

Squeak and squawk and speak and talk? Martin Edwardes talks to the animals

Chatting with chimps

In the book *The Planet of the Apes*, chimpanzees, gorillas and orang utans have all become able to speak English, while the humans have lost their language skills. It is a clever concept, allowing the author to explore what it means to be human.

However, the idea that apes could speak had already been disproved long before Pierre Boule wrote his story. In two early experiments, chimpanzees were brought up as if they were human children to see whether they would spontaneously learn to talk. Both experiments failed for the same reason: the vocal equipment of nonhuman primates is just not capable of the complex muscle movements needed to produce speech.

In the first of these experiments, in the 1930s, Winthrop and Luella Kellogg tried to train Gua, a female chimpanzee, to speak in English. Gua never spoke, although she demonstrated a clear understanding of about 70 words. The experiment ended because the Kellogg's son, Donald, began to sound more like a young chimp than a human child: the experiment had worked but in the wrong direction! Gua died a year after the experiment ended, at age 3. Chimpanzees can live for 50 years or more, but early death (often from pneumonia) was very common among captive chimpanzees at this time.

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produced vocal approximations of 'papa', 'mama', 'cup' and 'up', but nothing else. Once again, she understood many more words than she could produce and sometimes used pictures she tore out of magazines to indicate what she wanted. Viki died at age 6.

Time of the signs

For a while it seemed that human language might really be limited to humans; but doubt was cast on this in the 1960s, with new experiments using nonvocal symbolic communication. Not all human language is spoken: writing involves producing language using manual gestures; and deaf community sign languages also use manual gesture (as Kateryna's article on page 18 of this issue explains sign languages are not spoken languages turned into gestures,

Animal language

Human language is ... well, 'human, isn't it? You need to be a human to use it properly. But does that mean that other animals are completely excluded from using any aspects of language with us? Anyone who has a pet dog knows otherwise: If you call your dog by its name, it responds; and it is possible to train them to do particular things when they hear certain command words, such as 'heel' or 'sit'. Indeed, what made dogs useful to humans in the first place was their ability to obey our

spoken instructions reliably. Dogs, of course, cannot talk back to us in human language. We are, however, able to do something very language-like with our dogs: we can get ideas from our minds into theirs. And those ideas can be quite complex: dogs can be trained to herd sheep, hunt other animals, act as eyes for blind people, sniff out drugs, and perform many other useful tasks for us. They may not be full members of our linguistic culture, but they can certainly operate effectively within it.

Over the last hundred years, linguists, psychologists and other scientists have been

trying to discover how much human language animals are able to understand and use. They have been experimenting with large-brained animals – chimpanzees, bonobos, gorillas and dolphins – and they have also been working with animals which have traditionally had close relationships with humans – dogs and parrots in particular. The experiments have been many and varied. Some have been ingenious, others less so; but they have all given us important clues about how humans use language, and how humans, as a species, may have come to use language.



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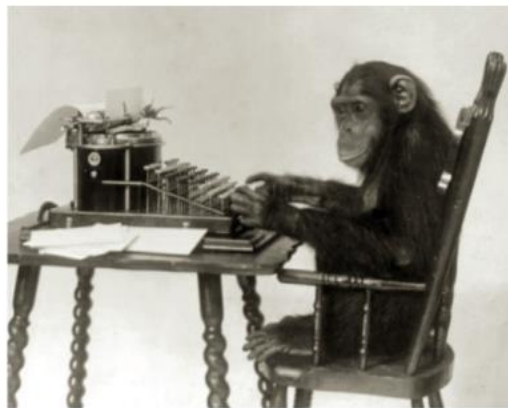
they are real, full languages with their own grammar and syntax, and all the capacities of spoken languages). While chimpanzees may be limited in terms of speaking, they are quite dextrous and their hands are quite similar to ours; would it be possible to teach them a form of writing or sign language?

David and Ann James Premack started work with a team of chimps, using a magnetic board and abstract shapes as word tokens. The chimps had to put the shapes (each of which represented an object or action word) onto the board to form well-ordered sentences. Of the five chimps, Sarah was the star pupil, and showed an understanding of both the symbolic meanings of the tokens and the simplistic syntax needed to create sentence-like meanings. She could reliably convert signs on the board (e.g. 'book on plate') into real-world relationships of objects (by putting a book on a plate), and she could describe real-world relationships using the symbols on the board. Elizabeth and Peony also grasped the principle, but performed less reliably; and Gussie and Walnut never really understood what was happening. Sarah was 50 in 2012, and continues to live in at Chimp Haven in Louisiana at the time of writing.

Allen and Beatrix Gardner decided to try the sign language route, and started work with a female chimp called Washoe. She was brought up as part of the Gardner's family to give her access to human culture, but communication was completely in ASL (American Sign Language). In her first year she had learned at least 25 signs and was combining them productively, and by the time of her death she had a vocabulary of over 350 signs.

Once again, the experiment was cut short because of Washoe's increasingly chimpish behaviour in the human home. She was moved to the Oklahoma facility where she joined a group of chimps (Moja, Tatu, and Dar) learning ASL with Roger Fouts and his team. Most of them learned some sign (and Washoe greatly increased the number of sign-words she knew, and her understanding of ASL syntax), but the star pupil was Lucy. She learned hundreds of signs, produced simple syntactic sentences, and combined signs to make new descriptors: watermelon she called CANDY-DRINK and radish became CRY-

"... Duane Rumbaugh, Sue Savage-Rumbaugh and Ernst von Glasersfeld created the Yerkish keyboard at the Yerkes Institute. The keyboard is a set of abstract symbols, or 'lexigrams', which are arbitrarily associated with objects and actions, and it is sometimes called the LANA keyboard after Lana, a female chimp who was the first nonhuman introduced to it. Lana learned how to put together simple action-object strings, and used the keyboard spontaneously to make her demands known."



Monkeys may not be able to produce the works of Shakespeare on a typewriter, but researchers created the Yerkish keyboard (right) that enabled a chimpanzee to make its demands known.



Joyce Butler teaching sign language to chimp Nim Chimpsky

HURT-FOOD. Unfortunately, Lucy became the subject of another experiment, to see whether apes brought up in artificial environments could survive back in Africa. She did not have the necessary fear of humans, however, and was killed by poachers in 1988.

Meanwhile Roger Fouts took advantage of the fact that chimpanzees often adopt the young of other chimps, and he introduced Washoe to a young male chimp called Loulis. He hoped that, as part of her parenting, Washoe would teach sign to the newcomer. To make sure the sign language was being taught by Washoe and not by the human carers, the carers switched back to vocal language when Loulis was present. Washoe did teach a reduced set of her vocabulary to Loulis (much the same as human mothers do), and Loulis went on to become a strong and spontaneous ASL signer. Loulis continues to live with other signing apes at the Chimpanzee and Human Communication Institute in Washington, USA. Washoe was also part of the group until her death in 2007.

The 1970s proved to be a rich decade for research on animals using humanlike

language. In one experiment, Francine Patterson began to teach ASL to Koko, a female gorilla. Gorillas are less manually adept than chimps, so Patterson calls Koko's gestural approximations GSL (Gorilla Sign Language). She has made some extravagant claims about Koko's ability ("Koko has a working vocabulary of over 1000 signs. Koko understands approximately 2,000 words of spoken English. Koko initiates the majority of conversations with her human companions and typically constructs statements averaging three to six words."), so her work remains controversial, but it does seem that Koko can associate gestures with objects, and possibly understands the difference between object words and action words.

Sue Savage-Rumbaugh used the Yerkish keyboard with Sherman and Austin, both male chimps. They seemed to understand the relationship between the symbols on the keyboard and real-world objects, and they recognised that an object could be represented by more than one keyboard symbol. However, they did not seem to understand the importance of syntax for creating meaning. Lana and Sherman continue to

live at the Language Research Centre in Georgia, USA.

All of this hopeful work received a serious blow, however, when Herbert Terrace published the results of his experiment. Terrace had worked with Nim Chimpsky, a male chimp. He believed that learning would be best in a controlled environment, so he removed all distractions from Nim's "classroom", making it a bare and largely empty space. After several months of teaching, Terrace believed that he had gathered evidence of language-like communication by Nim; but when he analysed his tapes more closely he was forced to conclude that Nim was not producing even simple syntax, only scabbles of words and repetitions of his trainers' signs. It seemed that Nim understood that the words represented real-life objects but he was unable to combine them in what in spoken English would be syntactically reliable ways. One problem, however, is that syntax in ASL and in spoken English are very different, so comparing 'syntax' in ASL-using subjects with spoken English doesn't make much sense.

Nim Chimpsky is often cited as the evidence that chimpanzees cannot use even simple forms of a human language. However, after Terrace had finished his experiment, Roger Fouts took over care of Nim. Fouts placed him in a group with other signing chimps, assigning one of his students, Robert Ingersoll, as Nim's carer. Ingersoll showed that, after his exposure to other signing chimps, Nim became a strong and spontaneous signer. Nim's history continued to be complicated, however: he was sent to a primate experimentation laboratory (against the wishes of his carers),

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rescued, and died of a heart attack at the young age of 26. Undeterred by Terrace’s negative results, in the 1980s Sue Savage-Rumbaugh started work with five bonobos using a Yerkish-like keyboard. Bonobos are a species closely related to chimpanzees and, for a long time, thought to be pygmy chimps. However, they aren’t simply smaller, they are less aggressive, and their societies are dominated by females, not males. The first bonobo introduced to the keyboard, Matata, did not understand it; but her son, Kanzi, proved remarkably adept. He now produces short syntactic utterances using the keyboard, supplemented by some tokenised gestures. He also signs spontaneously, and responds to a certain amount of spoken English as well as signs – Kanzi may be the first nonhuman who can have a real, if restricted, conversation with you. Kanzi and Matata continue to live at the Bonobo Hope Sanctuary in Iowa, with three other bonobos who use Yerkish.

Pool talk, bird brains and dog toys

Other experiments have shown that some cognition needed for symbolic representation seems to be present in other animals. In one of these experiments, Jarvis Bastian tested the dolphins Buzz and Doris to see whether they could use sound alone to communicate direction. The two dolphins were separated so that they could hear but not see each other, and Doris was presented with two lights, one steady and one flashing. She had to signal which one was flashing, left or right. Buzz then had to press the correct button, left or right, for them both to receive a fish. They reached the point where 90% of the tests resulted in fish, and Bastian was able to tentatively identify sounds which might have represented left or right. However, one problem with this experiment was that there was no way of knowing what Doris was signalling to Buzz about the lights – she got the fish based on the reliability of her signal, not its meaning. Although the signal clearly meant something

to her and to Buzz, what it meant remains unknown.

In the early 1980s, Louis Hermann worked with the dolphins Akeakamai and Phoenix to see whether they could understand a rule-governed language-like system. His team created an artificial sign language involving nouns, verbs, and a simple syntax, and used it to communicate instructions to the dolphins. Akeakamai proved particularly adept, and understood the difference between word orders (e.g. that ‘surfboard person fetch’ involved different actions to ‘person surfboard fetch’). Although neither dolphin produced language, they showed that they understood word meanings and the role of simple syntax in constructing sentence meanings.

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did he understand differences between colours, he seemed to understand the abstract meaning of ‘colour’ itself. He also understood the meanings of the labels ‘shape’ and ‘material’, and he could respond to multiple questions about the same object, labelling its colour, shape, and material. He understood the relative concepts of bigger and smaller, and same and different; he understood absence, a zero-like concept; he spontaneously understood that numbers represent order (three follows two follows one) as well as quantity; and his comprehension skills matched his speech capacities. Although Pepperberg was not particularly interested in syntax, Alex could use simple phrases, like ‘I want X’ or ‘I wanna go Y’ and, if given large collections of items of various colours, shapes, and materials, could respond to questions such as ‘What toy is green and wood?’ Alex died of natural causes in 2007, and Pepperberg has so far been unable to duplicate all of Alex’s achievements with other parrots. However, her work with Griffin and Arthur, two other grey parrots, is very promising.

Symbolic communication experiments with animals are less common in the new century; but Juliane Kaminski has been working with a collie dog called Rico to see how many word-object relationships he can understand. Rico had a large box full of different toys, and he was able to identify over 200 of them by name. More impressively, if a new toy was added to the box and Rico was asked to fetch a name he has not heard before, he assumed that the new name must relate to the new toy, and fetched that. Rico shows that the capacity to associate arbitrary words with real-life objects is probably quite common among

mammals. Kaminski has more recently worked with another collie, Betsy, who is also showing sophisticated skills in associating words with objects and their pictures.

But is this language?

Are all these experiments just examples of animals doing tricks, or do they tell us something important about human language? To understand their significance we need to consider one of the assumptions made in the past about language origins. At one time it was assumed that language was a single system which came into existence with a single genetic change. However, the fact that some aspects of language can be shown to exist in nonhumans indicates that this single genetic change is unlikely: language is not a unitary, dedicated system. Instead, it seems to use many different cognitive capacities, some of which are new, but many of which probably pre-date the existence of our species. This is a more reasonable explanation in evolutionary terms: a steady accumulation of small changes is much less improbable than

the massive change needed to produce all of language in a single step.

That does not mean, though, that language-like communication comes easily to nonhumans: no nonhuman animal has been able to use language the way humans use language – although Kanzi and Alex, and possibly Koko, do seem to have come closer than we thought possible. There does seem to be an important difference in humans – perhaps our cognition, perhaps our culture, perhaps our social habits – that makes language more natural for us than for other animals. Human language does seem to be, in some important ways, a skill at which only humans can excel. But then it is, after all, *human* language; and how many humans do you know who can signal effectively in chimp, or bonobo, or parrot, or even dog? 🐾

Martin Edwards is the author of *The Origins of Grammar: An Anthropological Perspective*. He lectures in Psycholinguistics at King’s College London, and in language origins at the University of East London.

Find out more

- Books**
The Articulate Mammal: An Introduction to Psycholinguistics (5th edition) by Jean Aitchison (Routledge, 2008)
Next of Kin: My Conversations with Chimpanzees by Roger Fouts with Stephen Tukel Mills (Avon Books Inc., 1997)
Nim Chimpsky: The Chimp Who Would be Human by Elizabeth Hess (Bantam Books, 2008)
The Alex Studies by Irene M. Pepperberg (Harvard University Press, 1999)
Kanzi’s Primal Language: The Cultural Initiation of Primates into Language by Par Segerdahl, William Fields and Sue Savage-Rumbaugh (Palgrave, 2005)
- Online**
 The Alex Foundation: www.alexfoundation.org/index2.htm
 The Bonobo Hope Sanctuary, Iowa: www.iowaprimaterelearning.org
 Chimp Haven, Louisiana: www.chimphaven.org/
 The Chimpanzee & Human Communication Institute, Washington: www.cwu.edu/chc
 The Language Research Centre, Georgia: www2.gsu.edu/~wwlrc/