The Psychology of Language
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Lecture-13
Sentences-II

Hello friends welcome back to this 13th lecture, in the course on the psychology of language. Now in the last lecture we were looking at sentences in some aspects of sentences which are psychologically nature. Today what we will do is we will complete that section by looking at how sentence comprehension takes place.

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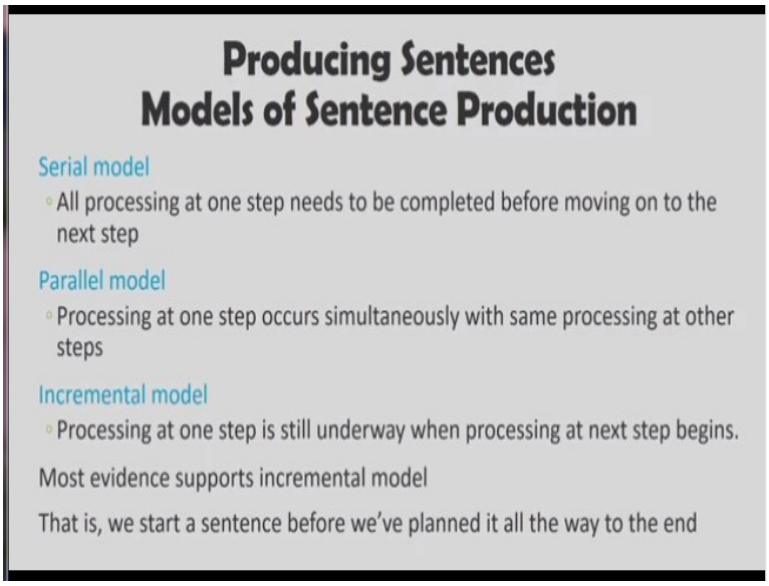

And how syntactic rules which is sentence forming rules are learned by both adolescent young people. Now as we have been doing in all the past lectures what I am going to do is take few moments here and travel back in time and make the context or gives the context in where this lecture stands. So we started this course by discussing how or why languages used, what is the need of language.

And for that we needed to define the basic difference between language and communication. Now communication is a form of language but in communication a number of ideas cannot be

expressed and so for the study of language we started looking at something called the animal communication system which is the most basic form of language. So there we saw why animals communicate and how do they communicate, what are the methods are there communication.

We looked at things like calls from where wait monkeys, we looked at had honeybee wangle dances and other aspects with basically explain the idea of animal communication system. And further to that we took a look at what the human language system is all about and compared between the animal and human language system. So how the human language system has developed over a period of time.

We define briefly that the human language systems starts with phonology or basic phones and how it progresses through the morphing level to the word level to the sentence level to the level of discourse and further on. So basically this structure of how the language is based or how human language system is made and sews is that is what we were discussing.

Further on we were we focused a little bit on to the idea of how language evolves, so the evolution of language is what we were concerning. So we looked at the idea of how language would have evolve out of Africa and the idea of how the recessive recession in language is used. We also looked at the idea of how are ancient and grandparents, grand great grandparents they develop the language.

And towards end of this section we looked at something called evidences to the fact that how language would have developed and so we looked at things like the use of proto language system, the use of pit games and other basic evidences which point out to the fact that how language would have developed. We also looked at the evidence from baby talk and how babies express their ideas and so this these provides us enough evidences to the fact that how language would have developed.

So that was what we are doing in the first chapter, we just looking around and working around trying to understand what is language first of all. And so how animal language system then human languages system developed and then little bit of history. Now if we have to progress

further we needed to explain what kind of research is done in language and how research is done in language.

So the next session that we did was on looking on research in language. So what aspects of research in language are there. So we looked at the science of language, we looked at the scientific method which is used for doing research in language, we looked at this methods in terms of the theory, in terms of the hypothesis. In terms of how this hypothesis is tested by data, what kind of designs are used and all those kinds of experimental procedures which are use for doing research in language.

We took the example of the evolution of n-400 and how this fits into the whole idea of how language research is done. Within focused on experimental designs, what kind of designs can be used in language, so we looked at both the within subject, between subject and within subject designs. And we also look at some more designs which can be used in doing research and languages.

For that we looked at some behavioral techniques that I use for doing language research particularly we were interested in measuring the accuracy and reaction time latency and accuracy and how this latency and accuracy give us an idea about the language systems at the brain or how the brain produces language or language processing and those kind of facts.

And towards the end of this section we focused on something called the language on the brain, so we were looking at what kind of techniques are used for doing language studies, how the brain can be studied by a newer techniques like a EEG, FMRI, and MRI, and how these techniques helps us in understanding language. We also looked at certain brain areas which are dedicated to language for example the wernicke and the broca area.

So that is what we were doing up till the second section, now once we had the tools to do research in language and once we had gotten past the fact that how language has developed. We moved onto the section of understanding how speech is produce, so we were interested in

looking at how speech production happens. Because the next step was to understand how language is produced and how language is perceived.

So these 2 sections of perception of language and production of language is what compared it of the second section. Now in the second section we started off by looking at how the speeches perceive what is the way in which speech is perceive as a started off by looking at auditory perception, how does auditory perception takes place. So we looked at facts like what are the fundamental frequency and what are overtones things like how the speech in a form of way when how this way is measured, what are the measures of this wave, what are amplitude, what are frequencies.

And those kinds of things are that you have a look interested in. We have also been interested in looking at the look and field of sound of how does sound actually appears both in the physical and the psychological domains. Now from there we looked at in or we focused onto the idea of how the year is made or the conceptualization of human ear which basically helps us in perceiving sound or listening to sound.

Then we moved towards the idea of what the speech stream consist of, so basically what is speech made up of. And then we were looking at with the help of a spectrogram we looked at how speech is continuous in nature. And what is the nature of this speech stream, so you will focusing on things like phonation we have focusing on things like prosody which is fluctuations in this speech stream.

We were looking at the formants and the idea (()) (07:54) we are looking at all those kinds of qualities of this speech stream or this peculiarities of speech stream and other necessary characteristics of the speech stream. Then once we were done with this we moved on to looking at the how this speech is develop in invent.

So what is the process of development is speech and in infants and so we started looking at how the language learning happens in the womb. So we looked at all those factors, all those evidences which are out there which help us understanding that how the language learning happens in

infants or within the womb. Now we also looked at how newborns perceive language and what role does baby talk have in the perception or speech.

So what evidences can baby talk provide us in how speech is perceived or by or how speech perception is developed in the infants and neonates. Now after once we had been able to establish the facts of how the speech stream is deciphered and understood by infants and how they use this we moved on further to understanding or focusing on the theories of speech perception that is where what we were ending in.

So in the series of speech perception is basically looked at the motor theory with basically say that there articulators, motor movements basically in addition to the moment that is happening in terms of speech hearing and so they coordinate together to mix speech. So we looked at the idea of the motor theory, the general auditory frame work and the idea of direct realism which are the 3 theories which have been given in speech perceptions.

Now once we have been cleared of all this we the next thing that we wanted to look is how speech is produced. Because we have covered up till now at up to the point that how speech is perceived or how one hear speech and so we jumped onto the idea of how speech is produced. In that we started of that session started off by looking at the idea of the vocal tract and the production of speech.

So how the vocal tract looks like, the vocal box looks like and how speech is produced and how this speech production basically is then transfer to different people were hearing the speech. Next we looked at speech areas in the brains have various speech areas and how they are combines, the wernicke and broca area what is the relation between them how different connections from the broca in the spear and the wernicke area are there and what do they mean.

Next to that we looked at models of speech production, so various models of speech production like the feedforward and feedback control model, the auditory suppression during speech model. The diva model and the dual stream model which basically explained how speech is formed or speech is produced. And lastly we looked at the development of speech production.

So how speech production develops in infants, so that we looked at the cases of wobbling the frame then content model, the social aspects of wobbling and how all of these explain the perception of speech or the production the development of production or speech in the smaller children. Now once we have clear off from these 2 aspects of looking into the history and science of the language or speech we started focusing on more bigger issues.

And that is where we dedicated 3 lectures sections on words because words are central to explaining any idea to explaining any form of idea within the language. So we started off by looking at the section on words b looking at the anatomy of a word. So what are the word look like, what is the anatomy of a word and so that we looked at how words are labeled used as label for different concepts.

And what are the different forms of words which are there, so we focused on the content word and functional words suffixes, prefixes, shape drifters, the phonology of word forms and so on and so forth. So we basically focused on what are word and what is the anatomy of the word. Now once we had an idea of what words are or what is the anatomy of a word, we jumped onto looking at how words are basically learned.

So the ways in which the words are learned by people around us and there we looked at things like how children of different ages learn different words and how that is a initially there is a slow down progress but then there is growth spot in word learning and then it falls off after 6 months. So we looked at those evidences, we looked at how mapping fast and slow mapping actually help us in learning of words and we also looked at how neighborhood density and in the symmetric networks help us in learning different words.

Now once we had looked at how words are learned, the obvious question that remain is to look at how words are basically stored. So what is the way in which words are stored into the (()) (13:16) and there we looked at 2 different formats are basically more different formats and so we looked at that most words are not only stored in terms of the pronunciation which is the

phonological form we also looked at that words are stored into the mental lexicon in terms of the symmetric forms also.

So basically we looked at how the words are stored into the mental lexicon, we also looked at how the cortical organization of this mental lexicon is. So how this mental lexicon is arranged in the cerebral cortex and we looked at some models of basically explaining it. And lastly once we know how words are same we were interested in looking at how words are retrieve then so that was the last thing that we wanted to do.

So we looked at word retrieval model, so we focused on recognition and recall which are the 2 methods of retrieval of any information from memory. So we look we started off by looking at how spoken words are recognize and then we looked at how spoken word are produced. And we also looked at several models of word retrieval one being the leaflet free forward model rather being the dell interactive model and a third model being the.

So the 2 models basically the feed forward model and the dell interacting model and how these model explain that how words are retrieve from long term memory. So once we were done with words in the last lecture which is lecture number 12 we started off by looking at sentences. Now via sentences in the sentences are necessary because we can think without words and sentences but for expressing a thoughts to people we need words.

And these words have to vary in certain sequences to form sentences because it is sentences that expresses in transferring ideas between people. So we started off the section by looking at the structure of a sentence, so how does a sentence structure look like. And there we looked at that how the various parts of a sentence are amalgamated, so basically what are the various parts of a sentence the subject were object.

And we looked at how English reach it this kind of our organization, the SVO format we also look at how the agent and patient which are the 2 actors and the idea of the verb which explains the event which is connecting the agent patient how they are assigned the thematic role. And

how this thematic role assignment and the idea of the subject object verb, they combine together to give us an idea of what sentence structure looks like.

So we looked at how sentences can be broken down into which clauses into it is various subseries into the SVO format and so and so forth. So we looked at the syntactic structures in which a language can be processed. Further to that we also looked at how complexities are added into the sentences and there we looked at how cleft sentences are use for adding complexities.

We have also looked at how relative clause can be use for maintaining complexity in sentences. And we also looked at the way how are dative construction can be use from making complexities. Lastly we also looked at how the agreement is necessary for maintaining or agreement provides the complexity of sentences or they agreement adds onto the complexity of sentences.

Once we clear of that we will looked at comprehending sentences, so how sentences are comprehended or understood. And there we were looking at the idea of ambiguous sentences which are called the garden path sentences. Because garden path sentences sort of gives us an idea of how sentences are formed or how sentences are comprehended and from there we come to know that there is a 2 stage model of sentence comprehension one at the symmetric level the other is the syntactic level.

Then we looked at the idea of heuristics which are used in sentence comprehension and we looked at the late closure heurist which is a syntactic parts in strategy that continues to at newer to the current structure until there is sufficient evidence and new structure begins. And so we also looked at the idea of minimal attachment which is another heurist which is used for maintaining or comprehending sentences.

We also looked at how priming an anticipation can help us in and comprehending sentences. And finally we looked at the idea of broca area which are the new evidences of the idea broca area which says that broca's area is not only responsible for the syntactic structure of sentences. But

broca area in an newer light with newer researchers is basically a way station is **is is** kind of a working memory system which integrates the schematic and syntactic inputs of sentences.

And how it processes these 2 input and how broca area what told us broca area played in this kind of a process sentence processing, what we are going to do today is we look at how sentences are produced. And we will also look at not only we look at how sentences are produced, we will also be focusing on how do we learn syntactic structures.

So the 2 main aim for today's lecture is to focus on the production of sentences and the learning of syntactic structures. So basically it is believe that sentences are produce most sentences they are process through 2 streams one is called the ventral stream and other is called the the dorsal stream. Now just like as we saw in word production and how words are produced, we believe that word production follows a 3 level structure.

Now sentences nothing more than just words are in the right syntax, so I look at the word production of how words are produce will give us some idea how sentences are produced. Now word production starts as a 3 step processing, the first state is at the schematic level where the concept when a word when a thought is induced the concept or that explain that particular thought is first initiated.

From there the mental lexicon is searched for the lemma of that concept which is the lemma is the abstract from other concept and all kind of endings say morphological and syntactic endings which added this lemma is in the second state. And if the third stage these lemma is then send to the phonological level where a pronunciation of the word is made and this is how the words are produced.

Now if you extend this concept to a sentence production we basically come to the idea that what as we produce sentences information tends to flow both in the vertical and the horizontal direction. Now the vertical dimension represents the flow of information from conceptual to phonological level. So sentence production goes to vertical information flow as well as a horizontal information flow.

And in the vertical information flow what happens is the information flows from conceptual notes to phonological notes. So basically that is how the words are processed, similar to how verb production is. But at the horizontal level, at the horizontal information flow the information are at the horizontal information flow follow some models and these models can act both in serial or parallel base.

So sentence production models are follow basically as serial order as serial model order or a parallel model. Now what do I mean by this a serial model is a model in which all processing of the sentence happen at 1 step and it needs to be completed before moving to the next step. So in the serial model what happens that the whole sentence the whole idea of looking at the conceptual level of thought.

Then moving it to the lemma level where the abstract form of that word is extracted and then moving out to the phonological level where the pronunciation of that particular word all these happens at the same time. So 1 sentence at a time kind of 1 word at a time kind of a processing. Now in serial order what happens in, in serial processing what happens is 1 word at a time is **is** processed and that is how the sentence is processed, the serial order or serial model says that.

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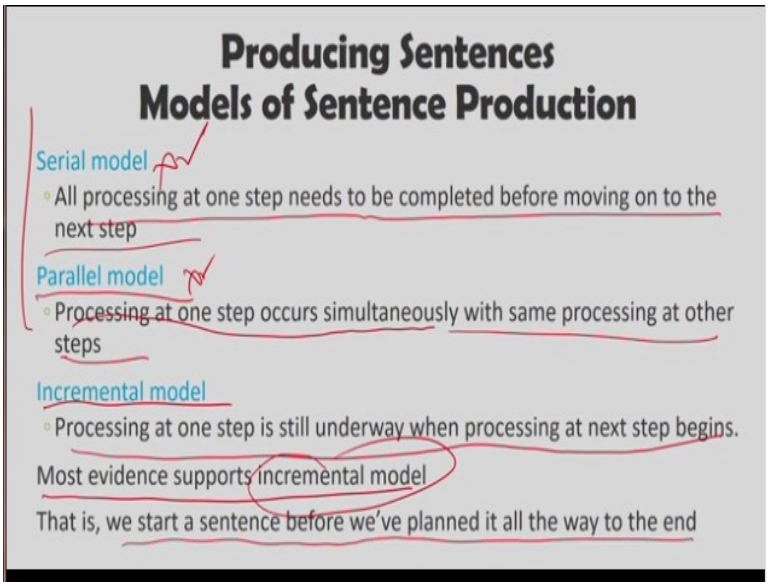

So basically what the serial model says is all processing at 1 step needs to be completed before moving to the next step and so this is how the sentence processing happens in the serial model. But then we also have something called the parallel model and what is the so basically in the serial model what happens is a strictly serial model require the speaker to go from a concept activation through lemma selection to the phonological encoding of any sentence before it can move from 1 concept to the next concept.

That is what I said so word by word kind of a processing, we also have a parallel model of processing, in the parallel model processing what really happens is the processing is happening at 1 step occur simultaneously with the same processing at the other step. And so you are at what happens is all words are process in the same time with the sentence and so all processing steps are taking place at the same time, so there is a parallel movement.

Now is a model in which the processing of 1 step occur simultaneously with the same processing of the other steps. In a strictly parallel model the concepts would be activated as the same time and after that the 3 the lemmas will be activated at the same time of all the words in a sentences and a phonological structure we also be activated at the same time of all the words in a sentence.

But then what researchers would have found or researcher have found is that sentence processing neither follows the strictly serial order nor as strictly parallel order. But what happens is the sentence processing generally follow something called a incremental model. So processing at 1 step is underway while processing the next step begins. So more scientific evidences such as that the incremental model of sentence processing is use, that is we start as sentence before we have planned all the way to the end.

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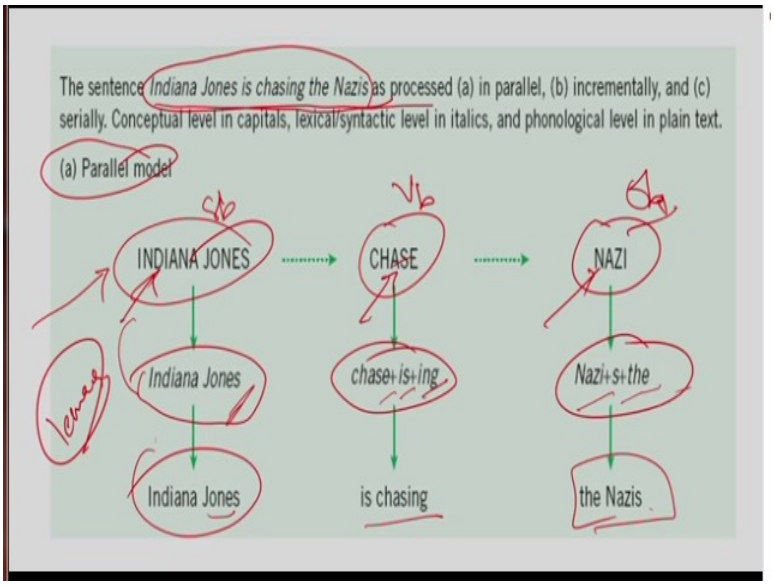

Now this is the parallel model now we looked at this particular sentence Indiana Jones is chasing the Nazis this is the sentence that we have. And what we want to see is how this is processed, how the sentence should be processed by using the parallel serial and incremental model. And this is the parallel model example, so in the parallel model example what will happen is Indiana Jones which is the subject chase which is the verb and Nazi which is the object.

They all are processed at the same time, so in what will happen is at step 1 the concept of Indiana Jones, the concept of chase in the concept of Nazi we will be excited. And then following that the lemma the abstract form of this word will be selected from the mental lexicon. So Indiana Jones this is the lexicon chase is + ing that is the lexicon and Nazi s the this is the metal lexicon and so after that we will have the phonological level.

At the phonological level the pronunciation of Indiana Jones is chasing the Nazis that is how it is going to be processed if it is happening at the parallel. So all 3 stages right from the conceptual level where the concept is taught about to the lemma level where the most abstract form of that word is selected. And then new structures or new syntaxes and morphological endings are added to the word from there to the phonological level, each of the step happens one by one.

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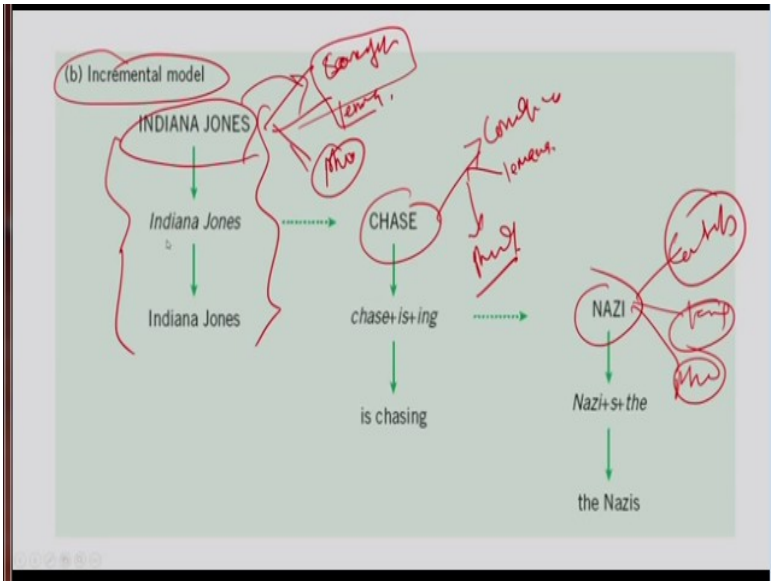

Now if you use an incremental model the same sentences Indiana Jones chase the Nazi will be happening in this way. So first the Indiana Jones will be process and while the Indiana Jones is being processed at the 3 level which is the semantic or the conceptual level the lemma level and phonological level what will happen is. So maybe the conceptual and lemma level of Indiana Jones has finished and chase starts getting processed at the conceptual level.

And by the time this chase has started processing at the lemma level the phonological level processing of Indiana Jones is finished. And what will happen is at this point of time the conceptual level of Nazi would have started and whether time we have the phonological level of this sentence being finished. We have the lemma level being excited and the phonological level being start.

So what happens is 1 sentence 1 word of a sentence or couple of words of a sentences is being processed at 3 levels. And they have processed in incremental way, so by the time Indiana Jones the lemma level of Indiana Jones is activated the conceptual level of the second the verb in the sentences already been started, so this is called the incremental level.

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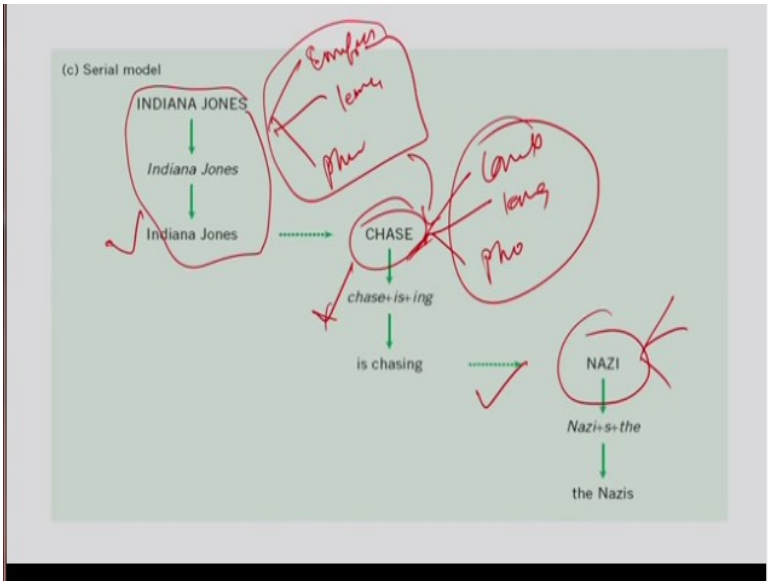

Now in the serial model what would happen is one by one, so in what will happen is Indiana Jones the 3 levels the conceptual level, the lemma level and the phonological level of Indiana Jones is first finish. And then only chase processing of chase we start and then the conceptual level processing, the lemma level processing and the phonological processing phonological level processing of chase would have end and then the Nazi would get processed at 3 levels.

So once this step has finished only then the step starts working and then the step working, so serial model. So there are 3 models of processing which are suggested for the processing of sentences.

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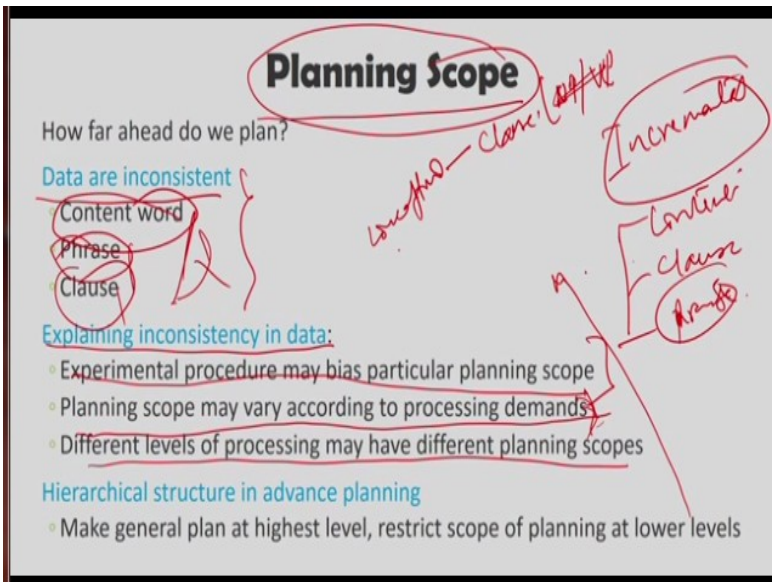

Giving given the fact that we use incremental model of processing how far do we plan ahead, planning scope. So how far do we think or do we let ourselves think before end processing of the first sentences. So given that spoken sentence production is incremental psycholinguist disagrees on half are ahead we planned. Now results experiment suggest that we plan sentences 1 content word at a time while other points to the phrase or clause level.

So basically they are 3 views, 1 view says that we plan at the level of content the other says we plan at the level of clause. So the clause by clause processing and then we have something called the phrase by phrase processing. So these are the 3 kinds of processing which is the, so data is inconsistent what data would suggest is that either we process through a content word kind of a thing or we process ahead, we plan ahead at the level of phrase or at the level of clause.

So how do we explain this inconsistent of the data points in all direction regarding how far advances . In once you plan a sentences and different since different researchers use different kind of procedures for testing this or different experimental design for planning this kind of as of a for investigating this planning scope. There is no consistency on how far do we plan.

So this inconsistency in data explained by experimental procedure may bias the planning scope. So why this inconsistency of how far we plan one is because the experimental procedures may bias different experimental procedure and so that will one of the reason. Also planning scope may vary according to the processing demands, now some sentences are easy by example if you are doing.

If you are giving a lecture this case the cognitive demands are very high and so we plan ahead in a different way or plan ahead sentences in different way. But if we are chit-chatting then planning may not be planning ahead is an automatic process or sometimes there is no planning at all. And so depends upon the processing demand. And third is different level of processing may have different planning scope.

So I could also be possible that different levels of processing may had different planning scope. So same sentences at some level would have clause by clause planning at the other level it would

have a phrase by phrase planning. Now the scope of planning of the conceptual level maybe the clause while the scope of the planning at the lexical level maybe at the phrase or the content word.

And so what this basically says is that at the conceptual level, the planning happens at the clause level. So planning non clause, verb clause various classes which are there and at while at the lexical level.

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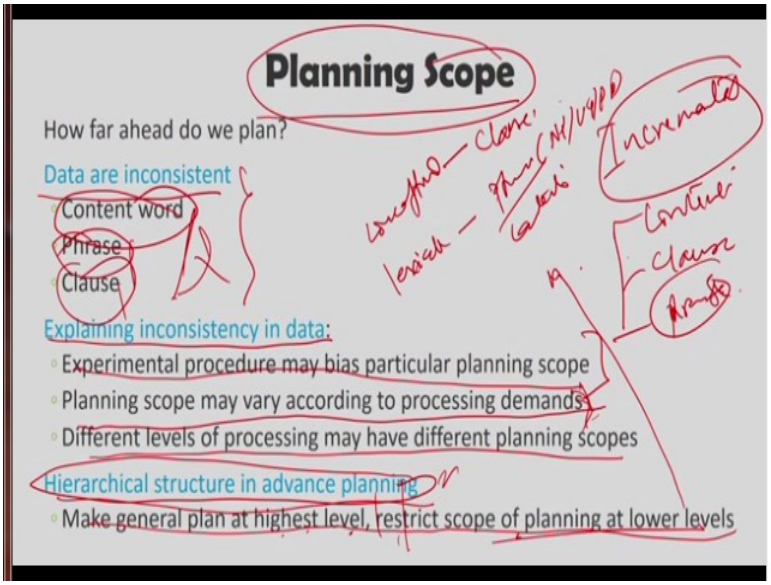

The planning happens that the phrase, so we have the noun phrase the verb phrase or the participle phrase or it is done at the level of content word. So how many content words are there and this is by clause, so different clauses are there, subject clause, object clause and that kind of a planning would have explained, so basically what it says is that different levels of processing may have different planning scope.

Now also hierarchical structure in advance planning, make general plan the highest level, restrict scope of planning at the lower level. So hierarchical structure so other processes that the brain may engage in planning ahead the scope of a sentence would work in terms of motor performances or by looking at this hierarchical structure in advance planning is an actually computer based program.

And so what it says is that we make general plan at the highest level, restrict scope of planning at the low level. So once you make a general plan at the highest level this reduces the scope of planning at the lowest level. So whatever we plan at the higher level that decides how the planning for the lower levels will actually induce.

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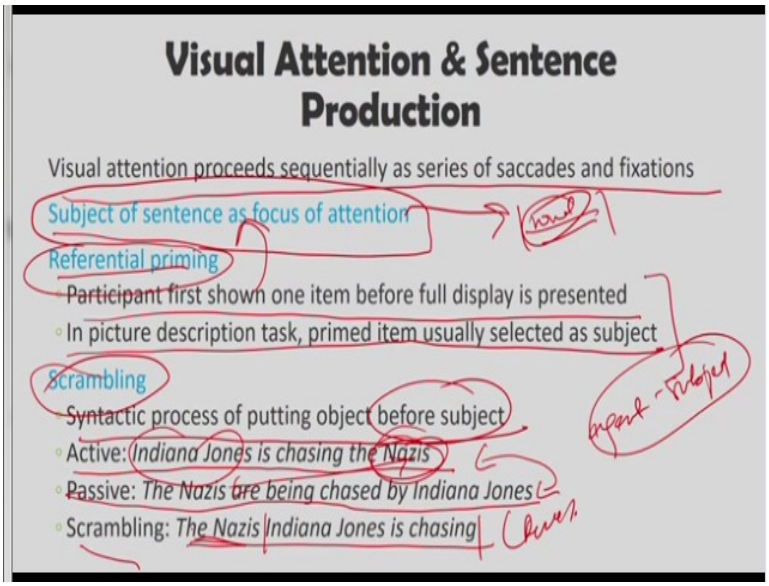

Now the visual attention has it is own say or it gives as an own idea about gives an idea how sentences processed. Now visual attention we are seen before that how researchers use the visual word paradigm and how this visual word paradigm with eye tracking examine how (()) (31:59) we are comprehending spoken sentences. Now this eye movement that people do in visual paradigm that gives us some idea of what kind of processing is happening at which word in a sentence.

So basically visual attention proceeds sequentially as a series of huh if we are able to see how people are reading a word. And if we do an eye tracking that will tell you how people are producing this sentence or how people are comprehending this sentences. So basically that gives us a idea of how sentences being produced or how sentences been comprehended.

Now generally speaking most sentences has subject as the focus of attention, now it is believe that visual attention plays an important role in sentence production. And in fact the sentence

production in visual attention they some structural parallels. Now when we open an eyes of wide visual scene appears before it but we cannot take in the whole scene at once.

Now instead we move from one what to the other word ((()) (33:08) actually define how sentences are processed or how sentences are produced. Now generally speaking visual attention proceeds through something called a sequential fashion visual attention proceeds through a sequential fashion as the sentences do.

So basically what part or which word content word do we make the subject of a sentence that is explained by the visual attention studies. So visual attention studies are eye tactic studies of visual attention task give us an idea of house of the subject whose reading a sentence decides what should be the subject of that particular sentence. We also use something called referential priming and so what is referential priming participant first shown 1 item before a full display is presented, in picture description task prime usually selected as the subject.

So in referential priming what really happens is that it is an experimental procedure in which the participant is first shown only one of the items of the visual display before the full display is presented. Now referential priming they tend to direct the participants attention or towards the primed item in a visual display and in picture description task the primed item tends to be selected as the subject of the sentence.

So basically referential priming gives us an idea of how the subject of the sentence is is basically selected. Now number of other factors can also influence subject selections, so how in a sentences or subject is selected is believe that humans are generally the subject in more sentences. And animate items or animate objects are selected as sentences also we have something called scrambling which is a syntactic process of putting the object before the subject.

So syntactic process of putting the object before the subject in what does scrambling do it also explains how the agent is selected as the subject. So scrambling is the phenomena which basically says or with basic explains how the subject is explain or how the subject is selected in a

sentence. And so basically what it does is this kind of visual priming studies or visual attention studies tells you how sentences are produce or how sentences are comprehended.

That is what the idea is, now if I have an active voice Indiana Jones is chasing the Nazis, the passive voice is the Nazis are being chased by the Indiana Jones. Now basically that 2 sentences now what as run is in this case the Nazis has the Nazis become which was the object now become the subject in English language. But what Russians tend to is the use scrambling, now what is scrambling as I said it is the process syntactic process of putting the object before the subject.

And so since the Russian nouns have they have mark for their role as a subject and object. So it does not really matter from the word order does not matter for there are sentences. So if the Russians are rewriting the sentences then the Indiana Jones or Nazis will always be the subject or even if you the change the word order that is the subject order is fixed.

And so if we use scrambling, Russians scrambling the sentences that they may is that the Nazis Indiana Jones is chasing. So this kind of a thing is possible in Russian but not in English language. So basically scrambling is the process of is the syntactic process of putting the object before the subject and still making a sentence. And why does it work, it works because in Russian word order is not important.

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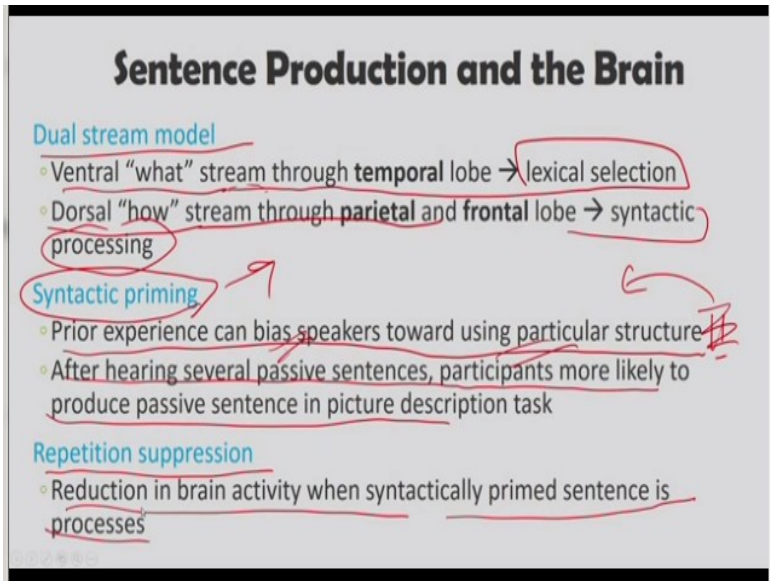

Now sentence in the brain, now brain imaging studies are sentence production are difficult to setup for a number of reasons. But are few have been performed so far and (()) (36:53) results that are consistent with the current model of language processing. So what is the current model the temporal lobe is implicated as a lexical selection and the left inferior frontal (()) (37:03) which is the broca area is implicated as for syntactic priming.

So there is a dual stream model of sentence production in the brain the ventral stream is what stream through which the temporal lobe the lexicon selection happens and then we have the dorsal stream with the house stream through parietal and the frontal lobe whether syntactic processing happens. Now syntactic priming can also lead to a particular structure being processed more easily and so sentence production the syntactic priming can actually help in producing sentences or explaining understanding sentences faster.

So prior experience can bias speakers toward using particular structure, now if we do syntactic priming this will help us in biasing subjects to using particular structures. Now after hearing several passive sentences participants are more likely to produce passive sentences in picture description task. And so this basically says that sentence production is affected by syntactic priming.

Similarly we have something called reputation or suppression what reputation suppression it is a reduction in the brain activity when syntactic prime sentences are process. So reduction in the brain activity when syntactically prime sentences are process so when you show a prime a syntactic prime before the actual word or actual sentences to be processed it is processed in a easy manner. And this leads to the lowering of the brain activity or the it makes the processing of the sentence easy, so basically it is reputations suppression is that kind of a thing.

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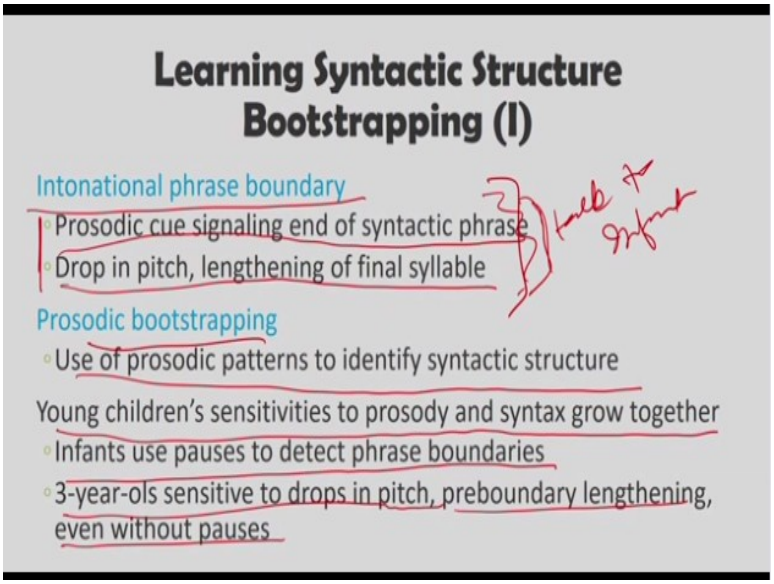

So once we are clear of what sentence production comprehension is all about let us now look at how do we learn syntactic structures. So what is the way in which syntactic structures are learned, now we come in the infants and or we as human beings we coming to the world already familiar with a pitch and rhythm patterns of the mother language. So we have already familiar with a mother's language and we are very familiar with the intonations and the pitch and rhythm of our mother's language.

Now these prosodic cues, these intonational cues are these clues of up and down tone serve as the key for the infant to crack the code as syntax. So basically how the infant learn the syntactic code by focusing himself onto the prosodic cues from the mother's speech sound. So basically then how does the infant learn this syntactic structure, the structure of how are sentence should be or where the sentences are should be broken.

So that meaning can be extracted out of it, so adult speech are essentially an adult speech which are essential and those adult speech which are especially directed towards the infant the flow in arts of rising and falling pitch that stretch across groups of words. So when we talk to infants the pitch goes up and down or it keeps on waving up and down and these up and down basically call in the intonation.

These up and down that we do in our voice modulation while talking to a infant are basically called an intonation. Now each intonational phrase boundary these up and down the boundary between these up and down according to intonational phrase boundary is a prosodic cue consisting of change in pitch usually downward and lengthening of the final syllable that signals the end of the syntactic phrase.

So what we tend to do is we tend use this intonational phrase boundaries when talking to infants. And these intonational phase boundaries are the ones that the infants actually use to understand the syntactic structures. Now we use prosodic cue signaling end of syntactic phrases and drop in pitch lengthening the final syllable to actually explain or to talk to infants, when we talk to infants we use these kind of structures or these kind of mappings.

And these kind of cues that we use or these kind of cues that we give to the infants when talking. They provide the infant tools through which they are able to learn syntax of a particular the syntactic structure of particular sentence. Now intonational phase boundaries are not always followed by a pause. Now when we talking to adult in adults the intonational phase boundaries are not followed by a which is very true when we are talking to infant.

So we give pauses so the infants are able to understand where is the break, just as infants you transition probability is now the infants use something called transitional probabilities to detect word boundaries . They also use intonational phase boundaries to group words together and the use prosodic patterns to identify syntactic structure is called prosodic bootstrapping.

So the infant use just as the infant use the transition probability to detect where the word as ended any word would have ended we have discuss this in words in how infants learn word. The

same way the intonational phase boundaries are use by infants dictate syntactic structures of sentences. So use of prosodic patterns to identify syntactic structure that is prosodic bootstrapping.

Young children's sensitivities to prosody and syntax they grow together, infants use pause to detect phrase boundaries, 3 year old sensitive to drops in pitch, preboundary lengthening even without the pauses.

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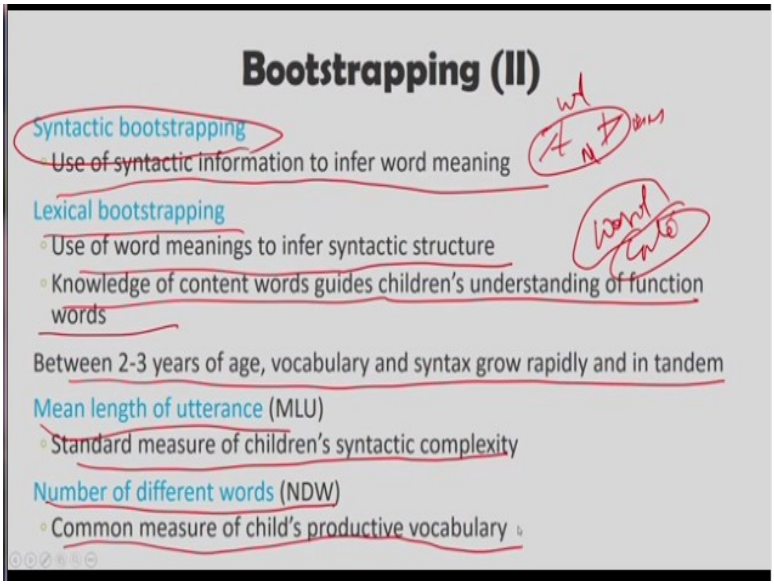

Now 2 year old childrens have the ability to use something called syntactic structure to infer meaning of words and this is known as syntactic bootstrapping. So infants generally use something called syntactic bootstrapping which is the use of syntactic information to make word meaning. So for example what is the content word, what is the noun, what is the verb and these kind of phase boundaries are use or these kind of syntactic information are use by the infant to get the meaning of the word which is being used in a sentence.

Now an example is that when 2 year olds they hear conversations about a boy mopping and they later prefer as scene of person performing an novel act alone. But when they hear this sentence that boy is mopping a girl and later on prefer sentences where which involves 2 people and so this gives us an idea that this kind of a syntactic bootstrapping is use by infants to generate infer word meaning.

Now children at the age of 2 also have the ability to use something called word meanings to make inferences about syntactic structures and this is called lexical bootstrapping. So what is lexical bootstrapping, it is the ability to use word meanings to make inferences about syntactic structures and this is generally used by the infants. So use of word meanings to infer the syntactic structure, knowledge of content words guides children understanding of the function words.

So what is the function word and what is the content word these kind of facts help the infant deduce the syntactic structure of a sentence. So between 2 and 3 years of old vocabulary and syntax grow rapidly in tandem. Now there is also something called mean length of utterance and mean length of utterance explain something about how sentences are perceived by the infant.

Those standard measure of children syntactic complexity is called the mean length of utterance, what is an utterance. An utterance is been defined as a continuous speech or speed boundary by pauses but it need not be complete or dramatically correct sequence. So it has to be continuous speech but it may not be dramatically correct or it need not be syntactically correct, so that is what an utterance is.

Another interesting thing for infants is something called the number of different words learn the NDW which is common measure of child's productive vocabulary.

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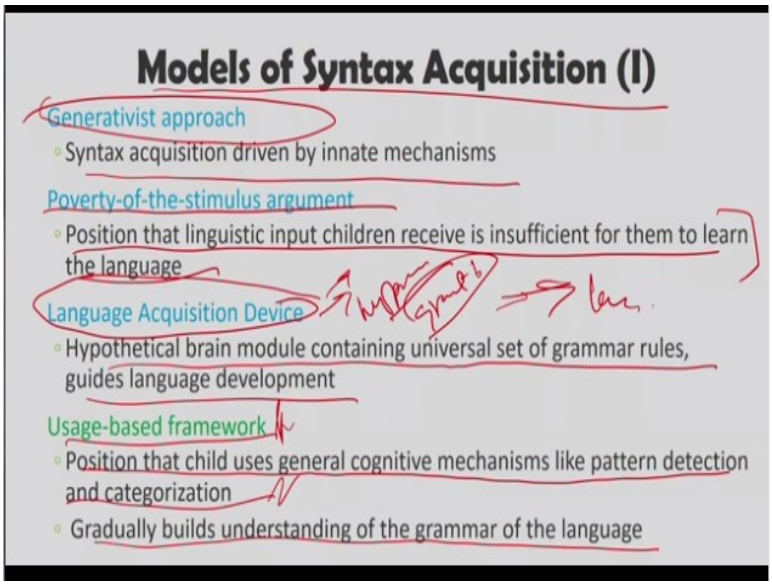

So this is how the children actually learn the syntactic structures also speech disruptions give us an idea of how the infant learns the syntactic stretch. For example a stall which is a disruption of speech that does not change the syntactic structure of the utterance and consist of silences or fillers like who and whom actually explain the what is being what process is being **is is** is being evaluated in sentence production.

Now staffs are believe to be the result of processing (()) (45:25) in either the lexical retrieval or the phonological encoding as the child is incrementally building the sentences. So this troll is explain in terms of I have how lexical retrieval is happening or whether the phonological encoding or how the child would have phonologically encoded what kind of errors would have happen in the phonological encoding.

So that is another factor which tells us how the infant is learning the sentence or sentence comprehension happens in infants. Now how do what are the various models of syntax acquisition, now there are several models of syntax acquisition. The first model of syntax acquisition is the generative approach and which believes the syntax acquisition is driven by innate mechanisms.

Now Chomsky (()) (46:10) transitional transformational generative grammar is very popular and that is the baseline for this kind of an approach. Now Chomsky took the position that the

linguistic input children receive is insufficient for them to learn the language and this is known as the poverty of stimulus argument. So Chomsky believe that the kind of the linguistic input there the children is seeing from people around him is not enough for him to learn the language and that is called the poverty of the stimulus argument.

Now Chomsky views that adult speech is too full of errors, adults have make a lot of errors to be fit for a good model of learning. Adults speech is completely full of errors and so these errors if these kind of speech errors are there they may not be the right way for how the child learns the sentences. So what he believes is he propose something called the idea of the language acquisition device and he says that most children have something called a language acquisition device which is a hypothetical module in the brain which has containing the universal set of grammars that guide development language development.

So Chomsky believes the idea of the language acquisition device and this language acquisition device hypothetical system which has it is own grammatical principles and so they favor the development of language. Now poverty of stimulus argument position that linguistic input receive insufficient for them to learn the language, why because the language that this children actually learn, they learn from adults.

And adult speech is full of errors and so this may not be the right word, so what Chomsky believes is there is something called a language acquisition device which is hypothetical brain module containing universal set of grammar rules. And these guides the language framework, but then are number of researchers have actually oppose the Chomsky view and they number of researchers they emphasize interactions between general cognitive abilities and a rich learning environment in childhood for the development of language.

This kind of usage based framework psychologist take the position that the child uses general cognitive mechanisms like pattern detection and categorization to gradually build an understanding of the grammar of the language. So basically there are the usage based framework says that there are no inherent or hypothetical brain module with language and grammar build systems which help us in learning language, what the usage based statistics says that.

If the position is that the child uses general cognitive mechanisms like pattern detection and categorization for making his own grammar. And he gradually builds understanding of the grammar of the language, so you uses this mechanisms based on this mechanisms she is able to produce sentences and this how the sentences are produced actually tells us how the grammar will be or the child learns the grammar or syntax.

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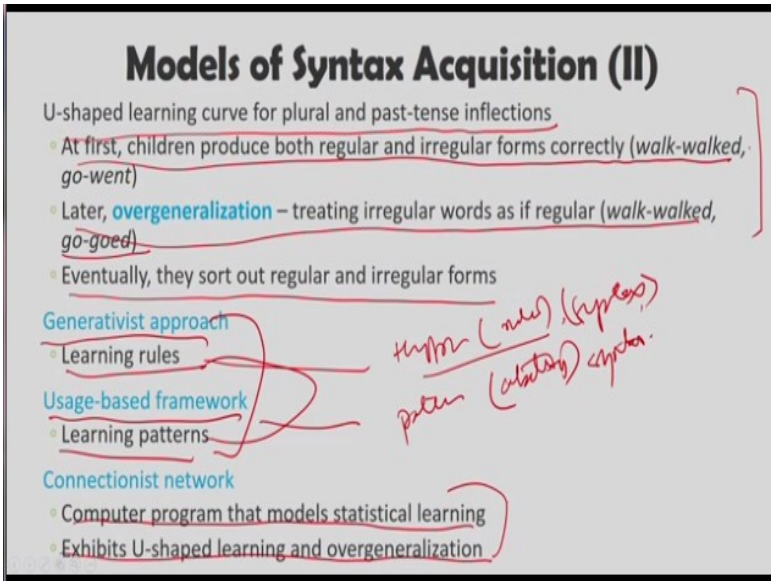

So basically the U-shaped learning curve for plural and past tense inflections at first the children produce both regular irregular word forms. For example walk, walked and later on the overgeneralization treating irregular words regular walk walked and go, goed. Eventually they sort out the regularity in irregular forms, so child (()) (49:22) and grammar develops through the second and third year and they exhibit a U-shape learning curve for plural and past tenses.

At first they produces both the regular and irregular inflection correctly as in walk, walked and go go went. Then they begun to use this version lesson, so initially they use this kind of a generalization but then they start using this for a longer sentences or they over generalize it the phase characterize by the treatment of irregular words as they were regularly inflicted.

That is they tend to say mans and foods comed and goed even and this basically says this idea says that it is the usage based framework or it tells the use of simple structures cognitive

structures to how the child learns grammar. Now the generative approach is basically of learning rules whereas the learning based approach is focuses on learning of patterns.

So learning approaches says that hypothetical system with rules make us understand the language whereas the or sentence the syntax of a sentence. Whereas the usage based frameworks says that patterns, understanding patterns actually give us the ability to learn syntax. The generative approach use overgeneralization as the evidence for acquisition of a rule and connective it is network that is our computer program that model statistical learning exhibits both overgeneralization.

And U-shape learning curve when train on plural and past tense inflections, so basically the connectionist network computer program that models statistical learning it exhibits a U-shaped learning and generalization in children's learning of the syntax.

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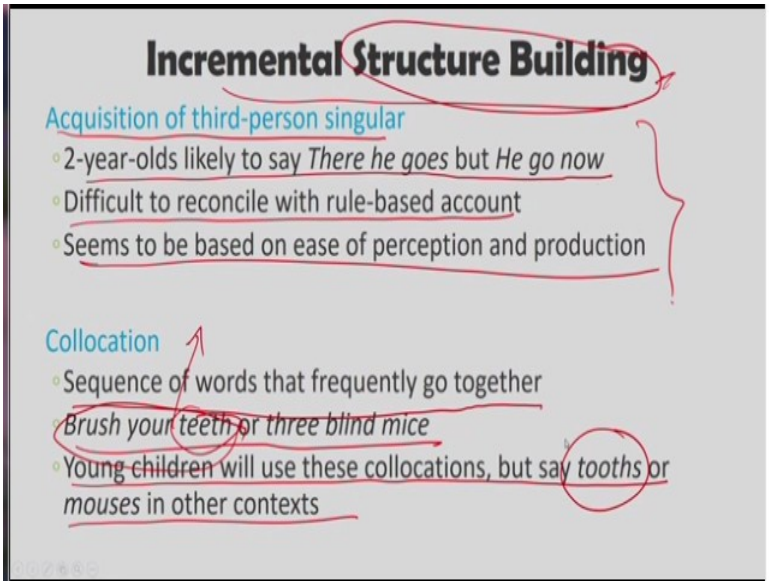

So there is a stronger evidence for the usage based network framework comes from children's acquisition of another inflection. The third person singular S suffix of verbs, 2 year olds are more likely to use the S inflection when the verb is at the end of the utterance then when it is in the middle. So basically then acquisition of third person and that says that the structure building is an incremental process in infant.

So basically 2 year old likely to say there he goes but he go now, difficult to reconcile with rule based account and seems to be based on the ease of perception and production. Now there is also something called correlation, so further evidences that incremental structure building happens or incremental syntax learning happen in children comes from the idea of collocation and what is collocation .

A sequence of word that frequently go together is called collocation and these predictable phrases are likely to be learned as chunks. So sequences of words that frequently go together brush your teeth or three blind mice. Young children will use these correlations but say tooths or mouses in other context. So when we are saying this particular correlation or this sentence in this comment children will say teeth.

But in all other sentences they will say tooths and so this basically says that the learning is incremental in nature.

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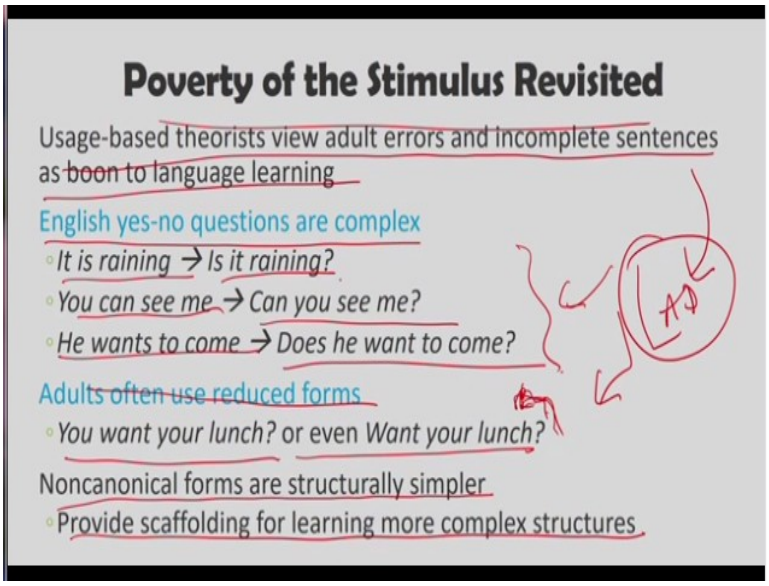

Now optimize of the poverty of stimulus argument in adults speeches filled with grammatical errors and incomplete sentences uses based theorist, do not disagree with the premise. But they argued that this supposedly fault input is a boon to language learning. So poverty of the stimulus revisited usage based theorist view adult errors in incomplete sentences as a boon to language learning.

English yes-no question are complex example it is raining is it raining, can you see me, he wants to come, does he want to come that kind of a thing. So a good example of this is the learning of yes and no structures which is quite common in English. The basic pattern involve inverting the subjects in auxiliary so that the statement, it is raining becomes the question is it raining.

So if we invert the auxiliary it is raining which is statement become is it raining which is now a question or you can see me becomes a question can you see me by just changing the auxiliary. And so this gives us an idea of how this as poverty of stimulus argument does not stand. Adults often use reduce form, for example you want lunch to even want your lunch as a statement.

And these basically explain the idea that the language acquisition derives the idea of language acquisition derives does not explain how sentences are learn by infants on the syntax of the sentence are learned by infants. Now noncanonical forms are structurally simpler provide scaffolding for learning more complex structures.

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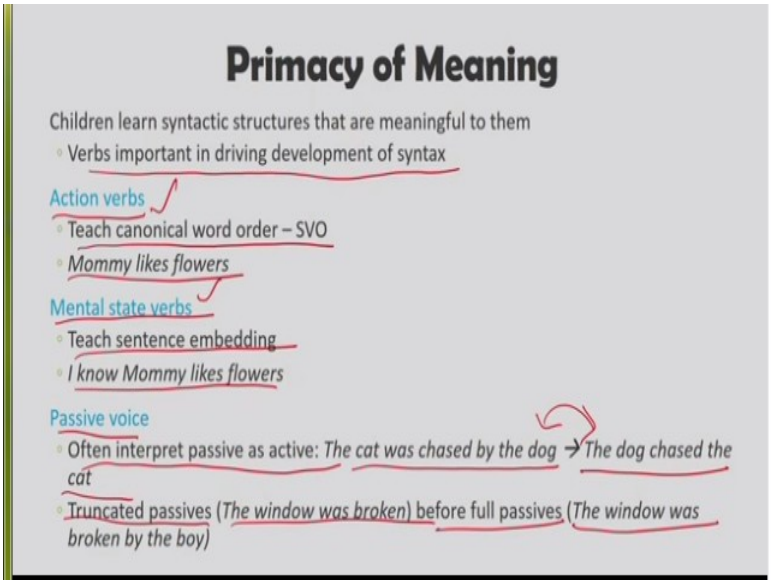

Primacy of meaning.

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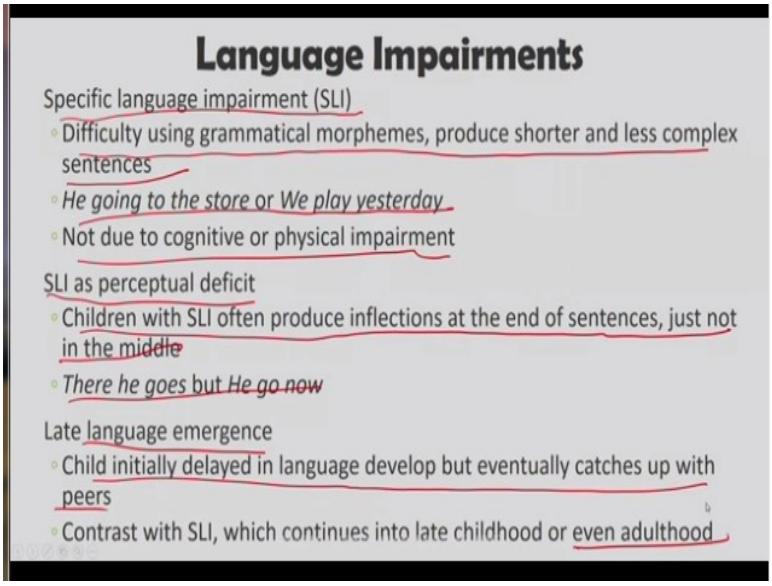

So basically children learn syntactic structures that are meaningful to them. For example verbs important in driving develop the syntax for sentence. So researchers working in the usage based framework emphasize that primacy of the meaning in the development of a syntax. Children's just do not learn patterns they learn syntactic structures that are meaningful to them, verbs are especially important in driving the development of syntax since it is a meaning that determines the structure of the sentence.

Now what kind of words can be learned we have action words which teach canonical word order for example the SVO in English for example mommy like flowers. We also we can use mental state verbs for example teach sentence embedding I know mommy like flowers. And so this kind of action verbs and mental state verbs are use and we can also use or passive voice is also another area of language development where we see a complex interaction between a form and a meaning.

Now children's ability to understand and properly use the passive voice develop slowly and it is not until around the 9 years of age that normally developing children can reliably use the passive constructions correctly. The meaning covered by a particular passive sentence influences how likely it is the children will comprehend it correctly. For example often interpret passive as active, the cat was chased by the dog was, the dog was chased by the cat.

But this is now how the passive active interaction happens, truncated passive for example the window was broken before full passive. For example the window was broken by the boy. Now the passive construction post the number of conceptual challenges for language users where the children or adults one challenge is the string tendency to equate subject with animate agents.

Especially for young children whose relying mostly on the meaning of the content word, to understand the meaning of the syntactic structures. Such sentences are difficult to process and do not even began to appear in children's speech until 7 or 8 years of age. Now another challenge which is post by passive construction is reversible sentences and so we have looked at reversible sentences, so we will not be focusing on that.

So these are the some of the things that explain how children's learn what kind of errors happen in children's learning of the syntax. Now there are several language impairments which are there specific language impairment SLI. It is a difficulty using grammatical morphemes producing shorter and longer complex sentences. He is going to the store or we play yesterday, not due to cognitive or physical impairment.

So SLI is basically a developmental disorder which is characterized by difficulty in requiring dramatical morphemes in the absence of other cognitive aspects. Now because English inflections and functions words are typically short and unstressed there are some debate about what specific language impairment is truly a deficit of syntax in problem or conception. SLI as a perceptual deficit, children with SLI often produces inflections at the end of a sentences, just not in the middle.

For example there he goes but he go now, is also important to distinguish specific language impairment from late language emergence which is a condition say what is late language emergence it is a condition in which the children are initially delayed in language development. But eventually catch up with a peers of children in initially delayed in language development but eventually catch up with a peers. And contrast with SLI which continues into the late childhood even adulthood.

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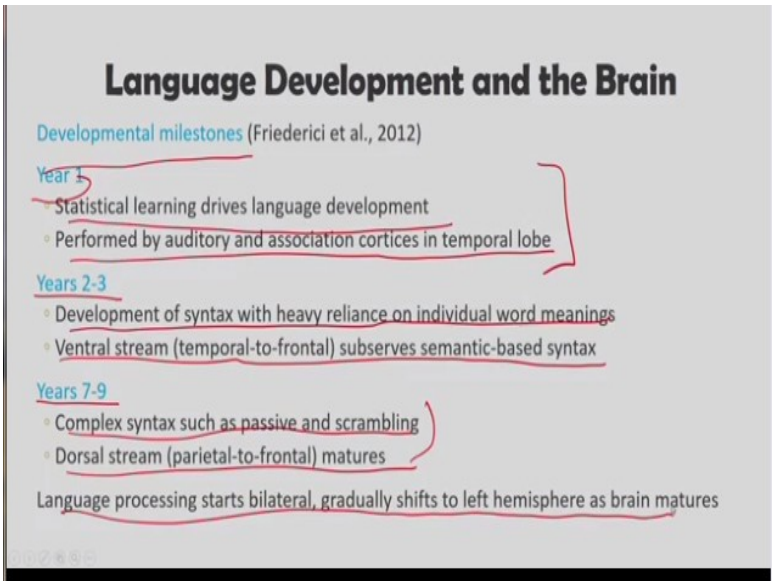

Now language development and the brain, let us look at little bit about how language development happens in the brain. So language development in childhood stands from changes in the brain structures during the first year of life for developmental milestones year 1, statistical learning drives language development performed by auditory association cortices in the temporal lobe. By year 2 and 3 development of syntax with heavy reliances on individual word meanings and ventral stream temporal to frontal subserves the semantic base syntax.

And from year 7 to 9, the complex syntax such as passive and scrambling and dorsal stream parietal to frontal matures. Language processing starts bilaterally, gradually shifts to left hemisphere **and the** as the brain matures.

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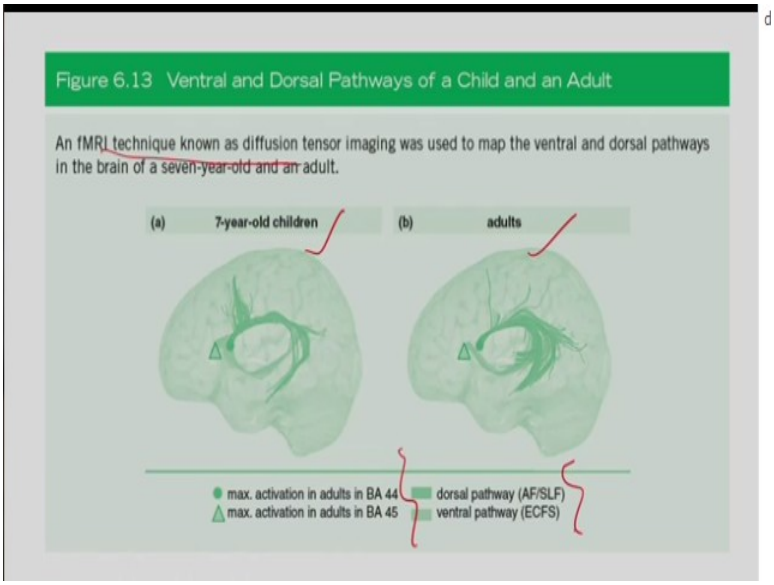

And so looking at this the fMRI study of a 7 year old an adult and as you can see these are the maximum activations of different area. So in all what we did today is we are looked at in today's lecture of how sentences are comprehended what are the various ways of how children learn syntactic structures, how syntactic structures are learn. As now the theory is which explain how syntactic structures are extracted out of sentences by children.

And some form of how language disorders the certain idea of language disorders happen in language. So we looked at not only at the sentence production in the brain, we also looked at how syntax acquisition or the idea of how syntaxes are extracted from sentences happens in language in sentence processing not only for adult but also for children.

And we also looked at how the language developed in both in the adults and children, when we meet next we will take another interesting topic and venture into that. And till we do that meet again, it is thank you and good bye from here.