven verlangen oder zwei verschiedene Tonbänder spielen lassen.

Im Laufe des zweiten Jahres, das soeben begonnen hat, hoffen wir so weit zu kommen, dass wir Lana Fragen stellen können über die Filme, Lichtbilder und Arten von Musik, die wir ihr zugänglich machen. Einige einfache Fragen beantwortet sie schon jetzt. Genau wie Washoe, der Zögling der Gardners, antwortet sie sehr verlässlich mit dem richtigen Lexigramm, wenn man ihr einen von etwa zwei Dutzend bekannten Gegenständen zeigt und fragt: *Was ist* (der) *Name von das?*

Neue Lexigramme lernt Lana erstaunlich schnell. In der Regel genügt es, ihr das Lexigramm und den bezeichneten Gegenstand zwei- oder dreimal zu zeigen. Wird das am nächsten Tag wiederholt, so behält sie es auf lange Zeit. Gegenwärtig kennt sie etwa 55 bis 60 Lexigramme mit Sicherheit; einige andere, die in den letzten Wochen und Monaten kaum verwendet worden sind, kann man durch einmalige Wiederholung in ihrem Gedächtnis auffrischen. Aufgrund eigener Beobachtungen und des Vergleichs mit Washoe wissen wir, dass wir die möglichen Grenzen ihres effektiven Wortschatzes noch lange nicht erreicht haben.

Was Lanas syntaktische Fähigkeiten betrifft, so sind wir heute viel optimistischer als zu Beginn des Projekts. Vor einigen Monaten hat Lana einen ersten Syntax-Test glänzend bestanden. Sie hatte zweierlei Aufgaben zu lösen. Die eine bestand darin, von uns angefangene Sätze korrekt zu beenden. Wir tippten zum Beispiel: *Bitte Maschine gib . . .*, und Lana hatte jeweils mehrere Möglichkeiten, den Satz korrekt oder auch falsch zu beenden (in diesem Fall waren *Nuss, Wasser, Stück Banane* usw. richtig und *Film, Lichtbild, Musik, Fenster* usw. falsch).

Die zweite Aufgabe bestand darin, einen falsch angefangenen Satz auszulöschen, statt ihn auf irgendeine Weise zu beenden. In beiden Aufgaben waren Lanas Reaktionen in 89 Prozent der Fälle korrekt, ein Ergebnis, das auf alle Fälle ermutigend ist.

«Nein!»

Der endgültige Beweis syntaktischer Kompetenz ist freilich die spontane Formulierung neuer, d. h. vorher nie gesehener Wortfolgen, die grammatikalisch einwandfrei sind. Obschon Lana bereits einige solche Formulierungen produziert hat, die nicht ganz leicht als Zufall abzutun sind, ist es doch noch viel zu früh, um ein endgültiges Urteil über diesen wichtigen Punkt zu fällen. Wir haben den Eindruck, dass Lana nur sehr selten planlos auf der Tastatur herumtippt. Zufällige Lexigrammfolgen sind Ausnahmen und keineswegs die Regel. Doch sie macht freilich Fehler — und so ist es im Einzelfall nicht mit Sicherheit zu sagen, ob eine «neue» und korrekte Lexigrammfolge nicht doch auf einem Fehler beruht, weil Lana eine andere, bekannte, Lexigrammfolge tippen wollte. Diese Frage kann nur aufgrund einer statistischen Analyse reichhaltigen Materials entschieden werden — und das Material, das zur Zeit vorhanden ist, ist bei weitem nicht reichhaltig genug.

Der Rückblick über das erste Jahr in Lanas Spracherziehung ist jedoch überaus befriedigend. Ihr Fortschritt war bedeutend schneller, als wir erwartet hatten, und einige ganz unerwartete Einzelleistungen haben unser Vertrauen in Lanas latente Fähigkeiten und somit in die Zukunft unseres Unternehmens gehörig bestärkt.

Vor einigen Wochen, als *Timothy Gill*, Lanas Haupterzieher, am Morgen in den Versuchsraum kam, um die unterschiedlichen Automaten zu füllen, nahm er ohne zu denken eine Bananenscheibe und steckte sie sich selbst in den Mund. Lana, die es sah, zeigte sofort ihre Missbilligung durch Drohstellung und Haaresträuben; dann — fast, als sagte sie sich, dass das hier nicht viel ausrichten würde — lief sie zur Tastatur und drückte energisch auf die Taste, die das Lexigramm für «nein» trägt. Es sieht also tatsächlich so aus, als sei sie im Begriff, sich Yerkisch als Ausdrucksweise anzueignen.

—D. M. Rumbaugh, T. V. Gill, Emory Univ., E. C. Von Glaserfeld, U. of Georgia; in *Science* 11/16/73

Lana, the chimp, works busily at her special typewriter.

—Art by J. Kersell

WHAT'S NEXT, LANA?

Atlanta, Ga.—Lana is in her office busily typing. What's so special about that? Plenty! Lana is a chimpanzee.

People have always believed they were much smarter than animals. That's because people can learn to talk, read, and write. But now some scientists are not so sure.

There are chimps all over the country learning to use language too. Some are learning to read from pictures. Lana does this. Some are learning sign language.

These chimps are proving that animals can think. Lana, for example, can read a question written in pictures. Each picture stands for a word, like *apple* or *give*. Lana can answer the question with her special typewriter. The typewriter prints pictures instead of letters.

Lana is smart enough to know when she makes a mistake. Then she starts again.

On a chimpanzee farm in Oklahoma other chimps live with human friends. The chimps have learned to use sign language and picture language. They use these to give messages to their human friends. Some of them even use sign language with other chimps.

'Dirty Monkey'

One of these chimps was once bothered by a monkey. He didn't know the name of the monkey in sign language. But he put together two words he knew—*dirty monkey*.

After that he called anybody he didn't like a "dirty monkey." In sign language, of course.

Chimp Babies

The people who are raising these chimps hope the chimps have babies soon. Then they can see how much the chimps like using our language. If the chimps do like it, they will teach their babies to use it too.

Just think, someday you may be walking down the street talking to your favorite chimp. Who knows? Maybe he's got a lot to tell you.

Make Up Your Mind

Abuse . . . or Simple Punishment?

1. Parents punish young people to stop wrongdoing. Most punishment is *not* abuse. What kinds of punishment might be abuse?
2. How *should* parents punish?

The United States

3. If you could live in any country you wanted to, which country would you choose? Why?
4. Are you proud of your country? Why or why not?

Monkey Business

5. What are some things human beings can do that chimps could never learn to do? Why?
6. How are chimps and humans alike?

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Chimpanzee learns to 'talk' —politely and grammatically

By Ronald Kotulak
Science Editor

DR. DOOLITTLE was right. You can talk to some animals and they will talk back if both of you are speaking the same language.

For several years, excitement among psychologists has been rising because of the growing possibility that some animals, primarily the great apes, may be able to communicate with humans.

Now a team of researchers from Atlanta has shown that the ability to learn a language may not be limited to man.

With the aid of a computer, they have taught a 2½-year-old chimpanzee named Lana how to read and write. Showing a remarkable mastery over elementary grammar, Lana can read simple sentences. And by pushing buttons with a symbolic language on them, she can write out what she wants in complete sentences.

"Please machine give piece of banana," Lana writes when she wants to nibble. "Please machine make music," she punches out on the keyboard when she wants to be entertained.

The computer attached to her "typewriter" rewards only correct sentences, and Lana has learned to be almost 100 per cent right, an achievement of which any English teacher would be proud.

INSTEAD OF just using her new language skills to ask to eat, Lana has demonstrated that she has other interests, including a liking for some esthetic things not normally associated with animal behavior.

She will ask that the shutter over the window be opened so she can enjoy the view outside, or she may ask to listen to music—her favorite is jazz. When the mood strikes her, she asks to watch a movie featuring a baby gorilla.

"Lana can comprehend complete sentences and she already has learned a simple form of conversation with humans," said Dr. Duane M. Rumbaugh, chairman of psychology at Georgia State University.

Lana will ask for things she wants, and she will answer questions, but she has not learned yet to ask questions on her own, a critical step in the full mastery of a language, Dr. Rumbaugh said.

BUT, HE SAID, he is optimistic she will learn to ask questions.

"We would like to have her describe what she sees in the movies or when she looks outside. What things are of interest to her. How she feels and what she would like to do.

"We also would like to use her as a translator to ask her what certain chimpanzee vocalizations and postures mean—in other words, how chimps communicate with each other."

The work with Lana, which is being conducted at Emory University's Yerkes Regional Primate Research Center in cooperation with scientists from Georgia State University and the University of Georgia, Athens, has a number of broad implications:

- It may open up a whole new field of learning research. How are things, such as language, learned? It may give scientists new tools for studying language disorders and the biological and genetic factors that influence one's ability to learn.

- Chimpanzees that converse with people could be used in psychological experiments. For the first time, animals would actually be able to tell researchers what they are feeling, such as fear, anger, or stress, and what they are learning.

- The research raises some fundamental questions about whether some animals have feelings and thoughts. Consciousness, awareness, and emotion have in the past been regarded as exclusively human characteristics. Apes are men's closest relative in the animal kingdom.

A smart chimp, Lana, punches out a simple sentence on her computer.

Chicago Tribune Jan. 6, 1974

UGA research project focus of international attention

A psychology professor and a computer technician at the university have key roles in a research project on a "talking" chimpanzee which is receiving widespread attention from scientists and the news media.

Inquiries and requests for information about the project, which involves a three-year-old chimp named Lana, a computer and a special language called "Yerkish," have come from as far away as the Soviet Union, Africa and India. Reports on the work have been carried by newspapers, magazines, television stations and in professional magazines.

University personnel associated with the study are Dr. Ernst Von Glasersfeld, assistant professor of psychology, and Pier S. Pisani, a systems analyst at the computer center.

Lana, who lives at the Yerkes Regional Primate Research Center at Emory University, has been taught to "read" Yerkish. The language, which was created for this project, is built from nine simple geometrical figures that are superimposed on each other to form different symbols, or lexigrams, that stand for various concepts or words. There are symbols, for example, for such concepts as give, come and make, and for such words as banana, juice, milk and music.

The lexigrams appear on a special keyboard attached to a computer. Lana has learned more than 60 symbols and can punch them in the proper sequence to form grammatically correct requests, which the computer will automatically grant. The sentence structure she uses is "Please machine give piece of banana," or orange, candy, raisin or other foods. She can also ask for music, a short movie, a toy and for a window to be opened.

The purpose of the project, said Von Glasersfeld, is to determine if chimps, gorillas and orangutans can be taught, in a controlled environment, to use a language-like system for their own purposes. If the apes can learn to communicate without the promise of material rewards – to describe something or "talk" about something they do not necessarily want – then conceivably they could learn to ask questions and perhaps even to use the language to "converse," on a simple level, with humans.

The research may also reveal important information about problems children have in learning their language, the psychologist said.

Von Glasersfeld was instrumental in designing the Yerkish language and Pisani helped program the computer to handle the language and perform other functions involved in the study. Both men have key roles in compiling and analyzing the data growing out of the study.

The entire project is under the direction of Dr. Duane M. Rumbaugh, head of the psychology department at Georgia State University. Other members of the research team are Dr. Josephine Brown, professor of psychology at Georgia State; Harold Warner, a biomedical engineer at Yerkes; and graduate students Charles Bell and Timothy Gill at the Yerkes Center.

Last spring, the university's public relations office released a news story on the project which was carried in Georgia newspapers and picked up by a wire service and distributed across the country.

The story appeared as an article in the July, 1973, issue of *Computers and Automation*, along with a more technical explanation of the work written by Von Glasersfeld and his colleagues. The public relations office has since filled 95 requests for reprints of the two articles. The requests have come from scientists throughout the United States and from institutions in the Soviet Union, South Africa, Tanzania, India, Pakistan, Japan, Brazil, France, Hungary, Germany, Switzerland, England, the Netherlands, Canada and Israel.

The news release prompted an Atlanta television station to film a report on the project which was later aired nationwide on a network news program. Von Glasersfeld, Rumbaugh and the other scientists wrote a paper on the project that was published in the November, 1973, issue of *Science*. That article caught the attention of *Newsweek*, which carried a report on the research in its Jan. 7, 1973 issue.

The work has been reported in both the Yerkes center's newsletter and the *Bulldog Byte*, newsletter of the University of Georgia's office of computing activities.

The New York correspondent of Springer Verlag, a large German publishing house which publishes a number of daily and weekly newspapers and magazines, interviewed Von Glasersfeld for more than an hour over the telephone for an article.

Lana will be featured in an hour-long television program being prepared by a Boston firm that makes films for educational television. The show, which deals with the whole subject of communication with non-human primates, will include interviews with Von Glasersfeld, Rumbaugh and Pisani and shots of Lana using her keyboard.

Von Glasersfeld said friends have told him a report on Lana was carried in a news program on the Italian state television network.

Von Glasersfeld last year described the work in a speech at the University of Michigan and has been invited to speak at Michigan State University and Vanderbilt University. Rumbaugh has also received several speaking invitations.

Rumbaugh and a primatologist from New York State University are editing a special issue of the *International Journal of Anthropology*, a prestigious professional magazine, to be published later this year. The issue will include a chapter on Lana and an introductory article by Von Glasersfeld on the topic of inter-species communication.

Von Glasersfeld described interest in the project as "quite enormous. This is due mainly to the picturesqueness of the subject," he said. Funding for the project is assured for two more years, and the scientists hope to continue the work long after that if financing is available.

"We hope to use more non-human subjects," Von Glasersfeld said. "We also hope to learn some things that are relevant to the linguistic education of deaf and retarded children. We're very serious about that."

You should write to this paper who made the Yerkish for Lana!

LONDON

Lana the chimp talks by computer

By IAN BALL
in New York

A THREE - YEAR - OLD chimpanzee named Lana has been taught to read and write in the past year, researchers at the Emory University in Atlanta claimed yesterday.

Lana already has a vocabulary of 75 words and the seven scientists who have been teaching her believe this may expand to 1,000 words with more research.

With the words she already knows, she can order food — "Please machine give piece of banana"—or request music

"At this point no one can say what the limits of their capabilities are," said Dr Duane Rumbaugh, who devised the system of communication. ???

"Chimps are far more intelligent than we thought, and I've worked with them for 15 years. They aren't smart enough to manufacture their own language but can use one that's created for them."

System of symbols

Lana does not communicate in a conventional language but by a complex system of geometric symbols, each with a specific meaning, which has been programmed into a computer.

She makes her requests by pushing the right combination of buttons on the computer's console. There are 75 keys on the console and above it are seven projectors on which she can see each sentence

The computer is programmed to accept only properly phrased sentences. If Lana is making a request, the sentence must begin with the word "please."

If she is asking a question, it must begin with the symbol for "question." Unless Lana puts a full stop at the end of a sentence, the computer will not reply or act on a request.

Ernst von Glaserfeld:

Lana im Sprachstudio

Experimente mit Schimpansen (2): Verständigung per Computer

Ihr Menü bestellt die Schimpansin Lana per Computer-Taste. Wie Lana „sprechen" lernt, schildert der zweite Teil unseres Berichts.

Vor drei Jahren beschlossen wir, mit dem *Yerkes Institut für Primatologie* in Atlanta, ein neuartiges Forschungsprojekt zu starten. Der Grundgedanke des Unternehmens entsprang einer zufälligen Unterhaltung mit *Ray Carpenter*, einem der Begründer der modernen Primatologie. Man sprach über die Schwierigkeiten, die sprachliche Tätigkeit des Versuchstieres auch nur einigermaßen vollständig zu registrieren. Wer jeweils mit ihm zusammen war, mußte eine Doppelrolle spielen: einerseits als Gesprächspartner und andererseits als Beobachter, der jedes Zeichen Washoes sowie die Umstände, unter denen es gemacht wird, so genau wie möglich notiert. „Wieviel einfacher wäre das alles", sagte Carpenter, „wenn man da einen Computer verwenden könnte."

Die Idee war unmittelbar überzeugend. *Duane Rumbaugh*, der damalige Vizedirektor des Yerkes-Instituts (zur Zeit Leiter der Psychologischen Abteilung der Georgia State Univesity in Atlanta), erkannte sofort die experimentellen Möglichkeiten einer derartig „automatisierten" Anlage. Mein Freund und Mitarbeiter *Piero Pisani* und ich wußten, daß wir ein vollautomatisches Programm für die syntaktische und inhaltliche Analyse einer Zeichensprache ohne allzu große Schwierigkeiten entwickeln konnten — wir hatten bereits sieben Jahre, teils in Mailand, teils an der University of Georgia in Athens (USA) mit gutem Erfolg an der automatischen Analyse englischer Sätze gearbeitet.

Die Zeichensprache „Yerkisch" — zum Andenken an Robert Yerkes, der in den zwanziger Jahren das Versuchsinstitut gründete — besteht aus kleinen geometrischen Figuren, die je ein Wort darstellen und die wir „Lexigramme" nennen. An der Innenwand des Plastikwürfels ist eine Tastatur angebracht. Jede Taste trägt ein Lexigramm, und wenn man sie niederdrückt, erhält der Computer die Nachricht, daß eben dieses Lexigramm „ausgesprochen" worden ist. Eine Folge von Lexigrammen wird vom Computer als „Satz" betrachtet, wenn sie mit einem Anfangssignal beginnt und mit einem „Schlußpunkt" endet. Das Anfangssignal wird dadurch vermittelt, daß der „Sprecher" sich mit einer Hand an eine kräftige Stange hängt, die oberhalb der Tastatur horizontal angebracht ist und bei minimalem Herabziehen einen Kontakt schließt.

Der Computer wertet einen Satz als korrekt, wenn die Folge von Lexigrammen genau den Regeln entspricht, die in der vorprogrammierten Grammatik festgelegt worden sind. Es gibt da keinerlei Zweifel: Ein Satz ist entweder vollkommen richtig oder er ist falsch. Die Satzbauregeln der Yerkischen Sprache sind eindeutig und unerbittlich und gestatten keine Abweichungen — und darum freilich auch keine dichterische Freiheit (vorläufig wollen wir ja auch nicht die intuitiven oder künstlerischen Fähigkeiten unseres Schimpansenweibchens Lana prüfen, sondern nur ihre grammatikalischen!).

Wenn der „Sprecher" eine Taste drückt, so erscheint das Lexigramm, das auf der Taste steht, in dem ersten der kleineren Projektoren, die in einer Reihe direkt oberhalb der Tastatur angebracht sind. Das Lexigramm der nächsten niedergedrückten Taste erscheint im zweiten Projektor und so fort, bis der ganze Satz als lineare Folge wiedergegeben ist. Der Computer meldet dann seinen Befund: Ist der Satz korrekt, so folgt ein Glockenton, ist er falsch, so verschwinden die Lexigramme in den Projektoren, und ein neuer Satzversuch kann beginnen.

Diesen „Auswischmechanismus" hat Lana sehr schnell auf eigene Faust entdeckt und ausgenützt. Lana erspart sich damit unnötiges Tastendrücken!

Die technische Anlage erlaubt — und das ist eine der wichtigen Neuerungen — eine ganze Reihe von automatischen Antworten. Lana kann jederzeit etwas zu essen oder trinken „bestellen", vorausgesetzt sie formuliert den Satz so, daß er grammatikalisch korrekt ist. Wenn sie zum Beispiel auf der Tastatur schreibt: *Bitte Maschine gib* (ein) *Stück Banane*, so läßt ein Automat umgehend eine Bananenscheibe in eine kleine Nische in der Wand fallen, wo Lana sie erreichen kann. Ebenso kann Lana Apfelstücke, Rosinen, Brot, Nüsse, „M & M" (das sind ganz besonders beliebte Erdnußbonbons mit Schokolade), „Monkey Chow" (eine Art Hundekuchen, der die wichtigsten Nährstoffe und Vitamine für Affen enthält) und 4 verschiedene Getränke (Wasser, Milch, Fruchtsaft und, selbstverständlich, Coca-Cola) verlangen.

Lana übersiedelte Anfang 1973 in den Plastikwürfel. In knapp zwei Monaten lernte sie sich selbst zu ernähren. Seit März des vergangenen Jahres ist sie nur in den kurzen Unterbrechungen gefüttert worden, wenn der Computer nicht funktionierte. Interessant ist, daß sie sich eine völlig angemessene Kost zusammenstellt, obschon sie die Schokoladebonbons allen anderen Möglichkeiten vorzieht. (Die sogenannten „Cafeteria"-Experimente haben freilich gezeigt, daß auch menschliche Kleinkinder die Fähigkeit haben, sich, trotz der „Versuchung" unbegrenzt erreichbarer Leckerbissen, angemessen zu ernähren.)

Eine der Grundideen der Anlage ist, Lanas Umwelt so zu gestalten, daß ihr so viele Gelegenheiten zur Verständigung geboten werden wie möglich und daß ihre sprachlich formulierten Forderungen, soweit es sich machen ließ, automatisch gewährt werden können. Lana kann also nicht nur um Essen und Trinken bitten. Sie kann etwa tippen: *Bitte Maschine mach* (das) *Fenster auf*. Der Computer läßt dann den elektrischen Vorhang aufrollen, der das Fenster verdeckt, und Lana kann 30 Sekunden lang hinausschauen. Will sie länger in die Außenwelt schauen, so muß sie die Forderung jede halbe Minute wiederholen.

Lana kann auch einen Film verlangen, woraufhin ein 16-mm-Film-Projektor 30 Sekunden lang läuft; zur Zeit ist es ein Naturfilm, der Affen in der Wildnis zeigt. Um den ganzen Film zu sehen, muß Lana die Forderung achtundzwanzigmal auf die Tastatur tippen. Ebenso kann sie die Projektion von Diapositiven verlangen oder zwei verschiedene Tonbänder spielen lassen.

Im Laufe des zweiten Jahres, das soeben begonnen hat, hoffen wir so weit zu kommen, daß wir Lana Fragen stellen können über die Filme, Lichtbilder und Arten von Musik, die wir ihr zugänglich machen. Einige einfache Fragen beantwortet sie schon jetzt.

Neue Lexigramme lernt Lana erstaunlich schnell. In der Regel genügt es, ihr das Lexigramm und den bezeichneten Gegenstand zwei- oder dreimal zu zeigen. Wird das am nächsten Tag wiederholt, so behält sie es auf lange Zeit. Gegenwärtig kennt sie etwa 55 bis 60 Lexigramme mit Sicherheit; einige andere, die in den letzten Wochen und Monaten kaum verwendet werden sind, kann man durch einmalige Widerholung in ihrem Gedächtnis auffrischen. Aufgrund eigener Beobachtungen und des Vergleichs mit Washoe wissen wir, daß wir die möglichen Grenzen ihres effektiven Wortschatzes noch lange nicht erreicht haben.

Was Lanas syntaktische Fähigkeiten betrifft, so sind wir heute viel optimistischer als zu Beginn des Projekts. Vor einigen Monaten hat Lana einen ersten Syntax-Text glänzend bestanden. Sie hatte zweierlei Aufgaben zu lösen. Die eine bestand darin, von uns angefangene Sätze korrekt zu beenden. Wir tippten zum Beispiel: *Bitte Maschine gib . . .* und Lana hatte jeweils mehrere Möglichkeiten, den Satz korrekt oder falsch zu beenden.

Die zweite Aufgabe bestand darin, einen falsch angefangenen Text auszulöschen, statt ihn auf irgendeine Weise zu beenden. In beiden Aufgaben waren Lanas Reaktionen in 89 Prozent der Fälle korrekt, ein Ergebnis, das auf alle Fälle ermutigend ist.

Der endgültige Beweis syntaktischer Kompetenz ist freilich die spontane Formulierung neuer, das heißt vorher nie gesehener Wortfolgen, die grammatikalisch einwandfrei sind. Obschon Lana bereits einige solche Formulierungen produziert hat, die nicht ganz leicht als Zufall abzutun sind, ist es doch noch viel zu früh, um ein endgültiges Urteil über diesen wichtigen Punkt zu fällen. Wir haben den Eindruck, daß Lana nur sehr selten planlos auf der Tastatur herumtippt. Zufällige Lexigrammfolgen sind Ausnahmen und keineswegs die Regel. Doch sie macht freilich Fehler — und so ist es im Einzelfall nicht mit Sicherheit zu sagen, ob eine „neue" und korrekte Lexigrammfolge nicht doch auf einem Fehler beruht, weil Lana eine andere, bekannte, Lexigrammfolge tippen wollte. Diese Frage kann nur aufgrund einer statistischen Analyse reichhaltigen Materials entschieden werden — und das Material, das zur Zeit vorhanden ist, ist bei weitem nicht reichhaltig genug.

Der Rückblick über das erste Jahr in Lanas Sprecherziehung ist jedoch überaus befriedigend. Ihr Fortschritt war bedeutend schneller, als wir erwartet hatten, und einige ganz unerwartete Einzelleistungen haben unser Vertrauen in Lanas latente Fähigkeiten und somit in die Zukunft unseres Unternehmens gehörig bestärkt.

Von einigen Wochen, als *Timothy Gill*, Lanas Haupterzieher, am Morgen in den Versuchsraum kam, um die unterschiedlichen Automaten zu füllen, nahm er ohne zu denken eine Bananenscheibe und steckte sie sich selbst in den Mund. Lana, die es sah, zeigte sofort ihre Mißbilligung durch Dronstellung und Haaresträuben; dann — fast, als sagte sie sich, daß das hier nicht viel ausrichten würde — lief sie zur Tastatur und drückte energisch auf die Taste, die das Lexigramm für „mein" trägt. Es sieht also tatsächlich so aus, als sei sie im Begriff, sich Yerkisch als Ausdrucksweise anzueignen.

Wieviel Grammatik begreift sie? *Foto: Okapia*

Ernst von Glaserfeld ist *Professor für Psychologie an der University of Georgia Athens/USA*

Lexikon

Ersatz-Energie

Das Wort „Ersatz", längst auch im Angloamerikanischen eingebürgert, schwebt wie ein Gespenst über der Energiewirtschaft. Noch ein paar Jahre mit einem Defizit an Niederschlägen können bewirken, daß alles Planen und Hochrechnen, kommende Kernkraftwerke betreffend, in Dampf aufgeht, weil jeder fehlende Tropfen Wasser die Prioritäten verschiebt. Man wird das, was der Himmel liefert, für anderes als Kühlzwecke benötigen.

In solchen Zeiten sprießen Ersatzprojekte zur Energieherstellung gleich Pilzen aus dem Boden. Von der „geothermischen Elektrizitätserzeugung" aus dem Wärmereservoir des Imperial Valley in Südkalifornien (potentiell 20 000 Megawatt, der Leistung von 10 großen Kernkraftwerken entsprechend) bis zur Suche nach heißen Erdhohlräumen in zwei bis fünf Kilometer Tiefe, von Riesenschaufelturbinen im Golfstrom bis zu gigantischen Windmühlen schweift die Phantasie der Erfinder. Sehr ehrenwert — doch der Bedarf läuft ihnen davon. Denn er verdoppelt sich alle sieben bis zehn Jahre, was in Kürze zu immer kostspieligeren Ersatzprogrammen führen müßte.

R K

ATHENS BANNER-HERALD & THE DAILY NEWS SUNDAY, MAY 12, 1974

Talking Chimps Now the Rage

Talking dogs were once the rage of an assortment of jokes and nighttime talk shows, but it seems talking dogs may be replaced by talking chimps.

I'm one of those demented Americans who just happens to like television. I'm not very particular about what show happens to be showing. I just like television. Fortunately my wife isn't as easy to please. When she takes time to watch television you can be assured of two things. First, she hasn't got anything better to do and secondly, the program has got to have a high rating.

I've gotten off the track a bit and you might have trouble relating all this to talking chimps.

I was stretched out on the sofa one night this past week staring at the tube when Lynn finished some of my chores and joined me. That's when I had to change channels. During the search across the spectrum we happened upon a Public Broadcasting System report on channel eight. Talking chimps are not a subject of some science fiction report, according to this apparently well documented film.

The chimps do not verbalize words, but they do communicate with humans and in some instances with other chimps.

One research effort utilizes a computer through which the chimp and a research assistant communicate. The chimp has only the option of formulating a very limited number of sentences. By pushing a certain set of symbols in a certain sequence the chimp can ask for a piece of banana, a piece of apple, to have the window opened or to have the research assistant groom him.

The chimp mastered the symbols and their proper sequence. He learned to anticipate the response or reward which he desired. When he asked for the window to be opened, he would race over to the window after pushing the symbols and wait for it to rise.

When a researcher pushed certain symbols, the chimp would complete the series. If the researcher intentionally pushed the symbols in the wrong sequence, the chimp would push an erase button and correct the error. At one point during the documentary the researcher reversed the question and asked the chimp if he wanted to groom the assistant. The chimp comtemplated the question for a moment and then pushed the symbol which indicated 'yes.'

The chimp then began to carefully brush around the eyes of the researcher. He took great care to practice what is apparently the correct grooming procedure for chimps.

In another experiment involving a chimp named Warshoe, the chimps were taught sign language. This experiment apparently gave the chimps, and the researchers, a much wider vocabulary.

The chimps began quite adept at the use of the sign language and often embarrassed new assistants. The chimps, according to the documentary, would decrease the speed of their language whenever a new assistant was employed. The chimps maintained the slow speed until the assistants began adept in the use of the language.

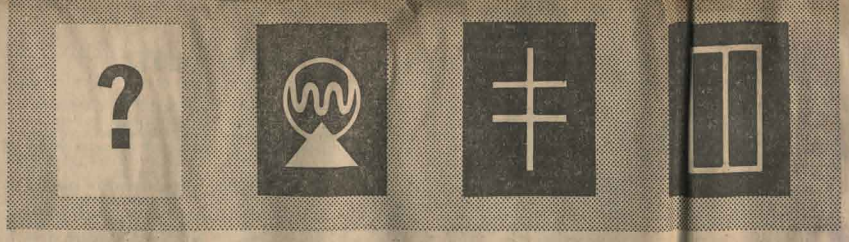
jon hunt

Athens Banner-Herald City Editor

A particularly fascinating aspect of the project was the use of questions. The chimps asked questions in a manner similar to our own. When we ask a question our expression relays a visual image that we have asked a question and our voice rises. It was easy to see that there was a definite difference in questions and statements made by the chimps. One chimp was shown asking if it was time to eat. He asked the question repeatedly, but he always emphasized the last word. The symbol for 'eat' was for the fingertips to be bunched against the mouth. When he was told that it was time to eat he repeated the word eat several times.

Such studies with chimps will likely cause some discussion about our evolution...or theirs, but what I find more facinating is the basic concept of being able to communicate with these animals...and perhaps others.

Weve learned a lot from the animal world. Now we may have an opportunity to learn even more.



*** Lana, the chimp, would understand that the symbols ask, "What (is the) name of this?"**

The answer is, "Talking With Chimps," an article about amazing conversations between chimpanzees and human beings.

By Boyce Rensberger
New York Times News Service

Timothy Gill peered into a Plexiglas room where a chimpanzee named Lana lives with a computer console. Lana pushed a series of symbol-coded buttons on the console and, outside her room, the computer typed out a translation of the symbols. "Please Tim move into room."

Gill, who read the message in symbols on a display panel above Lana's console, reached to his own console and pushed a button marked "yes." The symbol for "yes" flashed onto Lana's display panel and she excitedly rushed over to the door.

Gill, a graduate student at the Yerkes Primate Research Center in Atlanta, who is Lana's best friend, opened the door and went in. The chimpanzee took Gill's hand and they walked to the computer console, which acts as their medium of communication.

Gill pushed some buttons and Lana watched the display panels to see what he said. An automated typewriter monitored the conversation.

"Please, Lana, groom Tim."

"Yes," the chimpanzee answered, and immediately Lana began picking through Gill's hair, carrying out a friendly social behavior common among chimpanzees.

SUCH EXCHANGES are typical of half a dozen chimpanzees in research centers around the country that are demonstrating that chimps can learn languages approximating English well enough to read and write and even to converse with human beings.

Although efforts to teach apes to use human language were largely given up as impossible some two decades ago, renewed efforts using new methods over the last five years have shown that the animals are capable of learning hundreds of words and of chiming them into rudimentary but meaningful sentences.

In just the last year some of the chimpanzees have achieved still more remarkable language skills, such as the mastery of a rigorous grammar and an apparent understanding of conceptual and abstract terms.

THESE AND OTHER recent developments suggest that behind the sometimes comical face of the chimpanzees there lies an intellectual capacity vastly more sophisticated than even the most ardent anthropomorphists had dared to suppose.

The accomplishments of the chimps are growing so rapidly that it may be seriously questioned whether man can long continue to claim to be the only animal that uses language.

The issue is not likely to be resolved conclusively very soon for there is no generally accepted definition of language against which to measure the chimps' achievements. Some skeptics contend that the chimpanzees are exhibiting nothing more than rote learning or stimulus-response conditioning. While the chimps' teachers cannot prove this to be untrue, neither can the critics demonstrate that human language itself is not based simply on memorization or conditioning.

One possible application of the new technique could be in efforts to communicate with retarded or autistic children who fail to learn language under conventional teaching methods. If the researchers can devise ways to unlock the chimpanzee's limited intellect, such methods might also work with human beings of limited or isolated mental abilities.

THE BREAKTHROUGH came in the late 1960's when a husband and wife team, Allan and Beatrice Gardner, psychologists at the University of Nevada, hit upon a way to circumvent the chimpanzee's lack of pharynx, the space just above the voice box that changes shape to help produce the varying sounds needed in speech. The Gardners tried the sign language of the deaf and found that their chimp, named Washoe (for the county in which the Gardners lived) picked it up readily.

Washoe, who lived in a trailer behind the Gardner home near Reno, learned sign language well enough that visiting deaf people understood her and she them.

Washoe's earliest words, in the order she learned them, were: come-gimme, more, up, sweet, go, hear-listen, tickle, toothbrush, hurry, out, funny, drink, sorry, please, food-eat, flower, cover-blanket, you, in.

Early on, Washoe began to combine her words into sentence-like strings such as "come-gimme sweet" and "out please."

She also engaged in little conversations such as:

Washoe: Gimme, gimme.
Human being: What do you want?
Washoe: Sweet.

AFTER WASHOE LEARNED the word "open" in connection with opening a house door, she quickly generalized it to ask for the opening of refrigerator doors, car doors, cupboards and jars.

Whenever she sustained a cut or bruise, she learned to sign the gesture for "hurt" or "pain." Later, when she saw people with red stains on their bodies, she volunteered, "hurt."

In most cases she easily generalized a sign for the name of a concrete object to a picture of the object and even to the thought of the object.

Washoe, for example, does not like dogs. Once the Gardners tricked her, in sign language, by pretending there was a big dog outside. The chimpanzee immediately became agitated and nervous. Her hair bristled up and she behaved as if in danger of attack.

THE RATE AT WHICH Washoe learned new signs steadily increased during her training. In her first seven months, beginning when she was a year old and the equivalent of a human child of about the same age, Washoe learned only four words. During the second seven months she learned nine and during the third such period she picked up 21 new signs. At the end of three years she could understand and "speak" 85 words. After only one more year, her vocabulary nearly doubled to 160 words.

At about this point the Gardners changed their plans and wanted to start anew with younger chimps. Washoe was becoming too large and unruly. They turned her over to a student, Roger Fouts, who, upon earning his doctorate in psychology, took Washoe to the Institute for Primate Studies in Norman, Okla. The institute is a privately owned facility run by Dr. William B. Lemmon of the University of Oklahoma.

FOUTS TAUGHT WASHOE the sign for monkey and she readily used it for squirrel monkeys and gibbons, but when it came to a particularly nasty rhesus, she invented the term "dirty monkey." Previously she had used the word dirty only in reference to feces or soiled objects. Now she regularly uses the term for the offending rhesus and has even made "dirty" into a kind of swear word, repeating "dirty, dirty" whenever some human being annoys her.

Another instance of her inventing names for new things has impressed some experts as a genuine indication of a humanlike language ability — the combining of previously unrelated words (or signs or symbols) to signify a new meaning.

On seeing her first swans, Washoe invented the term "water bird," combining two words she knew independently.

These days Washoe, now 8 years old, is in semi-retirement, living in an indoor-outdoor cage with several other chimps with which she no longer tries to strike up conversations in sign language. (They never responded). Attention has turned to Lucy, another 8-year-old female trained by Fouts, who lives with a human family near the institute.

Lucy knows 93 words and is learning new ones at the rate of one to three a week, sometimes after only five minutes of demonstration.

RECENTLY LUCY sat for her first interview with this reporter, who knows sign language. Actually, she didn't sit very much. She jumped, rolled, climbed, walked and ran. But she did pay attention enough for brief sign language conversations.

Reporter (holding up a key): What this?
Lucy: Key.
R: (holding a comb) What this?
L: Comb (takes comb and combs reporter's hair, then hands comb to reporter). Comb me.
R: O.K. (combs Lucy).

My longest exchange with Lucy was this:
R: Lucy, you want go outside?
L: Outside, no. Want food, apple.
R: I have no food. Sorry.

"SIGN LANGUAGE is fine," certainly communication.

When she started to walk away, I signed, "Lucy, sit," and she sat. When I signed, "Where Roger?" she pointed to Fouts.

After each exchange, Lucy and I would stare into each other's eyes for a few seconds. I don't know how she felt, but I was nervous. I was participating in something extraordinary. I was conversing in my own language with a member of another species of intelligent beings. What was she thinking about me? What should I say to her?

LUCY IS ONLY EIGHT years old, and because chimpanzees have a life span of 50 to 60 years, she is really still a child. What will she know and say 10 years from now? Will she be able to tell us what life is like for a chimpanzee? What does she think?

Fouts who talks not only to Washoe and Lucy but also to three other similarly trained chimps at the institute, has given such questions much thought.

"First, of all," he said, "chimps are going to express themselves as chimpanzees. They aren't humans and the differences are likely to show up in language as in other things."

Dr. Lemmon puts it differently: "I suspect we'll come to recognize that the chimp, like the human, has a nature."

QUITE POSSIBLY Lucy thought it not at all unusual to converse with people. It is about all she has known. But Jane Temerlin, in whose home Lucy lives, tells of one incident that gives cause to wonder.

Lucy had a pet cat. One day when Lucy was alone with her pet, she was seen to sit down on the floor, place the cat between her legs, facing her, and hold up a book. Lucy pointed several times to the book and, signing so the cat could see her, made the sign for "book."

WHEN NEWS of the Gardners' success spread, a number of other researchers thought up alternate ways of communicating without speech. One was Dr. David Premack of the Center for Advanced Study in the Behavioral Sciences in Stanford, Calif. He constructed a number of distinctively shaped and colored pieces of plastic, each signifying an English word, and taught chimps both to arrange them in sensible sequences and to read the meaning of sequences he assembled.

His prize pupil was Sarah, a young chimp who knows over 130 words and can construct such simple sentences as "Ann give apple Sarah" and can read and obey sentences like "Sarah insert apricot red dish," selecting the correct fruit and dish from several possibilities.

Sarah, now considered too big to handle safely, is in retirement in a cage, and Premack has taken on two younger chimpanzees that are learning quickly.

Still another alternative to signing is the computer-symbolic language learned by Lana, which is under study by Dr. Duane M. Rumbaugh of Georgia State University. Dr. Rumbaugh hopes that through use of the artificial language programmed into the computer, Lana will learn to adhere to a rigorous syntax—something that some observers feel is missing from the signing chimps' language.

"SIGN LANGUAGE is fine," Rumbaugh says, "but it is [illegible] easy to accept an ungrammatical sentence from a signing chimpanzee and take it to mean what you want it to mean."

To eliminate any ambiguity in what is being said, Rumbaugh collaborated with Ernst von Glasersfeld and Pier P. Pisani of the University of Georgia to develop Lana's computerized language, called Yerkish in honor of the primate center's founder, Dr. Robert M. Yerkes.

Rules of Yerkish grammar are programmed into the computer and, if Lana is trying to command the operation of any of the automated food dispensing devices in her room, the computer will accept and relay only messages that are in correct Yerkish.

Thus, for example, if Lana pushes the word buttons in the following sequence, "Please, machine, give milk," an automated dispenser with a straw will fill with milk. If Lana says, "Please, machine, make milk," the computer will reject the sentence.

While it may be tempting to accept the sentence as a good try, it is, in strict Yerkish, nonsensical. The [illegible] "make" are "window open," "music" or "movie."

AFTER A YEAR and a half in training, Lana is now three and a half years old. She has learned 71 words, but Rumbaugh and Gill both say they have deliberately concentrated not on expanding her vocabulary but on teaching more sophisticated concepts and uses of words.

For example, Lana knows the names of colors. If a picture of a blue ball is projected on her room wall and Lana is asked, "What color of this?" she answers, "Blue color of this." If, on the next exchange, she is asked, "What name of this?" she readily composes a new sentence, pressing the button for ball instead of the one for blue.

ALL OF LANA'S WORDS and sentences are recorded by the computer-controlled typewriter. Because the computer is left running every night, Dr. Rumbaugh has an opportunity to see what Lana tries with language when she is alone. She often asks the machine to play her a movie or recorded music.

"We feel," Dr. Rumbaugh said, [illegible] has language. What we're learning for is to have continuing and meaningful conversation with her."

Dr. Rumbaugh looks forward to the day when Lana can become a partner in the behavioral study of other chimps, reporting in Yerkish the meaning of various things chimps do in their own societies. Toward that end he expects that Lana's training will continue for many years if adequate research funds can be found.

For the moment, Lana's interests are simpler. At night, when Tim Gill has gone home and Lana is alone in her room, she has typed out the sentences, "Please, machine, move into room" and "Please, machine, tickle Lana."

A SUMMER PLACE?

Canada—Not for Sale

By John D. Harbron

TORONTO — That annual summer horde of millions of friendly American invaders is ready for this year's visits to Canada.

Soon the kids from the cars with the many-colored U.S. license plates will rush into the familiar Holiday Inns or Howard Johnson's Motels which also have invaded Canada. Others will take off to canoe on Canada's quiet and still mainly unpolluted lakes. Others will build family campfires in the isolated woods just as Dad did when he was a boy.

The visits still are welcome, but if this year's summer visitors try to buy the land where they camp or the island where they swim, to join thousands of Americans who have bought Canadian vacation property in the past, they must expect a different reception here this year.

THE GROWING CRY in Canada is, "Americans, hands off our land!" This increasing concern about selling off so much shoreland and vacation country is part of Canada's larger political reaction against U.S. domination of the country's industries and natural resources.

For example, in British Columbia, Canada's rugged west coast province, remote ranches in that province's largely empty, Wyoming-style interior are being bought up by rich Western Americans or their land syndicates.

In Northwestern Ontario around Kenora, one of Canada's best freshwater fishing regions, wealthy Americans continue to buy more shoreland, eating up entire lakes.

IN AGRARIAN PRINCE EDWARD Island, one of Canada's Atlantic provinces, the provincial legislature passed a law last May restricting land purchase by non-residents (including other Canadians and foreigners as well as Americans) to no more than 10 acres or 300 feet of shoreline. The complaint with this law is that it came too late. About 40 percent of the island's lovely ocean shoreline already has been sold off.

PROVINCIAL GOVERNMENT action against American land-buyers, whether individuals or development corporations, is also coming from the New Democrat (socialist) administration in British Columbia which has a strong anti-American political bias.

In Ontario, where so many Americans are believed to own summer cottages and shoreland in Canada, tough new taxes on land speculators and foreigners have been introduced by the province's Conservative and usually pro-American government. Non-residents of Canada will now have to pay a tax of 20 percent on all land purchases. On top of that, land speculators who buy and sell land without adding any real value face another tax of 50 percent of sale price.

In Nova Scotia, responding to growing resentments against American ownership, the government recently expropriated a 5,400-acre shoreline estate owned by a Cleveland woman. Though smaller American properties have not been threatened, the sentiment against further American acquisitions is clear.

OF COURSE the land-buying trend by Americans in Canada is far from new. Any Canadian who spent childhood summers in the resort regions of Ontario, British Columbia or the Atlantic provinces remembers the friendly and often fiercely pro-Canadian American families who often pioneered summer settlement in many of these areas before Canadians could be bothered.

In the Lake of Bays resort district, about 170 miles north of Toronto, this writer as a boy in the 1930s was a summer pal to mainly American kids from Cleveland, Buffalo, Detroit, and even as far away as Florida.

The De Witt Clinton family of western New York, one of the great pioneering industrialist families of that state in the mid-19th century, owned a beautiful spot of land on the Lake of Bays with a large fully-equipped cottage called "Deep Waters."

Ironically, my father tried to buy the property from the estate of the late Mrs. Clinton, a warm and great lady who loved the Canadian woods. But he was prevented by the imposition of Canadian currency controls in the war summer of 1940.

NOSTALGIA FOR THE OLD days of Canadian-American camaraderie in these resort areas survives, but it is fast being eroded in a harder age when the friendly American families of the past are giving way to impersonal land speculators from the U.S. and commercially-oriented tourist development firms.

Many of those kids of the '30s from the now polluted, killing cities of Detroit, Cleveland, Washington and elsewhere, hanker after Canada for themselves and their families for reasons that, from a Canadian perspective, seem understandable and pleasant, but also almost gruesome.

For the Canadian summer home, if you already own one, has become an escape from America.

John D. Harbron is a foreign affairs analyst for the Thomson newspapers in Canada.

N.Y. Times

WEDNESDAY, DECEMBER 4, 1974

The

'Talking' Chimpanzee Asks For Names of Things Now

By BOYCE RENSBERGER
Special to The New York Times

ATLANTA—Lana, a chimpanzee who has learned enough of a modified English to converse with people through a computerized keyboard, has made significant progress toward a more sophisticated use of language since her earlier achievements were reported on this page six months ago.

Lana has moved beyond conversations using only words deliberately taught her to a stage something like that of a human child who suddenly realizes that all things have names and begins asking "What's this?" and "What's that?"

The scientists teaching Lana at the Yerkes Regional Primate Research Center here say she has apparently grasped the concept that she can ask not only for concrete objects by the names she has been taught, but also that she can ask for the abstractions, the names that represent objects whose names she does not know.

Lana is no longer a passive learner but has begun asking to be taught things that she wants to know.

Lana discovered the concept on her own during a routine session with Timothy V. Gill, a doctoral student who is the chimpanzee's teacher and friend. The session took place one morning when Mr. Gill began testing Lana on the naming of a bowl and a metal can by asking, "? What name-of this." In the Yerkes language, dubbed Yerkish, questions begin with a ? and name-of is a single word.

A Yerkish conversation is carried out using an electric keyboard in which each key represents a word. When keys are pressed, the words are projected in sequence on a display panel above Lana's keyboard. Lana and her teacher must read the projected images to get the message.

Lana had learned the names of "bowl" and "can" only a few days earlier and every time she answered correctly, for example with "Bowl name-of this," she was allowed to take a bit of candy from the container.

Mr. Gill entered Lana's room with a bowl, a can and a new object, a box baited with candy. Lana went to her console and pushed six buttons in the following sequence:

Lana:
? Tim give Lana this can.

TIM: Yes. (and gave her the empty can)

LANA: (put can aside)? Tim give Lana this can.

Tim: No can.

Lana: ? Tim give Lana this bowl.

Tim: Yes.

Lana: (put bowl aside) ? Shelley.

Tim: No Shelley. (Shelley, another technician, was not present.

LANA: ? Tim give Lana this bowl. (Before Tim could answer Lana typed out another sentence.) ? Tim give Lana name-of this.

TIM: Box name-of this.-

LANA: Yes. ? Tim give Lana this box.

TIM: Yes. (Whereupon Lana ripped it open and took out the candy.)

Later that day, when Mr. Gill brought a cup into Lana's room, the chimpanzee again asked for the name of the new object.

Lana's conceptual breakthrough marks a major step in the efforts underway in several laboratories to learn whether apes have the mental ability to understand a human-style language. Because apes lack the anatomy for speech, scientists have devised several nonvocal methods of communications such as the sign language of the deaf, the manipulation of shaped pieces of plastic each representing a word and the Yerkes computer.

Earlier research of this kind, based on simple conversations with apes had suggested that human beings could no longer regard themselves as the only animals capable of language. The new findings, demonstrating even more intellectual depth in the apes, have greatly strengthened that conclusion.

Lana, who has been in training two years, is now 4 years old, the physical equivilent of a first-grader.

"This project continues to delight us," said Dr. Duane M. Rumbaugh, who directs the research on Lana. He is a professor of psychology and chairman of the department at Georgia State University. "We've obviously always underestimated the intellectual ability of chimpanzees. It's now clear that we're not pushing Lana at all. She can learn a lot more things if we can only figure out how to teach her."

Dr. Rumbaugh said he was hoping to begin a related project to determine whether similar methods and equipment could be used to teach language to mentally retarded and emotionally disturbed

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The New York Times/Ron Sherman

Lana the chimpanzee pushing a sequence of keys on an electric keyboard to obtain food in teaching experiment at the Yerkes Regional Primate Research Center.

N.Y. Times Dec. 4, 1974

THE NEW YORK TIMES, WED

'Talking' Chimpanzee Asks Names of Things Now

Continued From Page 45

children who had failed to develop language on their own.

The idea is that if human children can grasp the idea that language is a tool for making their lives more comfortable or interesting, they will be motivated to switch from Yerkish to ordinary English.

Computers Are Complex

Although the computers and other hardware necessary to Lana's progress are complex, their operation is simple. In Lana's room is a console with 75 buttons, each bearing a ditinctive geometric symbol such as a triangle superimposed on a vertical line. Each button stands for one word.

When Lana presses a button, two things happen. The symbol is projected in the next available space in a row of display panels above the console and a teletypewriter outside the room prints the equivalent word in English.

If Lana presses the buttons for "Please, machine, give piece-of apple," a vending machine serves up a piece of apple. Lana can also ask for water, milk, the opening of a window, the playing of music or a movie from the "machine."

Human beings can also converse with Lana via the computer by pressing the buttons on Lana's console or on a similar console outside the Plexiglas wall of her room. Lana has learned to read the projected geometric symbols and interpret them as meaningful words and sentences. So, incidentally, have her teachers.

Knows Six Colors

Lana, for example, knows the names of six colors and of several objects. It is possible to go into Lana's room with three different objects, each a different color and ask such questions as "? What color of this shoe." Lana will usually give the correct color. The next question can be, "? What name-of this which-is orange," and Lana will, almost invariably name the orange object.

One recent interchange that indicates Lana's language ability is growing occurred when Mr. Gill walked into Lana's view carrying an orange, a fruit she had eaten but of which she did not know the name.

TIM: ? What color of this.

LANA: Color of this orange.

TIM: Yes.

LANA: ? Tim give cup which-is red.

TIM: Yes. (Gave her a red cup which she tossed away)

LANA: ? Tim give apple which-is green. (At this time Lana frequently confused the buttons for orange and green.)

TIM: No apple which-is green.

LANA: ? Tim give apple which-is orange.

On three other occasions later the same day Mr. Gill brought in more oranges and Lana immediately asked for them as "apple which-is orange."

Dr. Rumbaugh said he regarded Lana's invention of a plausible name for the new object, combining previously known words to create new meaning as a significant step in her improving grasp of language.

Lately Mr. Gill has been teaching the chimpanzee the meaning and use of prposition. One recent exchange involved a shoe that had been placed in a cardboard box. Mr. Gill asked where the shoe was and Lana said it was outside the box. Mr. Gill said no and Lana typed out, "Shoe is in." Mr. Gill asked, "? Shoe is in what" and Lana answered, "Shoe is in box."

One day Mr. Gill was preparing to load Lana's vending machine with milk. He walked into the animal's view carrying a pitcher of milk and his coffee cup. Lana spontaneously went to the console and said, "Milk name —of this." Mr. Gill said, "Yes."

Before Mr. Gill could go behind Lana's room to load the empty vending machine, Lana typed out, "? Tim move milk coffee." Mr. Gill did not answer and Lana "wrote" a new sentence.

LANA: ? Tim move behind room.

TIM: Yes. (He moved behind Lana's room but deliberately left the milk behind. Lana hooted loudly and frowned. Mr. Gill then went back and picked up the milk.)

LANA: ? Tim move milk behind.

TIM: ? Behind what.

LANA: ? Tim move milk behind room.

TIM: Yes. (whereupon he poured the milk into the machine.)

LANA: Please, machine, give milk.

In the past, some people have questioned whether the behavior of animals such as Lana and Washoe, a chimpanzee who learned to converse in sign language at the University of Nevada, indicates true language ability. Linguists differ on the definitions of language and there has been little agreement.

Dr. Rumbaugh said he now believed that it was useless to try to define language as meeting any fixed criteria. Rather, Dr. Rumbaugh suggests, language is a continuum ranging through various degrees of sohpistication.

"Lana's skills are clearly related to human skills," Dr. Rumbaugh said. "They're obviously not equivalent to human skills but it seems to me that we have to admit this is a language ability somewhere on the continuum."