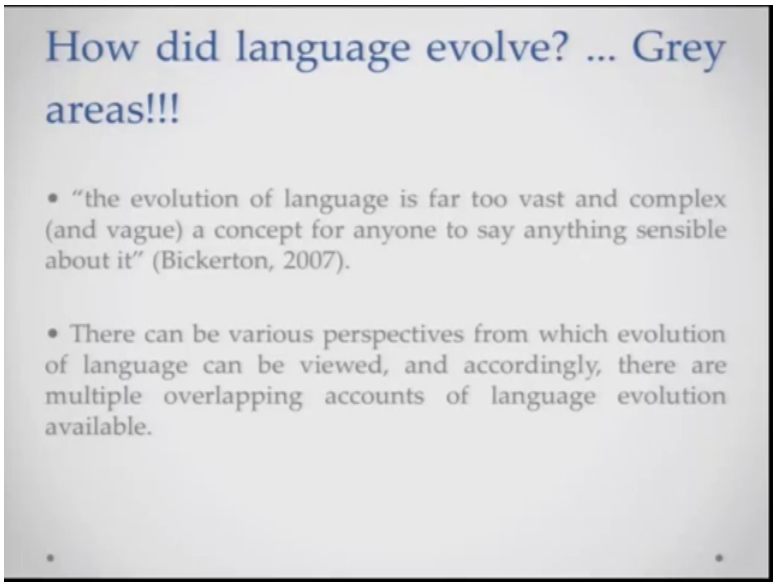
Advanced Cognitive Processes
Dr. Ark Verma
Department of Humanities & Social Sciences
Indian Institute of Technology, Kanpur

Lecture – 13
Evolution of Language

So, we have been talking about some of the historical you know background of where psycholinguistics come from what are the different thoughts, what does contemporary psycholinguistics really concerned about and so, we have talked about that in this in the earlier part of this lecture. Now let us move to a different topic let us move to where language really comes from now, this is probably something that you know almost everybody would have thought in at some point of time in their lives.

And in this section of this particular lecture I will try and take you towards various theories of where language really comes from, again I am not really you know because of the scope of this course is such, I am not really going to into much detail of each of these different theories, but I will try and just put forth some of the very interesting proposals that have come up in when you know when you talk about evolution of language.

(Refer Slide Time: 01:05)



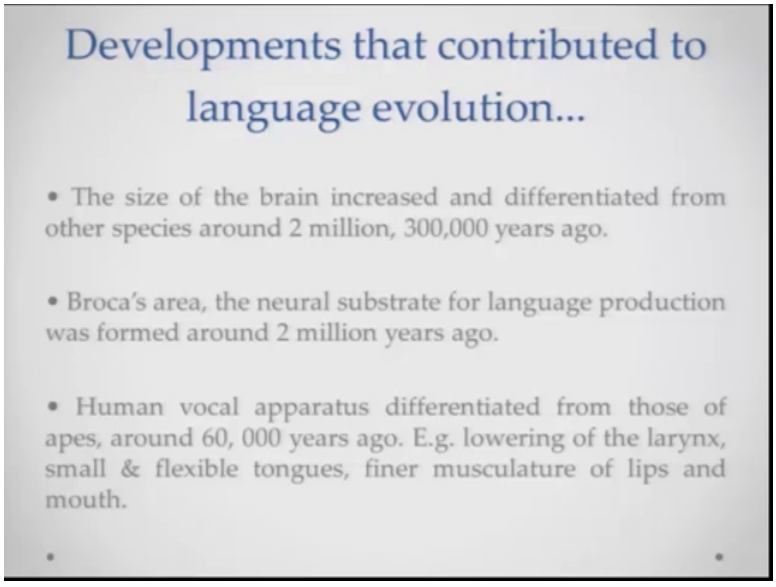
One of the first things and a really funny thing that you will really you know come across, when you are reading articles on evolution of language is something, we just said

by Bickerton in back in 2007 Bickerton says that you know the evolution of language is such a far too vast and a complex and vague concept, for anyone to say anything sensible about it.

So, he says it is such a vast topic it is. So, complex that it is very difficult for somebody to say anything that makes sense. The aspect here is that different people might be talking about evolution of language in their own ways, and there is so less crosstalk between all of these different disciplines, and because the evolution of language is such a vast biological, and psychological, or a cognitive phenomenon that any of these different approaches might not really be grasping the totality of this.

So, it is very difficult for somebody to really comment about evolution of language in it is totality, and again this is one of the things that people who have been interested in evolution of language have realized, and acknowledged at various points in time that is pretty much what I have been saying.

(Refer Slide Time: 02:18)



So, let us move to some of the developmental you know milestones that might have contributed to evolution of language. So, one of them is in the size the human brain increased, and differentiated from that of other species apes, and chimpanzees around 2 million 300,000 years ago. So, that could be one of the major milestones you know our brain evolved the number of neurons and the kind of connections probably differentiated, the way the organization of brain was kind of differentiated these many years ago.

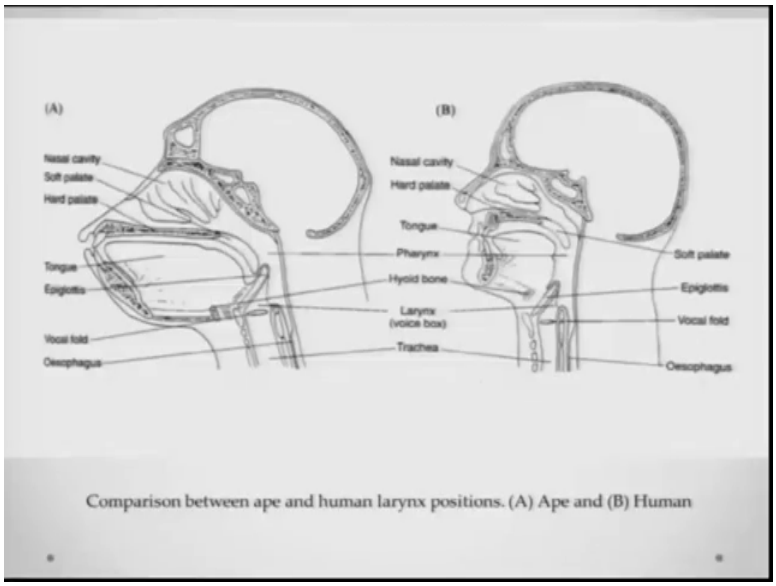
And this one could be one of the milestones that might have led to our brain having an extra capacity to use language, in such a sophisticated way that we are using; obviously, it has been a changing process the brain is not stopped evolving you know since that particular point in time so; obviously, our abilities are getting better in bed probably by the day, but the idea is this probably was one of the milestones that would have lived or paved a lead or paved the way of evolution of language. Another very interesting thing that happens neuraly of neuraly is this aspect of brocas area.

Now brocas area is an area, in the infer temporal cortex. In the inferior frontal cortex that is suppose that is attributed the function of production of language. So, brocas area the neural substrate for language production was are formed around 2 million years ago. So once the brocas area was formed, and that is the milestone that would have probably led the way of producing language around 2 million years ago.

Another thing is human vocal apparatus you know the vocal apparatus that is used to produce language, differentiated from the ones that was being used by apes around 60000 years ago. So, around 60000 years ago things like lowering of the larynx happened you know we have we got smaller and more flexible tongues that we could use to create all of these different kind of sounds, you had this finer musculature of lips that could be you know very easily wielded.

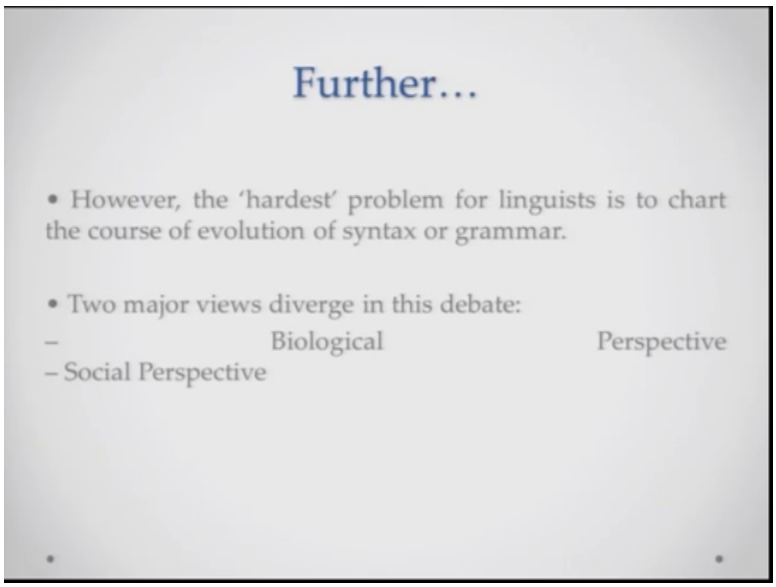
And all of these things put together that is basically your vocal apparatus came together to allow us to make certain kind of sounds you know. There are some kinds of sounds that the apes make and apes have been you know people have been trying to make them talk or use produce sounds that we produce that is typically not possible, because their biology their vocal apparatus the structure does not really allow that our structure The structure of this species the vocal is the structure of vocal apparatus in this species kind of you know differentiated around 60000 years ago from the apes, and again that might have also led to the evolution of spoken language the evolution of speech for that matter.

(Refer Slide Time: 05:00)



Here is a diagram you know really com comparing the vocal apparatus of the ape on a in panel A, and the vocal apparatus of a human being in panel B, and you can see there are very striking differences things like say for example, the larynx is in much lower position the voice box that allows these vibrations to transfer to you know get communicated is much lower in the you know human vocal apparatus than in the ape vocal apparatus. That is probably one of the things that is not allowing them to make these kind of sounds.

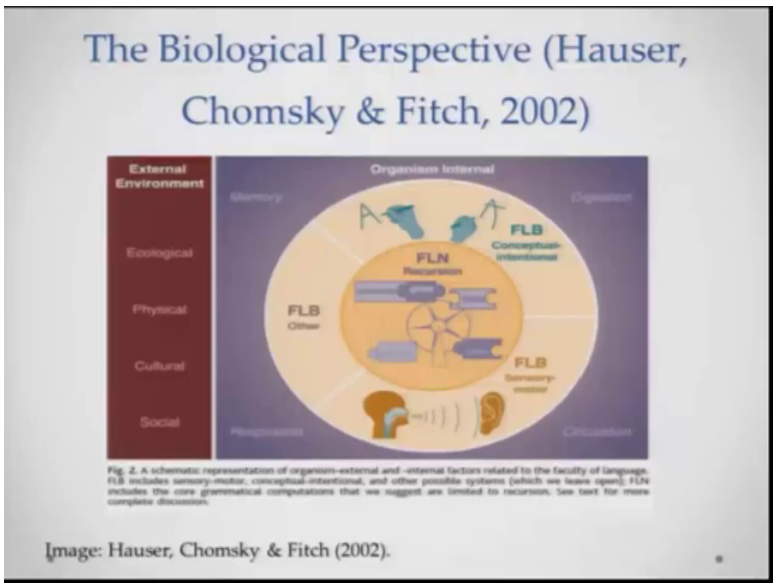
(Refer Slide Time: 05:35)



Further again we can talk about one of the things is further the hardest problem; however, it is not really only production, it is not really only the physical or the neural apparatus. One of the hardest problems that people working in evolution of language have come across is the growth of syntax you know where does grammar come up you come up, how does grammar to start playing role in you know language where is this sophistication a part of the sophistication of our language can be attributed to grammar, where is this coming from how is this started how did the how did this start to evolve.

So, this is one of the questions that has really troubled a lot of people interested in this, and there are two major you know points of view, two major perspectives about this debate one of the perspectives is the biological perspective, I will really touch upon this in a in a brief moment. And the other one is the social perspective. So, let us you know look at the biological and the social perspectives.

(Refer Slide Time: 06:33)

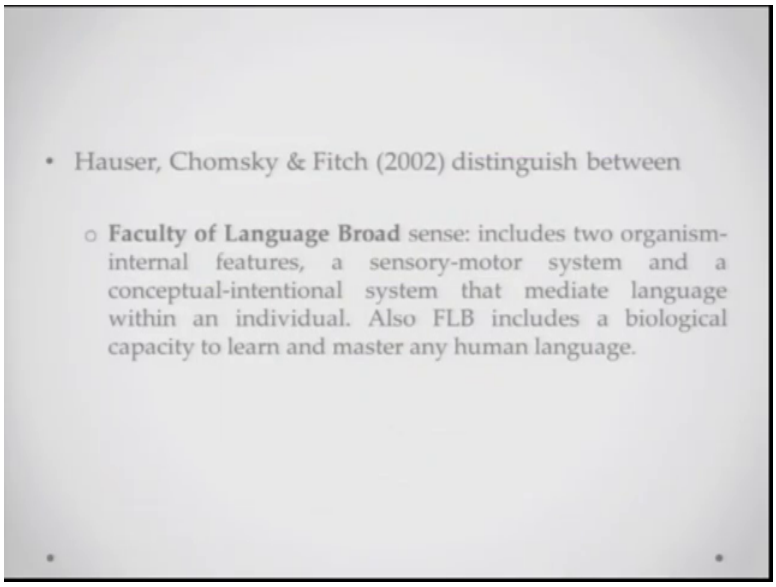


Now, the biological perspective is mainly championed by norm Chomsky you must have heard of fame, if you not he is one of the oldest linguist, I have talked about norm Chomsky in the earlier lecture when I was talking about. The norm Chomsky Hauser and Fitch, they came up with this description of something called the faculty of language broad, and the faculty of language narrow.

So, they are saying that differentiating this language you know evolution or the ability of language into 2 aspects, they are saying there is one conceptual intentional system which

is the faculty of language broad, and then there is one very specific system to humans that is called the faculty of language narrow that kind of you know achieves this task of recursion or generating, let us talk about this in a bit more detail.

(Refer Slide Time: 07:16)



So, they are distinguished between faculty of language broad this is basically about, organism internal features you know a sensory motor system attention, and perception those kind of things, and these sensory motor system interacts with the conceptual intentional system. So, what do I have to talk about, and how do I have to talk about it, you know do I want to talk about my vacation. What are the concepts that are there you know?

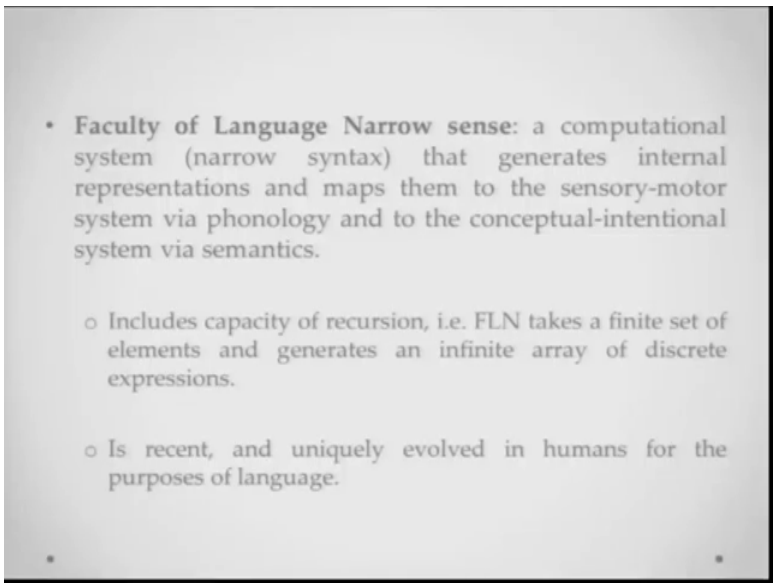
You know probably, a beach maybe, a son maybe, a hill maybe, a sunset maybe, the fruit side maybe the party I had the conceptual system and the Indian how do I want to talk about it. So, a sensory motor system and as conceptual intentional system that mediate the language of an individual you know, one of the basic components of whatever our language is can be captured by these two concepts.

Also the faculty of language broad includes a biological capacity to learn and master any human language so, any of the human. So, when a person is born you know it is not really sure, whether he is born into a family is going to be born in a family which speaks in the English, Russian, Punjabi, Urdu or whatever. So, the idea is at birth this, but there should be a biological capacity because we are talking about the biological perspective,

and Chomsky, and Hauser, and Fitch, they basically believe there is something unique about human languages that must be inherited from the genetic maker from the genetic evolution which goes back millions and millions of years.

So, there must be a biological capacity, which will allow us to learn and master any human language obviously, with the condition of adequate input and so, many other things which will talk about at some later point. So, faculty of language broad contains two organism internal features first is a sensory motor system, second is you know a conceptual intentional system, and it also includes an ability to master any language that the child is exposed to I am talking about a child I am not really talking about, adult language acquisition at the moment; obviously, the system will allow adults to learn other languages as well, but I am just kind of defining the focus of what the discussion here is. Another very important thing that is mostly unique to humans, again in the views of Chomsky Hauser and Fitch is a computational system.

(Refer Slide Time: 09:35)



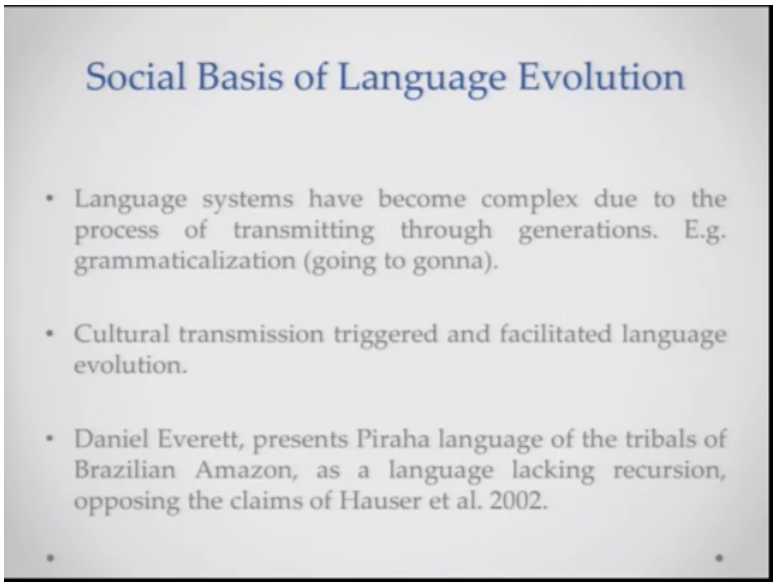
Now, this computational system is a narrow syntactical system it is a outlaying of particular kinds of rules. And this outlaying of particular kind of rules generates what are called internal representations, and maps them on to the sensory motor system via phonology this is how this word each word has to be spoken, this is the organization, this is how these phonemes have to be organized, and the conceptual intentional system via semantics.

So, the sensory motor system interacts with this recursion system via phonology, and the conceptual international system interacts with this particular system via semantics. What do you have to talk about? What are the different ways that you can talk about it? How can you write the same sentence in? So, many different forms these kind of you know manifestations, again I am not really giving you a really you know a real verbatim explanation of what Chomsky Hauser and Fitch were talking about and trying to kind of simplify, and give you a paraphrased version of all of this once again we are not really into a language course, we can talk about this if at some point I am giving a total course on language, but idea is you have to just get the concept of what I am talking about.

So, what I am talking about is that this system of syntax, this system of rules is what kind of specifies what is there how things are to be executed in the sensory motor system, and it interacts with the conceptual intention system via semantics you know what has to be talking about how does we talked about and those kind of things. This faculty of language narrow, this system that is considered unique to humans involves the immunity of recursion.

So, faculty of language narrows that system that can not taken in can take a finite set of symbols phonemes for that matter or you know, and generate an infinite array of discrete expressions. So, you take just these 40 48 phonemes use particular sets of rules, and you can create info language. So, what is it that is allowing us to do it that is this system faculty of language narrow. So, again this is what the biological system or the biological perspective of evolution of language or evolution of syntax or grammar is.

(Refer Slide Time: 11:37)



The other interesting view slightly in contrary you know slightly contrary toward the biological uses is the fact that language systems basically were not as complex as they are now, since the beginning. These systems have become so, complex and so, sophisticated due to the process of transmitting through generations you know, the language that probably our ancestors were speaking was not this complex.

You know it it was not as rich as our language yes, but what has happened is that it has been changed, it has been you know passed on from generation to generation through various processes and that is what has led to this kind of this nature of language. Some of one one of the example of this process is called grammaticalization, I mean you see that language is changing all the day, sometimes people you know at some point people want it to say, I want to do this now you can hear people saying and you know, I want to do this or I am going to you know go to this place and, I am not going to it is not like I am going to go to this place this is too old fashioned probably.

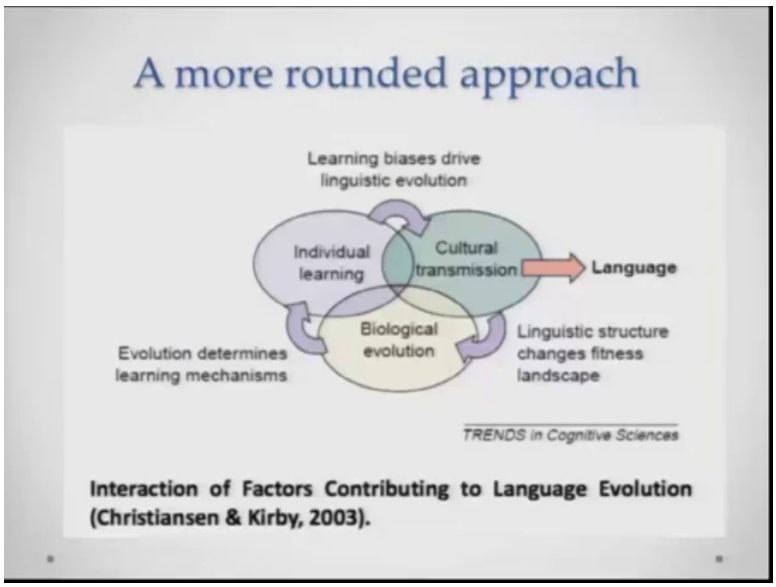
So, somebody would say I am going to go to this space, and there are again this is a very simple examples. There are so, many other examples in which the language has changed and language keeps evolving through social societal interchange through the number of people, they are saying you can always see say for example, they are almost all the time new words coming up new words being added to the oxford dictionary of words, new words being added not only in English for that matter in Hindi as well in other languages

as well. And how is that happening this is happening as a part of a social exchange that is something, but one needs to remember.

So, the idea is that cultural transmission basically triggers and facilitates evolution of language, it is not biology per see maybe by biology has a part to play, but mostly the dominant or driving factor in evolution is the cultural factors is the transmission across ages. Daniel Everett is one of the leading scientists in evolution of language he is basically you know he went to live in Brazilian Amazon, and he came across a tribe called the Piraha tribe, and he basically documents a lot it documented the kind of language they were using, and he basically documented all the very interesting things, and says that Piraha basically lacks what is called recursion, and he says that that is self sufficient language that is a language that this set of people are using.

And so, the claim that Hauser and Chomsky, and you know these people were making earlier that every human language should have recursion is contestable, again there are different ways, and there are different manners in which this debate has been handled, there are different manners in which people have referred to average views or Chomsky's views, but ideas again there is some contrariness there is some debate between what basically consider you know can be thought as the basic process of language or the basic driving force of evolution of language.

(Refer Slide Time: 14:34)



The other interesting things as well, but one of the things again I will just take a bit of a break and talk to you about, is if you really have to look at you know having a more rounded or inclusive approach, you can actually look at this very interesting paper by Christensen and Kirby, and they basically talk about learning of language or evolution of language as a tripartite process.

They say there are three aspects there are individual learning, there is cultural transmission and there is biological evolution. And the idea is that biological evolution whatever you are born with whatever you are inherited from your various species, you will also add to it your individual learning your experiences about language, your ways of using language the kind of words that you are using.

Now, the kind of words that your children we use those kinds of things, and you kind of transmit this individual learning to your children, and they will transfer it to their children that is basically these kind of learning biases you know what kind of words you want to talk about. Nowadays you will see a lot of people talk in terms of you know what is app language, SMS language, twitter language, and there the idea is that are kind of reducing and condensing language. Now nowadays nobody really wants to talk in Victorian English which used to have sentences like 3 lines or 4 lines or 10 lines long.

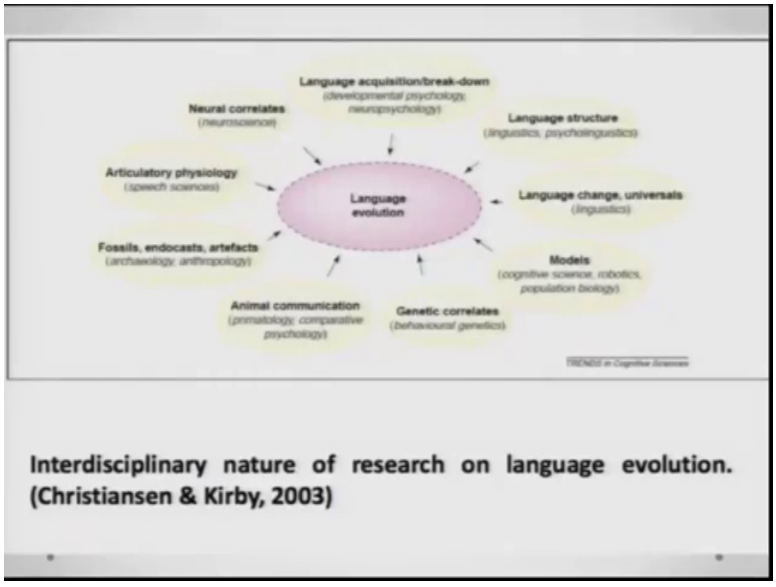
Now, these people you know like to talk in crispers shorter sentences. So, these kind of learning biases will in some sense govern how the what is the nature of the language that is going to be transferred to your later generations. So, this will basically also be one of the factors that are driving a linguistic evolution, and this linguistic evolution is basically a you know what is considered as part of language. This linguistic structure changes what is called the fitness landscape. So, suppose for example, there are set of words that people are using all the time, and that you know people are you know continuing using over time, and some of the words some of the structures just fall out and they are not being used at all.

So, the fitness landscape is because a lot of people are using particular kinds of words particular kind of sentential structures, those are the sentential structures and words that will survive. So, that is the fitness landscape, and if those are the structures that only survive they will have some bearing probably on the biological evolution, again I am talking of a much broader time scale, I am not really talking about this in 5 years, 10

years, 1 generation to generation and talking about a much broader time scale here. So, all of these three processes contribute almost in a cyclical sense, and the cycle could be of 1000 and millions of years for that matter which really drive what is called evolution of language.

So, again this this this is something that I am kind of you know more at home with one, because this approach kind of keeps into mind three very important aspects it keeps in mind evolution individual, and biology all of the same time.

(Refer Slide Time: 17:22)



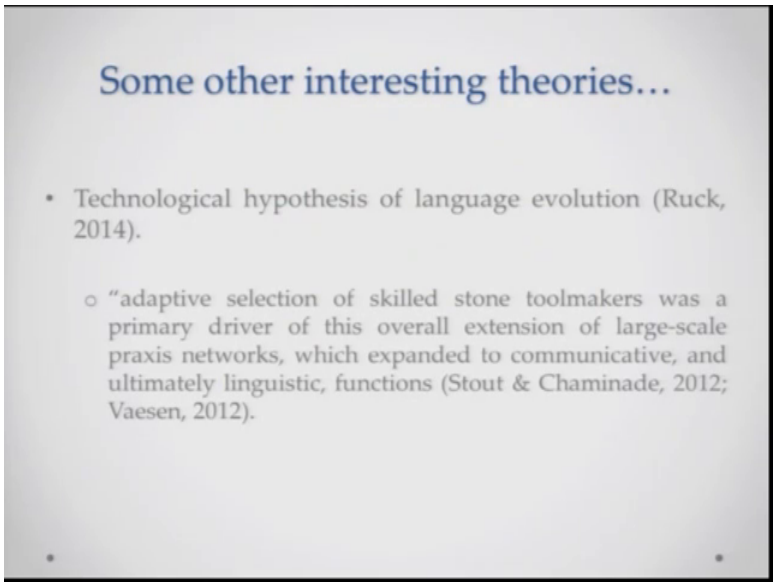
That is one of the reasons why evolution of language is basically you know at this moment studied from. So, many different perspectives you know there are neural correlates that you would want to talk about that is articulated, the physiology that you would want to talk about, you would want to talk about models of evolution of language, a lot of computer scientists robotics artificial intelligence people, machine translation people, natural language processing people are trying to build a particular kinds of models of language how is language understood, how is language produced.

What are the rules and patterns in here, the psycholinguistics linguistics are more guns are about the structure of language, you know what happens if this word order is reversed, what happens if you know there is a relative clause, and you know subordinate loss what are those kind of things. Also a lot of people try to do comparative work between animal communication, and human communication there are people who are

working with fossils to trace back the time from their human language would have started and date, it in some sense and kind of correlated with other you know advances in human cognition.

So, it is such a varied topic such a vast topic you know you might be reminded of what this guy was saying in the beginning that, it is such a vast topic that it is actually very difficult to talk about language in a any sensible way.

(Refer Slide Time: 18:37)



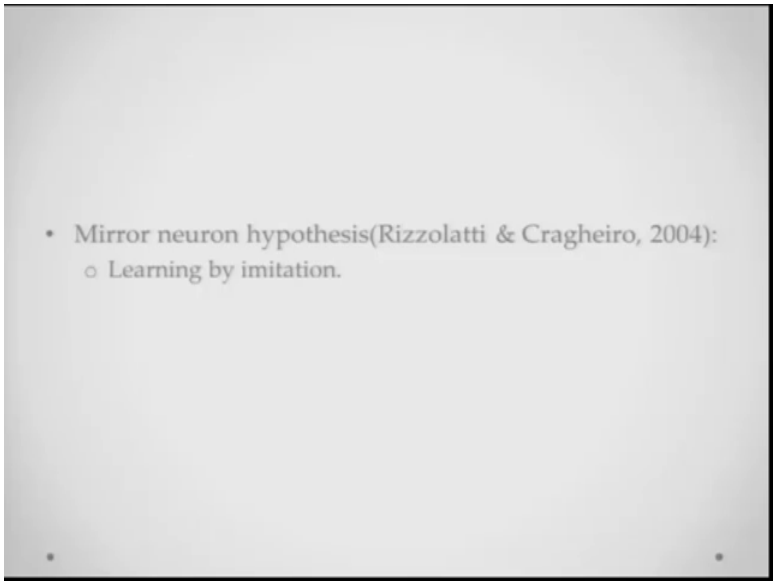
There are a couple of other interesting theories that I could I will just point you out to you might you know if you want go and read them. So, all the theories is the technological hypothesis of language evolution by linearity, and she says that adaptive selection of skill stone and stone tool makers, was one of the primary drivers of the overall extension of large scale praxis.

And again it is sounds a bit complicated I will just sum it up for you, the idea is that when people started making intricate tools made of stone you know, if you have to really sharpen a piece of stone you have to be very very soft with it, you have to have very refined gestures on it, and that is something that kind of defines you know.

The kind of dexterity that was coming up, and this is a dexterity basically transferred from just manual textures like showed your fingers to vocal gestures to you know these fine muscles developing, and allowing us to speak the language that we are speaking. So,

she she believes that technological hypothesis could be one of the major drivers of evolution of language.

(Refer Slide Time: 19:43)



The other very interesting theory comes from the mirror neuron hypothesis, I have probably talked about this in one of the earlier lectures mirror neuron hypothesis basically was given by you know, and Rizzolatti and Cragherio and these people are talking about it. The mirror neuron hypothesis is that when first individuals started making vocal gestures, and there is the set of neurons in the frontal area of the brain that if I am making a particular gesture you can look at me, and you will try and make the same gesture.

And the idea is this is probably what would have lent to propagation of these kind of gestures manual gestures, and later vocal gestures. And that would have been the driving force behind evolution of language from you know being just a vocal gesture made by one person to 2 to 22 to 42 to 5000 people, and could have actually contributed to evolution of language, and spread of language across the human species.

So, that is probably all from me about language evolution we talked in this lecture about some historical background of psycholinguistic, and also evolution of language. I will talk about some other topics related to language in the next lecture.

Thank you.