Lecture – 08

Segmenting the

Speech stream

Hello and welcome to the course, Introduction to the psychology of language. I am Dr. Khurana, from IIT, Kanpur and we are, in the second week of the course.

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This week, we are talking about, development of language in young infants and children.

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This is the third lecture, of this, of this week. And in this lecture, we are going to, be talking about, one of the first tasks, that the child has to do, in order to, start learning language. In the last lecture, we talked about, the basic skills that the children would need, in order to start picking up, things from language. We talked about, perception and categorization of phonemes. Now, we saw, that perception and categorization of phonemes, is something that is, one of the most basic building blocks, of children starting to, understand or interact with language. We saw, that categorization of phonemes, is one of the basic abilities that, the children needed, in order to slowly develop an inventory of the sounds, that their mother language has and eventually, they will now be able to kind of, isolate these sounds, from the continuous. Once they're able to do so, that is, when they can move on to words and attaching, meanings to those words and then finally, creating longer sentences. We talked about, perception categorization of an image. This lecture, we will talk about, how these phonemes are, isolated or how these words are, isolated from the continuous, fluent, speech stream. Today, we are going to talk about, the segmentation problem.

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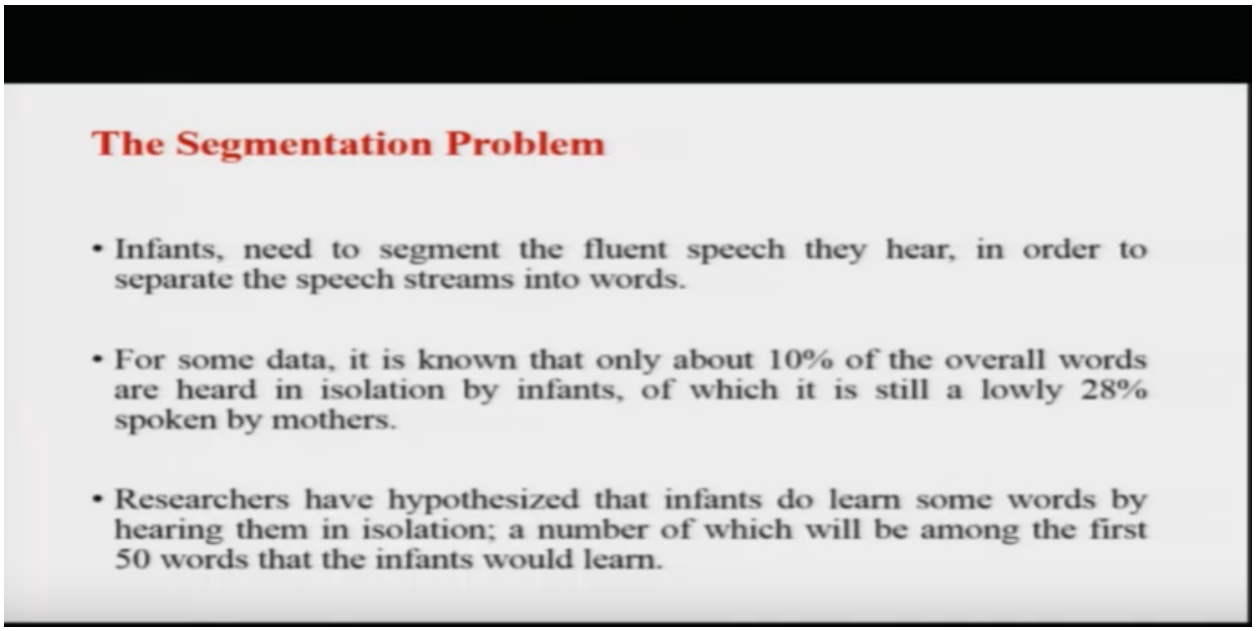

Now infants, do need to segment the few in speech that they hear, in order to separate the speech stream into words. They would need, to kind of know ,where a particular word is beginning ,where this particular word is ending and where is an beginning of the new word, where's the ending of this new word and so on. And so forth, again as I said in the last lecture, if you kind of think of this, as a trivial problem, try doing that, while you listening or while you're watching a movie, in a language that you do not know. Say for example, Chinese or your some of our Indian languages, Malayalam and Telugu, Tamil, anything. some of these languages, you'll still find, are easier to do so, because you can kind of rely on the pauses, you can kind of rely on the speaker's, actions, you can rely on say, for example, you know, the ups and down sin the tempos, in the tempo of the speech, so on and so forth. However, in today's lecture, we will see, whether and which of these, strategies are actually useful or say for example ,are actually employed by these young children ,in order to segment this, continuous, flow of speech, into meaningful small snippets, that are words .Okay? So, this will give you, a hang of this, for some data, it is known that only about 10% of the overall words, that the child hears are heard in isolation by them. Out of which on, about 28% of these words are spoken by the mothers. And the rest is by you know, different random speakers. So, it's not that, we are speaking to children, in isolated words and making life, easy for them. we talk to children, most oftenlyin, a very continuous normal speech way, obviously we talk to children in the, infant directed speech or the child directed speech manner, a lot, but still there those are continuous sentences, we do not talk to them, let us say, in telegraphic speech or we do not use a lot of isolated words so to speak .Okay? Researchers have hypothesized that infant. Or do learn some words by hearing them, in isolation. So yes, some of the words which we tell them ,in isolation, suppose we say, mama and we show mama or we saw show Papa or we show some food items, we show cats and dogs and some other toys, yes, some of these basic words, some of the first 50 words that the child would learn. Will have been learned by the child, in isolation. But, that does not explain, how quickly ,children can kind of master, the range of the words, the range of vocabulary that they do, eventually. Suppose they are not really listening,

all of the words that they learn, in isolation. Some of these words, they're obviously picking up, isolating from this continuous and fluent speech stream .Okay?

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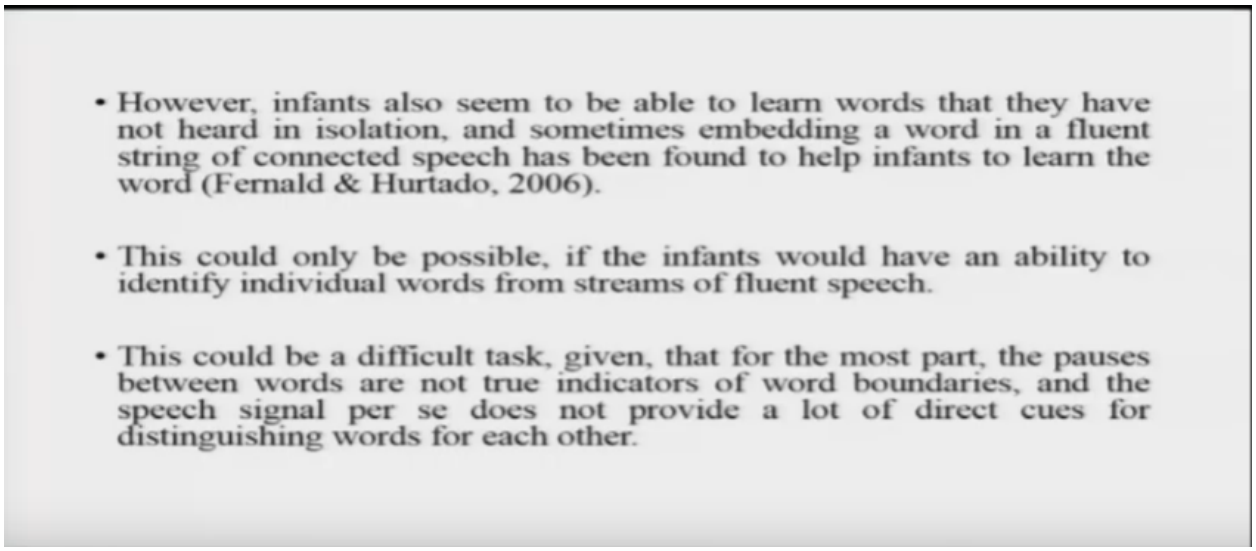

And this is what, the child has to achieve. Infants are it has been documented, there all this, also seemed to be able to learn words, which they have not heard in isolation. And sometimes, it has been reported ,that embedding a word in a fluent string of connected speech, seems more reasonable, seems more useful to them, as compared to speaking words, in an isolated sense. So this is also, one of the things. Now, this could only be possible, if the influence would have an ability, to identify individual words, from the streams of fluent speech, suppose you're kind of talking to the child. And you see mothers especially, what they do, is they're, in some cases, continuously talking to the child about something ,you know, they're narrating stories ,they are talking to the child about, what is let's say happening in the day, that you need to eat food, into that you become strong, so on and so forth. And they do it, in a very particular manner, in continuous speech, sometimes yes exaggerated in the Manor ideas or CDS exaggerated, but sometimes, also with, you see, now the child is paying a lot of attention to this, the child is kind of attending to this, in a very discreet ,in a very detailed, fashion, so as to pick up, where each word is ending and a new word is beginning and it does this iteratively, for whatever length of time, the child is being spoken to .Okay? So, this is what, that is one of the first challenges, that the child needs to figure out .Okay? so, this is obviously as I said, could be a difficult task, given that for the most part the pauses, so the kind of is, very interesting ,then the pauses, that speakers take, mother's or Father's or siblings or other agents in the environment, the pauses that we take, are not always very informative ,for the child to understand that, this is where, a word boundary lies .Okay? so, sometimes these, pauses are also not clear indicators ,of word boundaries, also some of the ups and downs, of the tempo of the speech also, can not be a very, reliable indicator of word boundary .so children, are kind of struggling, with this obviously, initially and then they , gradually pick up, some of these strategies and they gradually pickup, the way

that is needed to master these, boundaries. The master the ability of distinguishing words, from each other. In continuous speech, stream.

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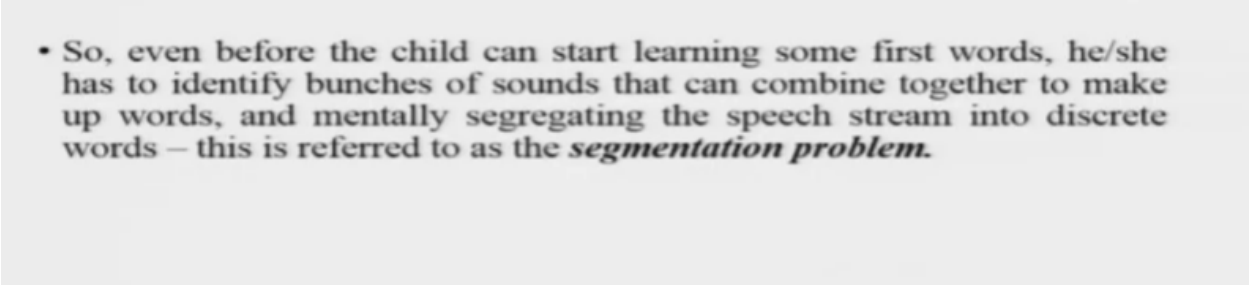

So, even before the child, can start learning some of the first words, he/ she, he or she has first to identify, bunches of sounds that combine together, to make up words and also need to, mentally segregate the speech, stream into discrete words. This is known, as a segmentation problem. And this is, one of the first steps of acquisition of ,language that we need to talk about.

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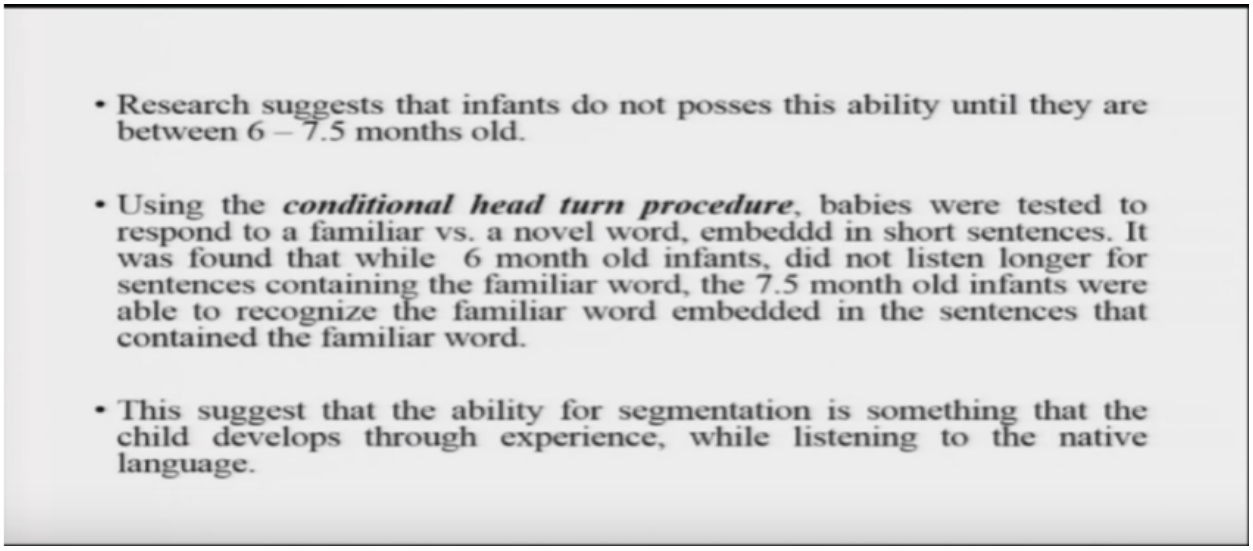

Now, research suggests, that infants do not possess this ability, until they are about, six to seven point five months old. Using the conditional head turn procedure. Now, let me pause here and tell you, what the conditional head turn procedure is? the conditional head turn procedure is one, in which the baby is there and there are two sort of beakers, on both sides and so both of the speakers, are kind of creating some sound, whatever the speaker produces a change, in the sound and the child kind of a Becomes are talking of slightly older children, I think it's by around three, three and a half months of age, that the child, you know learns to control the neck muscles and can move, the head to either side, so depending on where the in novel stimulus is there and where the stimulus changes occurred ,the child will kind of move, their

head slightly and start attending to that particular speaker, this is referred to as the conditional ,head turn procedure. Now, again this is, just a rough description of the paradigm. now ,using this conditional head turn procedure, babies were tested to respond, to familiar versus, normal words, which were embedded in short sentences .so they were habituated ,with a particular word and then that word, was embedded in some short sentences and the idea was, that if the child recognizes this ,habituated word or familiar word, the child will probably, prefer, listening to this. as opposed to, if the child, does not recognize a particular word, embedded in a short sentence, coming out from a different speaker, which I will not orient his attention or move the, head towards that particular speaker. So, the six month old infants were tested ,they did not listen longer, for the sentences that contains the familiar word ,telling us, that the child has not at this age, being able to isolate, the familiar word, from the continuous speech stream, on the other hand, the 7.5 month old infants, were able to recognize the familiar word ,embedded in the short sentences and they kind of oriented their head, oriented their attention towards, that particular speaker, that Hadley sounds. Telling us, that the ability for segmentation is, something that is, developing gradually. It's probably something that, is building up on the categorical perception, some of the other skills, that we've talked about, but it is not something, that the childish born with so to speak. It is something that, the child has acquired, with exposure to the native language and that, the child has acquired, obviously past, six months of age .Okay? So, this is something that ,I would like you to remember.

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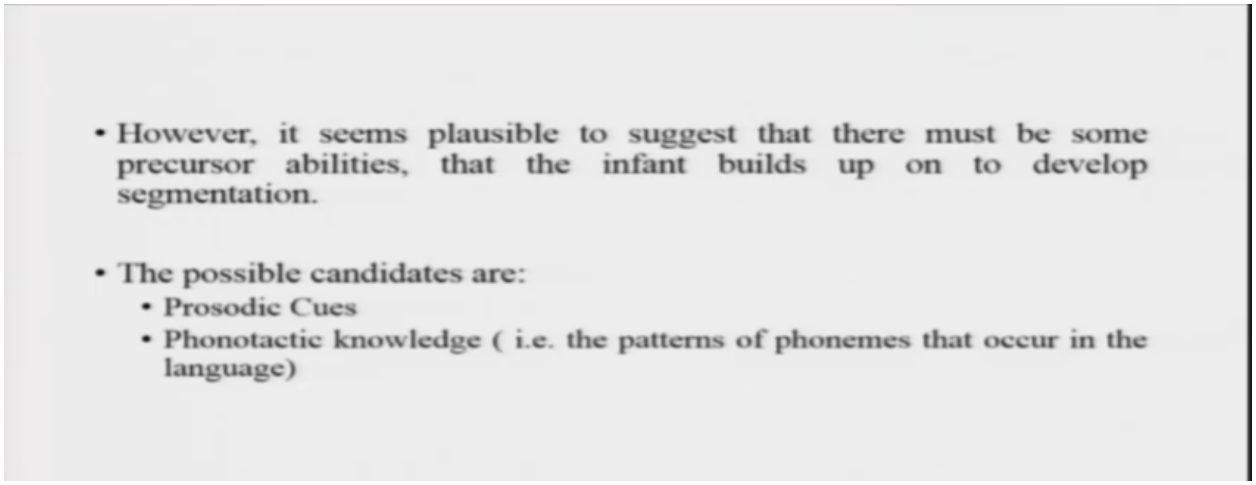

Now however, it seems plausible to suggest, that they must be some of the, precursor abilities, as I was saying, some of the abilities that are contributing, to the child being able to learn this capability. Some of these abilities, that basically are helping the child, to segment this speech stream, 2 candidates have been isolated, two candidates have been proposed. One is Prosodic cues , as we've been talking about, in some of the lectures. Also, the other thing is called,' Phonotactic Knowledge'. What is phonotactic knowledge? Phonotactic knowledge, is typically, the knowledge of ,what patterns of phonemes occur in my language. Say for example, in English there are no word, beginnings with the word GD, whereas in Polish, there are words that could start with GD, in English there ,are no words that start with BT or PB, so to speak .Okay? Or CK, so to speak. But, say for example, in some of the other languages, these could be valid

phoneme combinations. So the child, with exposure to the native language, has to figure out, which are the permissible phoneme, phoneme combinations, in my language, versus which phoneme, phoneme combinations, are not permissible, in my language .Okay? So, this is what the child has to figure out, now let us, come to this first example, in more detail first.

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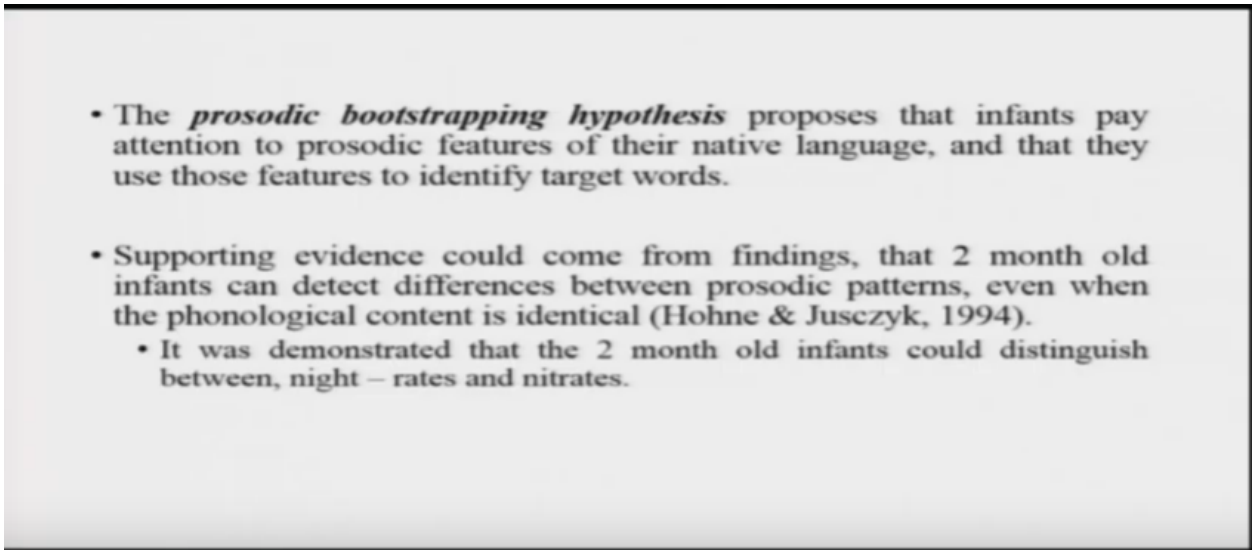

The prosodic cubes, there is something known ,as the prosodic bootstrapping hypothesis. And this prosodic bootstrapping hypothesis, proposes that infants pay attention to the prosthetic features of their native language, and by paying attention to this, they use those features to segment, the speech stream, into words .Okay? And supporting evidence is there, supporting evidence comes from findings ,wherein it has been shown that, even two month old infants, can detect the differences, between prosthetic patterns, even when the phonological content is, exactly the same or very similar .Okay? In a study, it was demonstrated, that two month old infants couldn't distinguish, between nitrates and nitrates .Okay? If you could, detect, a difference one is night- rates and the other is the chemical compound, known as ,nitrates nitrates. Okay? Infants, even two month old infants, can actually distinguish between nitrates and nitrates. Okay? And this is, basically, if you see the phonological content, is exactly identical, only the prosodic content, is slightly different, so children are obviously paying attention to the prosodic information here, and they are, being able to use this, in order to distinguish, the night from rates .Okay? Or in different other words, I mean, there’re so many examples, that you can ,think of .

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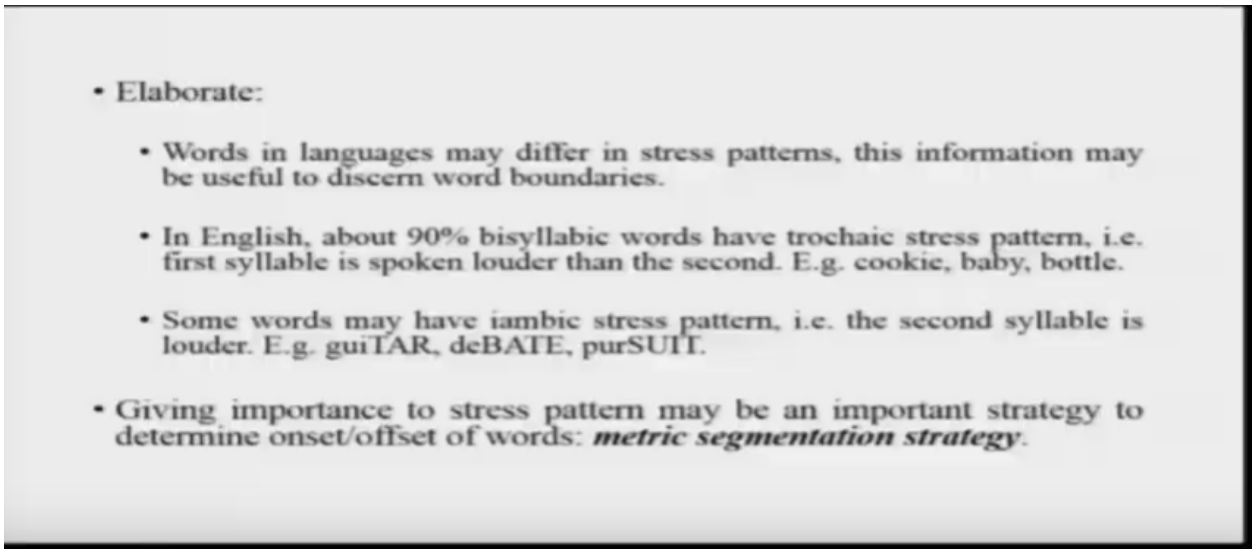

Let us, elaborate on this. So, words in languages obviously differ in their stress patterns. And even and different kinds of words, within their languages, also differ in the way, they are produced by way of stress patterns .Okay? so, this is a very important information, say for example, in English, about 90% of the by syllabic words, have what is called the,' Trochaic Stress Pattern'. What is Trochaic Stress Pattern? the Trochaic Stress Pattern, is where the first syllable, is the one, that is more stressed ,where the second syllable is slightly weaker. So, strong, weak. So, for example babe. Okay? Babe, is more stress and beings lightly lesser stressed. Bottle, bottle bot is more stressed, till is less stressed. You know cookie, party, any of the words, that you can think of, 90% of by syllabic words, which have two syllables ,have the same makeup .Okay? these are referred to as words having, crocheting stress patterns, 10% of the words also, however, have the opposites tress pattern, that is referred as the iambic stress pattern, wherein the first syllable is weaker and the second syllable is stronger .say for example, debate, guitar, you know, pursuit. so the first syllable you'll see here is weak, the second syllable here is stronger. So, in all the by syllabic words, that English language has, you will find that, the Trochaic Stress Pattern is more common, as i said, around up to 90% or more ,where is the iambic stress pattern, is much less common. So it's, about 10% or less. Now, children if they are paying attention to this stress patterns, they will probably be able to figure out, the word boundaries of the words, going by, say for example, if there is high stress, low stress word boundary. High stress, low stress word boundary. Something like that. Okay? This strategy of using stress patterns, to distinguish between words of a language, has been referred to as, the matrix segmentation strategy. So, using stress patterns, as in strategy ,to determine the onsets and offsets of syllabus, has been referred to as the metric segmentation strategy.

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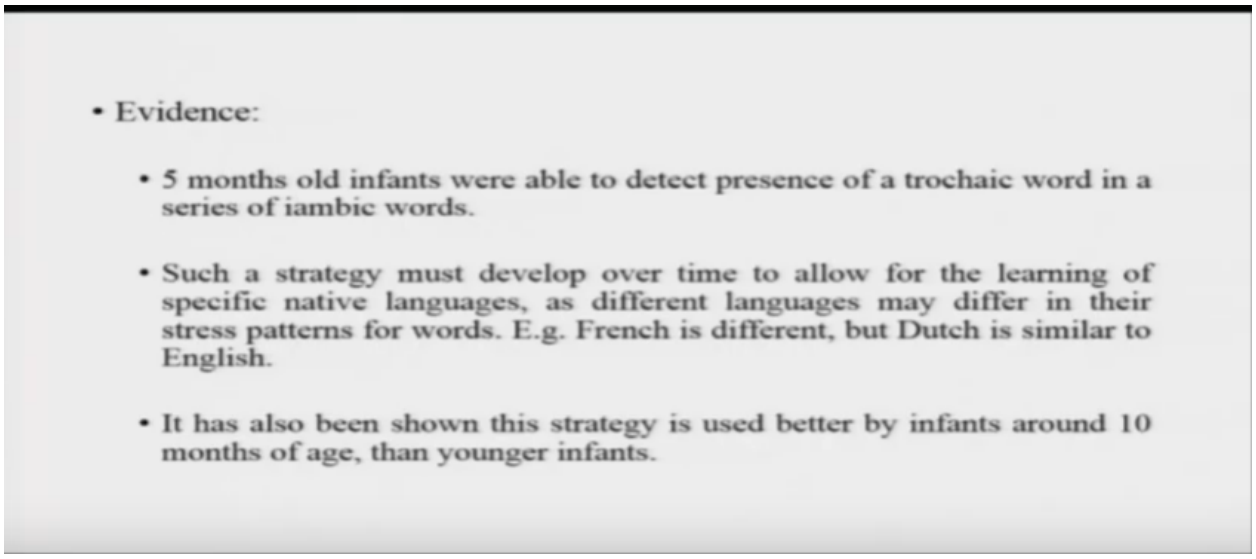

And it has-been proposed, that infants use the metric segmentation strategy, to segment, continuous stream of speech into words. Okay? That's what, there is, now is there, any evidence for this, do we see this, happening a lot of times, yes. Five month old infants ,they were able to detect the presence of a Trochaic word, in a series of iambic words. So, if you present them, a series of iambic words, say for example, again going to the same, guitar, debate, pursuit and party. They will be able to distinguish party very quickly, from this series of, iambic words. So, obviously are paying, a lot of attention to stress patterns. Now, such a strategy, obviously develops over time and it, allows for the learning of specific native languages, that the child gets exposed to, as different native languages ,have different, kinds of stress patterns in them or different distribution of stress patterns in them, what the child probably does, is that child kind of picks up, the most canonical stress patterns, in the in his or her own language and kind of starts using that, as a useful strategy, to start making sense of their language. this could also be usefull, say for example, if the child has to pick up ,a language that is, similar, as far as, the stress patterns are concerned. it has-been, shown say for example, younger infant from French-speaking families, find it very difficult to pick up Dutch, but younger infants from, Dutch speaking families, kind of find, it easy to pick up English. Because, both of these languages are very similar ,with respect to stress patterns .Okay? So, the same strategy can be, employed to pick up verse, from the other language ,as well, whereas because the stress patterns in French and English ,of French and Dutch, are so different the same study, will not really, apply across the two languages .Okay? so, it has been shown ,you know ,that this strategy is ,obviously being used by children. Also, it has been shown that, the strategy is better used by infants around 10 months of age, but not, so well used by the younger infants, so it is again something that, we can say that is happening slightly later, children are picking this up, but slightly later .Okay?

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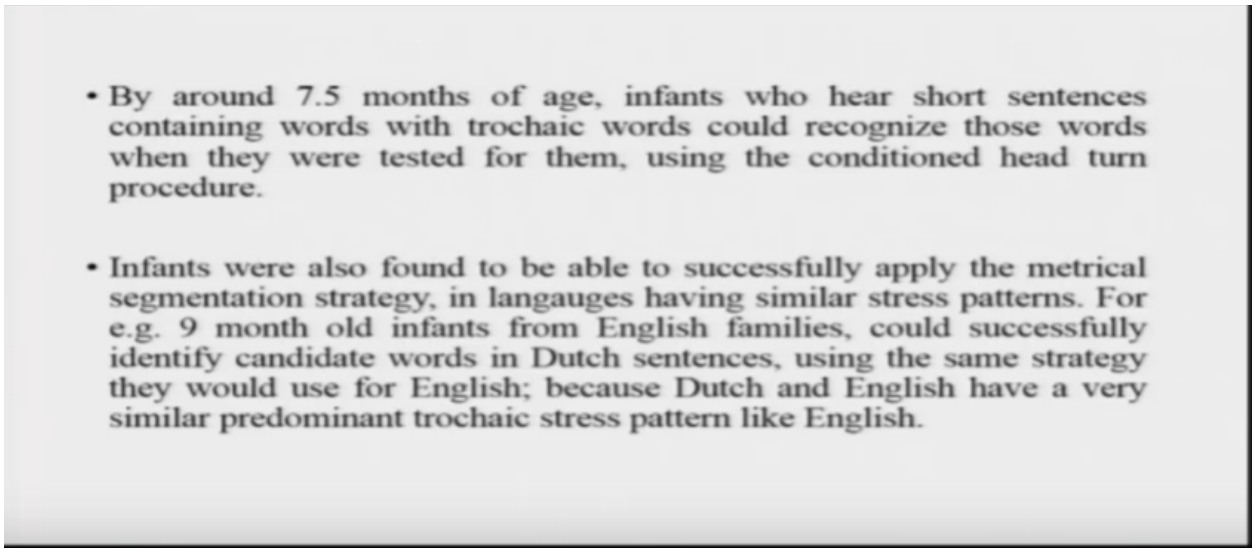

So, by around 7.5 months of age, infants who hear short sentence, containing words, with Trochaic words, could recognize those words, when they were tested for them, using the condition headstand procedure. infants were also found to be able to successfully apply ,the metrical segmentation strategy ,to a different language, having similar stress patterns, is something that I was describing already, nine month old infants from any speaking families, could successfully identify candidate, words in Dutch' sentences, using the same strategy as they were applying for English .Okay?

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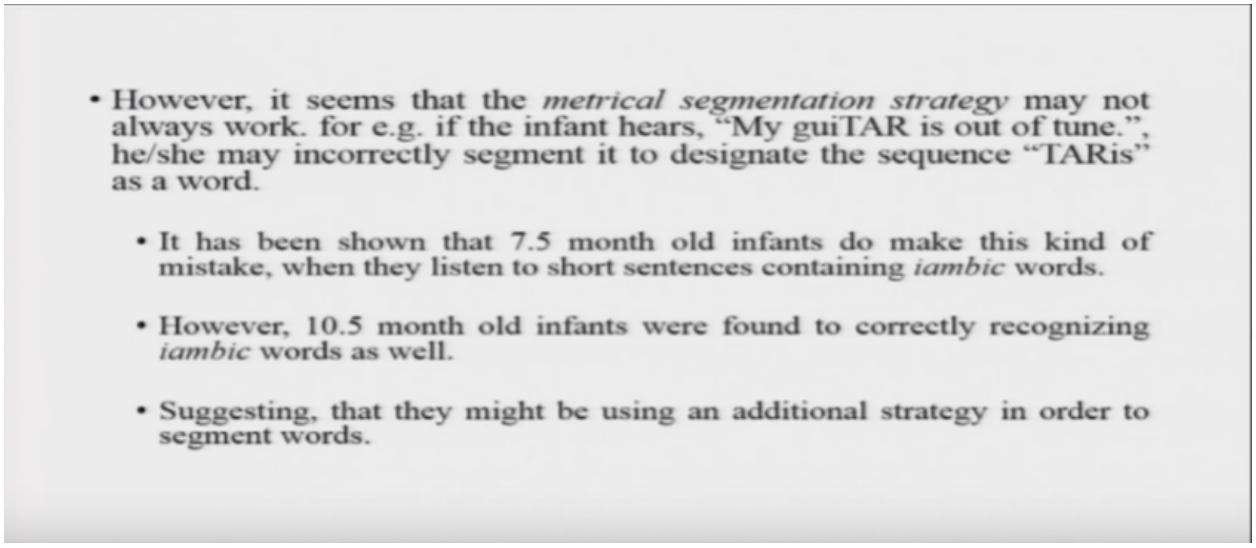

So this is, obviously some evidence, for the fact that material segmentation strategy, is useful and is also used, by children ,at around nine to ten months of age. Now, it is not really, there that the material segmentation strategy, is a hundred percent successful strategy and it works all the time. Because, for

example, if the child hears, a sentence likes this, ‘My guitar is out of tune’. if the child is following the metrical segmentation strategy, he would probably segment ‘TARis’ as one word. Because, tar hype I stress and then is gnosis, the child probably paid, club, TAR is together, as to say that, this is a valid word in English. But, we know that it is not, so in cases where the child will, encounter iambic words, this will lead to a particular problem. But, we see, that by seven point five month old infants do make this kind of mistake, around ten point five month old infants do not make this mistake, so much, they very successfully classify ,the iambic words also, which tells us what ? Which tells us, that there might be an additional strategy that the children are using, in order to segment words, from the speech stream.

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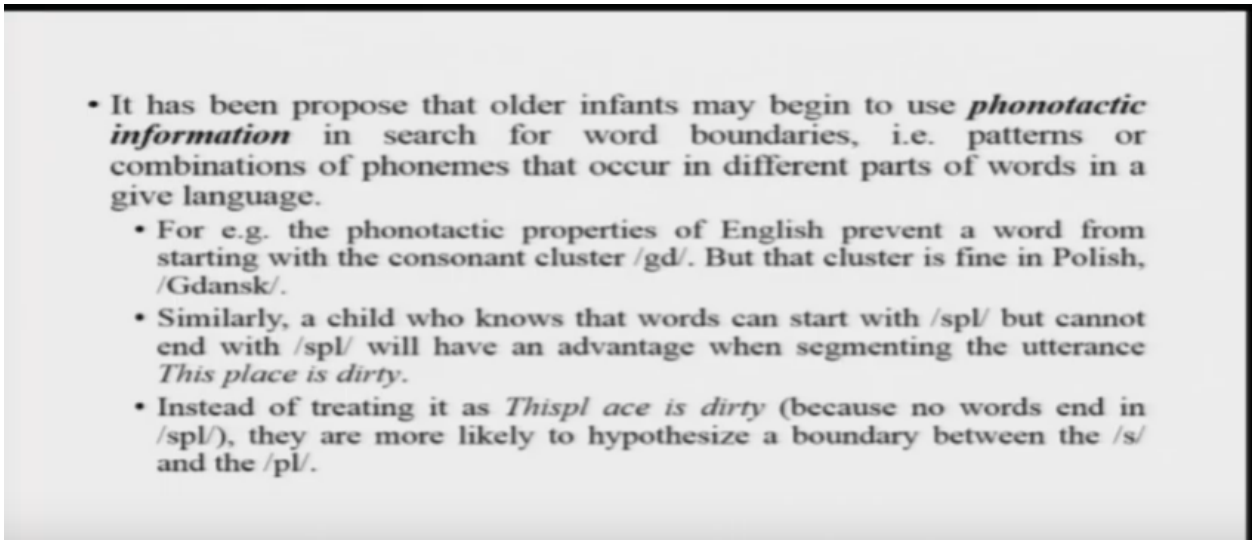

Let us, look at, what that strategy could be. The other strategy, is referred to as ,the strategy of using phonotactic information. What is phonotactic information? Phonotactic information, typically is as I said earlier, it basically is information about the patterns or combinations of phonemes, that occur in different parts of the words, in a given language. Let me give you, an example, the phonotactic properties of English, prevent word from starting with GD,PB,PT so on and so forth. But, in other languages, some of these things, might be equally plausible, so the knowledge about, what word beginnings are valid versus? What word beginnings are not valid versus? What word endings are valid in? What word endings are not valid in? My language, is typically having phonotactic information about my language. Now, suppose a child has been exposed to this sentence, this place is dirty. Okay? If the child kind of knows, that there are no words endings with Pl, the child will, not make this mistake, of putting, this pill together and ace is ready together, even though, if you really listen to this, this place is dirty. so this will, kind of fun logically speaking probably could come together, but that does not really happen, children do not make this mistake, because they know, that PL is not really a bonafide word, ending. Okay?

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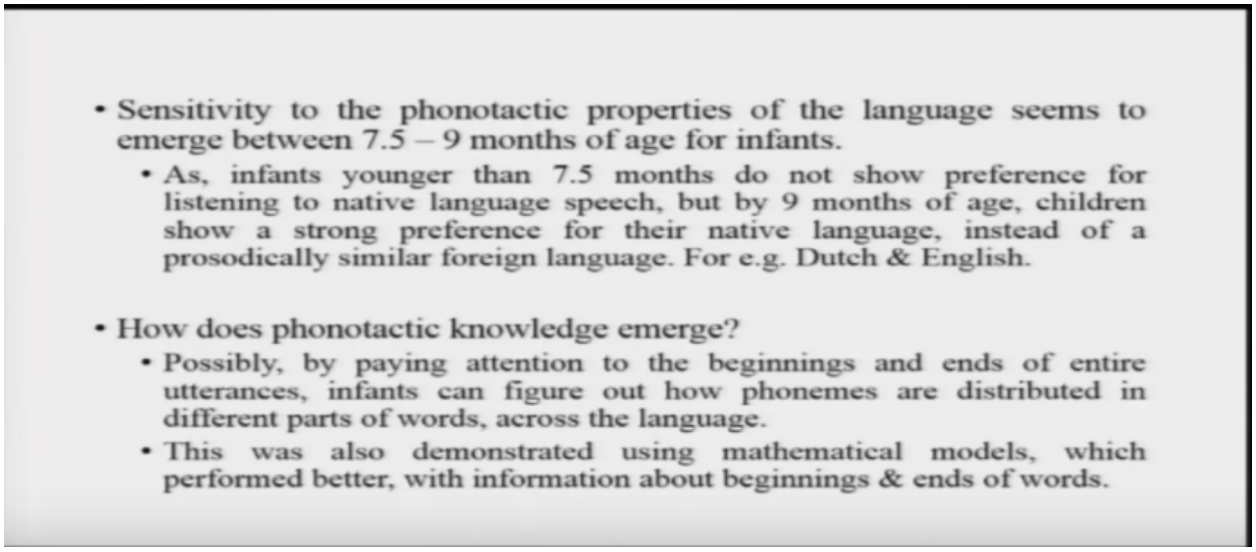

So, moving on, to some more research findings. So, sensitivity to phonotactic properties of language, seem to emerge, somewhere around seven point five months of age to nine months of age for infants. so as, infants younger than 7.5 months, do not show, preference for listening to native language speech, but by nine months of age, children show a strong preference for, listening to native language, over one, that has a, instead of a prosodically similar language. Say for example, English-speaking children or Dutch being children, they do not, prefer listening to either, English or Dutch. Which is not their native language, even though they are prosodically very similar, they show a person for, a preference for, listening to their own language. So at some point, we are saying that, they are kind of making, an additional qualification to the decision, than just Prasad. If they were, taking the decision solely based on Prasad, it would not matter to them, whether they are listening to English or Dutch. Because, they sound very similar, however they kind of know, that there is a distinction between 2 Prasadkaly similar languages, which means, that they have access to some other information, as well and that access could be, the access to phonotactic information. Now, we could wonder, that vary from does this phonotactic information emerge, where from does this phonotactic information come from? How is the child figuring this one or tactical information out? Now, a lot of things have been proposed ,one of which is that by paying, attention to the beginnings and ends of entire utterances ,infants can figure out, how phonemes are distributed in their native language .so, as I said, in the beginning as well children are paying a lot of attention, to whatever they are listening to from speaking agents around them, the mother, father, siblings, so many of the, you know, agents are around them and because, they‘re paying attention to these utterances, to whatever is being said, so discreetly, in such a detailed manner, they can kind of get some information, collect some information, about beginnings and endings, they would know that. Okay? This probably is a word beginning and this probably is a word ending and also, you know, you combine that with some of the prosodic information that is probably also something that might be helping .Okay? And they tested this proposal, out with mathematical models, models that were basically given, the task of you know, segmenting a speech stream into words and at that point the, models were, when the models were informed about the offsets in on sets. Now, the models performed better, so it kind of ,makes sense that the children might also be used in some of this phonotactic information, to segment the speech .Okay?

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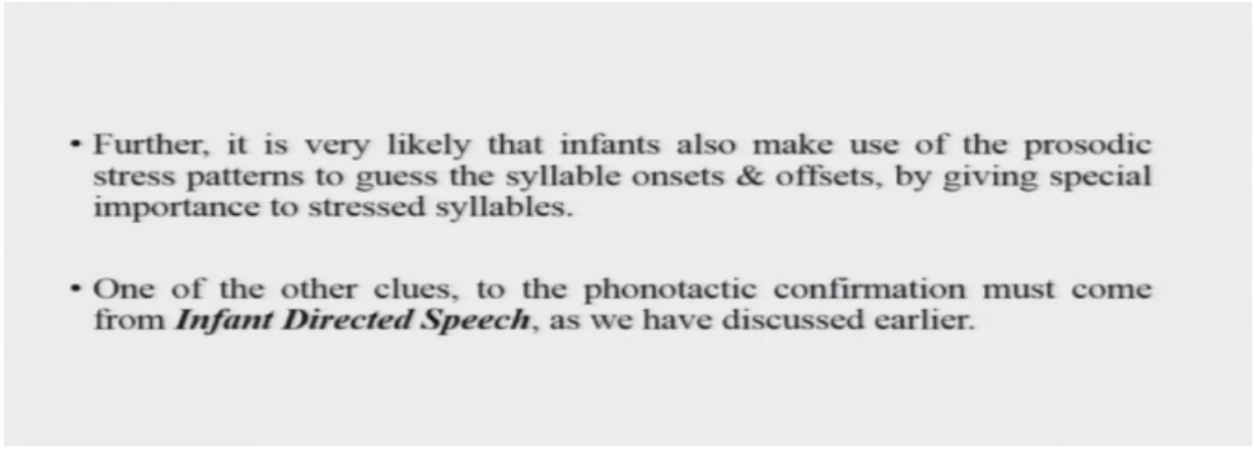

Also, it is very likely as I was saying ,that infants make use of the prosodic stress patterns ,to guess the syllable, offsets and on sets, by giving special importance, to stressed syllables. Suppose, say for example, they notice the stress variations between crochet can I make patterns, I am make words and they use that to kind of figure out .Okay? this must be the word beginning ,this must be the word ending and so on and so forth. So, both of these things together, might kind of help them, figure out some of this phonotactic information about their language. another candidate, another a clue, that has been proposed, as important in understanding, the phonotactic information, is that of infant directed speech, if you remember in one of the in the first lecture, of the week ,I talked about the importance of child directed speech or infant directed speech and I also highlighted some of the, interesting features of the, infant directed speech, I said that,

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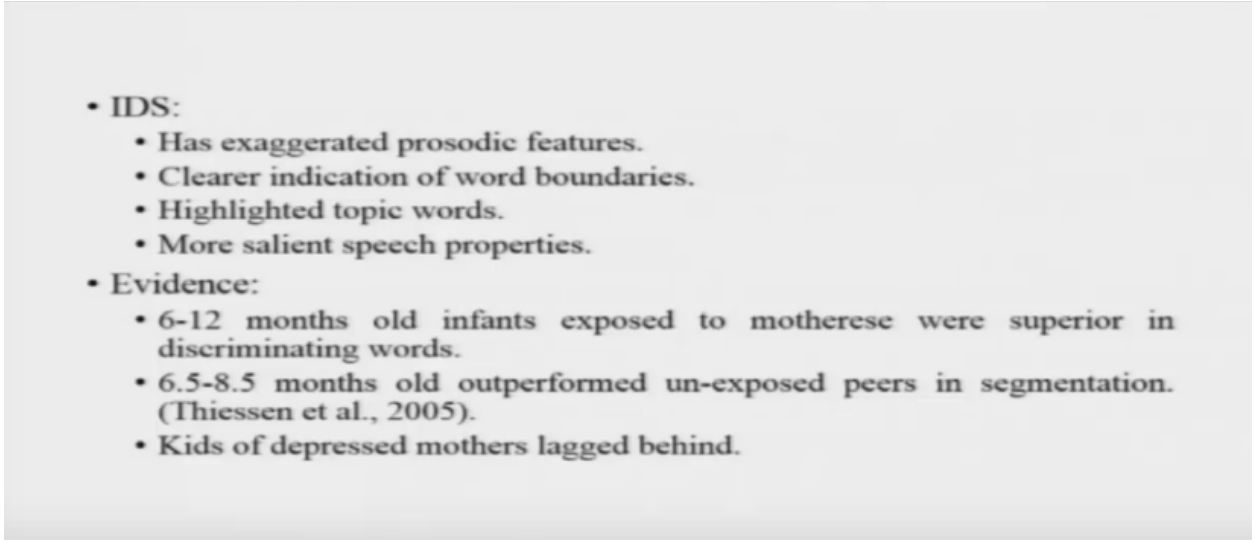

you know, they have exaggerated prosthetic features, they give clearer indication of word boundaries, they highlight the topic words, they use shorter sentences clearer words and they have more salient speech property. So, I said all of that and I said, that this might be, helpful to the child in some way, it was a kind

of giving the child, a sort of practice already, you know giving the child a sort of practice, with how adult language works, what added language sounds like, what are the patterns in the adult language. Now, it has been proposed, that infant directed speech, could be a very important clue or could be a very important practice board, so to speak for the child, to be able to discriminate, these things. Okay? So, there is also evidence for that, that the child kind, of prefers listening to, infinity liquid speech. So, say for example, infants between six, to twelvemonth olds, who are exposed to infinity directed speech, were found to be much more superior in discriminating words, as compared to infants that were not exposed. similarly another study, six point five to eight point five month old infants, outperformed peers in segmentation. Because, they were x given even more practice of infant directed speech. on the other hand ,in a different kind of an example kids, of mothers who were depressed, were not really able, to perform segmentation very well and they, lagged behind their peers, in this segmentation of speech, problem. because, apparently they ,were not really getting a lot of infant directly speech, on the mother. you know, it's hard to see, say for example, alcoholic or depressed mothers, because they, do not probably interact with the child so much, they do not speak to the child ,in this child directed speech, in this funny or strange language and because the child, mother does not interact, with the child so much, obviously it will have emotional and other consequences, but one of the important consequences is, that the child does not get enough practice in segmenting speech. Because, the child isn't getting practice in segmenting speech, the child is obviously lagging behind, its peers, in acquiring this scale, at a particular time.

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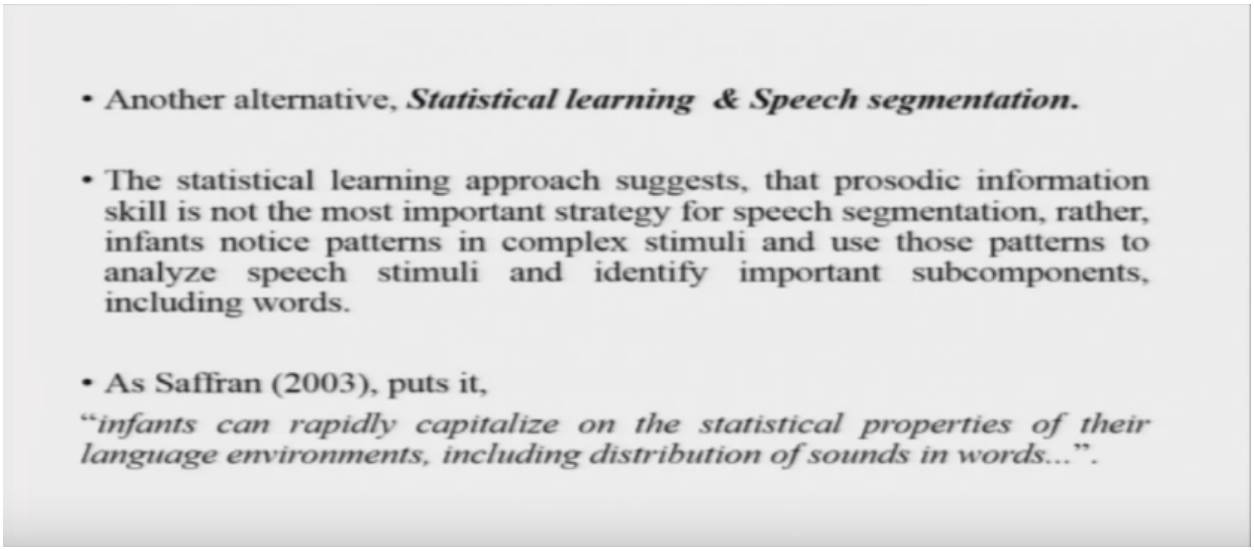

So, this is, is again a very, very important aspect. Now, these three they're, another they could be a completely different, alternative to how children are segmenting speech stream. Okay? So, there is this hypothesis, this is referred to as the statistical learning hypothesis or the statistical learning approach, which suggests, that you know prosodic information or four tactical information or even learning to isolated words, is probably got little or nothing to do, with how children are ,eventually going to segment speech. it probably basically, what is happening is, that children's, are noticing complex ,some of these patterns in, the complex stimuli that, they are exposed to and it is these patterns, that they are being able to isolate and they are being able to use these, patterns to analyze, the incoming speech stream, when they

use these patterns to in, analyze the incoming speed stream .this is how they get to analyzing and reaching to words. Okay? So, Saffran who was the pioneer of the statistical learning approach, as far as language acquisition is, concerned puts it in a way where he says, the infants can rapidly capitalize, on the statistical properties, of their language environments, including distribution of sounds in words. any kind of he's done a lot of work is conducted, so many experiments, in demonstrating, how and, how well, children are using statistical information, in order to achieve the segmentation of speech, which is on the foundational features, of foundational skills, in acquiring language. So, let us, look at some of his experiments.

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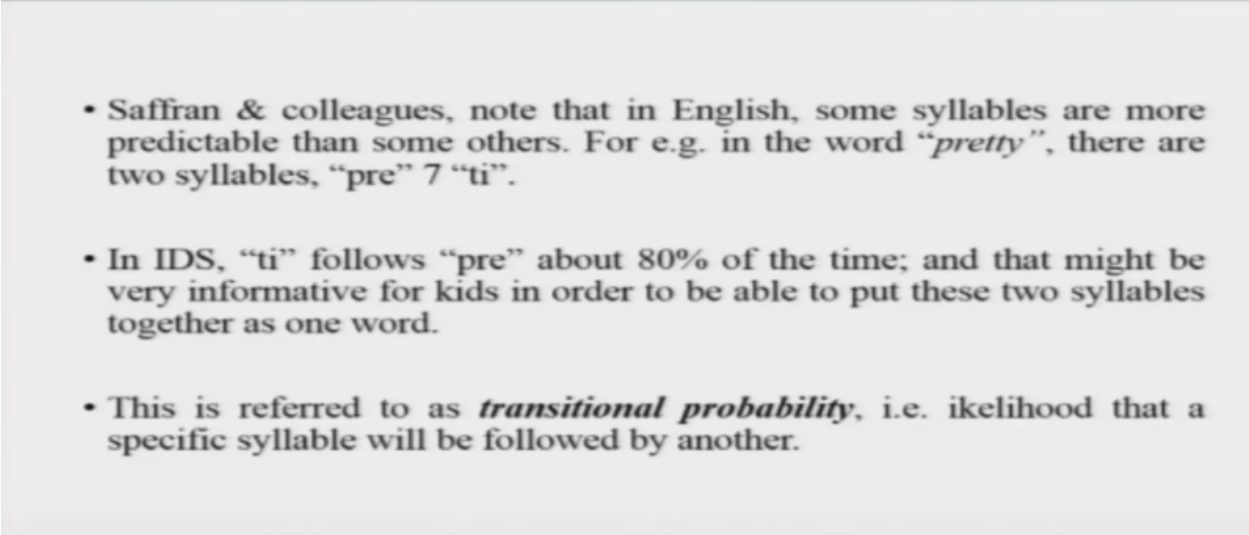

So saffran in colleagues, in around probably1996. Actually that is a different incidence, saffran and colleagues, kind of note that in English, some syllables are, definitely more predictable than some others. So, say for example, they note that the word 'pretty'. If you look at, pretty, it has two syllables pre and T. Okay? in infinity ,rectus speech, whenever you talk about, whatever we talk about, if the word pretty comes, the T follows pre almost, eighty percent of the time: with 80%accuracy a child can guess, that if pre has been said, it is going to be followed by T .Okay? What it really does, is it kind of providers, the infant, with this information, of the likelihood ,that this specific syllable ,will be followed by, this specific syllable and as soon as this specific syllable, is delivered ,the child says .Okay? This is my word boundary. This is how, I will be able to now ,distinguish words from other words.
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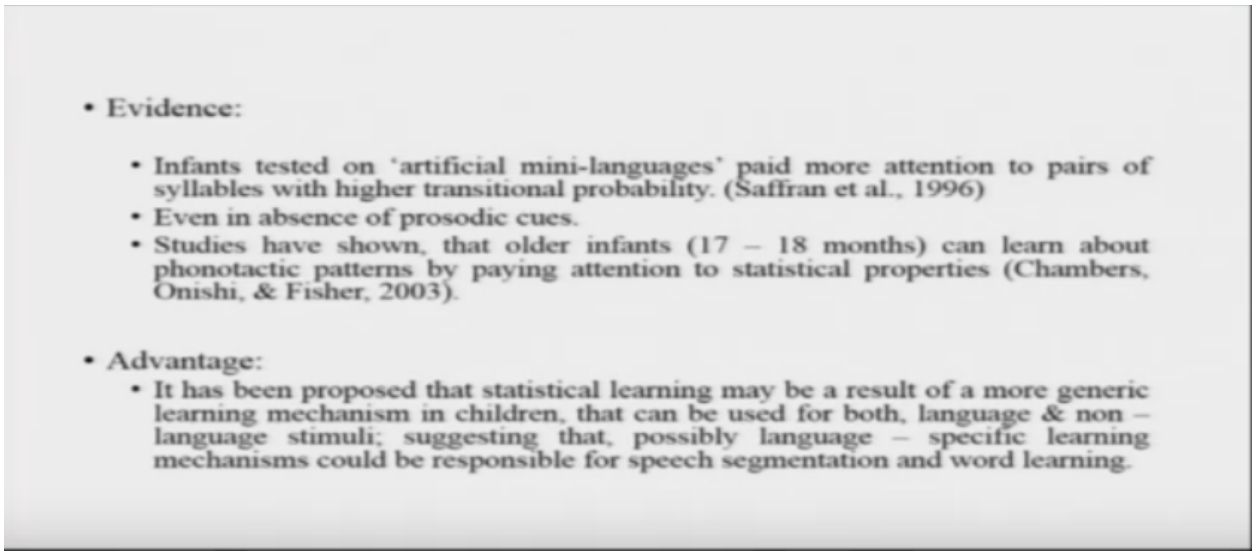

And discreetly chopped this speech stream, into discrete words, ok. so this, is what the statistical learning hypothesis says, obviously they have done, a lot of experiments and they have enough proof, for this as well. Say, for example, I was talking about this study earlier Saffran 1996. So, Saffran in1996, devised a way of testing, whether children are actually paying attention to these transitional probabilities, they created these nonsense, phonemes, they created these phonemes and they combine them into nonsensical patterns, so if I remember correctly, pop, they were, they'd, be, cootie, bureaus, you know and some, some others they were probably for such, verse that were made above these for you know phoneme's which didn't really mean a lot, but they were always occurred in such a way ,that who, the child will be able to, gauge the transitional probability, of these particular phonemes. So, Bobby, Cote,Budo, guava or whatever, like that and the thing is Bobby, K uh, so pal, after this becomes and then Kuh comes. So, this transitional probability is made, is preserved and then there could be other word, the other word could be happening here, or here anywhere, but Bobby coo, this transitional probability is preserved. Now, what happens is, they tested, the habituated children or this and then they, emitted this into regular speech streams and they wanted to test, whether children will pay attention, to any of this, it was found, that children did, pay attention to these words, having these kind of transitional probabilities, which told us that obviously children, arousing some these transitional probabilities, in some sense. in other studies, they also tried this out, in absence of complete Prasad cues, i mean, in this study also this was because artificial language, was generated, this whole segment of speech were created with, an artificial speech synthesizer, so you see that, there is no prosodic cues, to help the child ,but still the child is being, able to figure out these, familiar words, just on the basis of transitional probabilities .Okay? so, this and there are other studies, which have shown, say for example, that older and17 to 18 months old ,can learn about the phonotactic patterns, by paying attention to these statistical properties. so we know, that this is also, one of the techniques that the child, is using, an advantage of this technique, the advantage of the statistical learning approach or the statistical learning hypothesis, could be, that it can be used as a more generic sort of a learning mechanism, which is probably being used in language, learning or in other kinds of learning as well. This can be something that, the human beings or children, are using generically, to acquire all sorts, of different skills. Okay? which also at the same time, tells us, that probably nothing, in this sort of

a way, needs to be innately there, the child will kind of pick up these statistical patterns and we'll pick up the segmentation, of the words and we move, similarly.

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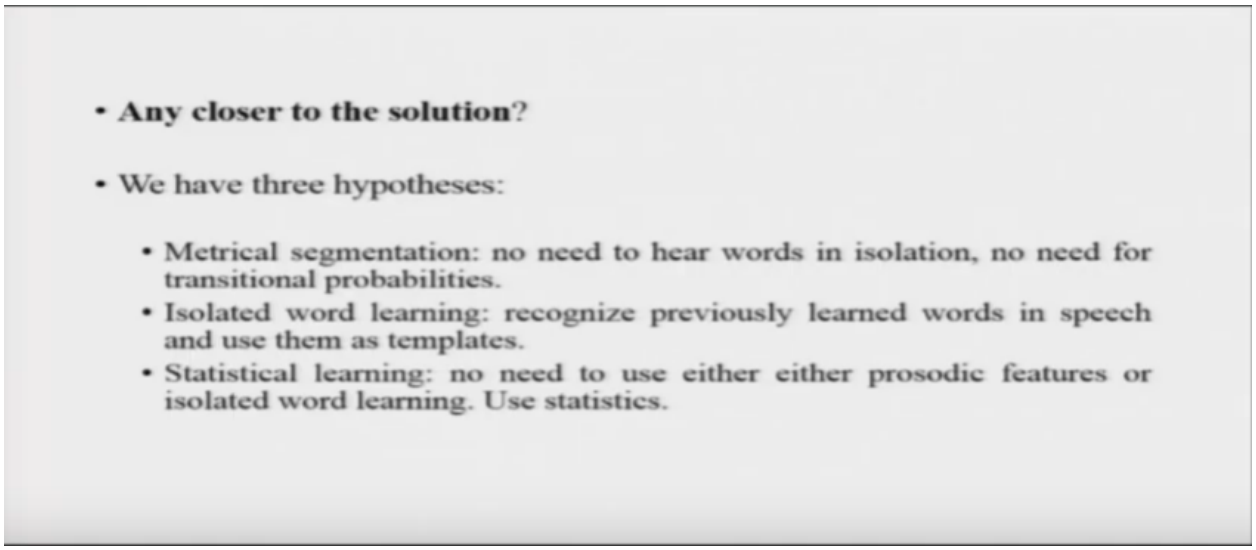

So, are we any closer to the solution, of the segmentation problem. let us say, let us look back, what do we have, we have the metrical segmentation strategy, wherein the children are ,kind of you know attending to the prosodic pattern, stress patterns. so to speak, with the isolated word learning strategy, basically, where the children are recognizing previously learned words, in speech and they use those words as templates to figure out, similar words. And then, we have the statistical learning strategy or statistical learning hypothesis, as you may call it, which says, that there is no need to either use, isolated word learning or to use respond us or anything, this use thestatistical distribution, information and that will be able to help, the children, you pick up, the skill of segmenting the speech stream, into meaningful words .Okay?

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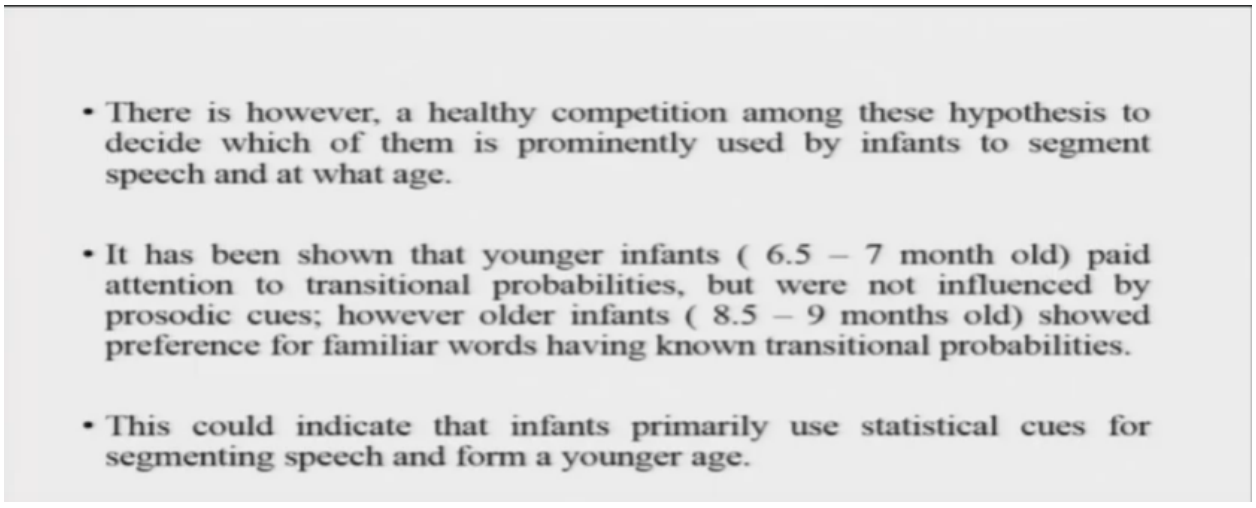

So, let us see, so all three of them are here and there is a healthy competition between these three and all three of these are kind of in, in that sense competing as to what is used more? And what is used earlier? Because that could be an answer as to how, children are actually acquiring language it has been shown, that younger infants six point five to, seven month old infants did, pay attention to transitional probabilities but, they were not influenced by prosodic changes, they are not influenced by prosodic cues, however, older infants 8.5tonine months old and older they showed preference for familiar words, having known transitional probabilities. So, they basically are kind of being able to use, some of these skills in an older age. Okay? This could kind of tell us, this could inform us that infant probably primarily, you statistically cues, for segmenting speech and they do it from a much younger age .Okay? So, this is there, should this kind of wrap up the debate for us, before we do that

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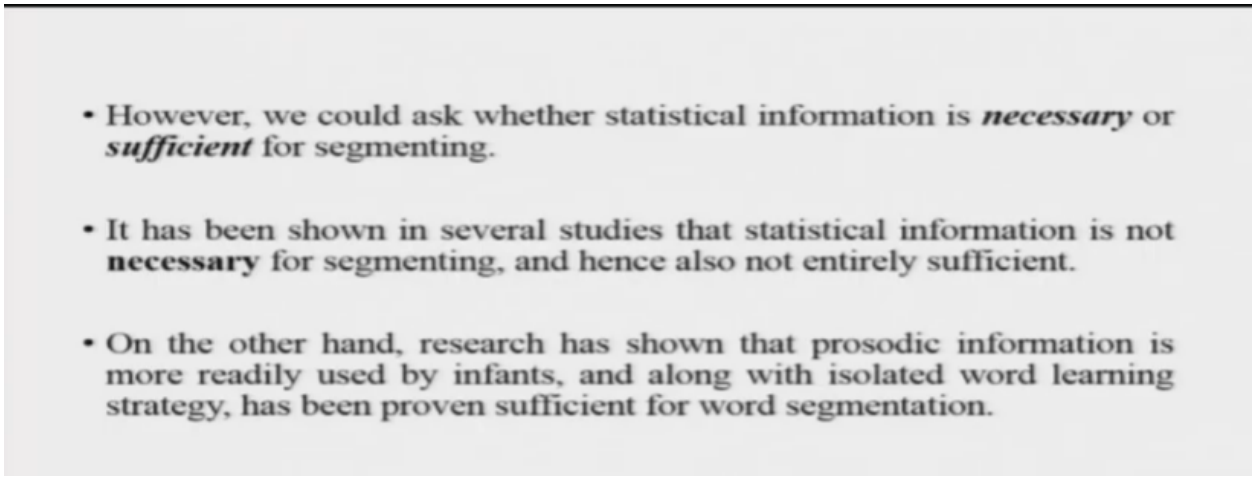

Traxler kind of puts this, two categories these two tests, to the strategy and asks, whether a particular mechanism is necessary is it, in itself, most important that unless this is there no segmentation of speech is possible or it is sufficient, this and this alone can guarantee, successful segmentation of speech. So, the two questions are whether one of the mechanisms is sufficient or is it necessary and unless it is, necessary it can also not be sufficient. So, we kind of look at it, once you look at some of the other studies that have been done, it has-been shown, that several studies, have shown that statistical information is not necessary for segmenting, even in absence for statistical information by way of transitional probabilities Chillan, have been able to segment speech, into words which tells us, that because it is not necessary in the first place it cannot be obviously sufficient to do, segmenting a speech as far as, the other two are concerned crow said information and isolated word learning strategies, they have proven sufficient for children achieving word segmentation, speech segmentation into particular words. So, that is, sort of a trade-off there, which kind of tells us that .Okay? And there are these three strategies and one of these and children use, a combination of these strategies, statistical learning strategy is probably very important but, it's not either, necessary or completely sufficient by itself ,to explain how children segment words .Okay?

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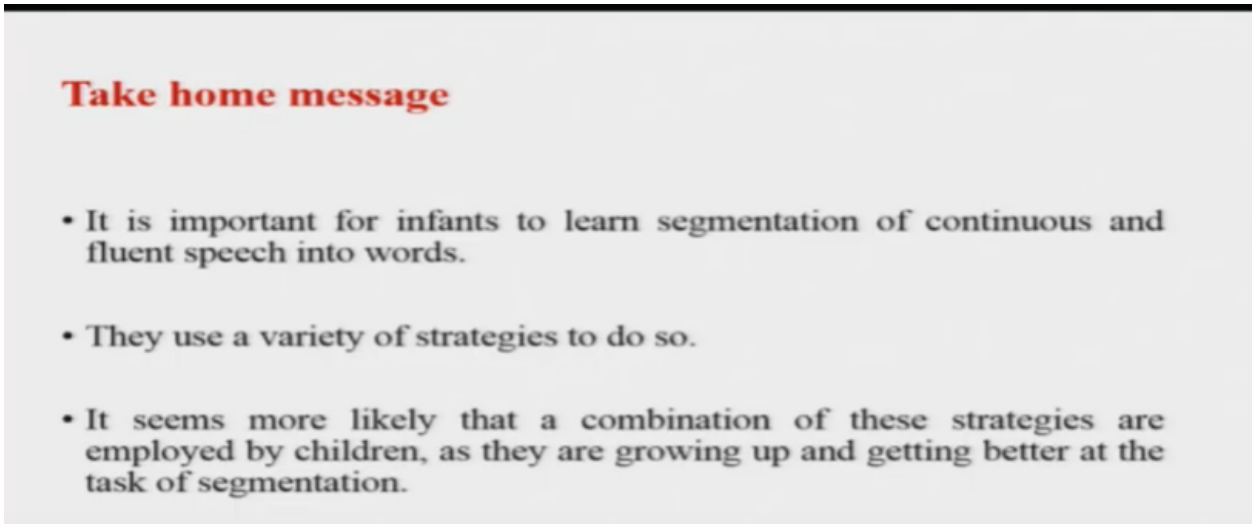

So, let's try an or I were to take home message forth lecture, it is, that children need to segment the continuous space stream into words, we know that they use a variety of strategies to do so, we also know that they probably use a combination of these strategies and the kind of huge combination of these strategies with age. So, either use probably one strategy atone age and they start picking up the other strategies as and when they are growing up .Okay?

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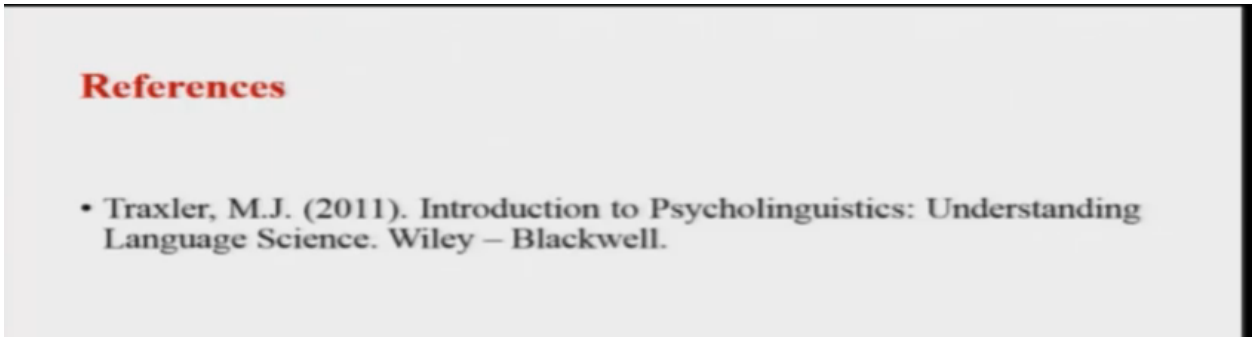

This was, about how children learn, segmentation or speech which is very, important fundamental skill, fundamental ability for them to, for them in order to acquire language .Okay? Thank you, in the next lecture, we'll move on to, learning probably word meanings and then we'll move to, other important skills of acquisition of language. Thank you.