6SSEL045 – Language Origins
Lecture 3
Teaching Nonhumans to Use Human Language

Is language uniquely human only because we define it to be so: language is uniquely human because it is the unique way that humans signal? Or is it uniquely human because it requires its own unique cognitive processes, and only humans have these? Or is it uniquely human because it requires cognitive processes which are not unique to language, but which nonetheless only humans have? Or does it appear to be uniquely human because it is a tool of human socialisation and culture, which are uniquely human even though the cognitive processes behind them are not?

Or was Doctor Doolittle right: language is just communication, and most animals can do that. What makes us different is not how we communicate but what we communicate.

TEACHING LANGUAGE TO NONHUMANS – SOME CASE STUDIES
In the last century, a series of diachronic training experiments (training over an extended period of time) were performed on a variety of nonhumans to discover whether they were capable of using human language. What was at stake was not just the exclusivity of language to humans, it was the exclusivity of human cognition. The experiments have not settled the questions decisively in either direction, and sometimes the same evidence has been used both for and against human language uniqueness.

GUA (1930-1933)
In 1930, Winthrop & Luella Kellogg tried to train Gua, a female chimpanzee, to speak. She was fostered into the Kellogg family and was raised alongside their son, Donald, who was the same age as Gua. The purpose of the experiment was to see how far socialisation could overcome species-specific capacities. Gua never spoke, although she demonstrated a clear understanding of about 70 words. The experiment ended after two years because Donald began to exhibit more chimpanzee-like behaviour than Gua was demonstrating humanlike behaviour. Gua died a year later, aged 3, of pneumonia.

VIKI (1947-1954)
In 1947, Keith & Kathy Hayes adopted Viki, another female chimpanzee, as part of their family. There was no human baby for comparison, but there were other children to provide a full human environment. Viki was supported with speech therapy in an attempt to enhance her language use. Eventually she was able to produce vocal approximations of papa, mama, cup & up, but nothing else. As with Gua, she understood many more words than this. The experiment was terminated in the fourth year, and the Hayes concluded that, because Viki's speech was so limited, chimpanzees were unable to master human language. We now recognise that Viki's problem was not with language but with speech: the chimpanzee vocal tract is not designed for complex articulation; they cannot use spoken language with the same dexterity as humans. Viki died of encephalitis at age 6.

WASHOE (1965-2007)
In 1967 Allen & Beatrix Gardner began to teach language to an under-two-year-old chimpanzee called Washoe. Unlike most animals used in these experiments, Washoe was born in the wild in Africa, and was kidnapped by the US Air Force for use in the space programme. She was re-allocated to language research after the successful launch of humans into space, and their retrieval, made off-planet experiments on chimpanzees redundant.

The Gardners taught ASL (American Sign Language) to Washoe, and she was brought up as part of the Gardner's family to give her access to human culture; initially, communication was, as far as possible, conducted in ASL, but English speech was used with increasing frequency as Washoe grew. Washoe learned at least 25 signs in her first year, and knew hundreds by the time she died in 2007, aged 42. The Washoe experiment did not end when the Gardners finished their work; she was transferred to other researchers, one of whom (Roger Fouts) worked with her until her death. Washoe is one of the key exemplar nonhumans to be taught human language, and she was the first to show that nonhumans can understand the principles of human communication, can use it productively, and can create new language where needed. The Washoe experiment led to many other attempts to teach human language to nonhumans.

SARAH (1959-2019)
From 1967 to 1987, David Premack & Ann James Premack worked with a team of nine chimpanzees (five trainees and four controls), using a magnetic board and abstract shapes. The chimpanzees had to put the shapes (each of which represented an object or action – a word in language terms) onto the board to form well-ordered sentences. Of the trainee chimpanzees, Sarah was the star pupil; Elizabeth & Peony also grasped the communicative principles involved, although their communicative production was erratic; but Gussie & Walnut never understood. The Premacks showed that:

- chimpanzees can understand that symbols represent real things;
- the symbols are nonetheless different from the real things;
- chimpanzees can understand segmented and differentiated combinatorial signalling;
- chimpanzees do seem to have a Theory of Mind (a term created by David Premack).

After the experiment ended in 1987 the chimpanzees were retired to primate sanctuaries with other human-language-enabled animals. Sarah was 60 when she died in 2019, an advanced age for a chimpanzee in the wild.

LUCY (1964-1988)
From soon after birth in 1964, Lucy was raised in a human home by Jane and Maurice Temerlin. She was taught ASL by Roger Fouts, who was working with a group of chimpanzees in the Oklahoma facility, teaching them sign language (Washoe joined the group in 1980, after the Gardner experiment). Most of Fouts' subjects learned some ASL, but Lucy was the star pupil: she learned hundreds of signs, produced simple grammar, and created novel descriptors, such as CANDY-DRINK for watermelon, and CRY-HURT-FOOD for radish. When Lucy was 12, the Temerlins found her too destructive to be kept at home, so she was sent back to Africa as part of a re-wilding experiment. She never fully settled into the local chimpanzee group, and she was found dead in 1988, presumably killed by poachers.

LANA (1970-2016)
In 1973, Duane Rumbaugh, Sue Savage-Rumbaugh & William Fields began working with Lana at the Yerkes Institute using a Yerkish lexigram keyboard. Yerkish was invented by Ernst von Glasersfeld in 1971 as a language-by-other-means for nonhuman primates. It consists of a set of abstract symbols which are arbitrarily associated with objects and actions, and which can be combined syntactically to make utterances. The keyboard is now called the LANA keyboard – partly as an acronym for LANguage ANAlog, and partly in honour of Lana, the first nonhuman primate to use it. Lana learned how to put together simple action-object strings, and she used the keyboard spontaneously to make her demands known. However, as her interactions were mostly with computers and not researchers, there is some doubt about whether she understood negotiation toward meaning or was just treating Yerkish as a complex stimulus-response mechanism (e.g. the combination "PLEASE MACHINE GIVE JUICE PERIOD" reliably produces juice; there is no need to know that the construct is composed of individual meaning-sign units).

Duane Rumbaugh negotiated for Lana to be moved to the Georgia Language Research Center when he became Director there in 1980. In 2000 she showed she could still recall the symbols on the Yerkish keyboard and use it effectively, despite nearly 20 years elapsing since

her last exposure to it. Lana died in November 2016, and Duane Rumbaugh died seven months later.

SHERMAN (1973-2018) & AUSTIN (1974-1996)
In the late 1970s, Sue Savage-Rumbaugh's team worked with two male chimpanzees, Sherman & Austin, using the Yerkish keyboard. Unlike Lana, they were taught in an environment where their requests were met by humans and not machines, to test their semantic understanding. They seemed to understand the symbol-object relationship, and they recognised than an object could be represented by more than one symbol. They also seemed to understand the principle of superordination and subordination, classifying objects by type (food or tool) as well as by name; but they didn't demonstrate reliable use of syntactic order. However, they did show that producing language and apprehending language are two different processes, because they needed separate training for "speaking" and "listening". Austin died in 1996, but Sherman continued to live and work at the Georgia LRC until his death in 2018.

NIM CHIMPSKY (1973-2000)
Inspired by the Washoe and Premack studies, Herbert Terrace began Project Nim in 1973. Nim Chimpsky, a male chimpanzee, was raised in a human family from the age of two weeks, to match the enculturation that Washoe received. However, it was not a family of signers, so Nim was trained in sign by taking him to Columbia University a few times a week for schooling. Unlike Washoe's rich and informal communication environment, Terrace attempted to formalise NIm's education with a training schedule, and he reduced extraneous features in the learning environment to prevent distractions. This, however, made Nim's learning a sterile and unnatural process.

Nonetheless, Nim clearly learned an association between certain gestures and receiving certain rewards. For four years, Terrace's students recorded any signs Nim made in an effort to show he was using ASL to communicate. However, when Terrace analysed his video tapes he concluded that Nim was not producing syntax, only scrabbles of words – Nim had no grammar. Terrace used this finding to discredit the Washoe experiment as just a "Clever Hans" phenomenon; but he was unable to do the same with the Premacks' work or the Yerkish keyboard work because there was no researcher judgement involved in interpreting the signs. Yet many Generativists saw (and still see) Project Nim as final evidence of the failure of all nonhuman language experiments.

Roger Fouts took over care of Nim after Terrace had finished his experiment. After Nim's transfer to Yerkes, Fouts found that Nim's signing was poor; but he became a strong and spontaneous signer when placed with other signing chimpanzees. As Fouts did not "own" Nim, he was powerless to stop his transfer to a primate research laboratory, but a public outcry saw him transferred to a retirement facility instead. Robert Ingersoll, who befriended Nim in the last years of his life, confirmed his continued use of sign in the new facility. Nim died at age 26 of a heart condition.

LOULIS (1978-)
After Washoe lost two babies within the first month after birth, Roger Fouts introduced her to an infant male chimpanzee, Loulis. Washoe immediately took over the care of Loulis, and he became the subject of a new experiment: would Washoe spontaneously teach him ASL? Washoe taught Loulis his first sign within days, and went on to give him a grounding in ASL. For the first five years, the human signers used only seven signs when Loulis was around, so he acquired all his vocabulary and grammar from Washoe and the other signing apes. He became the first nonhuman to learn a human communication system from other nonhumans, indicating that learning a humanlike language does not need the intervention of humans. Loulis went on to become a strong and spontaneous ASL signer. In 2013 he moved, with Tatu, another signing ape, to the Fauna Foundation in Canada.

KANZI (1980-)
After her work with Sherman and Austin in the 1980s, Sue Savage-Rumbaugh worked with five bonobos, including Kanzi, using a Yerkish-variant keyboard. The first bonobo introduced to the keyboard, Matata, did not understand it, but her adopted son, Kanzi, and her daughter, Panbanisha, proved remarkably adept. Panbanisha's story is not told here, but it is as remarkable as Kanzi's.

Kanzi now produces complex and clearly syntactic utterances using the keyboard and some tokenised gestures. He also signs spontaneously, and he listens and watches as well as producing language – he has a concept of dialogue, and seems to understand negotiation toward meaning. He is the nonhuman who has come closest to using human language in a humanlike way – so close that some argue that he really is using human language.

Kanzi has been involved in other parahuman experiments. In 1988, aged eight, he was matched against a 2-year-old human child, Alia. Over nine months, they were both given a set of 660 spoken instructions. Alia was able to carry out 65% of the instructions correctly, but Kanzi achieved 74%. In 1990, Kanzi was taught by Nick Toth how to knap stones to make sharp edges. He made a few blades the human way before he found his own, much simpler, way to make them: smash the stone onto concrete. He is able to use the blades to cut ropes to gain access to boxes of food: if presented with a tied box and a cobble, he makes blades.

KOKO (1971-2018)
In 1972, Francine Patterson began working with Koko, a female gorilla, to teach her ASL. Gorillas are less manually adept than chimpanzees, so Patterson calls Koko's gestural approximations GSL (Gorilla Sign Language) rather than ASL. Patterson's work remains controversial, and her claims extravagant ("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."), but it does seem that Koko could associate gestures with objects, and possibly understood the object-action distinction. Koko is noted for her interspecies relations (she had several pet cats) and for her longing for a baby. She had two male companions in her life, but no offspring. Koko died in her sleep aged 46, a good age for a gorilla in the wild.

CHANTEK (1977-2017)
To complete the set of the hominidae primate studies, Lyn Miles decided to teach ASL to a male orang utan called Chantek. Chantek was raised as if he was a human baby, he was toilet-trained, he was given toys, and he was even given pocket-money (steel washers) for some tasks. He was able to exchange these for other treats, but he also seemed to understand the idea of hoarding them for delayed gratification. He lived on campus at the University of Tennessee and became a favourite with the students. Chantek had a relatively small vocabulary of around 150 signs, but he understood the interpersonal nature of ASL, negotiating and wheedling to get his way.

In 1986, when Chantek became too big to be kept on-campus safely he was returned to Yerkes, where he stayed for 11 years. At Yerkes he was kept in a 5m-by-5m cage, where he soon developed depression and put on weight. Eventually, in 1997 he was moved to an enclosure with trees, a varied environment and (most importantly) other orangs. There, he was encouraged to paint, string beads and construct things. He died at 39, a little early for an orang utan.

ALEX (1976-2007)

In 1977, Irene Pepperberg began working with Alex, a grey parrot. Alex vocalised in English, he used segmentation and differentiation in his utterances, and he seemed to use some rule-based structure in his signalling. He also used humour and seemed competent in negotiating toward meaning. Alex could identify 50 different objects and he recognized quantities up to six. He could also identify seven different colours, five different shapes, and some different materials such as wood and wool. He understood the relational concepts *same*, *different*, *bigger* and *smaller*, and he was learning *under* and *over* at the time of his death in 2007. At that time, he had a vocabulary of over 100 words.

Pepperberg does not claim that Alex used human language, instead describing his interactions as "a two-way communications code". However, the fact that this was two-way indicates not just that Alex could make himself understood, but than he intended to make himself understood. Generativists dismiss Alex as a language-user, because his output was not complex enough; but in doing so they also exclude two-year-old humans (who have a similar level of language development) from being language users.

RICO (1994-2008) & CHASER (2004-2019)

In the 1990s, Juliane Kaminski worked with Rico, a male collie dog who had been trained by his owners to recognise 200 different toys by name. Kaminski avoided the "Clever Hans" problem by making Rico fetch the toys from a second room, which was unoccupied, and returning them to the first room. Rico was also tested on collecting a novel toy based on a novel label, a task he understood and carried out correctly. This is inferential reasoning by exclusion, a capacity previously thought of as exclusively human. Over all, Rico achieved a 92% success rate in accurate retrieval.

Chaser, a female collie dog, was similarly trained in semanticity by John Pilley. Chaser recognised over 1,000 different toys by name, recognised nonspecific nouns like ball and house, succeeded in the inferential reasoning by exclusion test, and seems to comprehend some simple grammatical relations.

Neither Rico nor Chaser are evidence of human language use by nonhumans; they are, however, indicators that some of the perceived differences in communicative capacities may be more wishful than evidenced.

DOLPHINS

In 1964, Jarvis Bastian led a team to find out if dolphins could signal abstractly. Two dolphins, Buzz & Doris, were put in separate tanks; one was given a left or right light stimulus and had to vocalise (in "delphinese") to tell the other dolphin which of two paddles to press so that each got a reward. Buzz & Doris achieved 90% accuracy, indicating that dolphins can use symbolic deixis, and have directional markers in their natural communication. This project ended in 1968, having achieved its aims.

Although one of the purposes of the experiment was to see if these abstract signals were already coded into "delphinese", there remains some doubt that Buzz and Doris would have had sufficient exposure to dolphin culture and communication: they were captured at the young ages of 2 and 3. They may have been able to cobble together an idiosyncratic communication system, but this could tell us nothing about normal dolphin communication. Bastian declared that his experiment was not about interfacing with dolphins using human language, and he did not believe that "delphinese" was comparable to human language. The results of his experiment are therefore, in human language terms, rather limited.

In the early 1980's, Louis Herman worked with dolphins Phoenix and Akeakamai to establish their competence in understanding human speech. He concentrated on reception rather than production because it is impossible to identify whether a signal is produced consciously or subliminally (this is true even for humans producing human language). Using a symbolic language similar to that used by the Premacks, Herman's team established that the dolphins were able to understand symbols whether represented in sound, orthographically or in gesture; and they were able to handle simple combinatorial syntax, for instance, the difference between BASKET BALL TAKE FETCH (take the ball that is next to the basket) and BASKET BALL TAKE IN (take the ball that is in the basket). This is important because it shows that human language complexity is not a product of just primate brains, other complex brains can handle it.

WHAT DOES THIS TELL US ABOUT LANGUAGE?

These experiments provide important information about the nature of human language as a communication system.

- Human language is different from other forms of communication – not only in form but also in function. It is, however, likely that the differences in form are driven by the differences in function.
- Some features of language may not be exclusive to humans. Other animals can be taught to use aspects of language, so the differences between language and other communication systems may be in the system and not in the species.
- Human language may be an effect of what makes us human and not a cause.
- Experiments teaching nonhumans to use human language are essentially artificial: nonhumans do not need human language, and they must be persuaded to learn it even in reduced form. Nonhumans will only use human language if trained within a human environment – or, at least, an environment of constant reward. We should look on these not as first- but as other-language acquisition experiments.
- Nonhumans may not be the most effective users of human language, but how many humans are effective users of nonhuman signalling systems? We know that interspecies communication occurs throughout nature, and that humans tend to believe they can communicate with animals they encounter using human language. So, either we accept that we are cruelly misinformed by our own beliefs, or we accept that some nonhumans have sufficient understanding of human language to justify our beliefs.