Communication Is Key: Language Learning and Language Acquisition in Interspecies Communication

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Introduction

For thousands of years, we have sought to distinguish the human from the animal. In The Bible, God commands humans to 'have dominion over the fish of the sea and over the birds of the heavens and over every living thing that moves on the earth' (*The ESU Bible*, Gen 1:28). The Bible has shaped our way of thinking of the hierarchy between animals and humans, and *Language* has often been highlighted as the distinguishing factor. Since humans became dependent on animals for our existence as early as wolves became our partners in hunter-gatherer societies, it has been important to communicate our needs and intentions to animals. Animals have made their way to our belief systems as we are fascinated by the prospect of talking to animals. It is evident that humans still fail to understand the nuances and complexities of animal communication systems; we even misunderstand the intended communication from animals that we are quite familiar with. This may be one of the main reasons that we continue to research human-animal communication.

Since the 1950s, a series of experiments with the goal of teaching animals human sign language have been carried out (Kulick 2017, 357). This approach has largely been replaced by a series of other discussions, from '[s]ociologists interested in symbolic interactionism, anthropologists writing about ontology, equestrian and canine trainers' (Kulick 2017, 357) and so much more. Thus, the field of human-animal communication is still thriving. In recent years, teaching human language to animals has gained a renewed interest from pet-owners. On TikTok and other social media, we are presented with ample evidence that we still have an interest in understanding the dynamics of human-animal interaction. Videos of dogs and cats communicating via sets of buttons with recordings of words have been popular on these websites – no wonder that *Dr. Doolittle* is reinvented time and time again.

It has been suggested that humans have an innate capacity for complex language, vastly different from animal communication systems (Terrace 2019b). Over the course of history, we

have attempted to teach animals some form of human communication, whether through sign language, verbal utterances, or by expressing needs by pressing a series of buttons. This article will examine the design features of human language and other means of communication, while discussing the question: Can you teach an animal human language?

This article first presents some definitions of language and discusses the ways in which the design features of human language differ from of animal communication. Furthermore, it examines the differences between behaviourism and the innateness hypothesis in order to establish how humans learn or acquire their first language in comparison to attempts at teaching (aspects of) human language to animals. Then follows a discussion of a series of experiments in which researchers have – more or less successfully – implemented this in their attempts to teach human language to animals. This leads to a final discussion on the main topic of this article, can you teach an animal to talk?

Throughout this article, for clarity and brevity, I will refer to only non-human animals as *animals*, though I recognise that humans are in fact animals too. This fact, however, is not relevant for the subject.

What is language?

Encyclopaedia Britannica states that language is 'a system of conventional spoken, manual (signed), or written symbols by means of which human beings, as members of a social group and participants in its culture express themselves' (Crystal and Robins 2023), thus categorically ruling out animals. Over the last hundred years, many other definitions of language have seen the light of day. From Sapir in 1921 defining language as 'a purely human and noninstinctive method of communicating ideas, emotions, and desires by means of a system of voluntarily produced symbols' (Sapir 2014, 7) to Bloch and Trager who argue that 'language is a system of arbitrary vocal symbols by means of which a social group cooperates' (qtd. in Lyons 1981, 4) to Chomsky, who considered language to be 'a set (finite or infinite) of sentences, each finite in length and constructed out of a finite set of elements' (Chomsky 2002, 13).

If we look outside the field of linguistics and academia, Kulick (2017) describes a field of human-animal communication (so-called animal communicators), who define language in far broader terms: 'Language encompasses images, smells, emotions, sensations, and feelings' (Kulick 2017, 363). In this view, the primary function of language is not to establish social relations, but to understand the inner feelings and emotions (Kulick 2017, 363). And in informal use, language typically refers to the specific cultural communication system, for example English, Danish, or Japanese.

The concept of language is thus complex, even in its definition: Language can both be seen as the cognitive ability (the instinct) allowing humans to participate in linguistic behaviour, it can be seen as an arbitrary system of symbols, vocal or signed, that when combined communicates a meaning, and it can be seen as a means of socialisation and communication, primarily between humans. Neither inherently excludes the other, perhaps quite on the contrary. The variation between the definitions indicates the diversity of the field. However, what we can generally extract from these statements is that language is perceived as a complex-structured system of sounds (or signs), that it is arbitrary, and that it is used for communicative purposes.

Features of human language

Now that I have presented some definitions of language, the pressing question is which elements constitute human language. Is human language special from other systems of communication?

I first turn to two articles on the faculty of language from Hauser et al. (2002) and Pinker and Jackendoff (2005). Both articles examine which components of the language faculty are uniquely human and discuss how the faculty of language has evolved.

Hauser et al. (2002) argue for a recursion-only hypothesis. Recursion is the ability to embed a constituent inside another constituent of the same type. For example, the sentence '*a book* [*that was written by the novelist* [*you met on the night* [*that we decided to buy the boat* [*that you liked so much*]]]]' (Pinker and Jackendoff 2005, 211) in which a relative clause is embedded inside another relative clause, a pattern that could theoretically continue indefinitely. Hauser et al. (2002) argue that recursion is the only uniquely human component of the faculty of language. They build their arguments on the evolution of various traits by comparing the ability and complexity of these in animals and humans. Pinker and Jackendoff are critical of the perception that 'the rest of language [is] either specific to humans but not to language (e.g. words and concepts) or not specific to humans (e.g. speech perception)' (Pinker and Jackendoff 2005, 201).

Hauser et al. pose three possible hypotheses: 1) either the broad language faculty (FLB) is common for all animals, and human FLB has the 'same components that underlie communication in other species, or 2) FLB is strictly a human trait, developed through natural selection into the highly complex communication system we see today, or 3) only the narrow language faculty (FLN), and thereby recursion, is a uniquely human attribute (Hauser et al. 2002, 1572).

In arguing for their third hypothesis, they discuss a series of examples indicating that animals and human share many of the same cognitive and perceptual mechanisms of the broad language faculty, though none are as complex as human speech. They argue for example that other animals (dolphins, parrots, and songbirds) are capable of imitation, but that non-human primates do not

have this capacity. Many species of animal are able to discriminate between human speech sounds. In the same vein, Hauser et al. point out that several other species than humans have a descended larynx, which could suggest that it has not developed for speech production. They conclude that their hypotheses open an array of other questions, and it would only be possible to determine how recursion has developed in humans by finding evidence of such complex recursion in other animals.

The article by Pinker and Jackendoff (2005) is a direct response to the article by Hauser et al. Pinker and Jackendoff pose a series of fundamental questions about the nature of language, in order to: 1) establish which aspects of language are learned from environmental input, and which are part of the innate design of the brain, 2) establish which parts of language abilities are specific to language, and which belong to other abilities, and 3) establish which aspects are uniquely human, and which are shared with animals (Pinker and Jackendoff 2005, 202).

Like Hauser et al. (2002), they acknowledge that some animals can learn to discriminate pairs of speech sounds, however, they emphasised that it can only take place with supervised learning. They highlight that humans are far better at this, even infants have this ability, and humans process speech sounds far more rapidly than the trained animals, and humans are not distracted by either faulty pronunciation or background noises. They remind us of other physical adaptations of humans, suggesting that vocal production has been specifically adapted for speech (i.e. voluntary control over breathing, greater cortical control over articulation, and an innate vocal babbling of human infants). While Hauser et al. (2002) suggest that humans are very adept at vocal imitation, Pinker and Jackendoff (2005) argue that this only applies to human speech sounds and perhaps melodies, as most humans lack the ability to convincingly produce environmental sounds, an ability found, for example, in some species of birds.

After a step-by-step discussion of Hauser et al. (2002), they determine that 'the empirical case for the recursion-only hypothesis is extremely weak' (Pinker and Jackendoff 2005, 217). They conclude that the problems observed in the article by Hauser et al. (2002) can be solved by viewing language as an 'adaptation for the communication of knowledge and intentions' (Pinker and Jackendoff 2005, 231). In other words, language is a complex adaptation for human communication.

Coleman (2006) presents a systematic overview of 16 design features of language as proposed by Hockett and Hockett & Altmann. Coleman divides these into three main categories: 1) vocalizations of land mammals, 2) features of primate communication systems (though including other mammals and birds), and 3) features specific to early hominoids and modern humans. The latter category includes *Traditional transmission* (the details of the communication system that are not innate, but passed down to other members of the species), *Displacement* (the ability to speak of past

and future plans), *Productivity* (the ability to compose novel messages), *Duality of Patterning* (that languages have a two-level structure, where minimal meaningless units are combined into larger, meaningful units), *Prevarication* (the ability to make false statements), *Reflexiveness* (the ability to use language to talk about language), and *Learnability* (the ability to learn more than one language). Rather than focusing on evolutionary traits like Pinker and Jackendoff (2005) and Hauser et al. (2002), Coleman compares studies of language in humans and other animals to Hockett's design features, referencing a series of experiments in teaching human language to animals. He argues that the animals in the studies underperform compared to humans on a number of points, including productivity, traditional transmission, and reflexiveness. However, some animals do exhibit displacement (such as the chimpanzee Sarah using symbols to ask for things not there) and prevarication (such as animal behaviour specifically designed to mislead), and ape sign language shows a degree of duality of patterning (Coleman 2006, 474). Coleman concludes that some design features originally held to be uniquely human no longer seem to be; animal communication systems (both natural and acquired through supervised learning) are more complex than we have perhaps believed them to be.

To sum up, even though the researchers draw different conclusions on the unique features of the human language, the common denominator is that humans are much better at learning and using all the complex features and mechanisms that constitute what we call human language. Many of these features may have precursors and parallels in animal communication, but humans are specialised in utilising this array of features.

The obvious question is thus to establish whether these are learned or innate.

Behaviourism and the innateness hypothesis

In order to answer this question, researchers proposed the theory of behaviourism. A typical behaviourist perspective is that children are born as a blank slate (a *tabula rasa*) on which all knowledge must be written (East 2023, 365). That is, knowledge is not inherent or innate, and is instead developed over time from perceptions and sensory experiences as children grow.

Skinner offered his theory of *operant conditioning*, namely that behaviour is determined by its consequence, that 'when a particular behavior is positively reinforced, it is likely to occur again; when it is punished, its re-occurrence is less likely' (East 2023, 365). Thus, Skinner's operant conditioning centres on the premise of motivation, that is, that the subject is motivated (or demotivated) to repeat behaviour, when rewards and punishments are used to reinforce said behaviour. The same principles apply to his stance on language learning and verbal behaviour. In essence, Skinner argued that '[i]n all verbal behaviour, … there are three important events to be

taken into accounts: a stimulus, a response, and a reinforcement. … the stimulus, acting prior to the emission of the response, sets the occasion upon which the response is likely to be reinforced … the stimulus becomes the occasion upon which the response is likely to be emitted' (qtd. in Christensen 2023, 9). Consequently, in Skinner's views, language acquisition occurs when children are exposed to a stimulus in their first language, and it centres around imitation and practice. That is, children practice and imitate sounds and patterns, leading to ingrained patterns and proficiency in their first language (East 2023, 365).

Today, Noam Chomsky represents the first and most influential critic of behaviourism. Lightbown and Spada explain it plainly: Behaviourism 'failed to account for "the logical problem of language acquisition" – the fact that children come to know more about the structure of their language than they could reasonably be expected to learn on the basis of the samples of language they hear' (Lightbown and Spada 2013, 20). In other words, if we presume that syntax is a 'productive, recursive and infinite system' (Carnie 2007, 15), it naturally follows that it is impossible for a child to be exposed to all possible combinations. There is a poverty of the stimulus, but despite this poverty, acquisition is very fast, and children as young as five are quite confident in their first language (Carnie 2007, 19). Additionally, children are exposed to imperfect input, including 'false starts, incomplete sentences, and slips of the tongue' (Lightbown and Spada 2013, 20), but these are essentially ignored. Despite these errors, children still learn to distinguish between grammatical and ungrammatical sentences. Thus, the 'mental grammar' (Pinker 1994, 22) is what allows their quick proficiency in language, and the environment only provides a basic contribution, namely that people are around to speak to the child.

Lightbown and Spada demonstrate that while many children do imitate words, it is 'unlike a parrot who imitates the familiar and continues to repeat the same things again and again, children appear to imitate selectively … based on something new that they have just begun to understand and use' (Lightbown and Spada 2013, 16). On the other hand, not all children imitate to the same degree, and their transcripts of children's speech suggest that the imitation of speech in some children, whose development in speech develops normally, is less than 10 percent (Lightbown and Spada 2013, 17). This further suggests that imitation does not provide the *foundation* of learning human language, but that imitation is used by children to learn specific words and their meaning and to practice pronunciation.

It has been argued that some aspects of language are innate, that humans have some common, universal principles, restricting the number of possible functions and combinations, thus preventing children from pursuing wrong hypotheses about language (Lightbown and Spada 2013, 20). Universal grammar can then be seen as a sort of short-cut to language learning.

Most linguists now agree that humans do have an innate ability to acquire language, and that we are far from blank slates. In other words, humans do not need to *learn* language actively by imitation and reinforcement, but we *acquire* it more or less automatically. That is, that humans have a 'domain specific intelligence' (Kidwai 2008, 249) or a 'language instinct' (Pinker 1994).

As argued above, there is ample evidence to support the hypothesis that at least some parts of language are innate, and Skinner's strict hypothesis of operant conditioning seems unlikely to form the basis of language learning. There is no doubt that language learning is more complex than simply either-or, and the innateness hypothesis is not to be understood as the ability to master language at the push of a button. It is not that languages are *learned*, as Skinner argues, it is that humans are innately programmed to *acquire* language over time. In a sense, some parts of languages are practised: Humans are not born with specific languages or accents, words need to be learned, but our language instinct allows us to do so.

Animal communication systems seem to be largely innate, much like human non-verbal communication (e.g. smiling, crying and laughing are largely involuntary actions). Terrace argues that animal signals are, in contrast to humans, 'innate, immutable and involuntary' (Terrace 2019a). On the other hand, it seems that songbirds (like humans) go through a critical learning period and failing to develop here results in persistently defective songs (Hauser et al. 2002, 1572). Furthermore, the fact that there are differences in the song of songbirds of the same species living in different location indicates that they learn at least some features of their songs (Wiley 2018, 2).

It is apparent that while we have identified some of the mechanisms, attributes, and features of animal language, we do still have a gap in knowledge. According to Terrace (2019a), we have little evidence to suggest that the signals of animals are anything more than emotional, that is, they lack the arbitrariness and conversational nature of words. With a basis in structure-dependence, Coleman argues that we have an 'almost complete ignorance about the grammar of the more complex animal communication systems, such as the vocalizations of songbirds, whales, and dolphins, or certain monkey species. Although such calls seem to have a moderately complex structure, we do not really know what the "words" are, nor what they mean, so we cannot determine whether they are distributed or show variant forms in a way that is comparable to structure-dependent operations in human language' (Coleman 2006, 472). Thus, it is obvious that there is much we still do not know about animal communication systems.

When teaching animals a language, we do not assume that they can acquire language in the same way that humans can. Animals do not acquire human language in the way that humans do (by building on an innate grammar). Rather, animals are *taught* human language, either because a set of commands are actively reinforced, or because they come to associate their owner or

caretaker's behaviour. Most pet owners will recognise that their dogs or cats pick up on words or routines: shaking the bag of pet food means dinner time, asking the dog to go for a walk causes an often-enthusiastic response, and even brushing your teeth as part of the night-time routine can become part of a set of signals to the pet. These behaviours and actions all become part of a recognisable pattern, or an operant conditioning as the pets respond to a stimulus – much in the same way that Skinner argued in the 1950s.

To sum up, it is not incidental that dog trainers – and trainers of other animals – recommend positive reinforcement, indicating that Skinner's operant conditioning is still relevant today. However, evidence suggests that animals do not understand the system of language in itself, and instead they learn to respond to a stimulus, whether verbal or non-verbal.

Teaching human language to animals

Over the years, many experiments in teaching various animals to understand and communicate using human language has been carried out. Pilley and Reed (2010) successfully demonstrated that the border collie Chaser had learned and retained proper nouns of more than 1000 objects. Chaser acquired '(a) awareness that words may refer to objects, (b) awareness of verbal cues that map words upon the object referent, and (c) awareness that names may refer to unique objects or categories of objects, independent of the behaviors directed toward those objects' (Pilley and Reed 2010, 184). As such, they showed that the border collie had a referential understanding of nouns.

Another example is Pepperberg's parrot, Alex, who acquired and used 50 nouns for objects and foods. Alex could combine these with a series of adjectives describing for colour, material, and shape to describe more than 100 objects with an accuracy of 80% (Coleman 2006, 475). It is worth noticing that Pepperberg's purpose was not to compare the parrot's language acquisition to that of humans, but instead establish a means of communication that would allow her to assess the cognitive abilities of the parrot (Kulick 2017, 362). These experiments are thus not attempts at understanding either human or animal communication, but to establish a common communication system from a human perspective.

The research attempting to teach great apes human language is more complex. Early research sought to teach great apes to talk. For example, the chimpanzee Vicki successfully learned to say 'mama', 'papa', and 'cup', but otherwise the field had little success, as the tongue and vocal tracts of apes are not appropriate for producing human sounds (Kulick 2017, 360). Later, several apes were taught a simple form of American Sign Language (e.g. Washoe, Lucy, Koko, and Chantek), the chimpanzee Sarah was taught an artificial language of plastic chips, the chimpanzee Lana was taught the artificial visual language Yerkish, and the apes Nim Chimpsky and Kanzi were taught to

communicate via lexigrams. According to Kulick, their purpose was to 'compare … language acquisition and use of linguistic forms with that of humans' (Kulick 2017, 362).

In 1979, Terrace (the psychologist leading the Nim Chimpsky project) and his team published an article that is 'acknowledged by everyone in the field as the blow from which ape-language research never recovered' (Terrace 1979; Kulick 2017, 361). Terrace et al. (1979) conclude that apes can learn vocabularies of visual symbols. That is, they can learn to use visual symbols to communicate, but their communication appears to be limited. The researchers found no evidence to suggest that apes can create novel words and express new meanings. Although the ape Nim learned an impressive 125 signs which he could combine, he showed a high degree of imitation and interruption, suggesting that he lacked the creativity of human children. Additionally, Nim used the symbols to satisfy a demand and obtain a reward, rather than to convey information or identify new things. Their research also indicates that Nim's three-sign combinations showed no evidence of lexical regularities, which also suggests that the combinations made by Nim cannot be understood as (primitive) sentences. In the words of Terrace et al.: 'Apes can learn many isolated symbols (as can dogs, horses, and other non-human species), but they show no unequivocal evidence of mastering the conversational, semantic, or syntactic organizations of language' (Terrace 1979, 901).

In an article from 2014, Rumbaugh et al. bring their research into a new field of inquiry. Rather than focusing on the great apes' *production* of language, their methods aimed at improving their *comprehension*. Their research indicates that the apes can understand the syntax of novel spoken sentences at levels compared to 2½ year old children, including reversed sentences such as 'Make the doggie bite the snake' and 'Make the snake bite the doggie' (Rumbaugh et al. 2014). The apes communicate with humans by supplementing their primary modality (the apes were taught using lexigrams) with others like vocalisations and gestures, and their language competence displays reveal patterns and regularities. Additionally, as with human children, Rumbaugh et al. argue that the apes in their experiments have a critical learning period by which the apes can come to comprehend hundreds of words.

It could be argued that they make a connection between *language comprehension* and *language competence*, a parallel that is not drawn by Terrace et al. (1979), and an argument that has been criticised by Kulick (2017).

Another project that has been criticised by Kulick (2017) is the Gardners's attempt at teaching the young, female chimpanzee, Washoe, American Sign Language. They claimed that Washoe was able to generate novel words, the most famous example being Washoe signing 'water bird', when seeing a swan for the first time. The results were published and caught the interest of

the public. However, Kulick (2017) states that the results were neither supported or reproducible, and '[w]henever available data were examined, they turned out to be either anecdotal or seriously flawed' (Kulick 2017, 360). It is a general problem when dealing with individuals – human and animal – that differences in personality affects scientists' ability to reproduce experiments one-to-one. This is why it is crucial that all data is available to scholars. This field is very sensitive to variation, because we still rely on qualitative rather than quantitative data.

Then, does the evidence support that animals can learn human language? Both yes, and no. This depends on how one defines the process of learning language and how we understand language.

Can you teach an animal human language?

In the previous sections, I have discussed that the concept of language has been seen in multiple ways: 1) as the cognitive abilities that allow humans to participate in linguistic behaviour, 2) as an arbitrary system of symbols that when combined create meaning, and 3) as a means of socialisation and communication.

Although Hauser et al. (2002) and Coleman (2006) present evidence suggesting that animals do exhibit some of cognitive abilities, for example imitation and the ability to discriminate between minimal pairs, the evidence suggests that humans are generally much more adept. Furthermore, recursion seems to be a uniquely human feature, and duality of patterning – if at all present in animals – has only been observed in trained animals.

Evidence indicates that some animals can name objects (such as the vervet monkey using different sounds for different predators), but their system of sounds seems to have a direct point of reference. In contrast, human language consists of a set of sounds that when combined create meaning (duality of patterning).

Human communication is largely a social construct – it may have been the main point of language to communicate with others of our species. The animals discussed in the experiments mentioned above certainly show a high degree of motivation and interest in communication with humans. Likewise, any pet owner will understand their pet's demand for food and attention. Vervet monkeys do not signal to themselves that there is a predator, and bees do not dance for their own pleasure (Terrace 2019a). As such, all language and communication systems must be understood as highly social.

The obvious difference at play here is, of course, that humans are much more adept at *acquiring* languages, and at the moment it seems that our system of communication is more complex than that of other animals.

The experiments teaching animals to talk stimulate a certain behaviour (in essence applying Skinner's *operant conditioning*). In and of itself, this indicates that animals lack the complexities of the mental grammar of the human mind, at least for the acquisition of *human* language. This is not to say that animal communication systems cannot be complex, but we still lack an understanding of communication systems different from our own. We know that some animals have quite complex communication systems: Bees can communicate the distance and direction of food by dancing, wasps communicate by releasing pheromones, and dolphins (like humans) communicate in multiple modalities (Terrace 2019a; Hauser et al. 2002).

As argued above, animal communication systems rely on largely innate, species-specific abilities. Thus, it seems like most of these abilities are not passed down from one member to the other, and unlike humans the meaningful details of language are not shared by traditional transmission (with some exceptions, such as the specific song of songbirds). While most linguists agree that we have an innate ability to acquire language, we also know that the meaningful details (such as words) are learned through exposure to the first language. But like humans are not innately programmed to understand animal communication systems, animals have not been shown to share our innateness for acquiring human language. The question of whether we can teach animals human language is perhaps inherently faulty.

Instead, we can build on our understanding of our own system of communication and how it is acquired in combination with understanding the communication of the specific species in order to optimise the interspecies communication.

A perfect example to this approach is developed by the horse-whisperer and equestrian trainer Monty Roberts (2005). He builds his theories of horse training on a thorough knowledge of the signals that horses use to communicate needs, requirements, and fears. Instead of imposing human communication systems on the animals, he responds to the horses' signals, building a common ground of communication. Instead of forcing the horses to speak human, he enables himself to respond to horse. In this way, he both optimises the horses' understanding of his cues (and thereby language) and his own understanding of the horses' communication signals. Thus, for both horse and human, this is a learned, common language that builds on the inherent ability of all creatures to communicate.

Concluding remarks

In this article, I have examined the concept of language, how it is acquired, and the design features that are – or may be – specific to human language. To do so, I have built on three aspects of language, namely language as a cognitive ability for linguistic behaviour, as an arbitrary set of symbols for creating meaning, and language as a means of socialisation.

I have argued that although some evidence suggests that aspects necessary for human language can be identified in animal communication, humans have evolved much higher competences in these skills. This suggests that human language is a unique feature.

It seems that an important part of language is innate, and that this enables humans to acquire language at a rapid pace and compensate for flaws and errors in this process. When attempting to teach animals human language, we build on Skinner's behaviourism and operant conditioning, repeating and reinforcing positive behaviour.

Although we have had an interest in the cognitive capacities of animals for a long time, we are still early in the process of understanding the animal communication on their own premises. We must also recognise that there is a difference between understanding a language and using a language communicatively (productive language vs. perceptive language).

The evidence presented suggests that we can never teach human language in its fullness to animals. It is impossible to teach animals to fully speak or communicate using human language. However, the experiments clearly suggests that we can teach certain aspects of human communication to animals. They can learn to recognise words and use them in simple combinations, and they can use this as another way of communicating their wants and needs. It is no wonder that pets pressing buttons with prerecorded sound have made their way to TikTok and other social media. As such, human language can be used as a bridge between animals and humans, and perhaps we are in fact teaching ourselves to respond to their communication. The question is: In all the time that we have worked on human-animal communication systems, and wondering whether we could teach animals to use human language, have we asked the wrong questions? In Herbert Terrace's words: 'Instead of asking whether a chimpanzee could create a sentence, we should have asked whether apes could learn to use words, a simpler task we took for granted' (Terrace 2019b, xv–xvi).

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