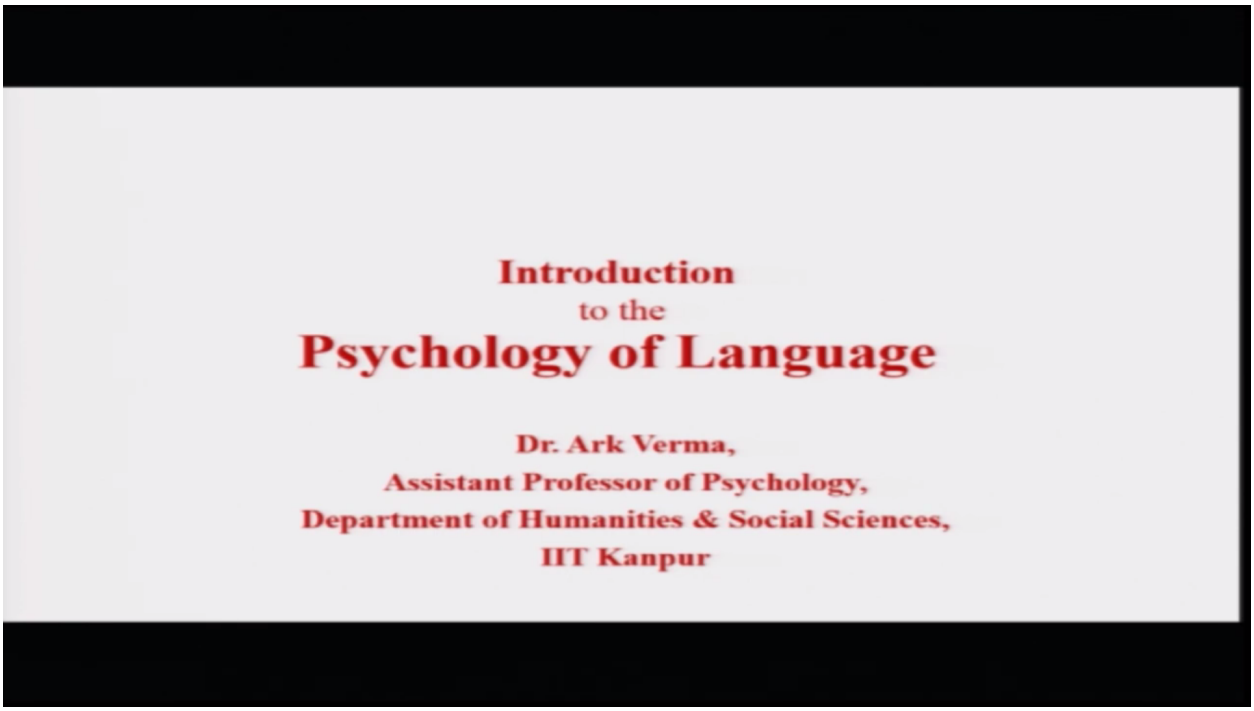
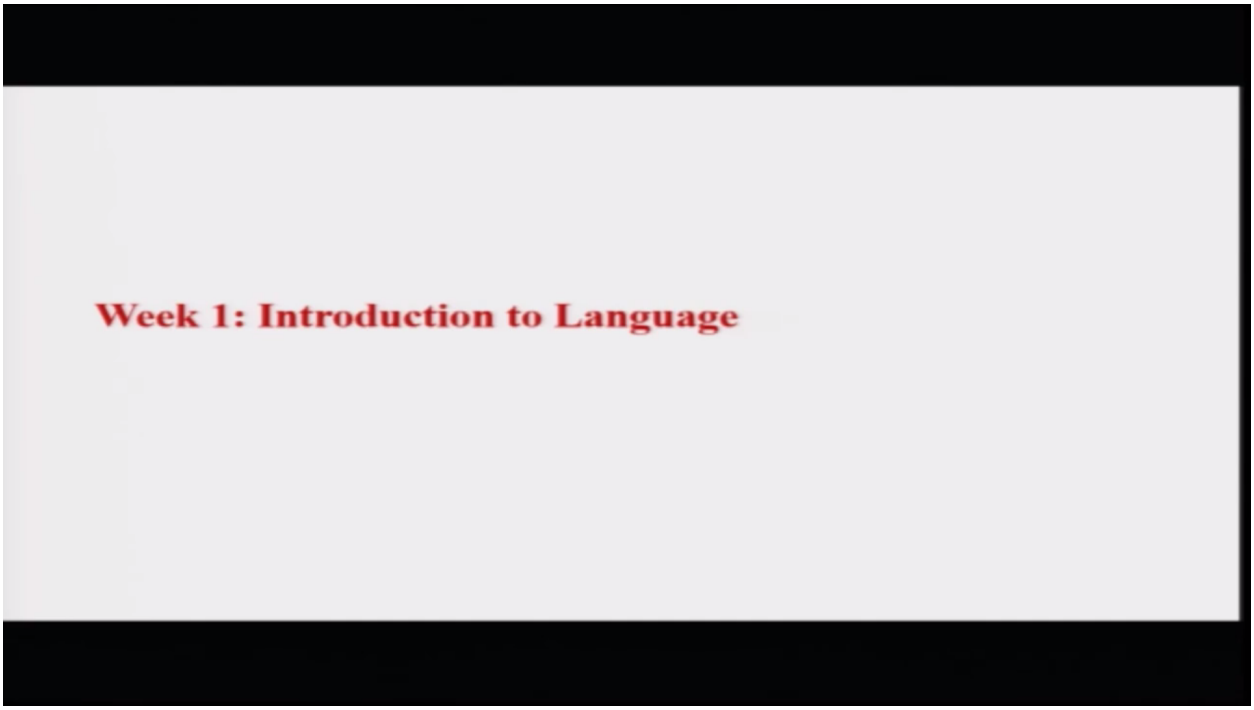


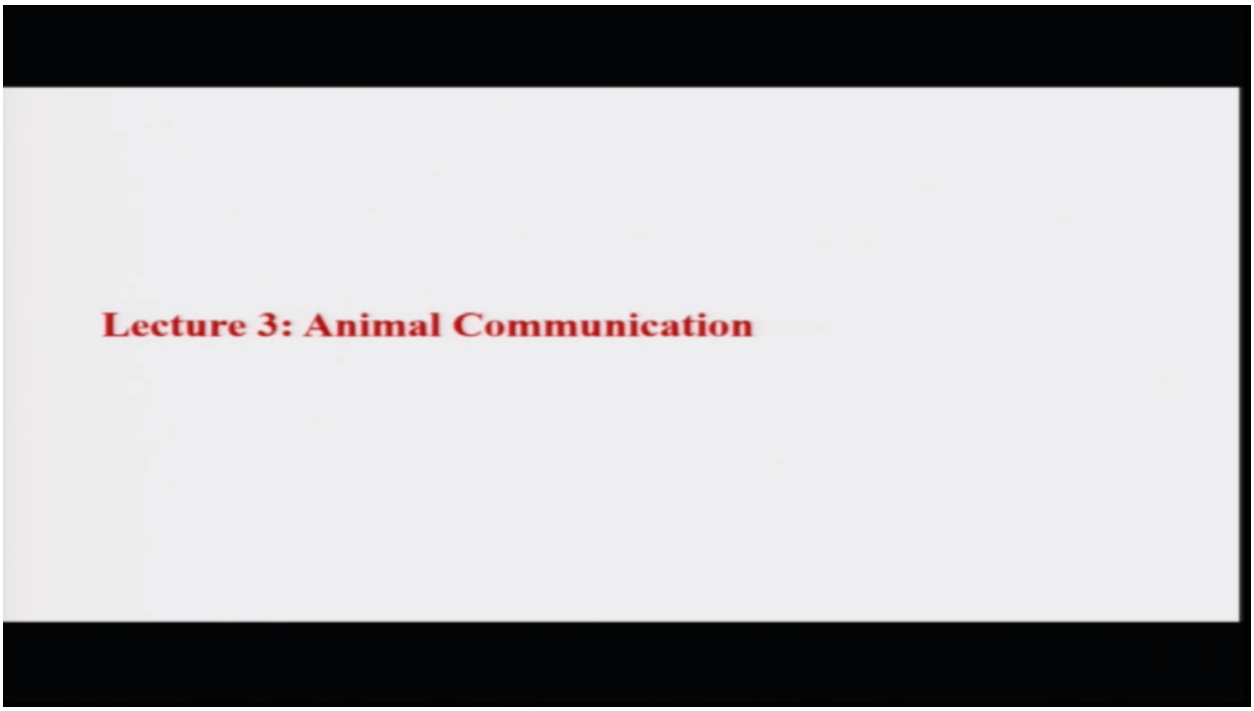
Ark Verma: Hello and welcome to the course on introduction to the Psychology of Language. I am Ark Verma. I am Assistant Professor of Psychology and Cognitive Science at IIT Kanpur.



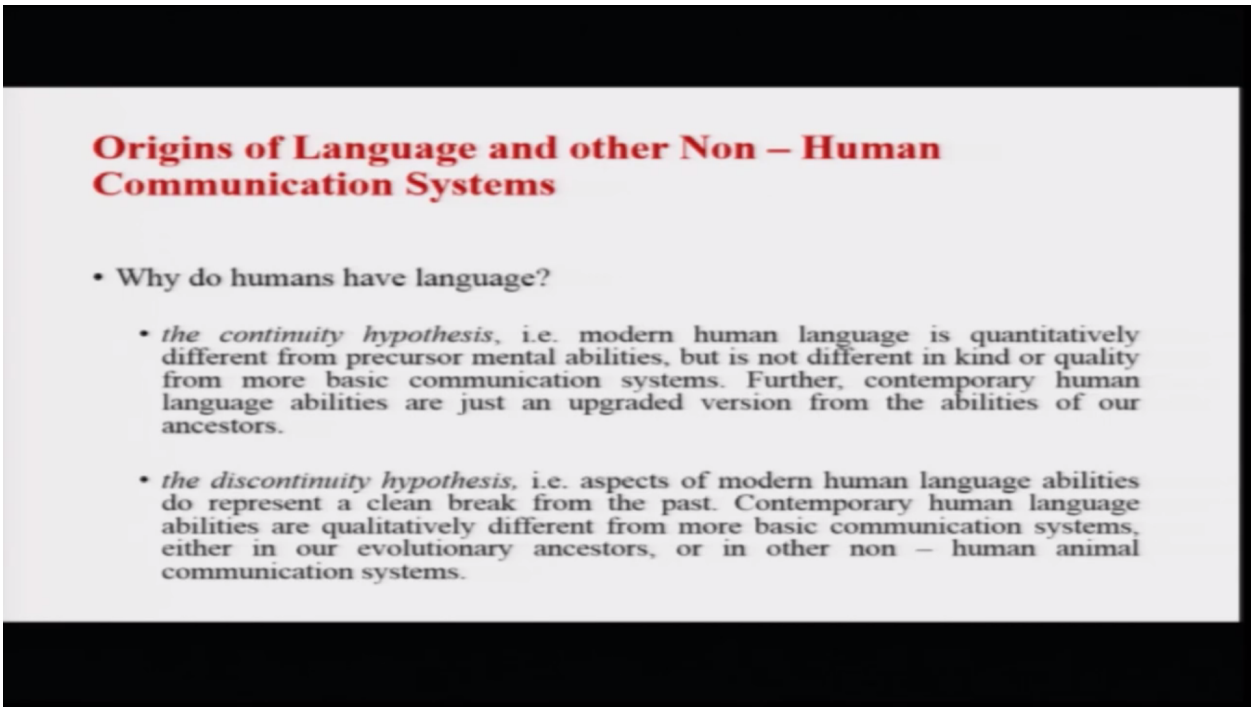
Now in this week, we are talking about different aspects of what it means to know a language. In the last lecture, we talked about what are some of the

basic concepts when you set out to study language scientifically. I talked about certain concepts, which are common to a linguistics, also concepts that are very relevant for psycholinguistics, which is this course.

One of the important things that we probably need to understand about language is what is it that makes our language different from the communication systems or, let us say, language used by the other species on the face of this Earth.



So in today’s lecture, I will be talking about various facets of animal communication and we’ll try and compare these facets of animal communication to some of the characteristics of human language. We’ll try and see if these are very similar, very different and also, say, for example, why these differences might be there. So let us begin.



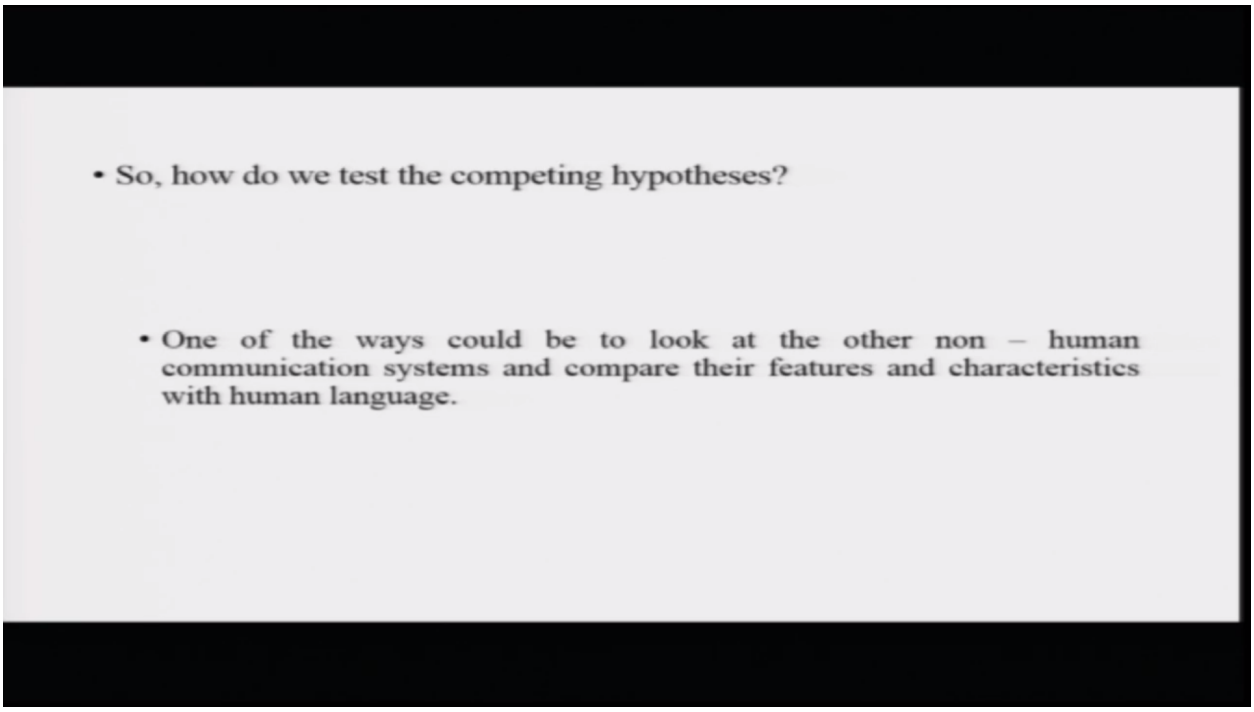
One of the questions that comes to mind is this question of why do humans have language, where did we have language from. Whether it is something that come to us very gradually from, say, for example, the first species as evolution has happened in smaller, smaller steps and it kind of graded in a much graded fashion evolved into what we use today, or is it something that kind of just came to this particular species that we are part of instantaneously, from nowhere. There was no gradation and I just kind of due to particular evolutionary milestones emerged in this species. So these are various stances that you can take or, say, for example, these are various questions that you can ask about where language is coming from or why do humans have language.

Now these stances have been verbalized in form of two competing hypotheses, and these hypotheses are as follows: The continuity hypothesis says that modern human language is quantitatively different from precursor mental abilities, but qualitatively it’s pretty much the same. So essentially, the idea is that our language is pretty much the same as the language of any other animal species that you might find on the face of this earth. The difference is only in the quantity or degree of some kind of sophistication or some kind of richness or complexity.

So that is saying that if you kind of assume this, if you agree with this stance what you are saying is that our language system is typically part of this larger family of communication systems. That is one stance we take. We can say, for example, look at evidence in favor or against this stand at some point.

The other hypothesis is the discontinuity hypothesis. The discontinuity hypothesis goes like this, and it says that aspects of modern human language abilities represent a clean break. They represent a shift from the past communication systems or from the communication systems of other species. So contemporary human linguistic abilities, what we speak and how we speak and the structure of language, we talked so much about grammar in the last lecture. All of this is something that is completely, completely different from whatever is present in the other species. There is no comparison of sort, this is not really graded conversion, it's not just upgraded version of let us say the other kind of communication systems.

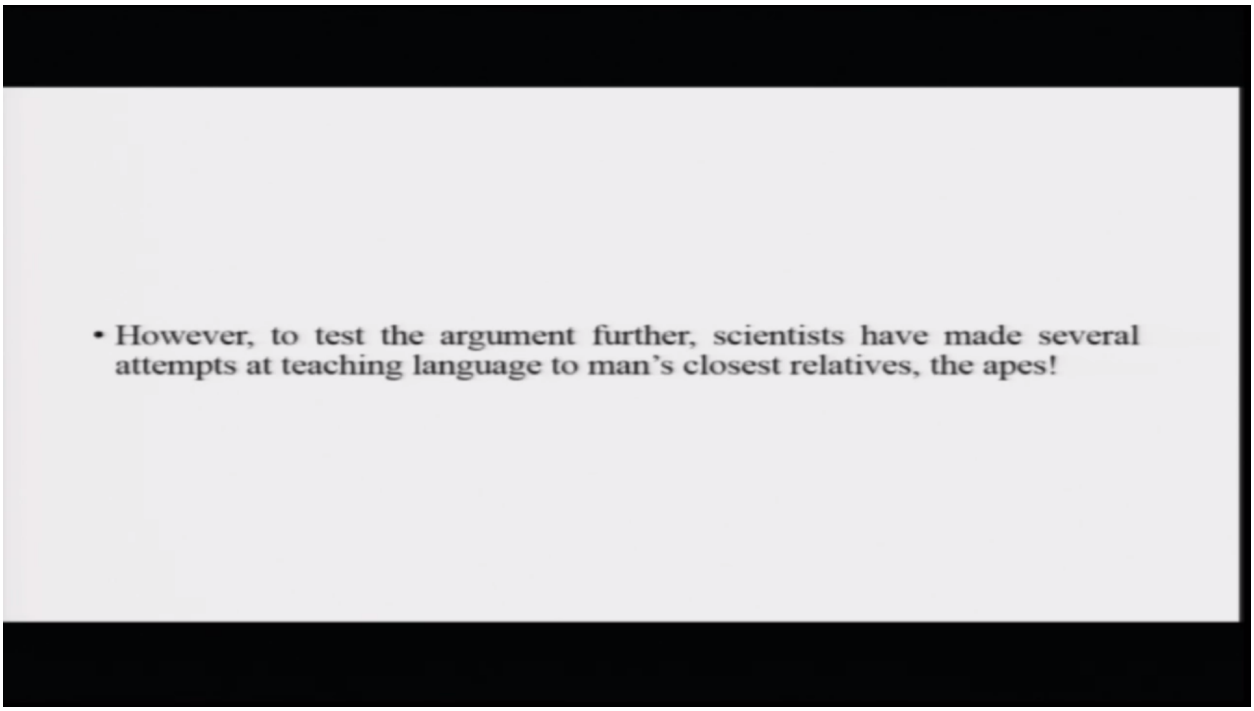
So if you kind of agree with this, you have to at some point say that something very drastic must have happened back in time that led us or that led this particular species that we are part of to have language, okay. So these are two very diametrically opposite stance and we can evaluate them in particular ways.



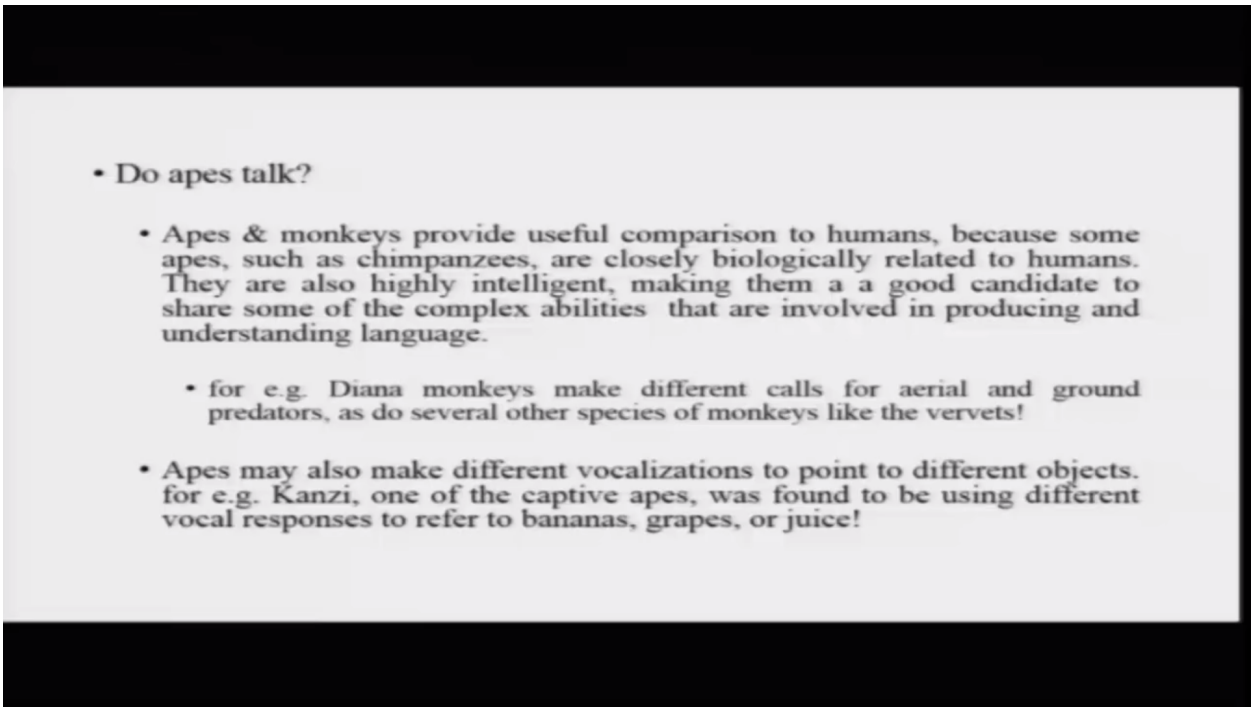
So how do you do it? One of the ways is probably that we look at the other non-human communication system and we compare the features of those communication systems with the features of our communication system, that is, our language and we see there are many commonalities or many differences, and we can also kind of focus a little bit, zoom in a little bit on what are these differences. Are these differences in quantity or are these differences in quality of what we're talking about?

So let us take this example. This is a figure that I have borrowed from the internet. It is just something that shows us different kinds of communication systems that are possible. So there is visual communication system possible, there's an auditory communication system, a tactile way of communicating, also there are chemical ways of communicating, and different animal species use these different variety of communication systems. You can see, say, for example, fireflies attract to glow mates, so that's a visual communication. Elephants use their trunks to talk to other herds over long distances, so they project some kind of sounds over long distances. Dogs lick their pups to bond with them, clean with them, so there's tactile, that is something which is via contact, and then you have chemical, say, for example, cats rub against object to mark them with their scent. So different species, different animal species, insect species, et cetera use these variety of modes of communication. You know that ants secrete pheromones and stuff. They use these different things to communicate with members of their own species. That is one.

However, if you look at this more closely, you'll find that none of these have that kind of sophistication. We are talking about grammar so much in the last lecture. None of these communication systems has that degree of richness, complexities, the recursive rule, the arbitrariness, semanticity, et cetera or some of the features might obviously might be common, but they do not have them in that degree of sophistication. So it's not really equivalent to the complexity of human language.

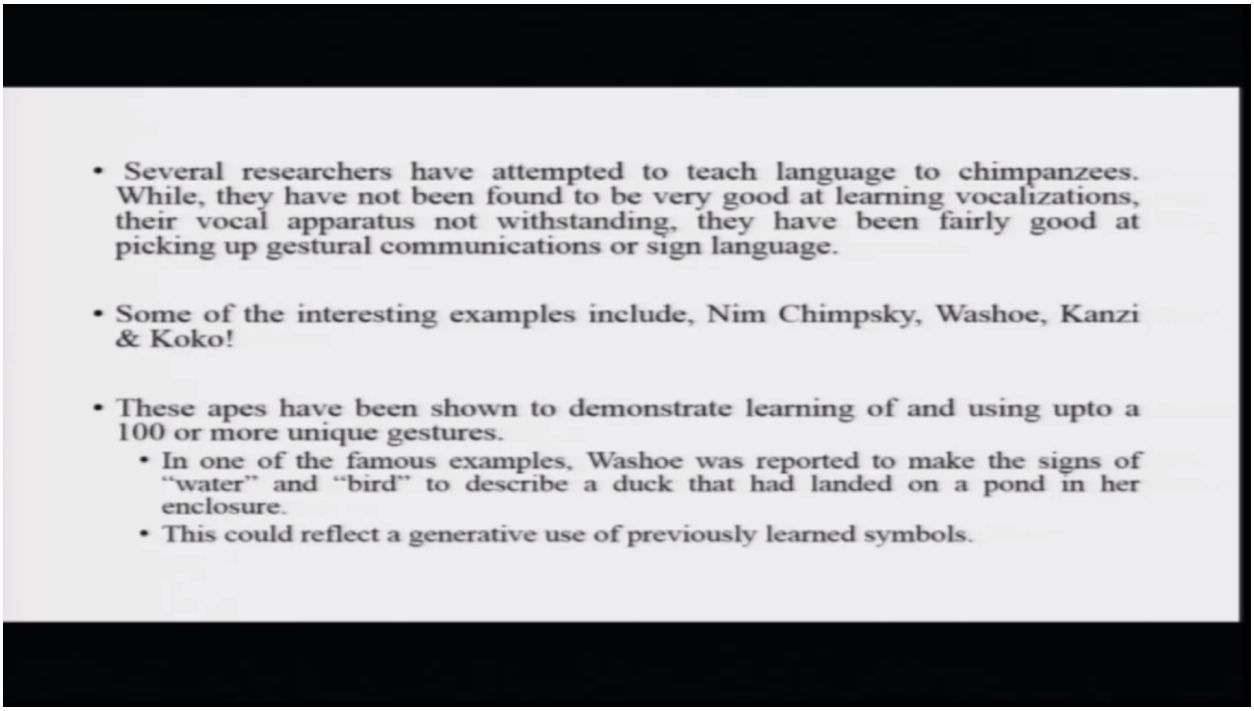


So one of the things we can say is that maybe these are not exactly what we are really doing, not exactly how we use language, let us say, but, say, for example, what if these species just have not ha the chance or the right environment or the right training to be able to learn language. So all of that is needed to produce and understand language is also present in those species, but they've just not got that kind of input. So people have kind of tried to look at that aspect as well. Having that in mind, what they've done is they've tried to teach human language or human-like language to one of the closest species, biologically speaking, to our species. So which is the closest, biologically speaking, closest species to us is the species, these variety of apes that we have, say, for example, bonobo monkeys, chimpanzees, gorillas, et cetera. So a lot of scientists have spent a lot of time and effort in trying to teach human or human-like language to these apes and they've kind of -- basically the idea was to see up to what extent these apes can gather something which is at least similar to what human language is. So that is something which we've tried to do.



Let us look at some of these effort. So the question you might as is, do apes talk, okay. Apes and monkeys, anyways, they have been acting as very useful comparison to humans, not only in a lot of biological studies, neuroscientific studies, et cetera, because, say, for example, they are very closely biologically related to us. There's a huge degree of genetic overlap, there's huge degree of overlap in the brain structure and so on and so forth that makes them a perfect candidate for us to compare with, for us to be compared with. They're also highly intelligent, making them a good candidate to share some of the complex abilities that we know will be required to acquire or use language. So that is one of the reasons why they are one of the most useful important candidates in order to carry out this comparison. Say, for example, you can talk about Vervet monkeys or Diana monkeys who are different species. They make different calls for aerial and ground predators, okay. So that degree of sophistication is still there. They can distinguish between whether the predator is on the ground, like it's a snake, or whether it is aerial, if it is a bird that is pouncing on their children, et cetera. So they can kind of, by the way they make these calls, make these distinctions possible.

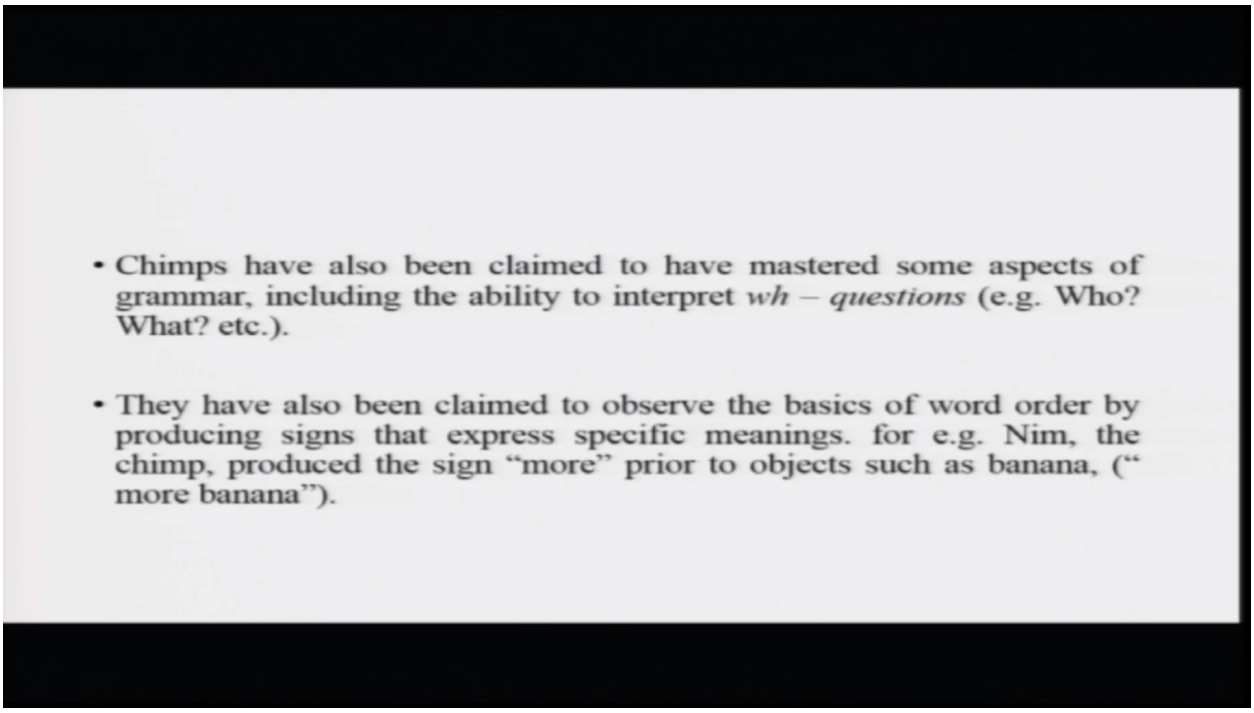
Also, apes, say, for example, themselves also make different vocalizations to point to different objects. There was this example of this chimpanzee, Kanzi, who used to make different sounds when she wanted to have bananas or grapes or just juice. So apes have also demonstrated that they can vocalize different to point to different things, which is very similar to us asking for an apple or a mango or a grape. So that thing is also there. That's also something that makes them a very interesting candidate for research.



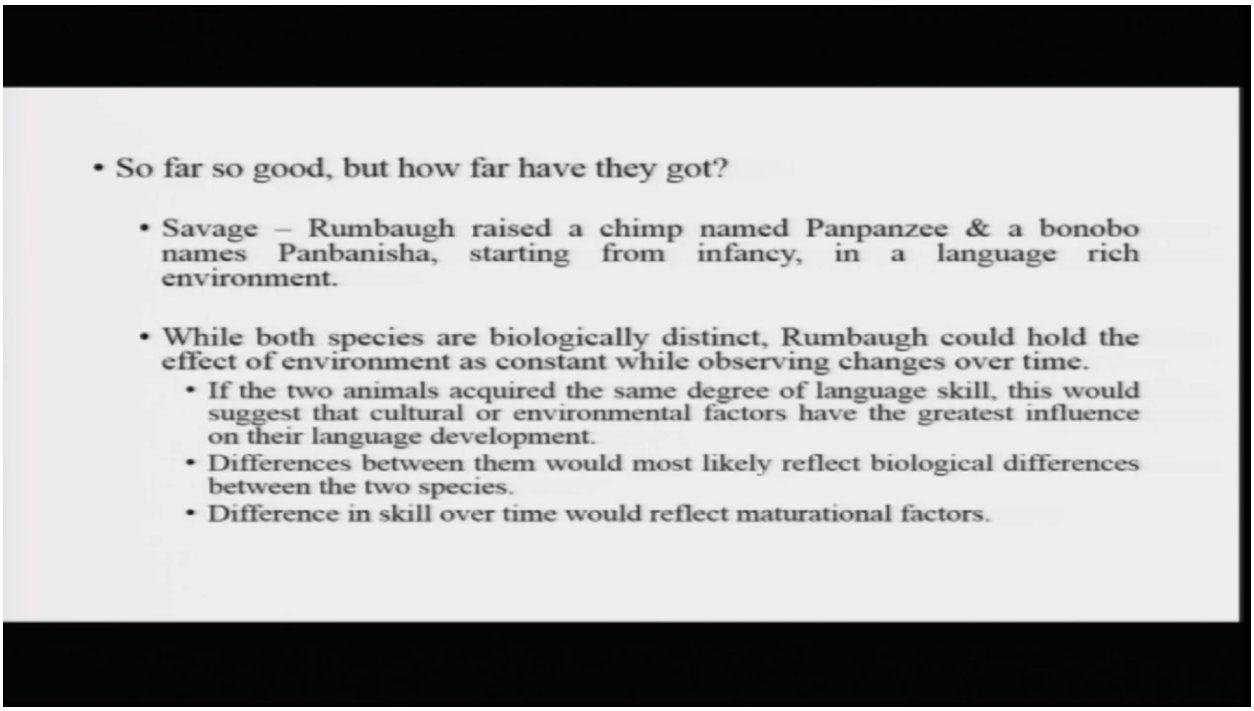
Now several researchers, as I said, have attempted to teach language to chimpanzees, and one of the things is that because their vocal apparatus does not really allow them to create language in the same way that we do, most of the efforts of teaching language to apes has been through gestural communication or sign language. So that is something that you have to keep in mind. So these interesting examples, and I would encourage you to look for them on YouTube, you to look for them to just understand how they have understood language. So some of these interesting examples include Nim Chimpsky, it was a chimpanzee; Washoe and Kanzi and Koko, which are these gorillas, and there are also, say, for example, some of these bonobo monkeys, et cetera, that you can come across. Most of these names if you type in on YouTube, you'll find some of the samples of them interacting in different language task and that will give you a good understand of how well these animals have been able to learn language. We will however here talk a little bit in more detail about these efforts.

So some of these apes have been demonstrated -- have been shown to demonstrate that is, learning of and using up to 1000 or more unique gestures, say, for example, we know 1000 words, so we can talk about 1000 different objects or actions. These have been able to learn 1000 unique gestures, which might be depicting 1000 unique objects or actions in the outside world. It's very similar as learning words. And one of the very famous examples, also it has been shown that these chimpanzees have started combining some of these words. So Washoe, this gorilla, if I am right, was reported to start combining two symbols that she had learned, water and

bird in order to denote a duck. So you see that conceptually they are doing something very similar to what human children might be doing. So when a duck landed in a pond besides its enclosure, Washoe combined the sign for water and bird to denote that this particular object here is a water bird. So that's a very interesting thing. This could probably demonstrate what is referred as generative productivity in our language. So that's something we'll come back to.



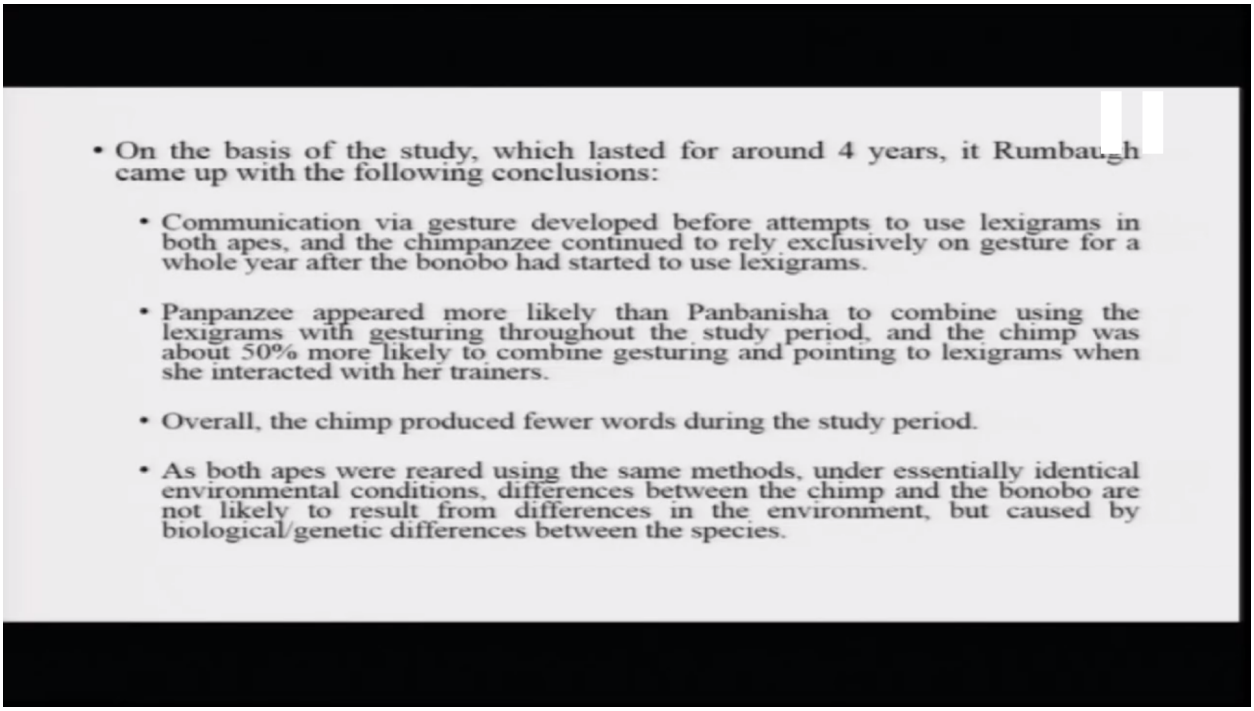
Now chimpanzees have also claimed to have mastered some aspects of grammar. That's the Holy Grail of how language is acquired and we've made so much of a big deal about this, but apparently some of these chimpanzees have probably been reported to have this ability to understand Wh questions, who, what, where, et cetera. They've also been able to observe the basics of things like word order, say, for example, Nim, this particular chimpanzee, could product word of more prior to objects like banana. So he would say more banana, more juice, more grape. It is also very similar to how we do it. We know which word to put in front of which word to convey what message, word order. Last calls, we talked about word order.



Also, say, for example -- these are instances that have been reported, but how have they got, how far, for how much time, till what extent have these chimpanzees been able to learn language. So, Savage-Rumbaugh, she raised a chimp called Panpanzee and a bonobo monkey called Panbanisha, and she raised it from infancy in a language rich environment. So she raised both of these animals in an environment where they were talked to, language was used again and again, so that they can pick up from this particular environment, okay. The idea was, say, for example, it was to compare the biological characteristics, whether biology is important or environment is important. If the two animals would learn language to the same extent, you could, say, for example that biology has not really much to do with language learning, it is just the environment. You can vary the environment or you can vary the ape. So we've already varied the genetical make-up. So if both animals are able to learn to the same degree, we think that okay the genetic differences or biological differences in these two species will not account for much.

However, if these two species learn language very differently in spite of raising them in exactly the same environment, we can at least conclude that biological makeup of these species has some bearing on whether and how much they can acquire language successfully. That will also, say, for example, remember I was talking about Chomsky in the last class. Chomsky had also said that language is something that is biologically unique to us, it is innate and it depends a lot on our brain makeup and generic makeup, et cetera. So it might be kind of answering some of those questions as well.

Also, the other thing could be, say, for example, if none of these factors -- if one of these species learn the same amount of skill just in a different time period, we can say that maturational factors might be at play. Both of them will eventually attain the same level of language. One probably will be one year slower, two years slower, x years slower, does not really matter. There these maturational factors kick in.



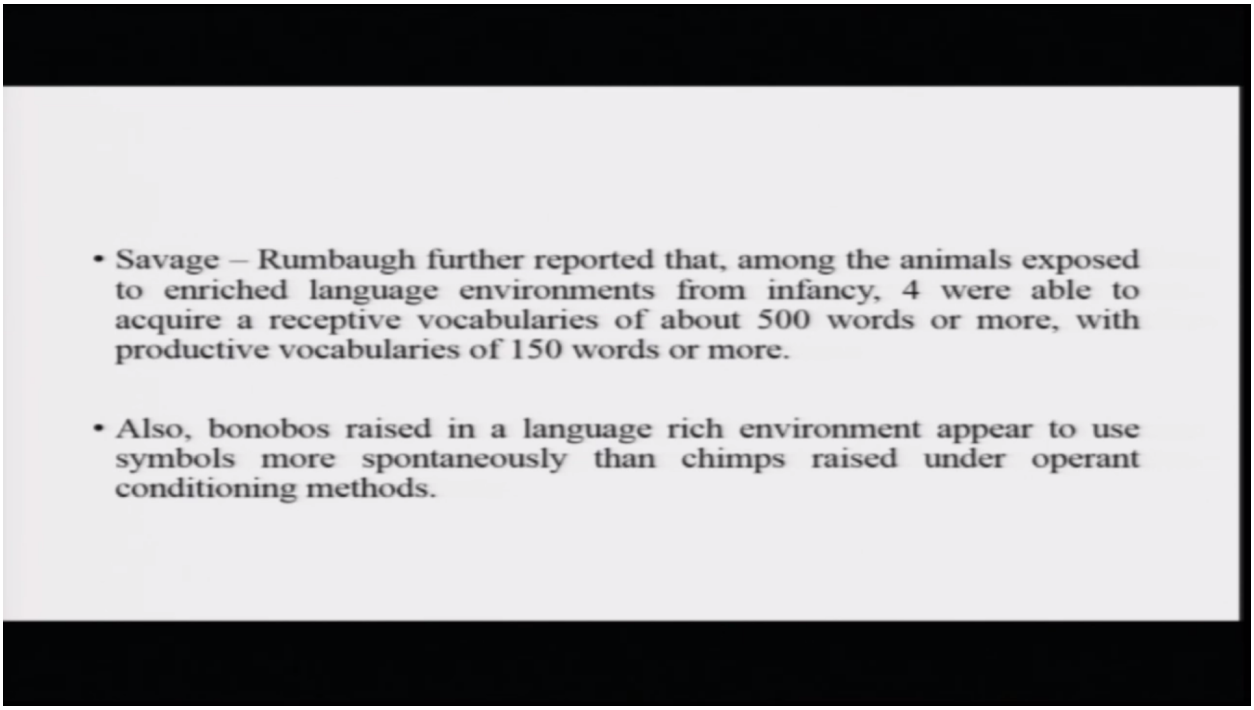
So let us see what happened in the study. The study lasted for almost four years, and the end of this Savage-Rumbaugh came up with this conclusion. She found that communication via gesture developed first and then only communication via lexigrams came up. Lexigram is typically particular symbols for particular things, say, for example, the animal is shown a particular kind of a symbol and it has been taught that this symbol exists for this thing. Say, for example, there'll be something, say, for example, a shape of theta and the theta refers to a banana in this particular language and the chimpanzee is being taught that. So if you ask the chimpanzee to point to a banana, she will point to this sign of theta. So that's it, that is lexigram.

So they said that communication via gesture was something that both the animals acquired earlier, and only then they could move to the acquiring lexigrams. Panpanzee, which is the chimpanzee was more likely than Panbanisha, which is the bonobo monkey to combine using lexigram with gestural communication. Also, the chimpanzee was 50% more likely to combine gesturing and pointing to lexigrams when she was talking to her trainers. So the degree of how much they use lexigrams versus gesture or

the proportion in which how much they use lexigrams and gestures is slightly different.

Overall, the chimpanzee produced far fewer words as compared to the bonobo monkey.

As both apes were reared using exactly the same methods, under essentially exactly the same circumstances, the differences, the kinds we were talking about now, in the extent to which both of acquired language could be attributed to specie level or genetic or biological differences. So we can at least conclude this that there has to be something in the biology of the animal that is responsible for the animal learning language. So that is something very important.

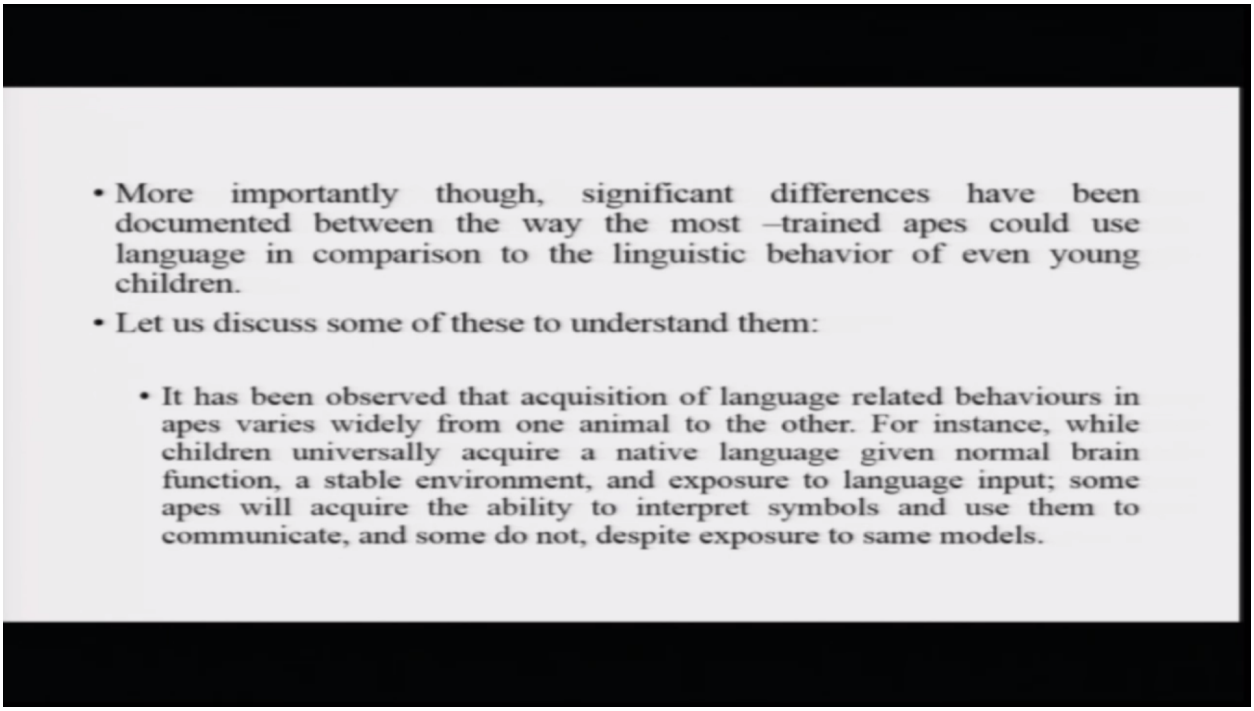


Savage-Rumbaugh further reported that among the animals exposed to enriched language environment from infancy only four were able to acquire receptive vocabularies of up to 500 words or more with productive vocabularies of up to 150 words or more. So not every animal that you spend time with in teaching these language have been successful. While we know that human children, it is almost al children, if biologically everything is fine, if the brain is working all right, if the nutrition is all right, do learn language perfectly. So that is one of the points that you can say that there is a difference, point of difference, between how a chimpanzee learns language or how a human child learns language.

Also, said that bonobos raised in a language rich environment appear to use symbols more spontaneously than chimps that were raised using operant conditioning methods.

Now one of the methods that scientists have used in teaching language to these animals is this method of operant conditioning, the method of reward and punishment. The chimpanzee makes one sound correctly, you give it the banana, it makes other sound correctly, you again give it a banana, and eventually, what the chimpanzee is doing is not really picking up sounds but creating a -- not really picking up what this particular thing means just creating particular sounds in a way that it is getting a reward.

So at least in this study, it was said because they compared the performance of these bonobo which was raised in the language rich environment versus other bonobo monkey which were raised in operant conditioning kind of environment, and they found that this bonobo monkey, Panbanisha, performed slightly better than other bonobo monkeys which were raised in an operant condition. So this is also something that came out of study.

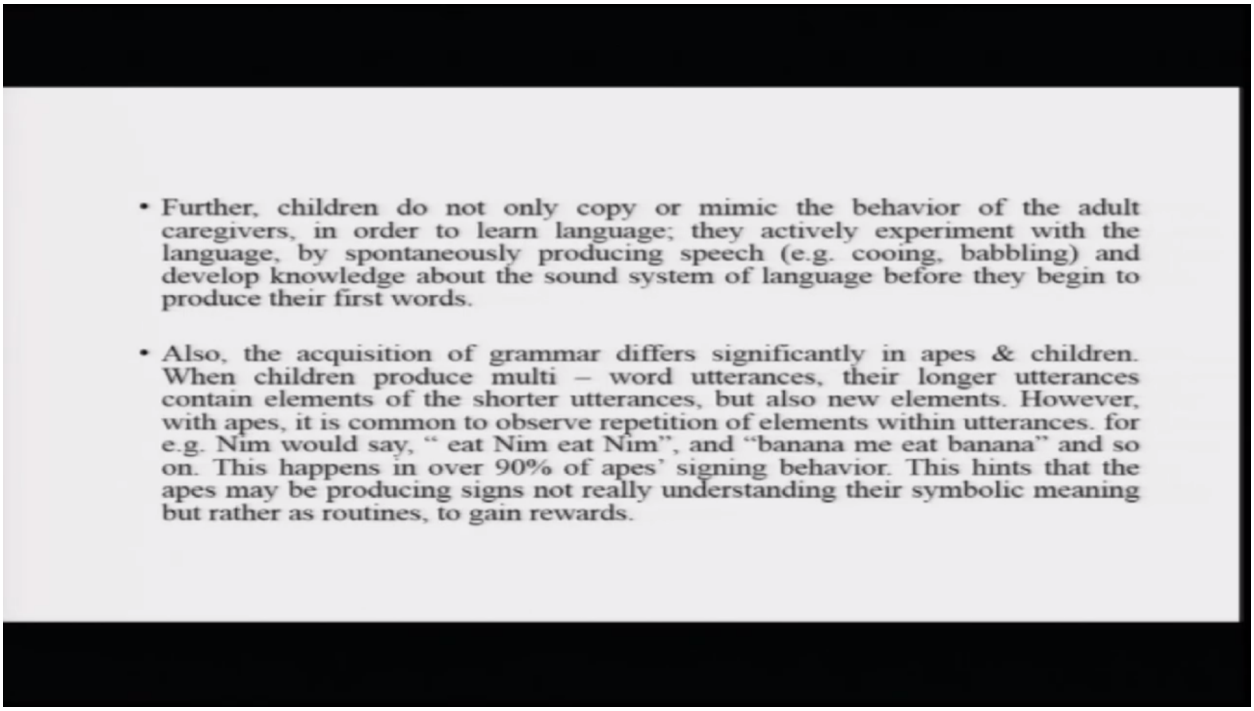


More importantly, however, the significant differences that have been documented between he way most trained apes could use language in comparison the linguistic behavior of young children has been there. So one of the things that we can kind of look at now once this study is done is if there is an ape, if there is a chimpanzee or a bonobo monkey or a gorilla and you spend, say, for example, five to seven years training them, do they

perform close enough or exactly similar to what two to three-year-old child which kind of picks up language almost automatically.

You will not remember training how to speak to a child. Obviously, we give our feedback, et cetera, but for the most part, they are picking language almost by themselves. How is the three-year-old child fairing as compared to a chimpanzee who has been trained for five to seven years. This comparison can give us very interesting insights into how well the chimpanzees or these apes can acquire language versus what is the most basic features of acquiring language as far as human children are concerned. So let's tray and compare, go through some of these observations.

So it has been observed that the acquisition of language related behaviors in apes varies widely from animal to animal while, say, for example, most children universally acquire a native language given that mental functions are all right, the environment is all right, the nutritional levels are all right. So as I was saying, there is a great variation into which apes and to what extent we'll learn language. However, for the most part, you can say that 99.9% of human children, given everything is perfectly all right with their brain and nutrition and the environment, will successfully learn language. So that is one point of difference.

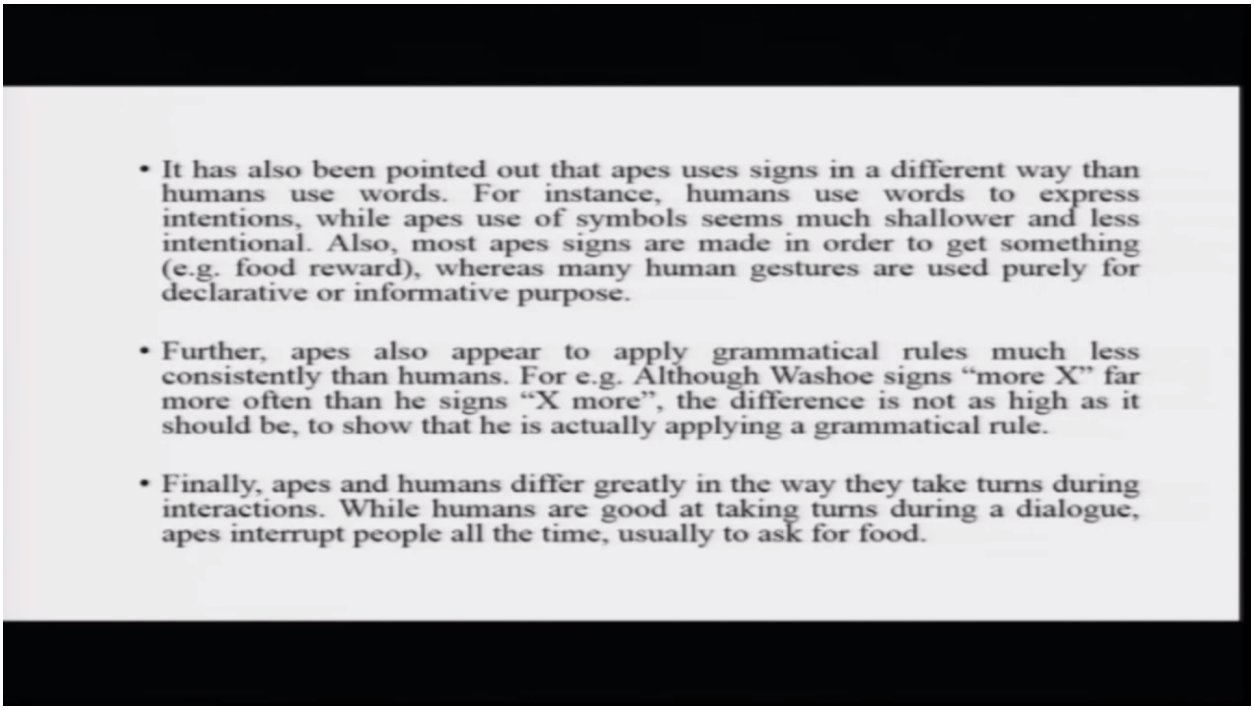


Further, you will see that human children do not just copy or mimic the behavior of their adults. They come up with new things all the times. Say, for example, a child could come up with a word, say, I thinked that you are there or I dranked the water, okay. These are things that children don't hear from

anywhere. These are thing that they are constructing themselves, doing their own hit and trial method to master the rules of language.

Chimpanzees or bonobo monkeys or any of these apes are not very constructive with the language. They'll not for the most past spontaneously use these particular gestures or lexigrams or whatever, they'll more often than not just mimic what is being told to them. So that's another point of difference. Also, acquisition of grammar is very different in these chimpanzees versus young children. Say, for example, when children produce multi-word utterances, the longer utterances basically are composed of shorter utterances. So they are doing some of that embedding that we have been already talking about, and they also have been creating some of the new elements. They create these new words all the time.

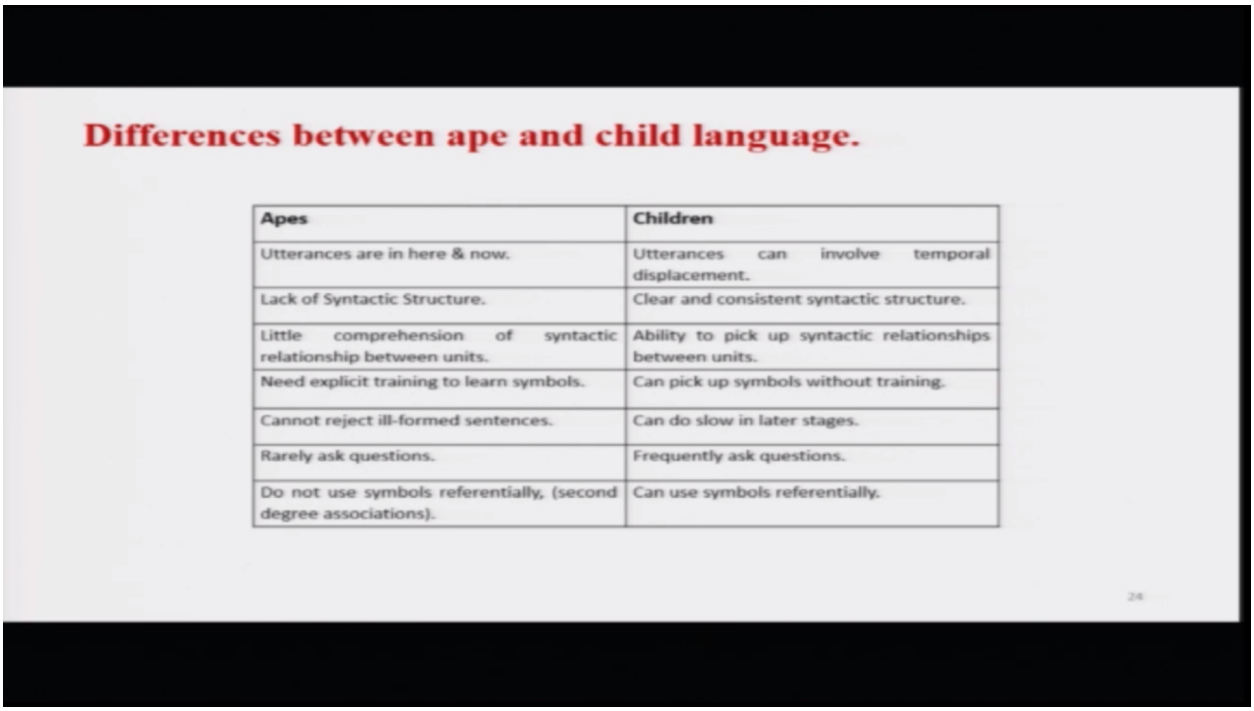
Chimpanzees, however, for the most part are repeating the same elements even if they are creating longer utterances. Taking this example from Brettler's book, Nim would some times say, eat Nim, eat Nim, eat Nim, banana eat, banana eat me, banana eat me, et cetera. So you'll see even in longer utterances, there are repetition of the same components, whereas you will see children as young as three, three-and-a-half, four years old, they create long utterances of completely normal elements. I mean they are creating all of that language by themselves. So in that sense, they are not probably really mastering this concept of productivity or mastering this concept of recursion or generativity that is considered to be the hallmark of how humans operate with language. So that is something very important.



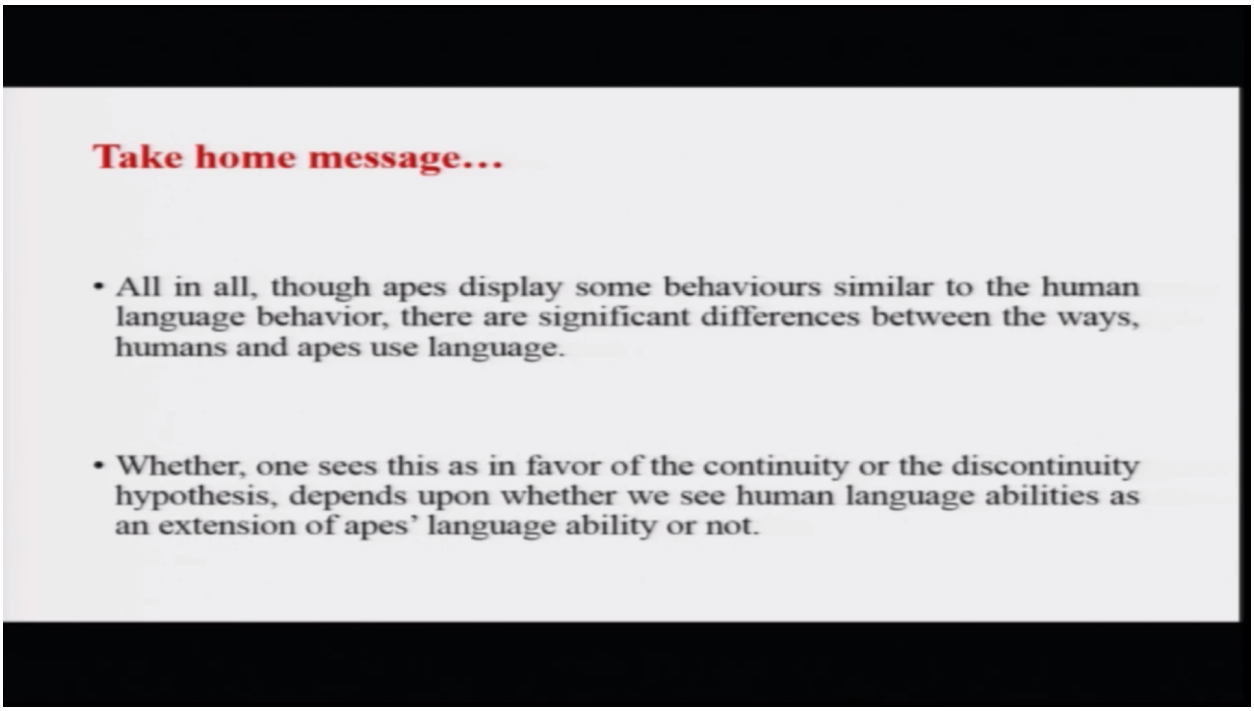
It has also been pointed out that apes use signs in a different way than humans sue words, say, or example, humans use word to express their intentions, to communicate their wants, desires and so on, while apes, however, use these symbols in a much more limited sense, suppose, say, for example, an ape has figured out, as I was saying in this operant conditioning environments, when an ape figures out that that if I say this or if I make this gesture in presence of this particular stimulus, I will get that kind of reward. So it's not really that the ape is mastering the relationship between this gesture and this object, it is just doing this in a sort of an associated fashion, if this is there and this object is there, I will get a reward. So that is very qualitatively different to how children are acquiring language.

You'll see very young children pick up the meaning of words very quickly. So that's again something that is very important. We are talking about grammatical rules. For example, Nim Chimpsky, as I said, could use more banana, more grape, et cetera, but the amount of times, he would consistently use more with this other object was far less consistent. So it was not really, say, for example, that this chimpanzee has figured out what more is used for more than just, say, for example, if I use more with this, I get more banana. So that is a very qualitatively different way of understanding or acquiring language.

Finally, apes and humans also differ very great sense in the way conversations happen. Say, for example, between human child and parent, you will see that conversation still happen in a very dialog sort of way. The child says something, the father listens, and the father says something, the child listens, and people take turns in formulating these conversations, and they don't interrupt each other all the time, even very young children, okay, to some extent. Chimpanzees, however, do not really understand this role taking, which is a very important aspect of mastering communication and that is also something that has been documented and said.



So some of these things are kind of tried to tabularize some of these differences between apes and child's language, and you can see some of these things, say, for example, apes utterances are mostly in the hear and the now. There's no concept of spatial and temporal displacement in their language, their language lacks syntactical structure, they need explicit training to learn these symbols. We do not train human children for all of these 500, 1000 or 10000 words that they pick up. Apes cannot reject ill-formed sentences. They very rarely will ask questions. So some of these are very significant qualitative differences. Remember, it's not quantitative, but qualitative differences between the way apes acquire and use language versus how children acquire and use language. So that is something which kind of tells us something very important how do you look at this, animal communication versus human language systems.



That was pretty much the take home for today. I mean we have seen earlier that different species animals and other mammals use visual, auditory, tactile and chemical modes of communication, neither as sophisticated or rule mound or systematic as our communication system. So what we did was we tried teaching our communication system or similar communication system to the best candidate, that is the species of apes that's very close to us biologically and genetically, but even in these apes, we find that even though these apes display some behaviors which are very similar to the human language, there are very significant qualitative differences. So one has to, in that sense, in the face of this evidence conclude that there must be something very, very drastic that must have happened to separate animal communication system even of the apes with human communication system that we talk about as language.

However, there are different scientists who are arguing both for and against these things, but, say, for example, how do you -- whether you see this as evidence for discontinuity hypothesis or continuity hypothesis, kind of depends on whether you look at our abilities as a continuation of apes abilities or a distinct break from those abilities.

So I hope this session on animal communication might have helped you see the differences between these two communication styles and might have told you something interesting about how human language is. Thank you.