Advanced Cognitive Processes
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Lecture-18
Language Production

Hello and welcome to the course Introduction to Advanced Cognitive Processes. I am Ark Verma from IIT Kanpur and this week we have been talking about various aspects of language. We began talking about what language is; we talked a little bit about the history of psycholinguistics the aspects of language. We talked a little bit about acquisition of language, how a child acquires various aspects of language.

In the last lectures you also saw that we were talking about comprehension of language. Now one of the very important aspects of language is being able to speak, now you know that is the basic form of how people interact, I mean writing came much later the first aspect of how did people start speaking.

So, language production that is speech is one the very important aspects of language and I thought I will use today's lecture to talk to you about production of language. So, let us begin I mean majority of human communication occurs via speech.

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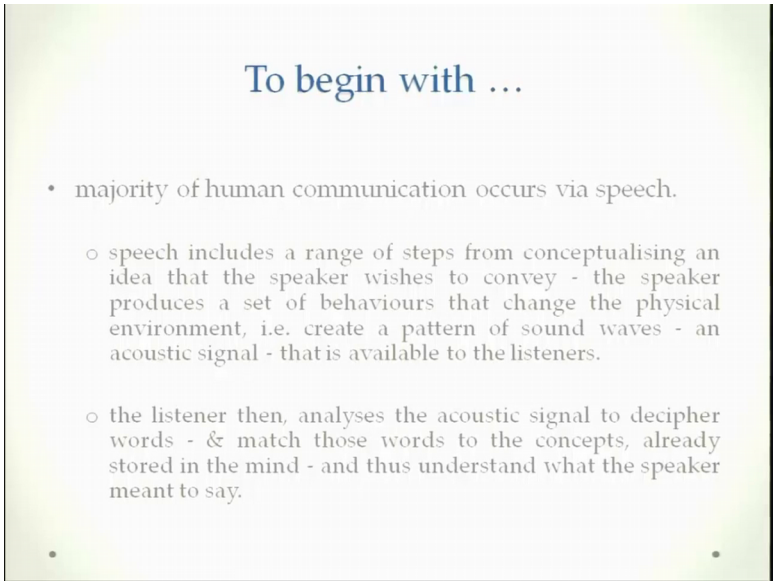

Speech includes a range of steps, now if you are talking about speech it includes a range of steps from first conceptualizing about what you really have to talk about you know, are you going to talk to me about your vacation, are you going to describe to me about the dinner you had last night, are you going to talk about some work that you have done and you want to explain to me.

So, it begins from conceptualizing an idea that the speaker that is myself wishes to communicate to you and the speaker kind of then produces a series of behaviours does a few things and that is basically what kind of converts this thought this idea into the sound.

So, speech production is basically converting this thought where the idea that, I wanted to talk about into the sound that you are hearing. So, this is what I will be talking about in today's lecture. Now the second aspect of speech production is the listener you know wherever this is going.

So, the listener then has to analyze and manage the acoustic signal that is coming out of from my mouth and then the kind of you know the listener will have to run backwards from this. So, he will have to decipher from this sound into you know whatever I had intended to mean. So, speaker goes from the idea to the sound and the listener goes from the sound to the idea that is the entire aspect of communication.

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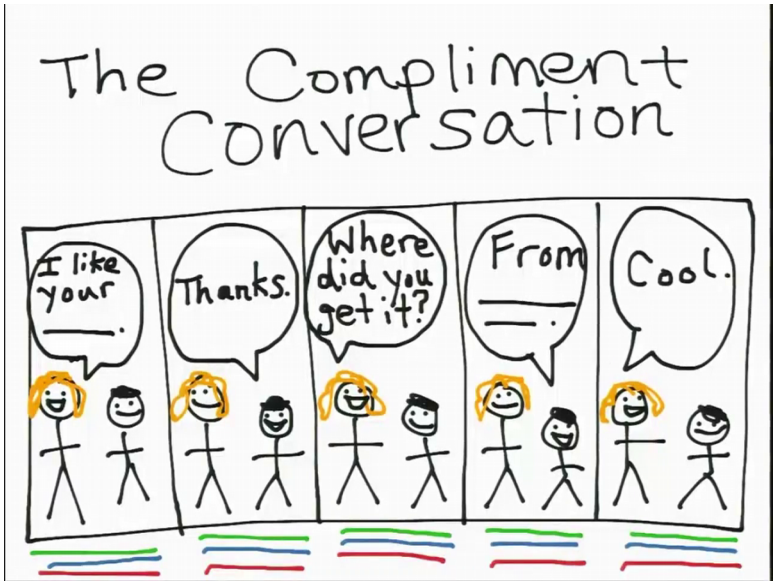

And these communications could be about anything there could be a compliment conversation.

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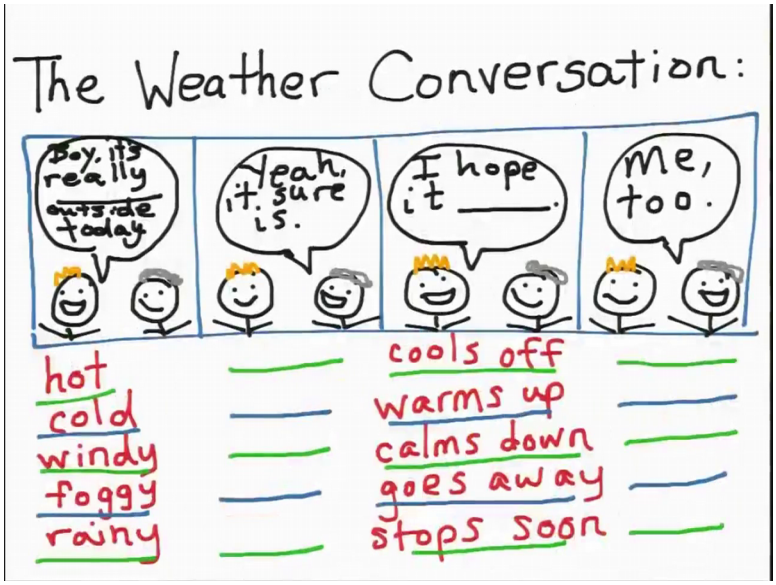

It could be a conversation about the weather of the day.

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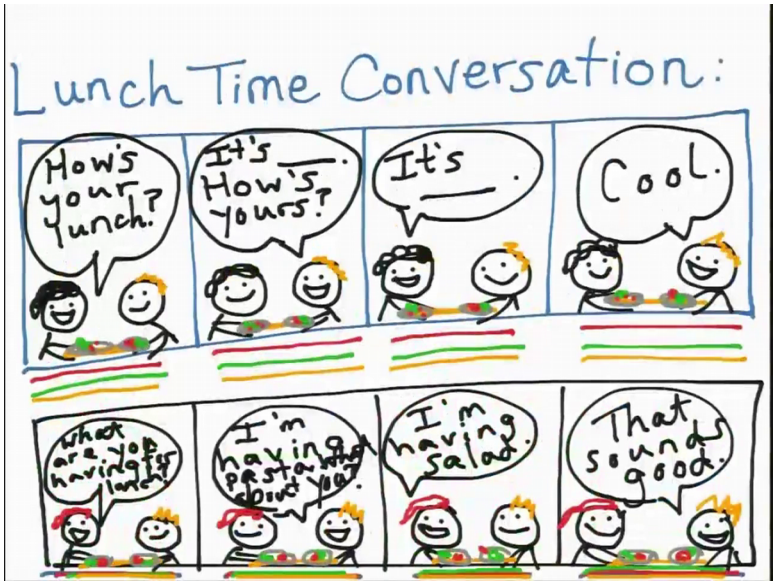

Or it could be a conversation about lunch time or so on and so, forth. So, these are the various ways in which people interact with each other as they talk about. So, many things sometimes the there is a need and want communication sometimes it is just plain gossip sometimes there is a description so on and so forth.

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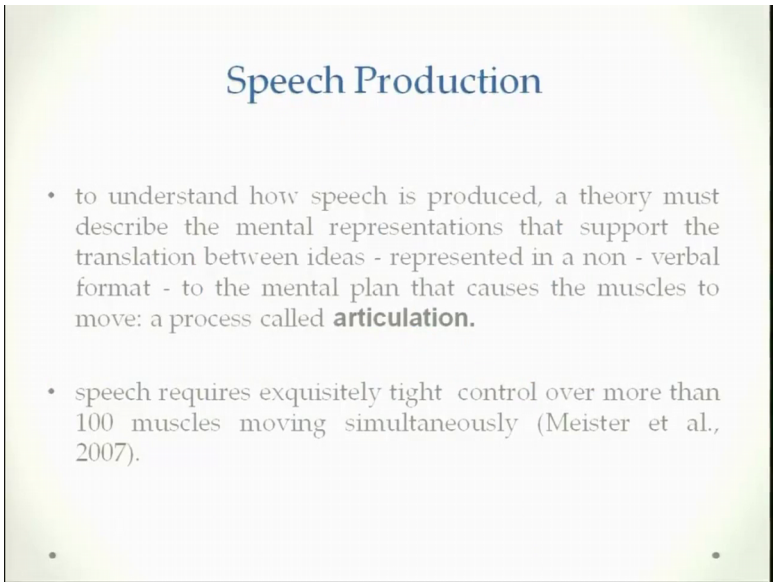

So, let us try and understand what speech production is about to understand how speech is produced; one should have a theory about describing about what do you mental representations are that support the translation from the idea to the sound. So, how do you represent something that is nonverbal, that is an idea to a format and bring it to a format that is verbal. So, the mental plan that causes you know the muscles to move the vocal apparatus to start moving is basically referred to as articulation.

Speech basically requires exquisitely tight control over more than around 100 muscles which are in your vocal tract the lips and the teeth and the tongue and you know vocal cords all of that. So, again see it is starting from the idea it is starting from something that is completely a metaphysical to something that has to move.

So, this is something which we are going to talk about and some important questions about this phenomena is that you know you have to know what are the steps that are needed, you know what is it that you need to do to retrieve the linguistic representation.

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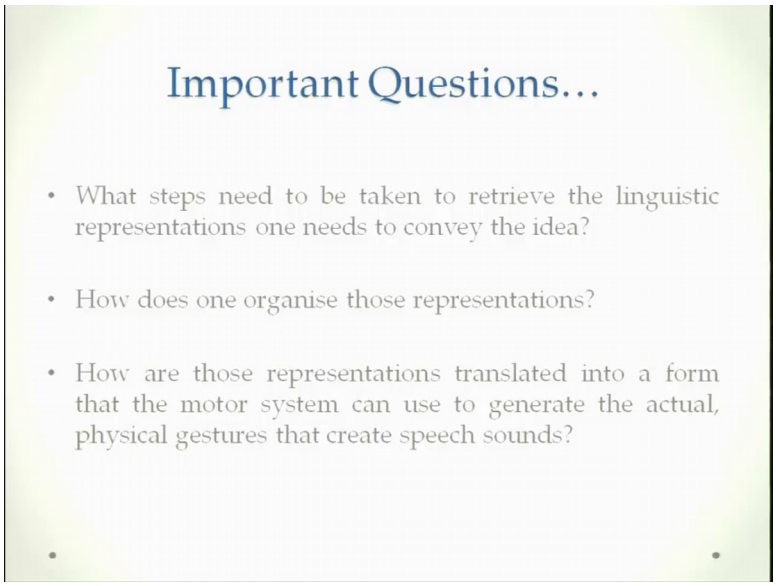

You actually you know need to have in order to present an idea suppose I want to talk about my vacation. Now, if I have to talk about my vacation and let us say I spent my vacation in a hilly area somewhere the idea is how do I you know what is the word for snow or what is the word for cloud do I have enough words for suppose feeling cold, do I have enough words for describing scenic beauty you know sometimes you would see people come up with the sentences like you know it was so, beautiful that it was hard to describe in words you know I was talking about word comprehension in one of the earlier lectures.

Now for a speaker this is actually a problem a speaker needs to figure out what are the words that will convey the reality. So, this is a very important question so, what are the steps, what are the linguistic representations that I am going to use in order to describe this event, this scene, this reality, that is one very important question. The second is suppose I have those representations now I have the word for, you know I have exquisite beauty, I have eclectic beauty, scenic beauty or so, many different words I might have, how am I going to use these words, what kind of sentences I am going to form, how am I going to put one word before the other in you know in doling out a particular sentence.

So, this is something which is again something very interesting something one has to figure out, once you have these two things you have you know you have to also convert this thing into a form that a motor system you know speech is a motor act speech is

basically done by your vocal cords, by lips and by your teeth and by your tongue from that idea you know you would looking and you know you are standing on a terrace looking out down on the mountains the snow is falling in the clouds are below you, you know from there to how do you start moving these muscles.

This is the third very important problem, how do you use those representations? How do you translate them into a form that the motor system this vocal apparatus can generate the actual sounds the physical gestures. So, this is basically in a nutshell three very important aspects of production of speech and we will in this course of this lecture try and look at various aspects of these things.

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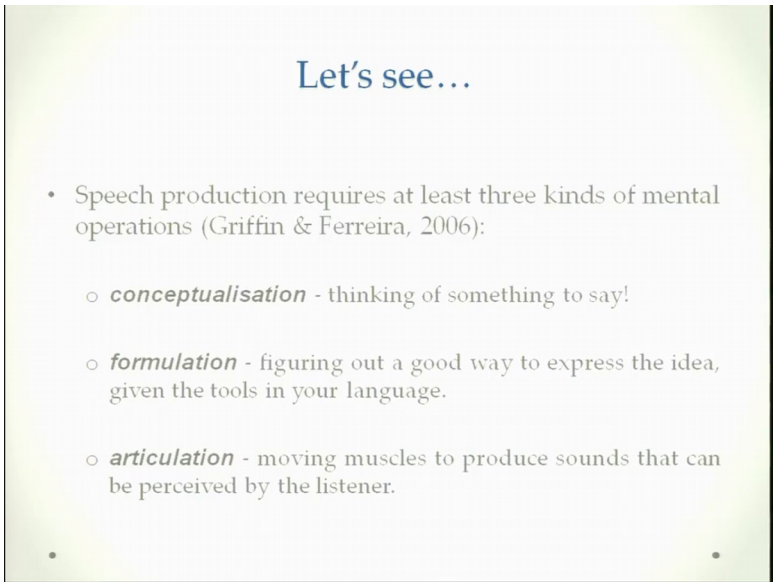

So, speech has three things in his first conceptualization thinking of something to say what am I going to talk about, second is formulation figuring out a good way to express the idea you know given the tools in your language, what are the words in your language some languages have exquisite vocabulary you know Urdu for that matter is exquisitely vocabulary, Malayalam has very good vocabulary, Hindi also has very good vocabularies, but these vocabularies are different you know figuring out a good way to say it.

The third is moving the muscles to produce the actual sound so, this is the third task that you would want to do let us talk about I wanted to describe all of these processes.

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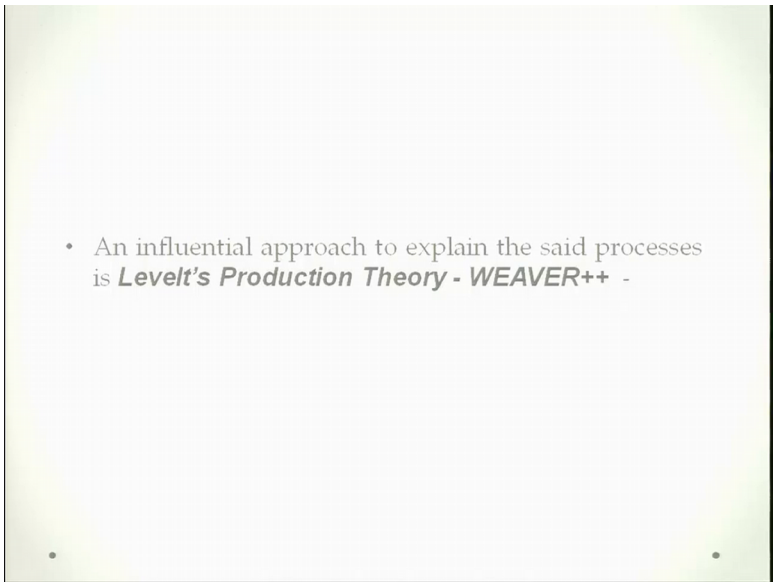

So, I am taking help of an approach which is William Levelt's production theory it is encapsulated in a model called the WEAVER plus plus model. So, now, I am going to talk about all of these 3 processes in the bounds of this particular model and you going to use this model as a tool to demonstrate all of this. So, the Levelt's model actually starts with the at the top conceptual preparation.

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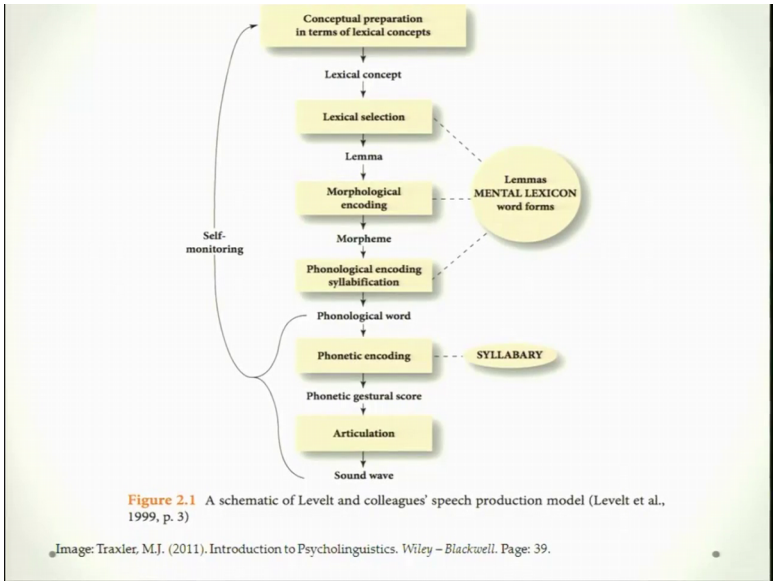

In terms of lexical concepts what are lexical concepts, I will talk to you about them in a while lexical concepts of words then you have once you select a lexical once you

activate. So, many lexical concepts then you have to do lexical selection then you have to talk about lemma. I will talk about what a lemma is in a while then you have to do morphological encoding you have to construct these words remember one of the earlier lectures I was talking about morphology, then you have to do the phonological encoding you have to put together the sounds how do I bring the sounds together then you have the phonological word what exactly you are going to say.

Then you have to have the phonetic encoding part what is the manner in which I produce these sounds then you will have something called a phonetic gestural score the articulatory plan and so on and so forth. Finally, you will be able to articulate this which will be a sound that you produce, now also once you produce the sound it is not that you are not hearing that what you are speaking. So, it has to be feedback from once the articulation has happened to the top levels of this model. So, that is some feedback loop is there again I have just very very briefly just mentioned this model.

Let me now detail this model a little bit so, that you understand, what are the various intricacies of these levels?

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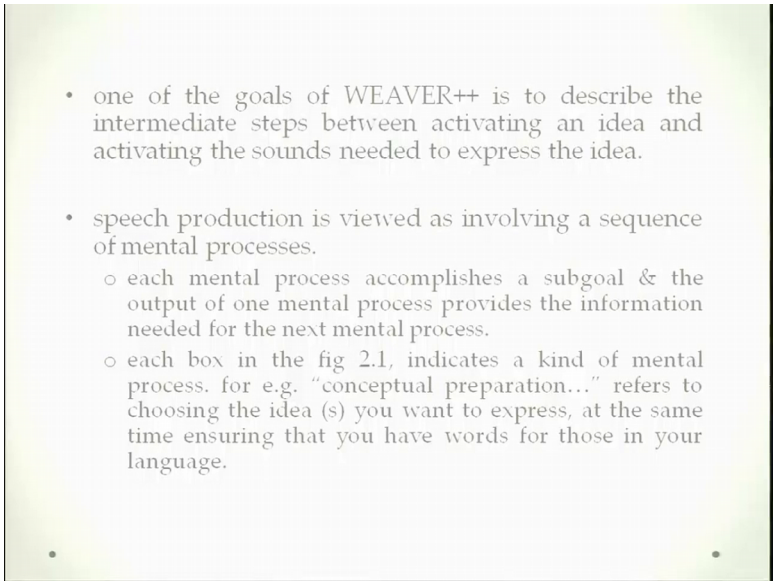

So, this model is the Weaver plus plus model one of the goals of this model is to describe the intermediate steps between activating an idea and activating the sounds that are needed to express the idea that is one of the tasks. Now speech production is viewed as involved being a sequence of mental processes and what are these mental processes each

mental process accomplishes a sub goal and output of one mental process acts as an input for the other mental process.

If you look at it is figure again and I will keep coming back to this it is something of a serial kind of a thing you accomplish one step then, you go to the second step then, you go to the third step whatever comes out of this step is a input for this one and whatever comes out of this one is an input for the next one.

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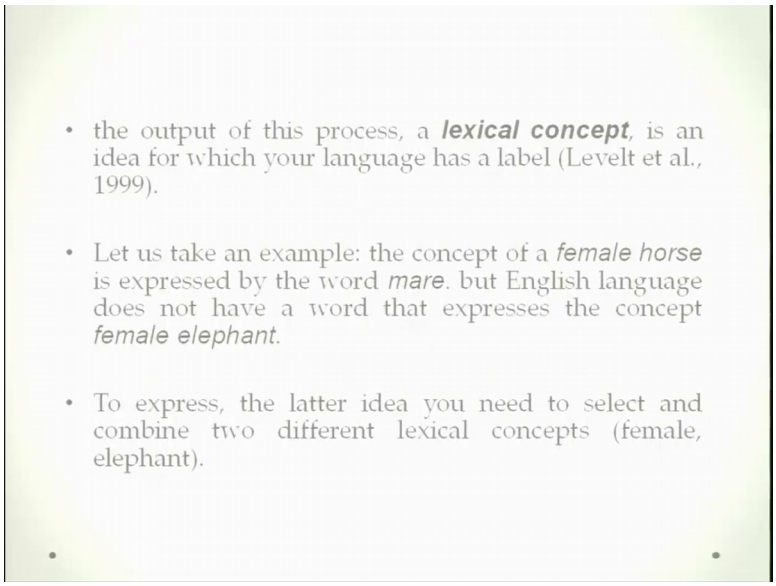

So, this is something which we will talk about the first step here if you look at this one here is the idea of the lexical concept the lexical concept very simply is an idea for which your language has a level or were for your which language has a word a lot of things in your language my language has words for a lot of things it does not.

So, you use whatever existing words are there to come up with this such a concept again the concept is say for example, there is a word for a female horse that is mare, but there is no word for a female elephant. So, then you will use female and elephant and then you, you will use this plainly.

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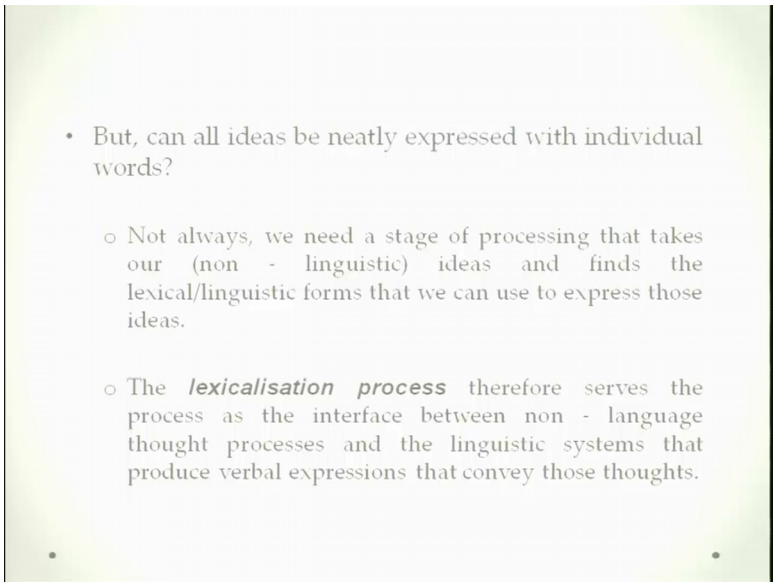

So, to express the latter idea you will just combine whatever is existing and come up with the female elephant can all ideas be neatly expressed with individual words not really again, we always need a stage of processing that takes you know our non linguistic the our idea or the visual form and finds the most you know probable lexical or linguistic forms to really you know have this translation from what you are seeing to what you are going to talk about again.

This process here from converting to what you are seeing to what you are actually speaking about producing is called lexicalization. Lexicalization is the process that serves as the interface between the non language thought processes; the reality that you see and the linguistic systems that have the ability to produce verbal expressions. You are seeing an exquisite scene and from that scene to actually describing that in words poetry what so and you know different kind of forms this interface is called lexicalization. So remember it is a very important aspect lexicalization involves a few things.

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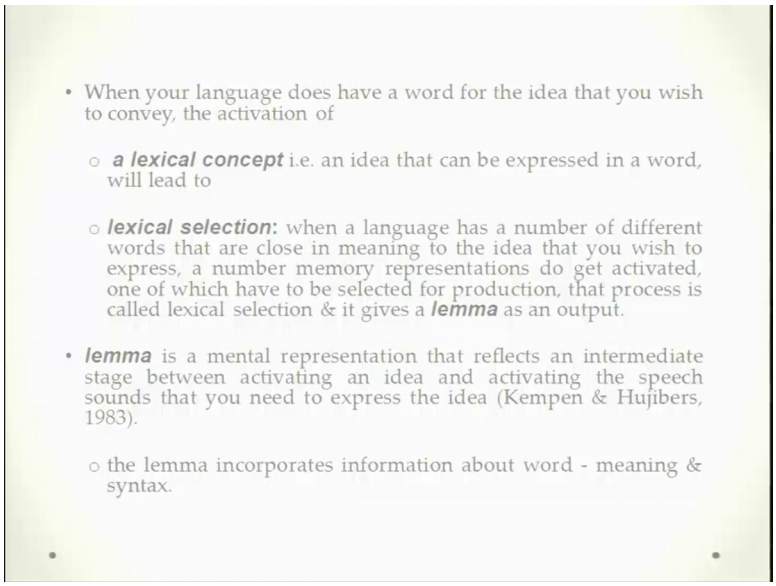

I will talk about first is if your language has a word for the idea that you wish to express you are the first thing you will have is you will activate lexical concepts, you will activate an idea that is expressible in a word. So, I want to talk about you know whatever I am saying from my terrace I see a cloud I see snow I see you know people walking by. So, I have words for all of this now this is what I am going to talk about. The second is now I have so many things available so clouds are referred to as you know also snow so, many different kind of things also possible is there, there is a there are people going back.

So, that I can talk about men, women, children so, many different thing so, some selection has to happen you will activate so, many different things you will activate so, many different things, so many competing concepts. So, a lexical selection is basically when a language will have more than you know a number of different words that are close in meaning to the idea that you want to talk about you will need to select one of them to be able to talk about them.

Now for example, you know you have these memory representations all of these are getting activated one of which has to be selected for production, only one of these you will select for really speaking the process is called a lexical selection.

So, you came to lexical concepts you activated so, many of them and you selected one of them. So, you have you achieved a lexical selection once you say once you have done

the lexical selection you will come up with what is called a lemma. What is a lemma? Lemma is a mental representation that reflects an intermediate stage between an activating an idea and activating the sweet sounds everything in the middle till you are finally; approaching it what is this lemma incorporates two things? It incorporates word meaning what do you intend to convey and syntax it is singular plural person you know thing object all of those kind of features are encapsulated in this concept called lemma I will talk about this in a bit more detail.

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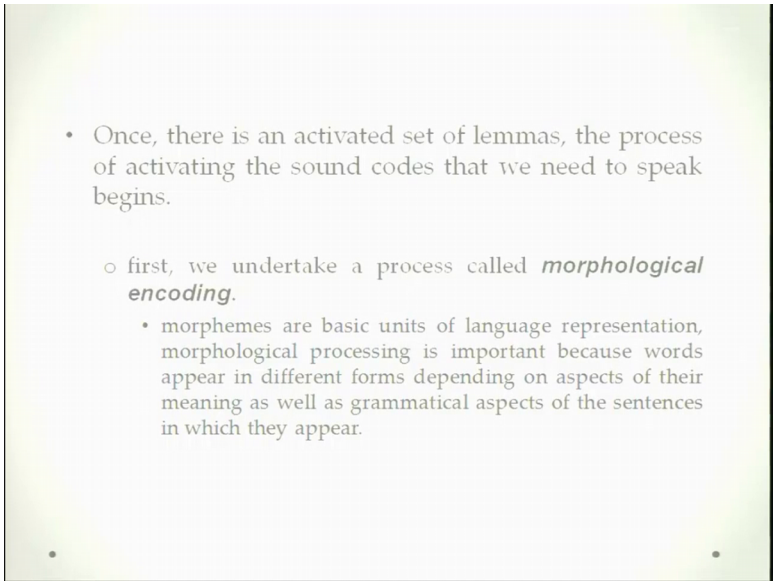

So, once you have activated you know set of lemmas all of this is what I am going to talk about then what you will do is, you would want to activate the words you will start you know putting the words together am I going to talk about plural he or a she or object or a person all of these information because you have now an activated lemma are there with you once they are there with you will undertake a process called morphological encoding. What is morphological encoding? Morphemes if you remember our basic units of language representation morphological processing is important because words appear in different form.

So, if you remember I was talking about in the chapter on language acquisition about things like kicks, kicked, kicking, I wanted to talk about some event that somewhere is somebody is kicking, now kicking is happening or kicking has already happened those

kind of things are there in my lemma. I have to now put up put together a word that represents this lemma information this is what morphological encoding will help me to.

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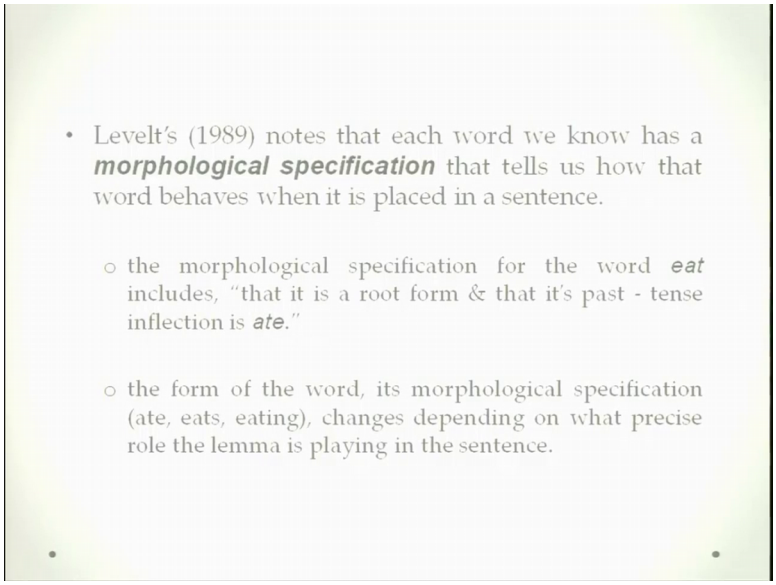

So, Levelt's kind of talks about something called morphological specification he says that each word that we know has something of a morphological specification and this morphological specification is what will tell us how is the word going to behave in a given sentence. Am I going to talk about kicking that is a continuous event, am I going to talk about kicked that is a perfect event you know something that has already happened and so on and so, forth.

So, I started from an idea I had many lexical concepts I did lexical selection, then I went to lemma now I have a lemma now what I am doing is I am doing morphological encoding one of the sub processes of which is morphological specification and just specifying what word form am I going to use.

So, the morphological specification for the word eat includes that eat is a root form and that is past tense is ate. So, now, you see if I had to talk about that, X ate my burger I have to have this idea there I cannot use X eat my burger or X is eating my burger because that is already happened, I have to have an idea of X ate my burger ate is basically derived from root form eat and it basically reverses the past tense of eat things like that.

Now, the form of the word that I am going to use eat ate or eating is basically you know that is what is specified in the morphological specification and this would precisely change you know basically on the depending on the lemma that I have you know received that is going that is activated so, this is something which you have to keep in mind.

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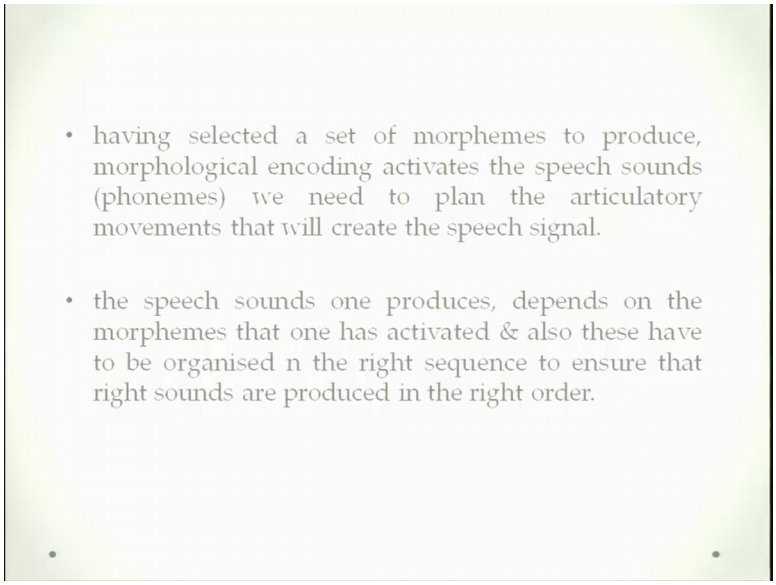

Now, having selected a number of you know a selected a set of morphemes to produce morphological encoding will activate the speech sounds what is exactly that you are going to speak eat and eating will require different kind of phonemes to get activated and then once you have this selection of sounds close by then this will form the basis for coming up with an articulatory plan.

You know you need to tell your motor apparatus the vocal apparatus to start preparing for producing something, but you will not be able to do that till the morphological specification is found because you have to be know you have to you know be knowledgeable or you have to be informed of the fact that whether you are going to use eat ate or eating again started from an idea lexical concepts lexical selection lemma; then morphological encoding, morphological specification as to what exact word form you are going to use then you go to the phonemic part I will talk about that.

So, the speech sound one produces depends upon the morphemes that one has activated that one intends to use and also you know these morphemes have to be organized in the

right sequence to ensure that the right sounds are produced in the right order. Now why am I talking about right sounds in the right order because speech is such you know speech is incremental one sound comes after the other and this order has to be respected because that is how you will create correct speech ok.

So, let us let us move ahead, let us try and summarize what we have had, what we have till now we have concepts.

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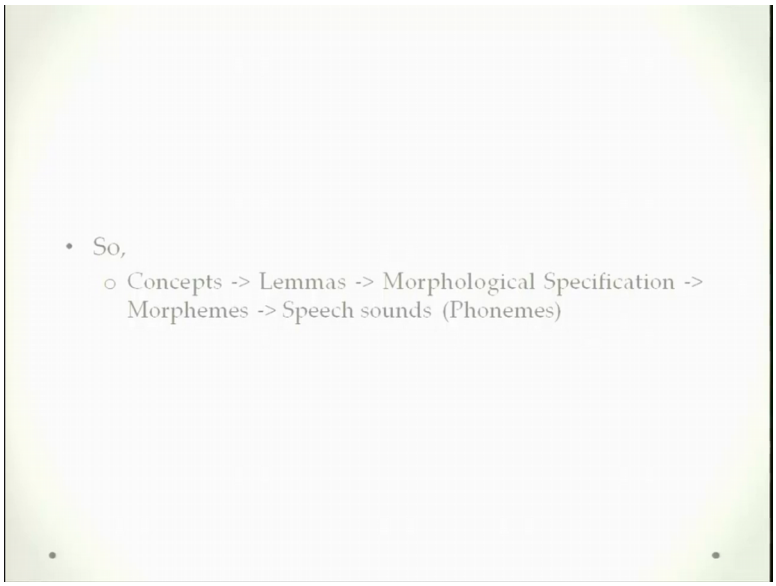

We have lexical concepts like lexicalization and then we have lemma, then we had morphological specification, then you have morphemes, what is it that you have to activate, then you have speech sounds phonemes have to be there this is middle of the you know entire chain. Let us move ahead now once you have the morphemes slotted into the right positions.

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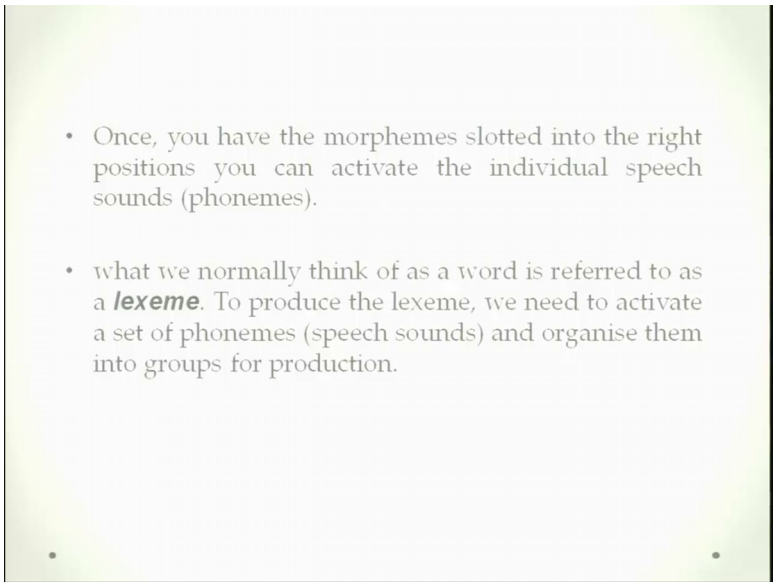

You can now start activating the individual speech sounds you have to activate so, this has to be happening in a correct order what we normally think of a word is actually referred to as a lexeme; again in this model or in reference to the mental lexicon the actual word is referred to as a lexeme.

Now, lexeme you know in order to produce the lexeme what you need to do is, you need to activate a set of sounds which are making up this lexeme you know which are kind of constituting this lexeme you have to organize them into a particular slot (Refer Time: 18:17) has to be organized in one to three slots so, that you are able to produce it correctly.

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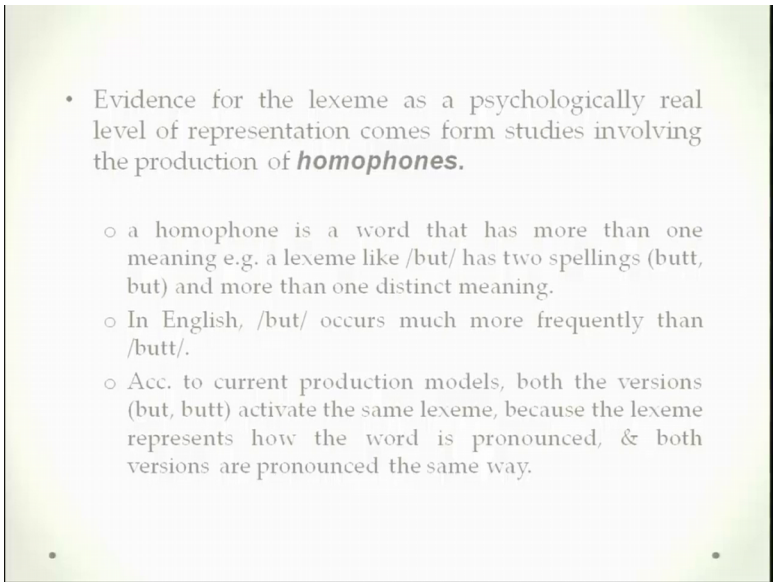

Now, evidence that there is a lexeme and just kind of digress and give you some evidence that this actually happens you know evidence for the fact that lexeme is a really psychological level of representation and some studies were done using homophones. Now what is a homophone? Homophone is a word which has the same sound, but different meaning, now suppose you have the words like, but you know b u t t has different meaning and b u t has a different meaning, but both of them sound similar.

So, these are referred to as homophones in English, but occur b u t, but occurs more frequently than b u t t butt. So, more often than not you will kind of take the probably the more frequent thing now in most common you know production models that are going around by the in the day and both the versions, but and butt will activate the same kind of flexing because you know they sound.

So, similar to each other because the lexeme represents how the word is pronounced and both the versions are pronounced in much the same way, but and butt it is basically the same thing there is no sound level discrepancy here both of them have the same set of phonemes.

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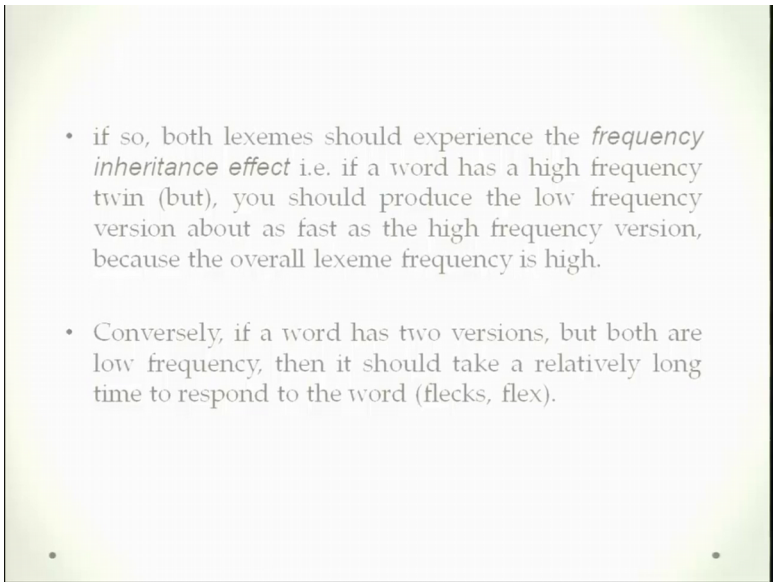

But if both of them you know have the same set of phonemes they should experience what is called the frequency inheritance effect. Frequency inheritance is basically if a word has a high frequency twin you should be able to produce both of them in the same manner because b u t t butt is less frequent b u t, but is more frequent, but the fact is that anyways you have to activate the same set of sounds. So, you will activate b u t t butt as easily as you will activate b u t, but this is what the frequency inheritance effect is.

So, conversely it could happen that if one of the members of this pair has a very very low frequency then that could also in some sense you know figure on a kind of rub on to the other level. So, we will see suppose there is a word called flecks f l e c k s and a word called flex as in flexible f l e x sometimes because flex is.

So, less frequent it might rub on to the other one flex as well. So, again this is the frequency inheritance effect because your practice with producing the same kind of sounds together is high in some case high in a pair both of them benefit if it is low and both of them kind of suffer and it is going there.

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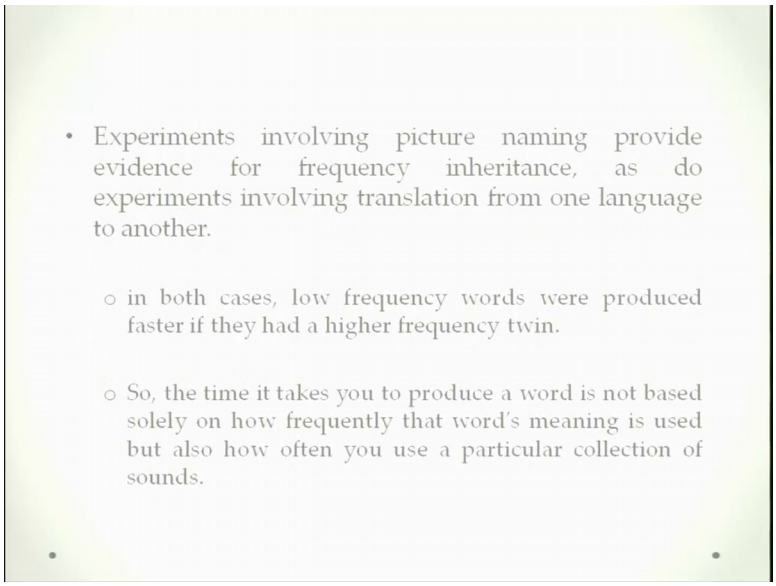

Now, experiments have been done involving picture naming people just give pictures and people have other partners have to name it and they were looking for this frequency inheritance effect you know as two experiments involving translation from languages there as well. Now in both cases low frequency words were produced faster if they had a higher frequency twin; if you have been practicing speaking a higher frequency partner of a low frequency word the low frequency word also is produced a little bit faster b u t t butt is low frequency b u t, but is high frequency if you are speaking, but again and again and if this word b u t t comes there you will probably print and pronounce it slightly faster because this one has been practiced a lot.

So, the time it takes you to produce the word is not really based solely on how frequently the word the words meaning is used, but also on how frequently you have been using a particular collection of sounds. Suppose I am talking about flexible now it will be something which probably you are not really using.

So, much, but flexed maybe if you are using you have been talking in some sense about flex and so, many things the thing is because you have had practice with this sound flex and flexible the idea is that the same kind of sound because you have been practicing will rub on and you will be able to produce it faster does not really have to do with meaning in this case so much.

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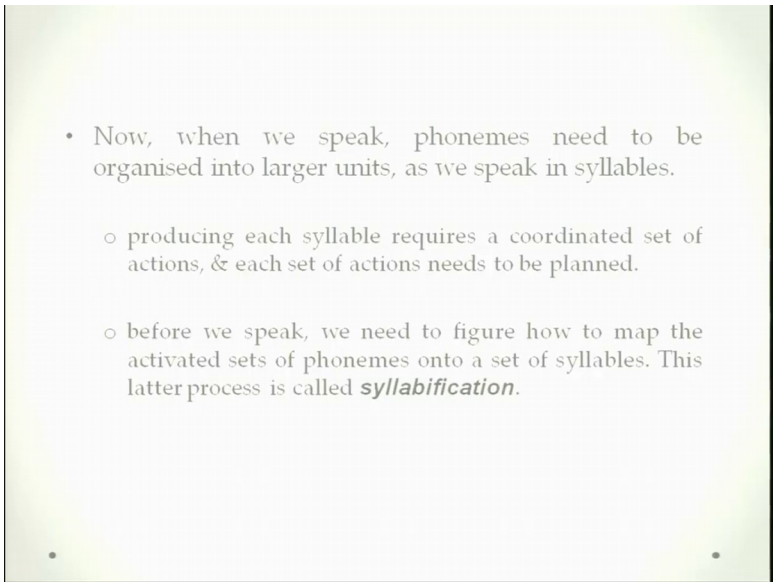

Now, let us kind of comeback to the thing I kind of digress a little bit to give you an demonstration, now once you have had the phonemes you can start organizing these phonemes into slightly larger chunks called syllables. So, you started from lexical concept selection lemma morphological encoding morphological specification you had what are the phonemes you want to put together now these phonemes are do not are not always just organized by single phonemes they are organized into syllables.

This process of putting each syllable putting across phonemes as syllables is called syllabification. So, producing each syllable will require a coordinated set of actions and each set of actions will need to be planned let me demonstrate this to you now before you speak you need to really figure out how to map the activated set of phonemes into these syllables this process is referred to a syllabification.

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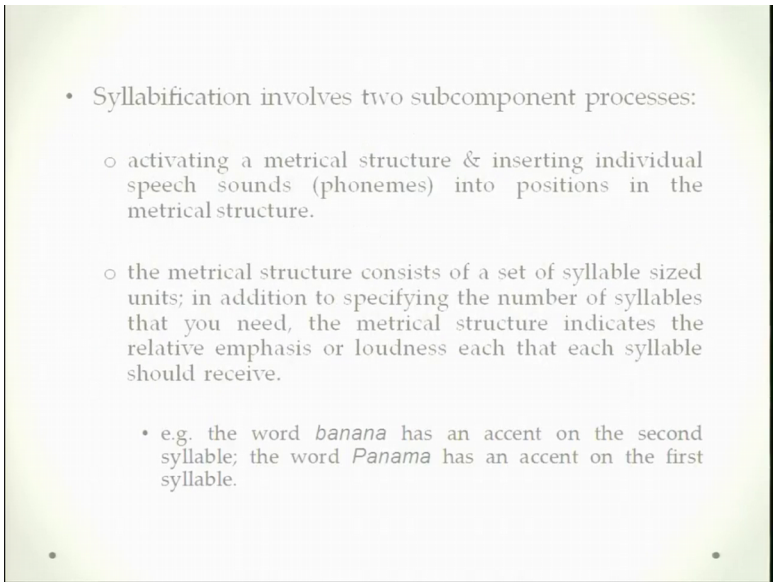

And how do you do it let me give an example syllabification involves 2 processes first is activating a metrical structure and inserting the individual speech sounds into positions right positions in the metrical structure. If you remember I was talking about this in the child language acquisition lecture when I was talking about (Refer Time: 23:25) stress patterns what is at (Refer Time: 23:28) stress pattern you have words like bottle and stuff like that where in the first letter is kind of first syllable is a stress and a second is less stress and if I am vague when the first syllable is less stressed more second when is more stressed.

So, in those kind of things if you have to say banana and banana is word or panama is a word you will have to kind of generate such a structure when it what is the aspect that you need to emphasize what is the aspect that you need to less emphasize and you have to slot your phonemes into these more emphasized and less emphasized slots so, that you get the correct pronunciation correct manner of speaking them right.

So, this matrix structure needs to be arranged the metrical structure consists of syllable sized units as I was saying in addition to specifying the number of syllables you need also the metrical structure does something it indicates the relative emphasis this what I was referring to indicates the relative emphasis or loudness that you need to associate to each of these syllables suppose the word banana has an accent on the second syllable banana ba is smaller nana is bigger the word panama has accent on the first syllable

panama actually said panama. So, panama is more stress on the first one amma is the second one is slightly less signifying both of these words have the similar set of similar number of syllables, but the idea is the stress patterns are different here.

So, if you have to speak something correctly you do not really need to only have the set of phonemes you need to figure out how are these phonemes going to be structured into syllables a you also need to figure out, what is the metrical structure where is the emphasis going to be whether the emphasis is going to be on the first set of syllables or the second set of syllables and both of these information you will use in order to come up with the final pronunciation.

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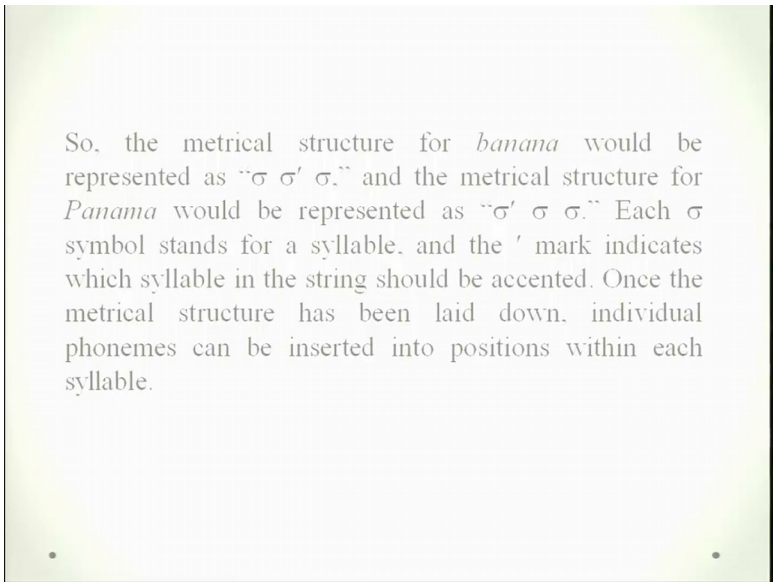

So, the metrical structure for banana would be say you can see the figure here will be stress on the second one and double stress on third one and for panama will be there just first and there is a stress on the first one and second and third is much lesser each symbol here stands for a syllable and the dash mark you can see stands for the stress. So, if you see banana ba na na the stress is on the second syllable panama the stress is on the first the second two are and the second, second and third are kind of non stressed.

So, this is again this is the detail in which your system has to relieve work out how to you know speak how to speak in syllables what are the stress pattern is going to be like what is the relative loudness patterns is going to be like. So, in that sense it is a far cry

that you have come from the idea till this house, but again here there is also a lot of work that needs to be done.

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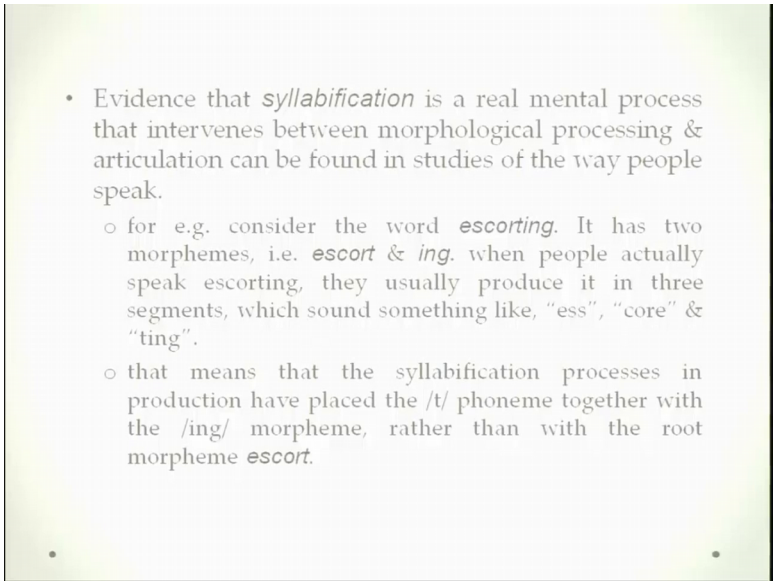

Let us move ahead again talking a little bit about whether syllabification is actually a reality. So, evidence for the fact that syllabification is a real mental process that intervenes between morphological processing and articulation can be found in the you know in the studies of the way that people speak suppose you want to you know ask somebody you speak escorting. So, typically you will see that morphemically this is like escort and ing. So, you know escort and ing should be spoken, but if you really pay attention to how people are really speaking people are actually speaking es corting.

So, they are actually having 3 syllables the stress is on es and cor and ting, that basically means that the syllabication process has you know produced the you know have kind of taken the ting morpheme from escort and pushed it to a different syllables escort ting comes to the third one, but technically morphemically escort cort should be in one and ing should be there, but again the way you have divided it in a syllable fashion you put escor and ting.

So, the ting has been pushed t has been pushed to the last syllable this is again. So, we do not really you know this is one way this is achieved. So, if you again take a step back look back see where we have come from we are not really activating just morphemes and

we are not just activating phonemes that go with each morpheme we have to do this in particular sequence.

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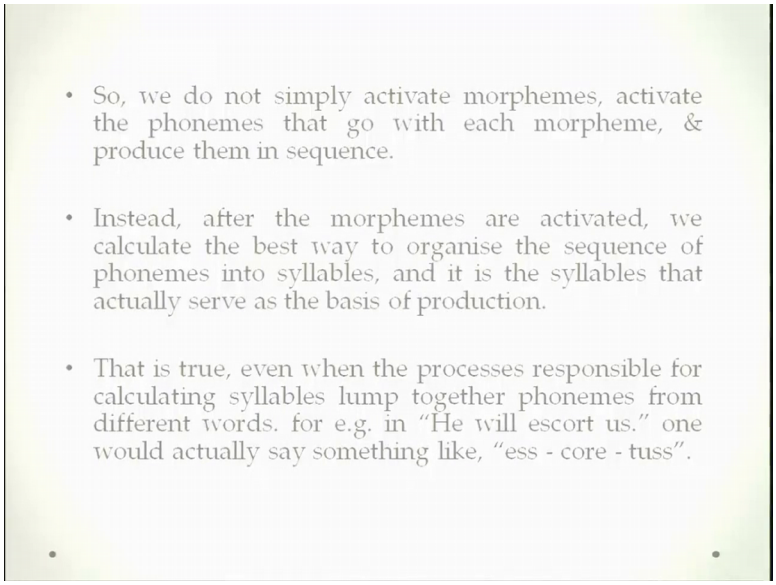

So, instead after the morphemes are activated you have calculated the best way to organize those you know morphemes or sounds into a sequence of syllables and it is the syllables that will basically serve as the template for production. So, from morphological specification you had this is the word I have to produce from that you had those sounds, but before you could actually start articulation of sounds you had this intervening level called syllabification; wherein you organize those sounds into syllables and into relative loudness and you know less loud patterns and then this syllabification basically is what is serving as the template for how your articulation will proceed.

So, it is true even when the process is responsible for calculating syllables lump together phonemes from different words suppose he will escort us now escort us should be there, but sometimes you will see the way people speak is escortus t u s that will come together this is something which is generally happening. So, while you need morphemes and words to plan.

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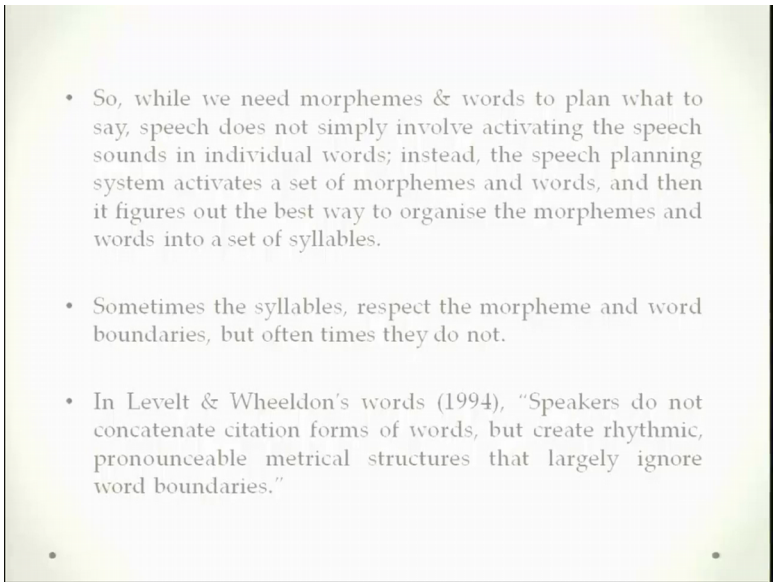

What to say speech just not really just involve activating the speech sounds in individual words instead the speech planning system activates a set of morphemes and words and then it figures out the best way to organize morphemes and words in to sets of syllables. Sometimes the syllables will respect the real morphemic boundaries sometimes they will not, but again syllable is the template for production of speech.

Levelt and Wheeldon kind of said this in 1994 and they say speakers do not really concentrate on citation forms of words you know the way words are written in dictionaries, but they create rhythmic pronounceable metrical structures how is it easy to speak this word and they the entire production of speech is kind of governed using these metrical structures.

So, once you have done syllabification you started from a lexical concept you selected the you did lexical selection, then you went into getting a lemma, then the lemma helped you do morphological encoding, morphological encoding helped you do morphological specification which form of word you have to speak and you had phonemes, but you chunk those phonemes into syllables material structure and so on and so forth.

Now, you have the set of things that you actually want to produce, this set of actually what you actually want you to produce which comes out of syllabification gives you what are called phonological words, this is what you are going to speak these are phonological component that you will finally, articulate.

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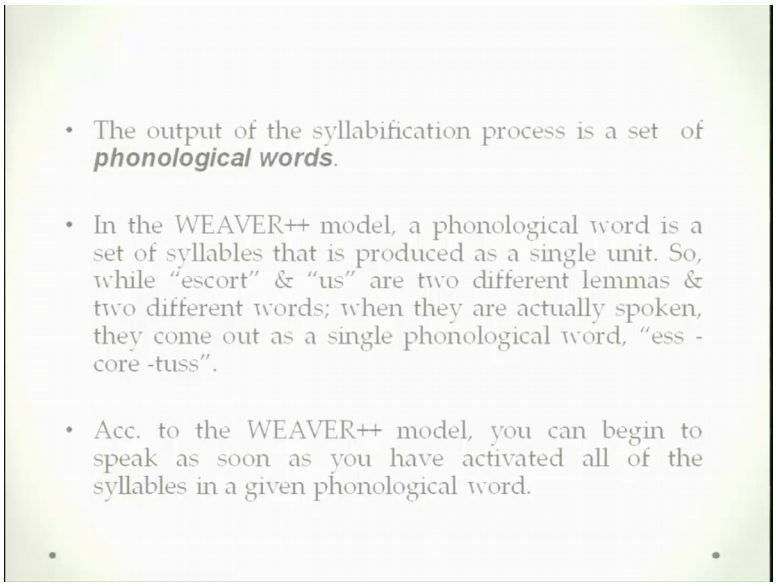

In the WEAVER plus plus model, a phonological word is basically referred to as a set of syllables that is produced as a single unit remember escorting, es cort ing is going to be produced 3 different syllables. So, escorting us technically are two different lemmas, but when you see he will escort us escor or tus our two phonological words ok. So, you have to kind of pay a little bit of attention here and get to the fact that morphemically words structures are different, but the way you speak the phonological word form will be different from the morphological word form here.

Now, according to the WEAVER plus plus model you can begin to speak as soon as you have activated all the syllables in a given for a logical word that is where your articulation will now start.

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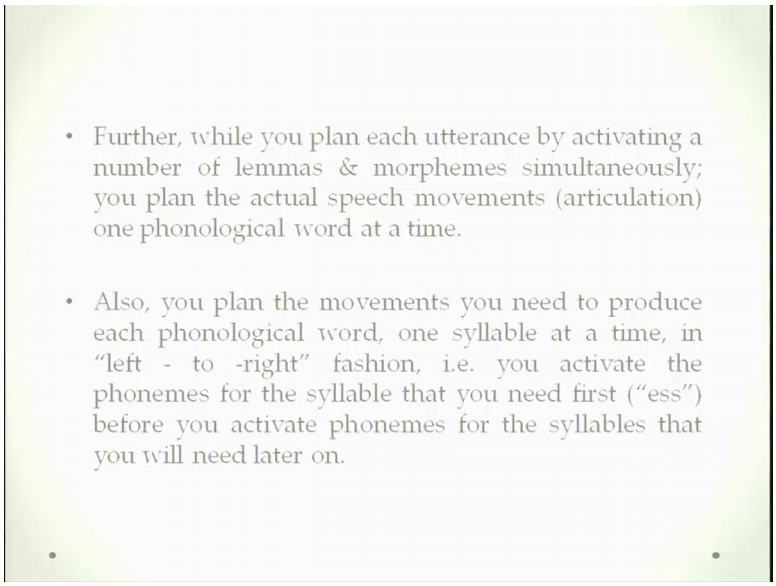

So, you have to plan each utterance by activating a number of lemmas and morphemes simultaneously you plan the actual speech movements based on the one phonological word at times escort uses co and tus three words and this is where you will start producing an articulatory plan, also you plan your these movements of the muscles you need to produce each word one syllable at a time in a left to right fashion you cannot suppose you have escort us is ready you not really kind of activate us first and cort later and then es.

It has to be sequentially in a left to right fashion because as soon as this is given going to get activated you have to do the articulation in the same order as well remember speech is something that is unfolding in time and it is happening sequentially. So, you activate the phonemes for the syllables that come first. So, you will activate es first and then activate cor and then you activate tus. So, this is how this process will move further.

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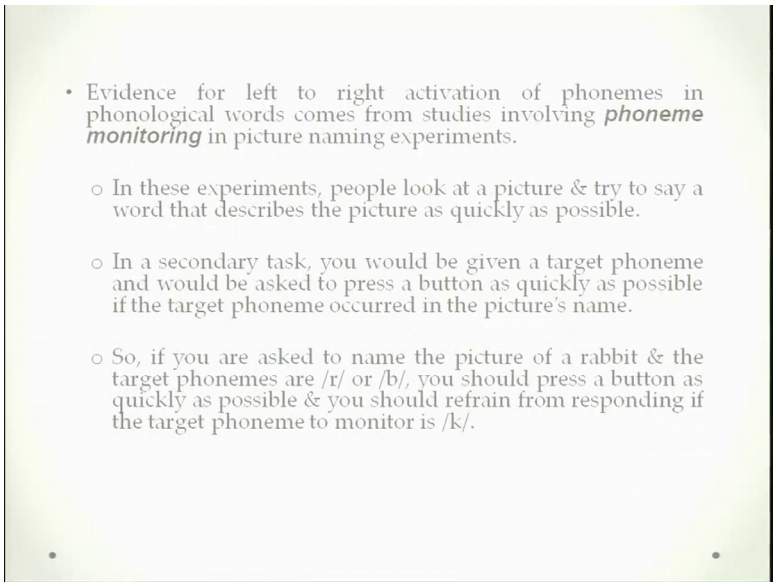

Now, the evidence for this left to right activation again, why do what is the evidence that we are doing this activation left to right fashion has been shown in studies of phoneme monitoring and what they have shown is that people you know, if people are trying to look at a picture and they try to say a word that describes the picture as quickly as possible, this is one of the tasks that was given to people. The second task that was given is that you have to be you know monitoring a target phoneme and as soon as a target phoneme comes you press a button.

So, I am showing you pictures the pictures will be; obviously, will have particular for phonological words and I will tell you that when this sound comes you press a button. So, if you are asked to name a picture of a rabbit and the phonemes are r or b you should press a button as quickly as possible and you should refrain from responding if the target phoneme to monitor is k ok. So, you have to say rabbit target phonemes are r or b and if you see k you do not respond that is the task.

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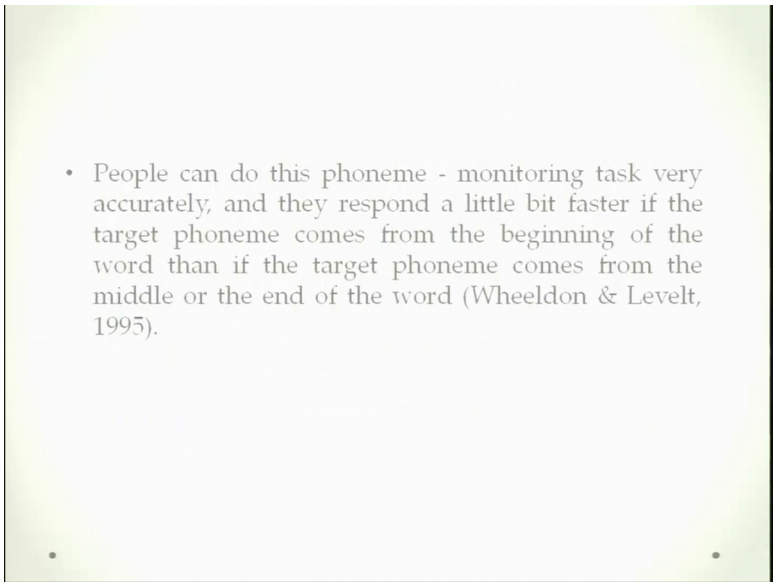

What happens, people can do this phoneme monitoring task very accurately and they respond a little bit faster if the target phoneme comes from the beginning of if their target phoneme is r then you are quicker compared to when the target phoneme is b you will our society you know you take a bit of time because it is happening incrementally you are listening you are activating this incrementally.

So, people are responding to this kind of task a little bit faster is it a phoneme coming from the beginning of the word then if the target phoneme comes from the middle or the end of the word this was taken as evidence for the fact that we are activating these things sequentially from the left to right.

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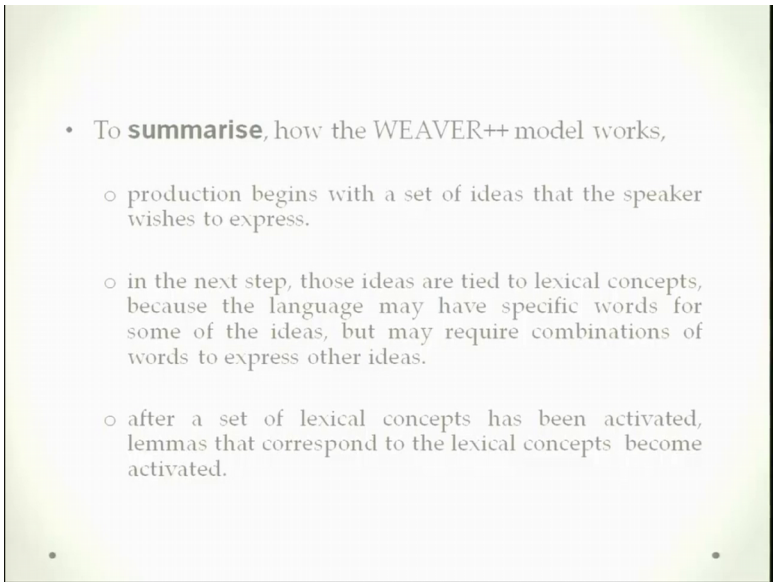

Once you have activated these things you are kind of you already have what you are the output of the suite processes this is what you have to move your muscles and produce and this is what the listeners will hear. So, let us summarize how this model has worked production begins with a set of ideas that the speaker wishes to express in the next step these ideas are tied to lexical concepts because of the language because different languages have specific words for these ideas.

Second is after set of lexical third is after set of lexical concepts have been activated, lemmas are corresponding, corresponding lemmas are also activated.

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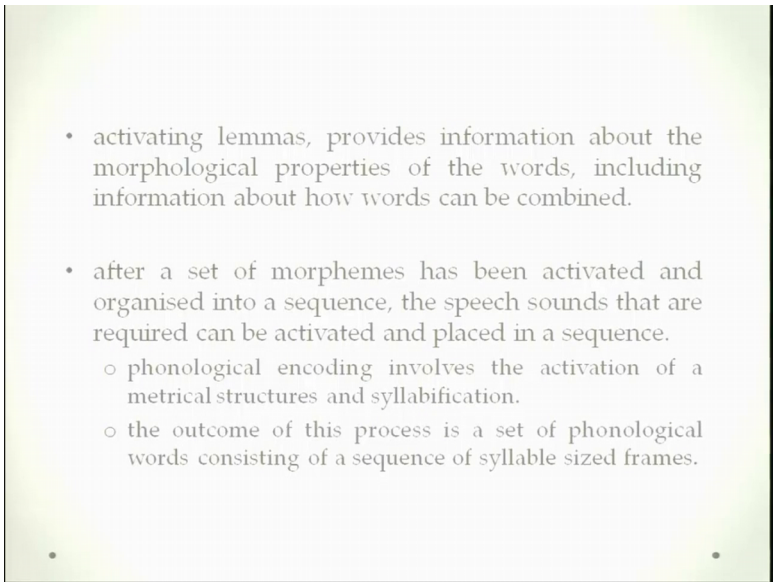

Then from lemma you provide information about the morphological properties of the word morphological encoding and specification are done after you have activated a set of morphemes you organize these into a sequence and the speech sounds that are required to be activated are placed in a sequence so, you do syllabification.

Phonological encoding involves two things it involves the activation of metrical structures and syllabification, outcome of this process is a set of phonological words and which are basically you know chunked into syllable size frames banana, ba na na are three things, three things that you are going to produce.

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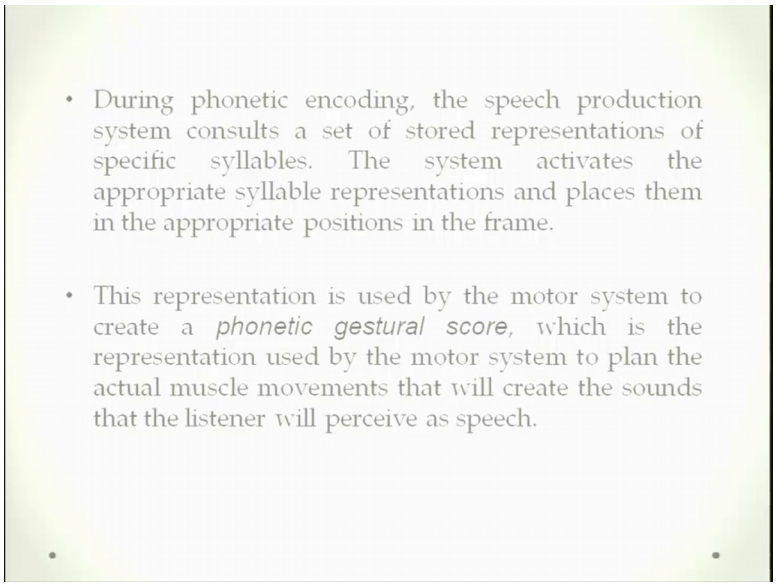

During phonetic encoding now, you are moving further than this the speech production system conserves a set of stored representations of specific syllables, how is this thing produced. So, cat versus cut so, how is this syllable actually produced this is what is stored and the phonetics will basically decide how you are going to produce a particular set of syllables. So, the system activates appropriate syllable representations and places them into proper positions in the frame this is how it has to be set.

So, for example, banana the second has to be stressed first does not have to be stressed third does not have to be stressed. This representation is later used by the motor system and the motor system creates what is called a phonetic gestural score which is the representation which is the motor system is going to use to plan the actual muscle movements, say at the phonological words from the phonological words you kind of come out with stress pattern planning and then what you create is called a phonetic gestural score this is how your muscles will move to create the word forms.

So, this is now the plan is there everything is there now the final thing what you have to do is you have to do the articulation you have to actually speak something out.

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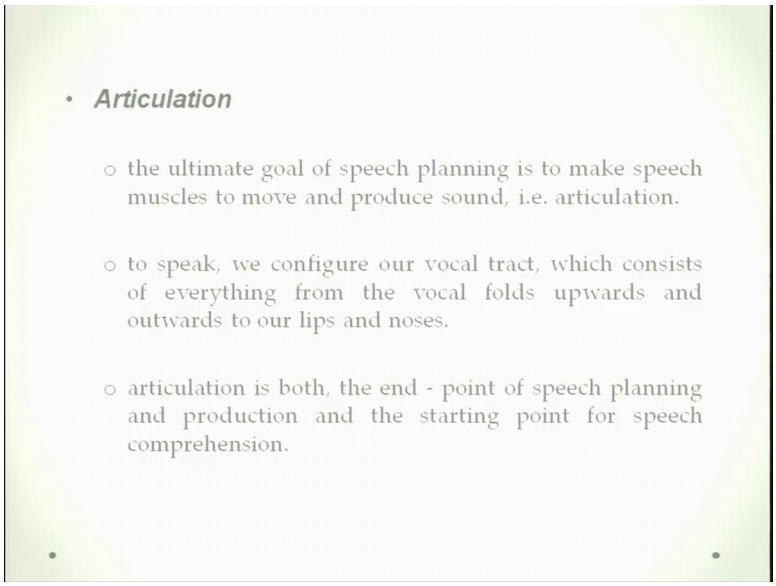

Now I am just kind of I mean we are kind of done with this speech production part I am just kind of spending a couple of minutes here, what is articulation? Now ultimate goal till this point I was talking about speech planning [FL]. So, ultimate goal of speech planning is to make speech muscle smooth and the listener here whatever the sound is coming up this aspect is called articulation, be able to speak we have to configure our vocal tracts which consists of everything from the vocal folds of words you know from the neck upwards to our lips and noses and teeth and tongue and everything.

Articulation is both the end point of speech planning and production and the starting point for speech comprehension you know from speech planning you have created the sound for a listener this is the beginning point of speech comprehension.

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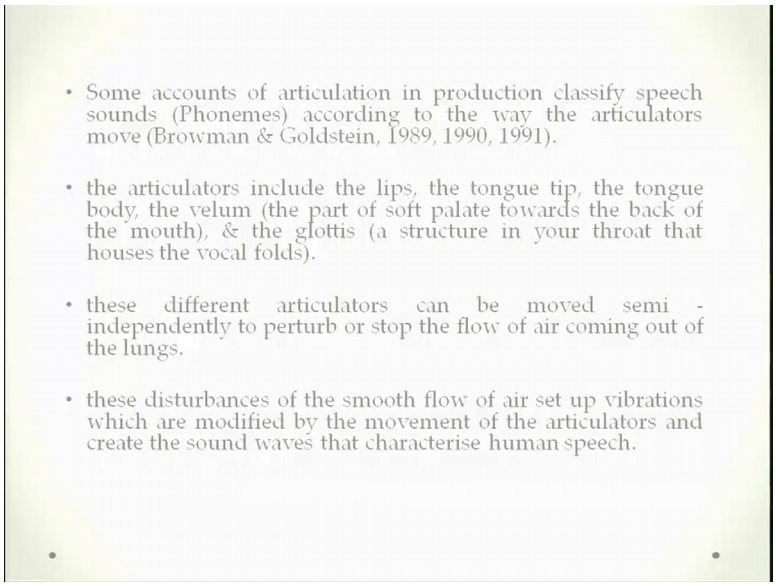

Now, there are multiple accounts of speech articulation that you will come across some amounts of speech articulation classify speech sounds according to the way the articulate is moved. So, you would have heard of things like labials, bilabials you know stops and other kind of things the articulators basically include things like the lips, the tongue, the tongue tip, the tongue the vellum that is soft palate towards the back and the glottis which is the structure of your throat.

These different articulators can be moved and semi independently of each other and they can be used to stop or you know perturb the flow of air and these disturbances from the flow of air is basically what will create the different phonetic contrast different ways a particular sound is produced.

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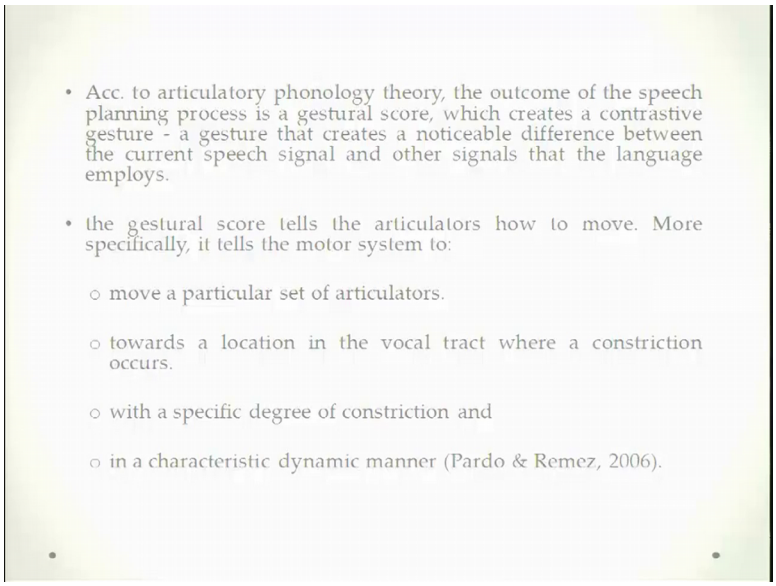

According to articulatory phonology theory the outcome of the speech planning process is phonetic gestural score. Gestural score creates contrastive gesture which is basically is creates the, you know the way in which you can differentiate between different sounds. A gesture that creates a noticeable difference between the current speech signal and other signals that the language implies what will this help is, this will help you tell the articulators on how to move, what is it that you need to do in order to produce this or execute this gestural plan.

Then it includes 3 or 4 things it includes moving a particular set of articulators you know towards the location, in the vocal tract, where the constriction of air has to happen, what is the degree of constriction is there completely stop or a little bit and it is a very characteristic it is happening in a very dynamic fashion. So, this is again this is a little bit of a physics of production of speech I am not really going into a lot of detail, but the idea is what you have to remember is till the speech planning part and also how the speech planning is executed using these different articulators.

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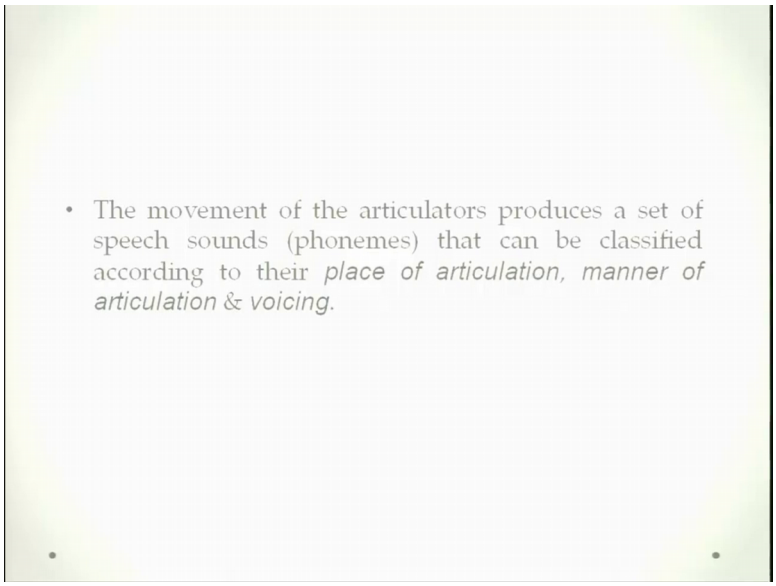

Now the movement of these articulators you know the tongue tip the tongue the vellum and all of those kind of things basically produces a set of speech sounds which is phonemes and that can be basically classified according to their basis of place of articulation, manner of articulation, whether it is voiced or unvoiced, those kind of things. In a different you know day on a different lecture I could probably explain about these different things as well, but I think I kind of limit myself to this and this is basically what the production of you know speech looks like.

Now, further also a little bit something that I would want to just talk about is you have to remember that we do not really produce phonemes in isolation.

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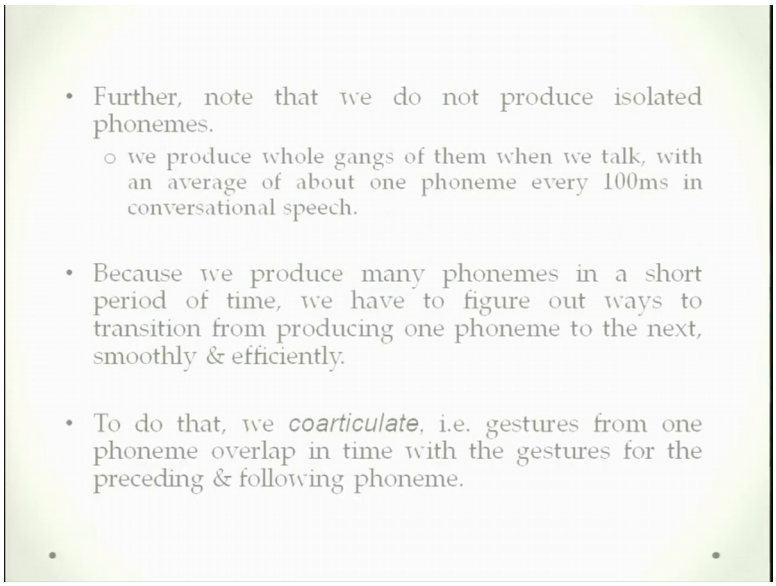

If you are saying what we do is we produce whole gangs of whole bunches of phonemes together when we talk at the average of around one phoneme every 100 milliseconds. So, we are kind of sounds are always meshing into each other you know you do not really produce one sound give a gap another sound give a gap it is not like this, just one sound is kind of you know just meshing into the other sound.

This process basically is referred to as coarticulation because you are producing so many phonemes in such a short period of time. We have to figure out ways of transition from moving from one phoneme to other and this moving from one phoneme to other what you do is you do co articulation, what is co articulation? Co articulation basically is gestures from one phoneme are overlapping in time with gestures for the other phoneme.

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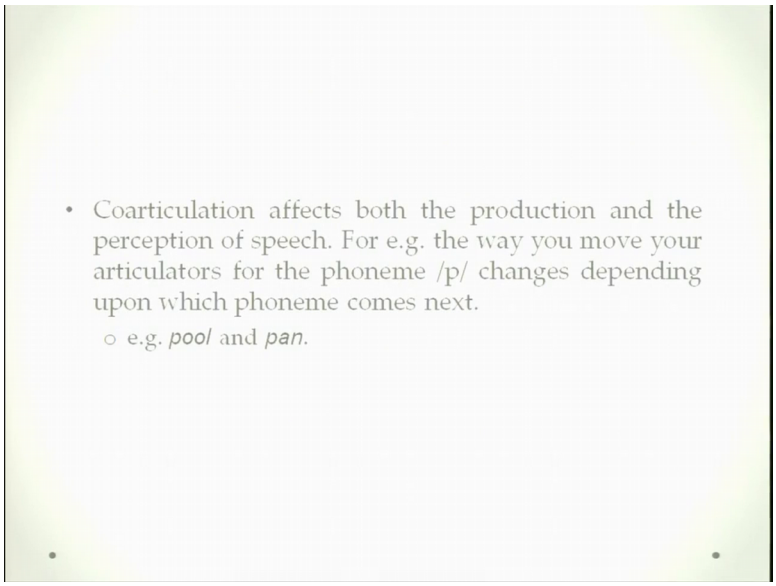

Suppose for example, the word is pool when you say pool, you make a completely different sound as come like you know you kind of the way you speak the p here is very different as compared to when you say pan, the sound the phoneme p sound is exactly the same, but the gestural thing is very different.

So these are referred to as co articulation effects basically coagulation is effecting both the production and perception of speech the way you move your articulators for the phoneme p changes depending upon which phoneme is coming next. So, if it is coming if so, the p sound is produced differently if oo is coming the person is produced differently you can actually do this pool and pan you will see the you know even the airflow is slightly different.

So, this is what I think altogether what I had about speech production I have tried to cover almost everything in here and so, this is pretty much you have to just remember you start from a lexical and you start from an idea pickup lexical concepts, select something move to the you know lemmas, do the morphological encoding, then you get the phonemes, you do the phonological encoding by doing syllabification.

Then you kind of come to the articulatory plan, then you have the gestural score finally, you are able to articulate what you have thought about, I hope you never thought about that this entire process is so complex this is what speech production looks like I will talk to you about different thing about language in the next session.

Thank you.