Lecture 11:
Speech
Production 1

Hello and welcome, with the course introduction in the psychology of language. I am, Dr. Ark Verma, from IIT, Kanpur and this is the third week of the course. In this week, we are going to talk about the process of speech production and comprehension, during the course of the lectures in this week, I will talk to you about issues that come up why do you want to go from an idea, to communicating about that idea, in a perfectly grammatically correct not making so many, years and so on and so, forth will try and understand this process, we will try and see say for example, once you have an idea how do you, put that

idea from completely metaphysical thought space, to something that you actually, speak out and speech is basically a physical process. So, you are actually moving your speech muscles, you moving your vocal tracts and you're finally creating some physical energy to go on with the speech sound, that is going to be the first, part of this week and the second part is also, once you said something, how does the other person understand it, say for example we'll also, talk about the processes that are involved incomprehension / understanding of speech, see once something is said, in the world the physical energy that you've created, it travels outwards but you also hear what you say? What really happens when somebody else or you yourself, are hearing some aspect of switch, how do you understand speech, what are the processes that are required in perception and comprehension of speech. So, this is going to be the outline for this week, we are going to talk about speech production and speech comprehension, now coming to the first few lectures, the first three lectures of this week, will basically be concerned more with speech production and aspects of speech production will basically be covering at least two models, one is the V word plus, plus mode land the other is the dells spreading activation model, we'll talk about some related phenomena of speech using those models and the second part of the week, basically in that is lectures four and five, will mostly be about perception and calm speech and the issues that come up therein women. So, let's not waste a lot of time and go to, understanding about speech production. So, today's lecture is basically a speech production first,
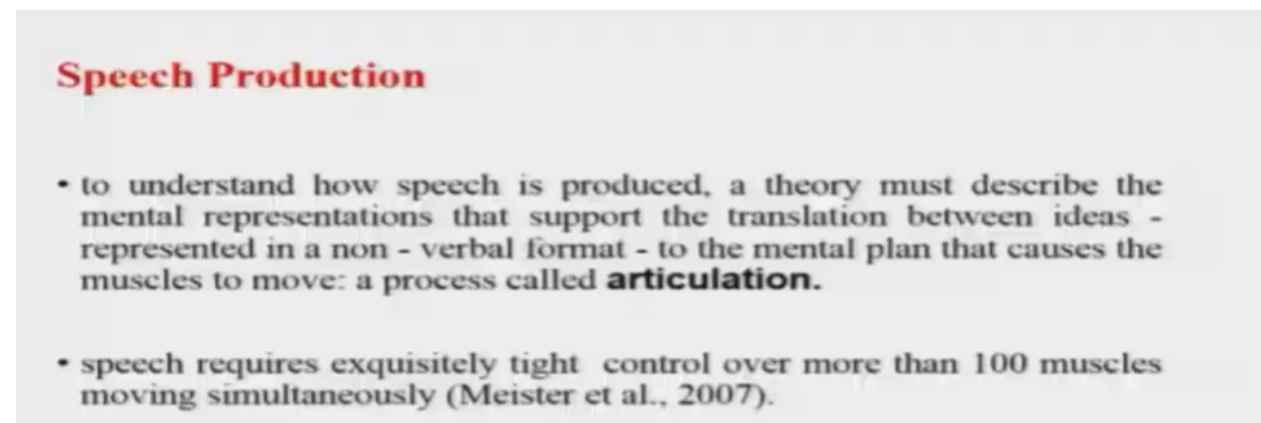
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To begin the conversation...

- majority of human communication occurs via speech.

    - speech includes a range of steps from conceptualising an idea that the speaker wishes to convey - the speaker produces a set of behaviours that change the physical environment, i.e. create a pattern of sound waves - an acoustic signal - that is available to the listeners.

    - the listener then, analyses the acoustic signal to decipher words - & match those words to the concepts, already stored in the mind - and thus understand what the speaker meant to say.

Let's try and talk about, what basically speech is about. Now I'm, sure you would know, that majority of human communication when it comes to language, is basically happening via speech, for the most part you're speaking to each other, obviously we communicate by our writing as well, by sending messages, by a drawing, why are so many, things but if you really, look at it, by a sign language and so on and so, forth but if you really look at it, the majority of communication that we actually do, is via speech, we speak to each other, by moving the vocal apparatus and the other person kind of hears us, by using the comprehension apparatus and kind of ones he or she understands a message, he acts upon it. Okay? or maybe he replies, back to us in some way. So, speech is certainly a very, important aspect as far as language is concerned, let's try and look at what speech, kind of Is, so speech basically includes a range of steps, from conceptualizing an idea that the speaker wishes to one way and then what happens is that once

you, have thought of. Okay? Now I want to speak about, let us say I want to speak about, a vacation that I had some time back. Okay? So, then what do you do is to, conceptualize that idea and then you produce a set of behaviors, which is basically that you select some words and then you finally move your jaws and move your lips and your tongue, to create some kind of signal that is the speech signal, that you set out in the open, this acoustic signal that you've created, is now available for the other listeners, to listen and to comprehend and to act upon. So, this is basically the act of speech, production the listener then, basically what he or she does, is it analyzes the acoustic signal, it's a physical form of energy, acoustic signal and basically it works on the go signal, to decipher the words and that and to kind of understand what each of those words mean and matches those words to the particular concepts and which the person would already have stored in mind and then basically that leads to the understanding of what has been said. So, basically these two are sort of, a loop sort of a process, one you have an idea and then you produce some sort of speech and the other is you have some speech and you have to go to that idea. So, this is basically the closed loop, of communication which is achieved via speech.

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Speech Production

- to understand how speech is produced, a theory must describe the mental representations that support the translation between ideas - represented in a non - verbal format - to the mental plan that causes the muscles to move: a process called **articulation.**

- speech requires exquisitely tight control over more than 100 muscles moving simultaneously (Meister et al., 2007).

So, let us see, how is speech produce, so to understand how, speech is produced we basically have to break down, the process and into a few sub processes and we will see how, that is basically achieved one of the first things, is if, there has to be a theory, of speech production or speech comprehension so to speak, it should describe first, the mental representations that support the translation between ideas and from those, ideas to actually creating a particular set of instructions for the body, to be able to move your tongue in exactly that way, say for example, if I have to talk about my pet dog, I should have a picture of what a dog is or say everything I should know, something about my dog, to the point that I can actually, read their words DO G, in a particular sequence that we hear, dog coming out of my mouth. So, how does this happen? I had basically just an abstract idea about what a dog is and from that idea I have to come, to a point where I can kind of move my vocal apparatus, to actually create the sound that will represent those concepts. No speech in that sense is a physical act and it's a complicated physical act, because it exquisitely requires you to have a very tight control, over more than hundred muscles, in this vocal operator. So, this is something which, is a very, sophisticated mental activity or rather say it's a very, sophisticated motor activity that, the motor area of your brain, really gets involved in achieving. So, this is, in that sense, something that is, slightly difficult and we have to try and understand it, how do you really get to the understanding,
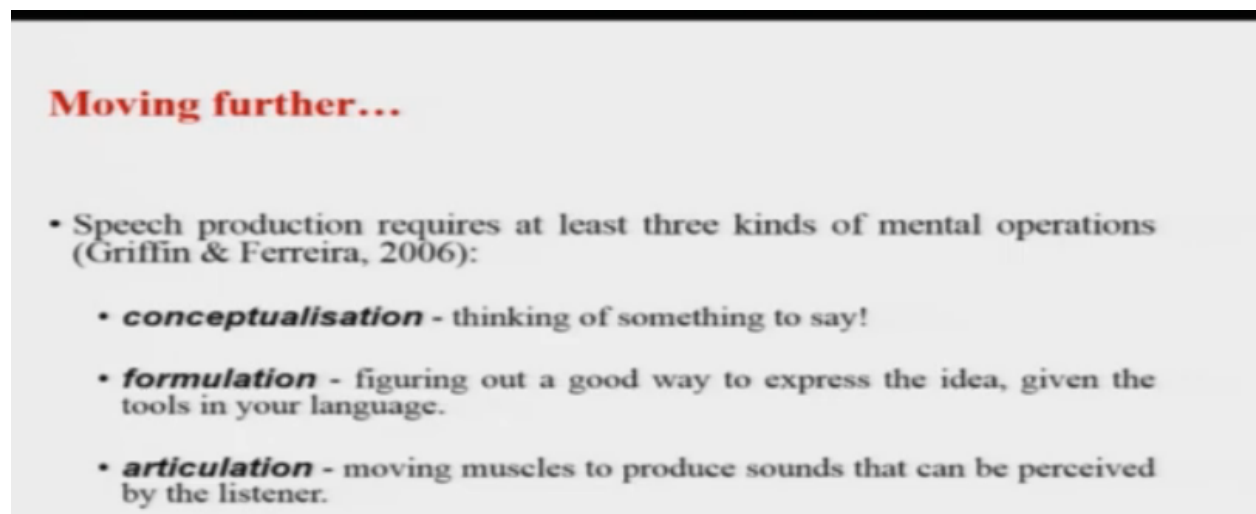
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Important Questions

- What steps need to be taken to retrieve the linguistic representations one needs to convey the idea?

- How does one organise those representations?

- How are those representations translated into a form that the motor system can use to generate the actual, physical gestures that create speech sounds?

Let's ask some of the basic questions that could be interesting and are important for us to understand speech comprehension. Now, when the first questions is, what steps need to be taken to retrieve the linguistic representations? One needs to convey the idea? So, I can have an idea about so many, things in life say for a example, lot of things you see, people sometimes say, that I do not have the words to convey this feeling. Okay? but then the communication will not have a say, you to have words to convey whatever feeling you have and what we do is? Sometimes we kind of find it a bit hard, sometimes you find it a bit easier, but you have to reach that space in order to dig, for those words that represent those meanings simpler concepts that's Al right? This could be this is a stylus, there is a chair, there is a camera, there is some lights were there, so these are some of the concepts as soon as, I look at the concepts I gather the words that I have to speak. So, what is it, in my head, that is helping me, reach that precise word let us say light or precise well let's say chair, when I see this chair. Right? In front of me. So, this is, what is it, in my head, that is helping me connect the idea, to the exact word that represents those ideas. So, that is one very important question and will kind of come to that. Now, once you have those representations how do you arrange them, in a way, that you have a particular sentence to speak, you can have, a thought about say for example, anything that you would want to talk about, suppose you want to have a very simple weather, conversation with somebody. So, you are, let us say waiting at some place and there's this, other traveler that comes and you just want to look at, the weather and say Okay? What a nice weather, you know? It's a bit cold today, so my children is not, typical for this time of the year, something like that how do you, organize those representations that they're syntactically, coming out correctly and in a very, intelligible way. So, that the other person can also listen to it and respond back, what are the processes that are kind of helping us do this, also how are those representations translated into a form, now even you can have words, even you can come to the point that you have this sentences, what I even going to speak? Suppose I am, reading out from someplace, if I am reading out from someplace, the initial part maybe I can skip, a little bit that I cannot when we talk about reading we will come to that but let us say, I don't really have to do the first part of what this process is, but I just have to read, if I just have to read even, I have to kind of get to appoint where I know the exact instructions that I have to give to my vocal tract muscles and this vocal tract includes a few things, I can tell you, these

vocal tract muscles and basically arrive at a point, where I say that Okay? The physical gestures will create the exact same message that I intend do Conway. Okay? Some of these questions will be something that we will be talking about partly in today's lecture as well and in the coming lectures, of this chapter. Now, let us kind of move a little bit further let us try and forgiving this discussion a little bit of shape, let us, try and look at a particular model I'm, going to talk to you about V word plus, plus which is will me William levels, model of speech production, am kind of discussing it from the book that I'm using for this course that is Traxler, introduction to psycholinguistics. Now, one of the things, if you look at that particular model, is that, you have to do at least a few things, in order to start speaking, what are the three things? Suppose I give you a task, you know? I ask you to pause the video a little bit and I ask you to basically, you know? Imagine, how you're going to describe something to me I'll say for example, you know? How do I, ask you to, let us say, if I asked you to write or see for me recite a little bit of an essay, on your favorite sport or a favorite animal or your favorite food or whatever, you know? Your favorite place to visit, how you will, achieve this task. Now there is a guess, you could probably even as the first process, you could be conceptualizing, what is it that I want to talk about? What are the experiences? What, what are the all, what are all the abstract ideas that I want to convey, when I want to convey about let us say my favorite place to visit, on my favorite food or whatever. So, this first part, is called, 'Conceptualization'. Basically it is about thinking of what to say,

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what do I want to, put in my message. The content of the message is, basically going to get captured in conceptualization; The second part is formulation, once I have the content of the message all Right? I have to figure out, in my language, words and structures that will be able to convey this message, faithfully. So, the second part is basically figuring out a good way, to express the idea exactly, how I am going to put this, I am angry with somebody and I want to kind of convey my anger at some point, how do I do it? Do I, go and shout in a particular way, do I kind of try and say it politely but I still, make sure that the message is conveyed, do I put a sarcastic comment, what do I do? Okay? So, I have to figure out exactly how, this message is going to be conveyed that is basically referred to as, formulation. Now, once I formulated the message I've, already say for example in formulation I already included putting the

words in together and you know? Putting the syntax, structure. All Right? All of that I've, already let us say factored in, so then what remains? The remaining part is basically the part that is called, 'Articulation'. Now I have to move my speech muscles in such a way that the person exactly here's, what I intend him to hear? Okay? So, I conceptualize what I wanted to say? The message I put that message into a particular formulation that this is what the person is going to hear and then I put this formulation into, the speech program such in, such a way that out of my mouth comes, only that message that I had initially conceptualized. Now this, is yeah, this sort of probably seems symbol at this moment but, it carries so many, steps and it kind of carries a really sophisticated process and this is, that process that we are going to talk about in today's, lecture. One of the models as, I was saying that attempts to kind of help us understand this entire process, is William levels model, called you know? 'William Schley Levels'. Weaver plus, plus model.

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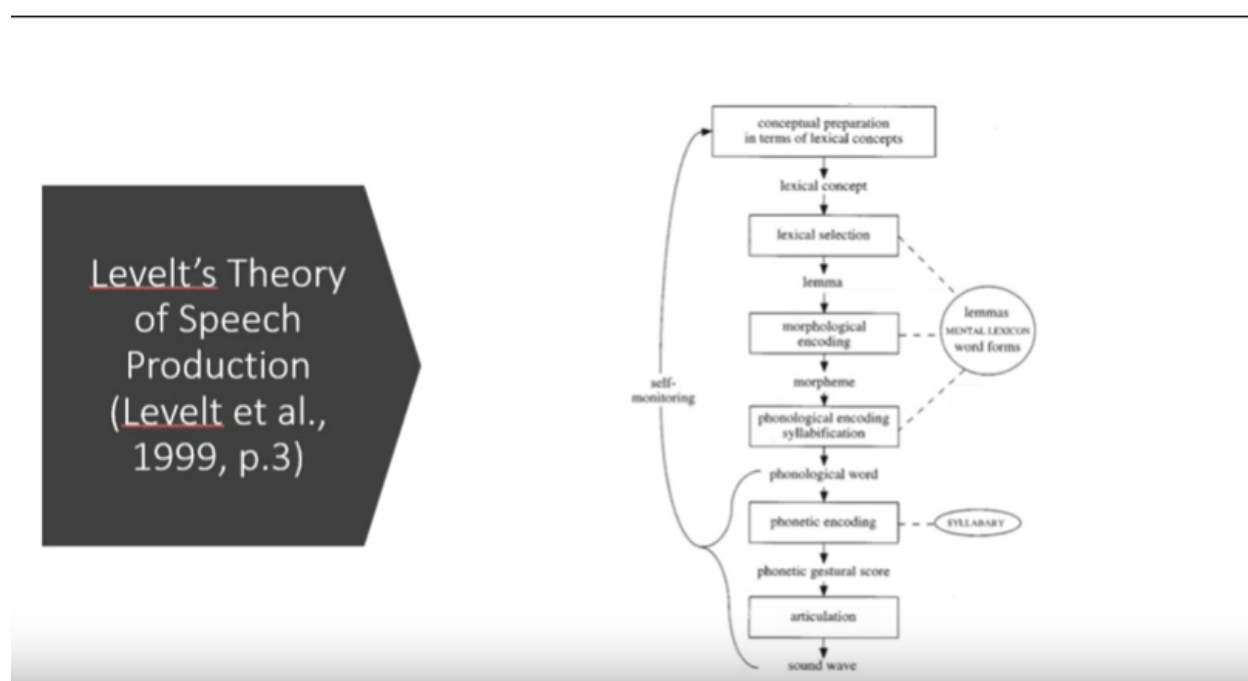
Let us look at the model now. Now this is the figure of that model, I've borrowed this from William levels original people and this is how, this model looks, before we kind of go into a lot of detail of this model, I would like you to, kind of pause and look at the figure, in a little bit of detail, maybe kind of take a swing short, keep this separately, because when I'm going to talk to you about the details, of this model I would really, want you to look at, each of these steps and wonder how, things are happening. Now if you look at this step, it starts with conceptual preparation on the top. So, conceptual preparation in terms of lexical concepts, don't worry, about these words I will kind of, you know? Talk about these words in much more detail when we go ahead. So, the first part, you see in the model is conceptual preparation in terms of lexical concepts, the output of that stage is lexical concept, then you get lexical, once you have one or many lexical concepts that's why? That's how you will do selection, once you've selected then you kind of go to, the lemma, of that concept, I will talk to you about what lemma is, after that you will do, what is called 'Morphological Encoding'? After that you will basically end up with a particular kind of a

morpheme, you will go into phonological encoding and solidification and then what you'll have in the end is, a phonological word form, once you have the phonological word form, basically you don't need much after this, you basically need a little bit of a phonetic encoding, which is say Leafication and stuff and then you go to a phonetic gestural score, going to articulation and once you've articulated you hear, the sound wave and you kind of try and comprehend it backwards. So, this is, basically you see there is a loop, starting from the phonological word form, to the sound wave, both of them connecting back to the conceptual preparation stage, basically it is, sort of a feedback loop which, tells us that, as soon as, you have the phonological words, you're already you have that, you know? Sort of inner speech that you're listening to and responding, by making changes in what you have to say, sometimes that can happen earlier, sometimes it'll happen a little bit later, sometimes say for example, you said something and then you've heard oh, this is something that I was, not intending to say. So, this would happen at both stages, that's why you see that feedback loop coming from both sides. Okay? So, this is basically the figure, I would really like you to, you know? Have a look at it, try and remember this as we go, into more details of this process today. So, in today's lecture we basically discuss this model in a little bit more detail. Now, moving further, one of the goals of this model,

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- one of the goals of WEAVER++ is to describe the intermediate steps between activating an idea and activating the sounds needed to express the idea.

- speech production is viewed as involving a sequence of mental processes.

  - each mental process accomplishes a subgoal & the output of one mental process provides the information needed for the next mental process.

  - each box in the figure that we just saw, indicates a kind of mental process. for e.g. "conceptual preparation…" refers to choosing the idea (s) you want to express, at the same time ensuring that you have words for those in your language.

Weaver plus, plus is to describe the intermediate steps, between activating an idea and activating the sounds needed to express the idea. so, I'm going to, the first part is activating the idea which is your conceptual preparation and the second side is the activating the sounds, how do you come from idea to sounds? Now, in this model or as William labeled kind of probably understands this speech production is viewed as, involving a sequence of mental processes. So, it's not like you just, thought of an idea and you finally articulated it there; there are so many small, small steps so many, mental processes that happen in the middle. What you will talk about, is say for example, in the model as well, in the figure if you look back, then each of these boxes are a mental process. So, each mental process basically will be able to accomplish a sub, goal and the output of one mental process basically provides the information for the second mental process. So, if you look at these boxes, again going back to the figure conceptual preparation, lexical selection, morphological encoding, all of these are basically each of them simple, individual mental processes each of these mental processes are creating an output, basically which is

going to be fed as the input for the next stage. So, this is basically a sort of a serial, you know? Model. So, each box in the figure has VJ and it is just so, indicates a kind of mental process for example, conceptual preparation, it refers to choosing, a particular idea that you want to express, at the same time ensuring that you have words for those in your language. So, you have two enough to do this.

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- the output of this process, a **lexical concept**, is an idea for which your language has a label (Levelt et al., 1999).

- Let us take an example: the concept of a *female horse* is expressed by the word *mare*. but English language does not have a word that expresses the concept *female elephant*.

- To express, the latter idea you need to select and combine two different lexical concepts (female, elephant).

Now, the output of what? The output of the conceptual preparation, which was the first mental process, is a lexical concept, what is the lexical concept? A lexical concept, basically is an idea, for which your language has a label, suppose you want to talk about something, if you want to talk about, say for example red colored flour and you know? You look at it, you kind of going around and in guarding, you kind of come across the ID red colored flour, as soon as you, look at a red flower you understand. Okay? This is a rose, as soon as you, look at a flower, you have the word activated. Okay? This is a rose or you look at an animal, suppose you're looking at a cat for the first time, when you're looking at say for example, a species that you've not come across, the closest what you really do, is basically you will say. Okay? This looks like a cat, maybe just cat something, this is how we kind of, create sometimes novel words but, more often than not for a lot of things that you would come across in your daily life, you will have a word for it, that word which represents that concept, has basically been referred to as a lexical concept, a concept for which words are there in your language, there is one. So, they've taken an example, the example of the concept of a female horse, now a female horse is called a, 'Mare', everybody knows, it so as soon as you see a female horse, you will have the word Mare. But, say for example if you see a female elephant, now a female elephant is not really a single word for saying a female elephant at least in English, I know, for sure that in Hindi there is, but basically then because you didn't really have a, single word for expressing female elephant, the idea of a female elephant, you will basically combine two ideas, you will have female and you don't have elephant, I will combine them and this, set of words becomes the word for that idea. So, that is basically sometimes, what you have to do? Okay? Now yeah, exactly this question,

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- But, can all ideas be neatly expressed with individual words?

  - Not always, we need a stage of processing that takes our (non - linguistic) ideas and finds the lexical/linguistic forms that we can use to express those ideas.

  - The *lexicalisation process* therefore serves as the interface between non - language thought processes and the linguistic systems that produce verbal expressions that convey those thoughts.

But, can all ideas be neatly expressed with individual words? Probably not, if not then what do, you need to do, we need a stage of processing that takes our non linguistic ideas and finds the lexical or linguistic forms. So, that we can, that we can use to express those ideas, this whole concept of combining female and elephant and conveying their idea of female elephant. Okay? This is really referred to as the lexicalization process, you know? You have to kind of, come up with words, for these particular concepts. Okay? So, this process of lexicalization, basically serves, as the interface, between the non, language thought processes and the linguistic systems that produce verbal, expressions to convey those thoughts, thoughts you can have, about anything thoughts you can have completely indefinite and infinite and so on and so forth, but eventually because you want to, communicate about those thoughts, you have to come up with words that kind of closely, as closely as possible, convey those thoughts. Okay? So, coming up with words, for those particular thoughts, is referred to as, lexicalization you have to remember this. Now, moving ahead, what does lexicalization include again, when your language does have a word for the idea, suppose I giving you an example of a rose, you know? So, when your language does have an idea,

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- When you language does have a word for the idea that you wish to convey, the activation of

  - *a lexical concept* i.e. an idea that can be expressed in a word, will lead to

  - *lexical selection*: when a language has a number of different words that are close in meaning to the idea that you wish to express, a number memory representations do get activated, one of which have to be selected for production, that process is called lexical selection & it gives a *lemma* as an output.

- *lemma* is a mental representation that reflects an intermediate stage between activating an idea and activating the speech sounds that you need to express the idea (Kempen & Hujibers, 1983).

  - the lemma incorporates information about word - meaning & syntax.

 For the word that you wish to convey, then you basically do what, you activate the lexical concept. A lexical concept is an idea that can be expressed, in a word and this will basically lead to a scenario, where you need to do what? You will need to do, lexical selection, you can come up with one idea, that's all Right? No sir action needed but, you probably will come up, with one or more kind of words for one kind of concept sometimes. So, then you will basically need, to do, lexical selection. Lexical selection basically is when a language has number of different words that are closing meaning to the idea that you wish to express, suppose you want to express your anger, it can range from, being mildly disappointed to being annoyed, to being slightly angry, to being completely, enraged about something. Okay? So, say for example for this particular idea, there are so many of, these words and you have to select from these words. So, this is basically a lexical selection, you have to select from these many words, which is the exact word that I want to communicate now. Okay? So, one of these lexical concepts, have to be selected, for production, this process will be called, 'Lexical Selection' and basically it comes up with the lemma as an output. So, it basically again lemma is also, a little bit of an abstract idea, lemma is what comes out of lexical selection. Okay? Now what is this lemma about, lemma basically is this Mendel representation that reflects the intermediate stage, between activating an idea and activating the sounds, see as soon as you, finalize this exact word candidate is the one that I want to speak about, that is when you start coming up with sounds. But before you, reach that point before you finalize that this exact word is, what I am going to speak? You come up with sort of an intermediate representation called the, 'lemma', the lemma basically has information about both, the words meaning and its syntax. This is the word; this is broadly what this word means and this is the syntax, so this is the way this word is particularly used. So, you kind of go from, activating lexical concepts, to doing lexical selection and from once you've done the lexical selection, now you come with, come up with a lemma. Okay? This is roughly what I have decided to speak, now I have a lemma in my hand, lemma has already told me a little bit about, this words meaning, what this word intends to convey and it also, told me a little bit about how, this word should be, used ideally both things.

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- Once, there is an activated set of lemmas, the process of activating the sound codes that we need to speak begins.

  - first, we undertake a process called *morphological encoding*.

    - morphemes are basic units of language representation, morphological processing is important because words appear in different forms depending on aspects of their meaning as well as grammatical aspects of the sentences in which they appear.

Now once, there is you know? An activated set of lemmas, the process of activating the sound codes needs to begin. Okay? So, as soon as you, kind of figured out. Okay? This is, what I need to talk about, this is what I'm, going to talk about, then basically we'll move on, slowly to activating the sounds because you speak in sounds, you don't speak in ideas, isn't it, unless you have sounds, you not be able to go further and produce those sounds. So, you have to come up with start coming up with. Okay? These are the sounds, how do you do it? This process is called, 'Morphological Encoding'. What is morphological encoding? Before that I late tell you, a little bit about what morphemes are morphemes, are these basic units of language representation and morphological processing is kind of important because words appear indifferent forms, depending upon the aspects of meaning versus, depending upon you know? The grammatical function of these words, if you remember I probably remember talking a little bit about morphemes, in the earlier you know? Chapters, but morpheme is say for example, you have to convey the meaning of cake, now you can be talking about kick or he kicked or he is kicking or he usually kicks. Now, the same word, can appear in so many, different versions, each of these different versions has, a different syntactical grammatical function, but also differs in meaning. So, the knowledge that one of this, has to be selected, is basically your, process of selecting a particular lemma, depending on what you, want to really speak, you will select one of these words as a, you know? As a candidate that Okay? In this sentence I am, going to talk about this person who is kicking, this animal at this point let us say, so I have to talk about, the act of kick in continuous sense, so let me pick kicking. Okay? So, let us say from this, process of, you know? Activating the lexical concept and to do, in lexical selection you had the lemma of kick activated, you have to once, you have to kind of you know? you've activated that lemma; you to figure out which version of the word kick, you want during you talk one so, you say Okay? I want to communicate about the continuous version of this act happening, let me pick up kicking. Okay? This process here is close to what is referred to as morphological encoding. Okay? During this morphological encoding, level notes, that for each word, we have, what is referred to as? A morphological specification, what is a morphological specification again it is, basically this that I was describing. Right? Now

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- Levelt (1989) notes that each word we know has a **_morphological specification_** that tells us how that word behaves when it is placed in a sentence.

  - the morphological specification for the word _eat_ includes, "that it is a root form & that it's past - tense inflection is _ate_."

  - the form of the word, its morphological specification (ate, eats, eating), changes depending on what precise role the lemma is playing in the sentence.

So, it tells us that how, a word will be behaved, will be behaving, when it is placed in a sporadic lesser sentence. So, when I put kicking, in a particular sentence, it implies that I am talking about an act which is going on at the moment. the morphological specifications say for example for the word eat, an example attraction it takes, integrates that it is a root form and it is a past, tense inflection and it's past tense inflection is 8 and it's continuous inflection is eating. So, all of this knowledge needs to come in, also the form of the word, its morphological specification exactly, which version is going to be used, changes depending upon what precise role, the lemma is supposed to play in the sentence. So, exactly, what is your sentence going to be about? What is the idea that the sentence intends to convey, on the basis of all of that, you will pick up this exact idea, this exact morpheme. Now, having selected, a set of morphemes to produce, ok. This is what I want to talk about? This is what I want to talk about? This is what I want to talk about? Refer slide time: (25:45)

- having selected a set of morphemes to produce, morphological encoding activates the speech sounds (phonemes) we need to plan the articulatory movements that will create the speech signal.

- the speech sounds one produces, depends on the morphemes that one has activated & also these have to be organised n the right sequence to ensure that right sounds are produced in the right order.

To produce morphological encoding basically, it starts activating the speech sounds that is the phonemes that are needed, to plan the articulator movements. So, as soon as you've kind of figured out ok I'm going to talk about kicking, there are two morphemes in your kick and ink you have to kind of create start creating a preparation, for the sound of a curve and ING in anger basically because you have to kind of have these more phonemes activated. So, that you can combine them and create the speech output. So, the speech sound, sounds one produces, depends then on the morphemes that one has activated. So, which so I have I activated kicked. So, then the morpheme said I would have activity will be kick and IDI versus, if I have to produce kicking then I'm obvious that I would have activated will be kick and Ink. So, I have to kind of select which of the morphemes that I have to activate. Okay?? So, obviously the speech sounds that will get activated will depend on these morphemes and also will have to be organized in the right sequence to ensure that the sounds of tears in the right order. So, I cannot say for example say, in cake I have to say King. So, in other than the fact that both kick and ink are activated I have to also make sure that kick comes, out of my mouth first after ink. Okay? So, this is also something that you really need to work about. Okay? So, let us kind of do a little bit of recap where have we come for now, we activated some particular lexical concepts,
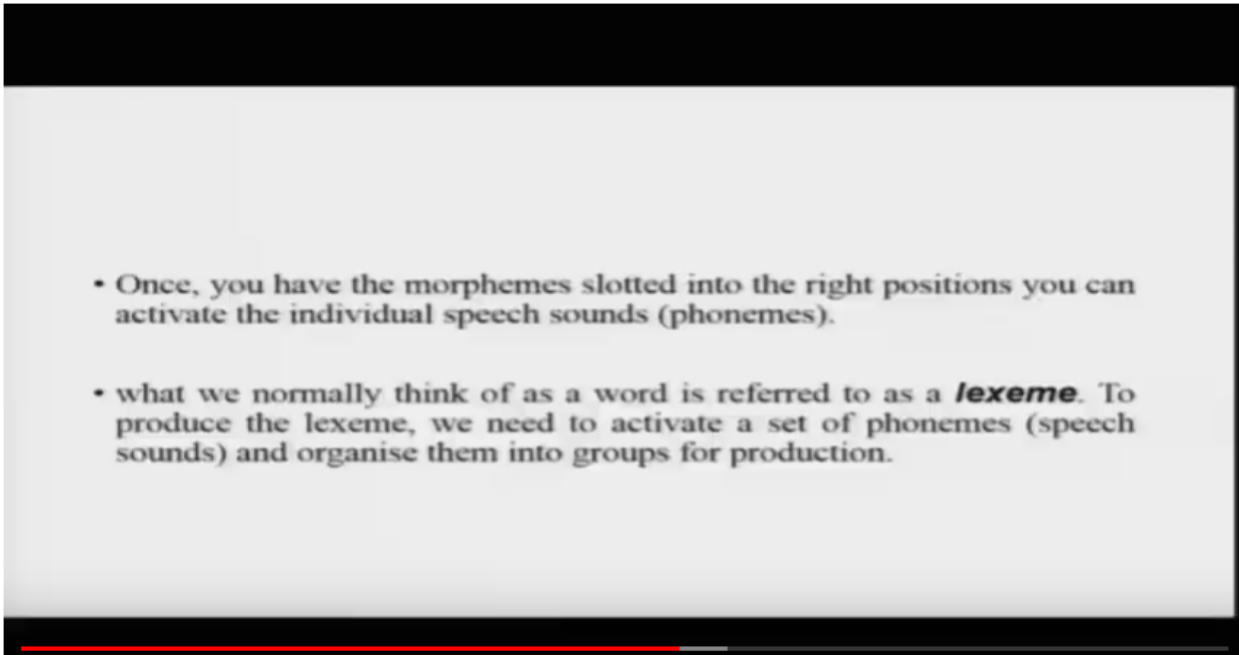
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- So,
  - Concepts -> Lemmas -> Morphological Specification -> Morphemes -> Speech sounds (Phonemes)
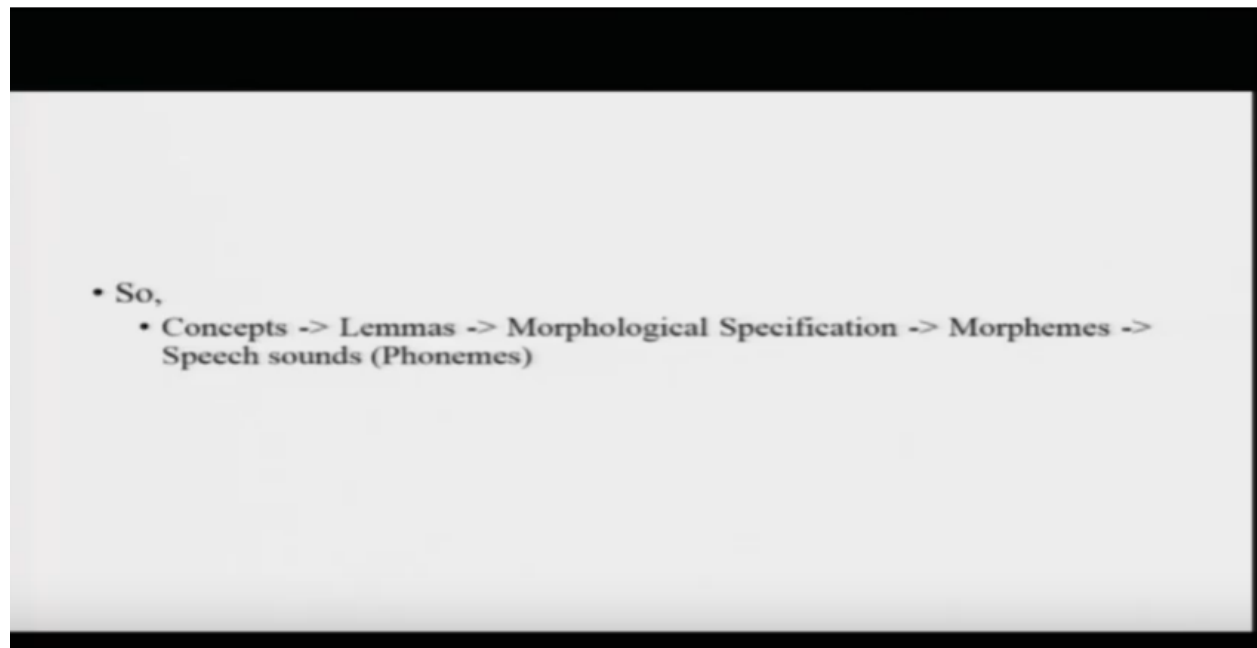
 We did a little bit of electrical selection there, then we came up two lemmas, after that we kind of went closer to look at the morphological specification of that lemma. So, suppose the idea was I wanted some version of the word kick, now the morphological specification that I am going to use is the continuous version. Okay? So, I am kind of now, sure that I have to produce the exact word kicking. So, I have no

after this morphological specifically, I have two morphemes kick and ink, once I have this I know which are the sounds that are needed which are the phonemes that onion it ka in ka an ink and ga. Okay? So, we have to have this so, we've kind of moved from the concepts to the sounds here. Let us move further,

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- Once, you have the morphemes slotted into the right positions you can activate the individual speech sounds (phonemes).

- what we normally think of as a word is referred to as a *lexeme*. To produce the lexeme, we need to activate a set of phonemes (speech sounds) and organise them into groups for production.

 Now once you have you know the morphemes slotted into the right positions, what you can do is you can start activating the individual space, also I Ka e ga and all of that you have to start activating, that from your memory, what we normally think of, as a word is referred to as a lexeme seam. So, when you talk about say for example words this is basically referred to as a lexeme, lexeme is the shortest unit in your mind the lexicon so to speak. Okay? To produce the lexeme to say these words you have to obviously activate, a set of forms you know ka e ka all of those say for example if you were to do a phonetic transcription of this word. So, you have to go to that and also you have to organize them. So, not only you have to have kick and ink incoming one after each other, even within the lexeme you have to see that the phonemes follow each other, say maker ka en ka so, he has to come between the two curves. Okay? If it comes then this is not the correct thing. So, you have to kind of organize within the lexeme as well and between the two morphemes as well, both kind both levels of organization, organization needs to be dead, in order for you to be able to speak without making a lot of errors. Now you see how complicated, sort of this is when I just have to say one sentence you know the man is kicking the dog or something like that. Okay? No is lexeme real so, before we go further is lexeme even a real thing is, is it a psychologically real concept. So, some people had doubts about, this I'm not really using a lot of references here I'm just I just want you to understand the concept.

- Evidence for the lexeme as a psychologically real level of representation comes form studies involving the production of **homophones.**

  - a homophone is a word that has more than one meaning e.g. a lexeme like /but/ has two spellings (butt, but) and more than one distinct meaning.

  - In English, /but/ occurs much more frequently than /butt/.

  - Acc. to current production models, both the versions (but, butt) activate the same lexeme, because the lexeme represents how the word is pronounced, & both versions are pronounced the same way.

 So, basically we investigate whether the lexeme is a psychologically really level of representation, some of the evidence comes from his studies involving the production of homophones. Now what are homophones as the name suggests homo basically means same phones basically means the sound so, same sounding things. Okay? Now homo phone is a word that, has more than one meaning same sounding does not mean having the same meaning so, homophone is words, that have the same sound but not necessarily the same meaning. So, homophone is a word that has more than one meaning, that is a lexeme like, but has two spellings but, but and butt, butt you, you appreciate the but is, you know the back side, of your you know body and but is this interjection that you know, I want to do this but I cannot do this because, of this reason something like. So, these are the two versions that I'm talking about, in English the beauty but, that is the interjection occurs more frequently as compared to the but that is the body part. Okay? But both sounds probably because, you know both the sounds are very similar. So, according to these current production models, that are float both the versions but and but they will activate the same sets of sounds obviously. Okay? Because the lexeme represents how the word is pronounced and both the versions are pronounced inexactly, the same way. So, even if you know the meanings are different, the sounds that are going to be get activated are exactly the same. Now if this is exactly the case,

- if so, both lexemes should experience the *frequency inheritance effect* i.e. if a word has a high frequency twin (but), you should produce the low frequency version about as fast as the high frequency version, because the overall lexeme frequency is high.

- Conversely, if a word has two versions, but both are low frequency, then it should take a relatively long time to respond to the word (flecks, flex).

Both lexeme should experience is what is referred to as the frequency inheritance effect. What is the frequency inheritance effect? the frequency in radians effect is basically, that if a word has a high frequency twin, you should produce low frequency version, about almost as fast as some as the high frequency twin. So, the beauty but, versus the beauty but basically one is much lower in frequency than the other beauty but is kind of spoken much, much more but the idea is whenever say for example if you give somebody a sentence and this button has to be produced, you will see that this bird is produced, almost as fast as this but basically because, the same set of sounds you have a lot of practice with producing. So, when you ask your system, to talk about the but you will probably have ready set of sounds activated and you can very quickly say this. So, this particularly fragrance is talking about, is referred to as the frequency inheritance effect. Now in a different scenario, conversely if the word, word has two versions and both are low frequency, then basically what happens is it should take relatively longer time, to respond to the word, because both sounds, you're not really very familiar with both sounds, you don't really have a lot of practice with saying. So, flex and flex so, you can see the slide flecks was flex both face you will kind of take a little bit more town time to produce them. Now there are a lot of experiments

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- Experiments involving picture naming provide evidence for frequency inheritance, as do experiments involving translation from one language to another.

  - in both cases, low frequency words were produced faster if they had a higher frequency twin.

  - So, the time it takes you to produce a word is not based solely on how frequently that word's meaning is used but also how often you use a particular collection of sounds.

That have been carried out in this field and some of the experiments involving picture naming, hey do provide evidence for frequency inheritance effect and also do experience that involve translation from one language to another. In both of these kinds of experiments, what has generally been seen is that low frequency words were produced faster if they had a higher frequency twin one. So, this is the evidence for frequency inheritance effect, other hand is that so, the time intakes you to produce, a word is not based solely on how you frequently that words meaning is used, but how frequently the sound related to those words have been used. Okay? So, beauty it but kind of gets an advantage of having a higher frequency twin, even though it is not really a very high frequent word, naming you'll probably not experience a lot of lag when you have to ask somebody to produce beauty but. Okay? So, this is again something that comes out of this, now when we speak,

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- Now, when we speak, phonemes need to be organised into larger units, as we speak in syllables.

  - producing each syllable requires a coordinated set of actions, & each set of actions needs to be planned.

  - before we speak, we need to figure how to map the activated sets of phonemes onto a set of syllables. This latter process is called *syllabification*.

Phonemes need to be organized into larger units. So, basically one of the things that I want to talk to you about also as a part of this, is that how are we organizing these sounds we're not organizing these sounds, only at a phonemic level, because that's a very micro level. Okay? Usually what we do is we organize them into slightly larger chunks and these larger chunks are referred to as, syllables let's talk a little bit about that. So, we organize phonemes into these large chunks called,' Syllables', producing each syllable requires a coordinated set of action and each set of action then needs to be performed, because this whole concept of order ka en ka coming one after, the other in that exact same order for you to be able to produce this exact same sound, now you have to take some action. So, before we speak we need to figure out how to map this activated set of sounds/ phonemes onto a set of syllables how do we take this slightly more amorphous organization, to a more organized way that is syllables, this process of organizing this activated set of phonemes, into syllables is called,' Syllabification', another concept that you'll probably need to remember. Now Syllabification let's talk a little bit about Syllabification.
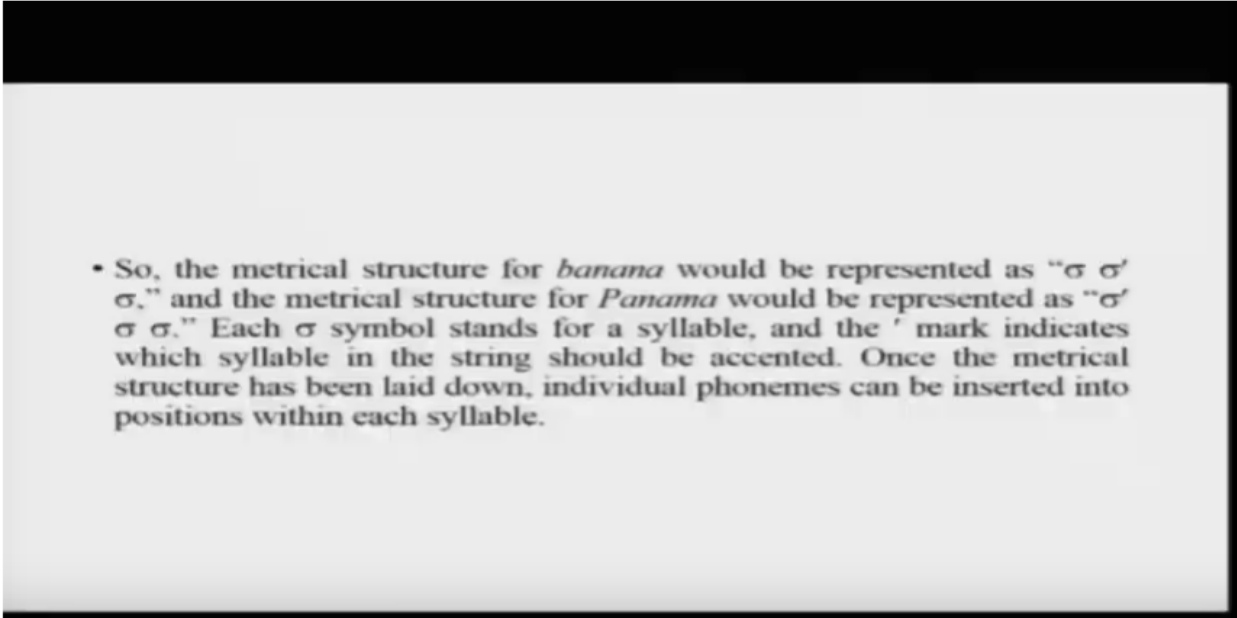
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- Syllabification involves two subcomponent processes:

  - activating a metrical structure & inserting individual speech sounds (phonemes) into positions in the metrical structure.

  - the metrical structure consists of a set of syllable sized units; in addition to specifying the number of syllables that you need, the metrical structure indicates the relative emphasis or loudness each that each syllable should receive.

  - e.g. the word *banana* has an accent on the second syllable; the word *Panama* has an accent on the first syllable.

Syllabification involves two subcomponent processes, first activating a metrical structure, means and inserting individual speech sounds, into positions in that metrical structure. What is metrical structure if you remember, I was talking to you about this development in the last week we're talking about infinite electorate speech and children being sensitive to stress patterns and so, there is this in English for that matter for that matter I can talk to you about is a lot of the words ninety percent eighty five ninety percent of the words are trochaic words trochaic words are where the stress is mostly on the first syllable rather than on the second syllable. So, for example baby, bottle the first syllable stress the second syllable slide of weaker strong weak strong weak. Okay?   Now this material structure basically is this arrangement of sound units, you know silver sized units in addition to specifying the number of syllables that you need you also need to specify the stress, basically how much stress is going to be put on VAE and you know on which part of the syllable. So, the material structure basically, needs to be activated how it will be activated you basically arrange these sounds into a particular way. Okay? This is the first syllable, this is the second syllable, this is the third syllable you also need to basically say this syllable will be stressed this will be unstressed something like that. Okay? If you're talking about by syllabic words or say for example if you say try syllable words see for example panama then you have to say which syllable stress which is not stressed. Okay? And the system needs to know that because, that is how it will be able to produce that remember we're not talking about writing we're talking about producing and we are producing, words we need to really know which part of what we have to produce, should be stressed or which part should not be stressed. So, we have to be really careful about this, let us take an example to understand this better, suppose I have to talk about the banana. Okay? So, banana has how many sounds burn Ana basically, two sounds one is the repetition severe, burn Ana the word banana, basically has which is the stress. So, just look at this banana. So, now basically the second syllable is the one that is stressed and the third and the first are slightly less stressed. Okay? Whereas Panama are basically, the first syllable stress and the second and the third syllables are not stressed. So, if the first thing that I really need you to pick up is that you see that the two words, composed of very similar syllables, basically are differing in stress patterns. Now how to suppose say for example, you have a D notation for each syllable,

you should also have a D notation for stress on each syllable. So, basically again something that I've kind of borrowed a little bit from Traxler is you can look at this. So, banana if you see that you know the symbol here, is, is representing the syllable, the tash mark is representing the stress so, you see for banana,

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- So, the metrical structure for *banana* would be represented as "σ σ' σ." and the metrical structure for *Panama* would be represented as "σ' σ σ." Each σ symbol stands for a syllable, and the ' mark indicates which syllable in the string should be accented. Once the metrical structure has been laid down, individual phonemes can be inserted into positions within each syllable.

 The stress is on the second syllable whereas in Panama the stress is on the first syllable. Okay? This is how you can you know basically so, you had morphemes and you had, the four you know sounds that needed to be produced, but before you can kind of produce the sounds you needed to organize them into syllables. And not only just organize them into syllable size units you also needed to specify, which part of these syllables will be stressed and which will not so, both of these things you really need to be careful about. So, yeah here each Sigma symbol stands for a syllable and the tash mark indicates which syllable, in the string would basically be accented or stressed once the material structure has been laid down, individual phonemes can be inserted into this material structure that makes up your syllable. This is basically your syllabification.

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- Evidence that *syllabification* is a real mental process that intervenes between morphological processing & articulation can be found in studies of the way people speak.

  - for e.g. consider the word *escorting*. It has two morphemes, i.e. *escort* & *ing*. when people actually speak escorting, they usually produce it in three segments, which sound something like, "ess", "core" & "ting".

  - that means that the syllabification processes in production have placed the /t/ phoneme together with the /ing/ morpheme, rather than with the root morpheme *escort*.

Now again, a question can be asked is syllabification, really happening is this a psychologically real stage of processing, yes you can ask this and then what we need to do is we need to look at how people produce words. So, let's take an example consider, the word escorting, escorting it has two morphemes escort and ing escort and ing when people actually speak escorting, they produce it in three segments, as I just said escorting so, "ess", "core" and "ting". Okay? That means the syllabification process in the production, have placed the t-phone in together with the ing morpheme. Okay? So, basically you have ess", "core" and "ting". Okay? Rather than with the root morphemes escort basically what has happened is we've not really gone with the morphological organization by speaking, we've gone with the syllable organization. So, we've said ess", "core" and "ting". These are the three syllables the morphemes may be different, the more fields are only to escort and ing, but there are three syllables here ess", "core" and "ting". And this is what you need to follow because you're speaking this out. Okay? So, this is something that I would obviously you know like you to remember, know so, we do so, we simply, if you again look back at what we've been talking about, we simply do not need to just activate morphemes.
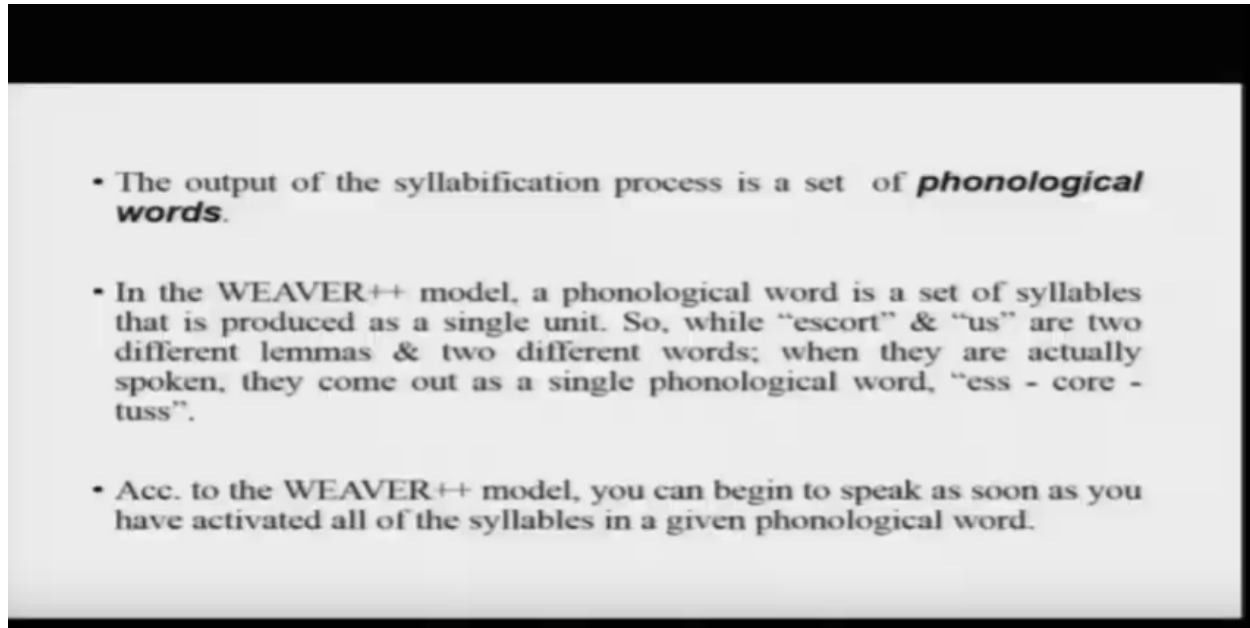
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- So, we do not simply activate morphemes, activate the phonemes that go with each morpheme, & produce them in sequence.

- Instead, after the morphemes are activated, we calculate the best way to organise the sequence of phonemes into syllables, and it is the syllables that actually serve as the basis of production.

- That is true, even when the processes responsible for calculating syllables lump together phonemes from different words. for e.g. in "He will escort us." one would actually say something like, "ess - core - tuss".

We also activate the phonemes that go and do not really simply list saying this again. So, we do not simply need to activate morphemes and then activate, the phonemes that will go with each of the morphemes and produce them in sequence, we have to do a little bit more, what we need to do? is after the morphemes are activated we calculate the best way of organizing these phonemes in two particular syllables and it is these syllables which are going to be serving as the template for production. We are not speaking morphemes by we actually are speaking by these syllables. So, you activate morphemes then you kind of activate the individual sounds and then you act organize the individual sounds in those syllables and then you basically use the syllable sass template for production that's basically what is happening here. Now even when the process responsible calculating syllabus, sometimes would lump together different words, for example in the case of he will escort, us you will have, "ess-core-tuss", you know people would usually say something like this, even though the small teams are only to, "ess-core-tuss". So, while we need, morphemes and words to plan what to say speech does not really simply involve activating the sweet sounds in individual words instead the speech planning system basically activates a set of morphemes and word sat once and then figures out the best way to organize the morphemes and words into a set of syllables and that set of syllabuses what we are going to say. Okay? Sometimes the syllables would, kind of respect the morphemic boundaries sometimes they will not, but for us at least as far as production is concerned the organizing place will be these syllables, again just to make, a caveat here, we are basically talking about English production, you know, I'm sure this could differ for different languages, the rules are different the syllabification process is different, the way of organizing and chunking the sounds is obviously different but again because we are talking about English, we have more data and more theory about that that is clear so, that's why in this course mostly, everything that I am going to talk about is pertaining to English. Now in level 10 wheeldon's words they say the speakers do not concatenate citation form of words, but rhythm pronounceable metrical structures, that most often they're not ignore word boundaries, you know people, say for you can see that this happens, with individual speakers, as well different speakers will kind of chunk the, you know the sound that they have

to say, the sender's in different ways people from speaking different languages do that all the time. So, we have to kind of be mindful of that what is the organizing principle here? Now once all of this is done once the syllabification process is done, what do you have? You have a set of phonological words. What are phonological words?

- The output of the syllabification process is a set of *phonological words*.

- In the WEAVER++ model, a phonological word is a set of syllables that is produced as a single unit. So, while "escort" & "us" are two different lemmas & two different words; when they are actually spoken, they come out as a single phonological word, "ess - core - tuss".

- Acc. to the WEAVER++ model, you can begin to speak as soon as you have activated all of the syllables in a given phonological word.

In the WEVARE plus, plus model, a phonological word is a set of syllables, that needs to be produced as a single unit. So, while "escort" and "us "are two different like seeing two different lemmas and two different words, when they are actually spoken they come out as, two simple phonological words, where is ,"ess-core-tuss". So, basically you know,"ess-core-tuss kind of comes across as one word almost. Okay? According to the Weaver plus, plus model, you can begin to speak, as soon as you have activated all of the syllables, that needs to be said so ,"ess-core-tuss "three silvers need to be activated for you to be able to speak he will ,"ess-core-tuss". Okay? Also while you planning each utterance by activating a number of these lemmas and morphemes simultaneously you,

- Further, while you plan each utterance by activating a number of lemmas & morphemes simultaneously; you plan the actual speech movements (articulation) one phonological word at a time.

- Also, you plan the movements you need to produce each phonological word, one syllable at a time, in "left - to -right" fashion, i.e. you activate the phonemes for the syllable that you need first ("ess") before you activate phonemes for the syllables that you will need later on.

Also have to plan the actual speech movements. So, articulation, one for a logical word at a time you can plan the entire sentence, but your articulator basically will need to plan one word or one unit at a time because that's how this muscles will work otherwise they will all get kind of mixed up. So, you plan the movements, you need to produce for each phonological word, one syllable at a time, again that's important in a left-to-right scenario, what were you talking about morphemes phonemes, phonemes in two syllables, now you have the syllables, but you also have to kind of ensure that the order in which these syllables have to come out. So, you have to not only kind of you know come up with one phonological word at a time, but you also have to ensure that each phonological word, is said inexactly that same order, otherwise you will be saying. So, yes you know as Corte something like that that you also have to remember. So, this has to happen in a sort of left-to-right fashion. So, to speak you know taking the phone script yeah. So, before you activate the phonemes or the syllables, you will need these things later on, you have to kind of ensure the order is this ordering,

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- Evidence for left to right activation of phonemes in phonological words comes from studies involving **phoneme monitoring** in picture naming experiments.

  - In these experiments, people look at a picture & try to say a word that describes the picture as quickly as possible.

  - In a secondary task, you would be given a target phoneme and would be asked to press a button as quickly as possible if the target phoneme occurred in the picture's name.

  - So, if you are asked to name the picture of a rabbit & the target phonemes are /r/ or /b/, you should press a button as quickly as possible & you should refrain from responding if the target phoneme to monitor is /k/.

Really necessary do we actually do this ordering again a question might come up, but people have kind of tested for this using something called the,' Phoneme Monitoring task', what is the Phoneme monitoring task in some of the picture naming experiments you know people are given pictures and they have to name those pictures, in some of these picture naming experience people have been tested on what is referred to as Phoneme basically, what happens is that in these experiments people look at a picture and they try to say a word that describes these pictures as quickly as possible. So, I can be shown pictures of apple banana, grape, something like I have to kind of speak these, things in a secondary task, while you naming this or while I am naming this you would also be given a target phoneme and you would be asked to press a button, as quickly as possible if the target phoneme occurred in the pictures name. So, as soon as power comes you have to press the button. So, I'm doing apple, banana, as soon as ba comes I press the button Okay? So, if you are asked to name the picture, of a rabbit and the target phonemes are ba and you should press a button ask UTS and I've been telling you that you should press a button as quickly as possible, you should refrain from responding if the target phoneme is Indian tribes money monitor is k. So, I'm giving you these words the target phoneme, is ka you go with Ra I enter rabbit you don't press it. Okay? Now this target phoneme,

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- 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 the word than if the target phoneme comes from the middle or the end of the word (Wheeldon & Levelt, 1995).

People can do this phoneme monitoring task very accurately they are very good at tracking what sounds they are producing that's Alright? But they respond a little bit faster if the target phoneme is from the beginning of the phonological world, as compared to the target phoneme comes from the end of the phonological word, what does this tell you it tells us that people are kind of producing this also in a left-to-right sort of a serial kind of a fashion. Okay? Now we've started from conceptualization we started, we went from lexical selection, we came out with a lemma, we went to morphological specification, we came out with a but instead of morpheme when we had a final morpheme you activated phonemes, that are single sounds once you had activated, those phonemes you put them into syllables you specified, the material structure, once you did all of that you came up with a phonological word, once you did all of that you kind of ensured the auditing into which how this is going to be spoken, once you have this then how do you move further. Okay? Then you come up with. Okay? This is what has to be said now let's look at, look back again and try and summarize this.

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- To **summarise**, how the WEAVER++ model works,

  • production begins with a set of ideas that the speaker wishes to express.

  • in the next step, those ideas are tied to lexical concepts, because the language may have specific words for some of the ideas, but may require combinations of words to express other ideas.

  • after a set of lexical concepts has been activated, lemmas that correspond to the lexical concepts become activated.

So, how does WEAVER plus, plus work one production begins with the set of ideas that the speaker wishes to express, second in the next step those ideas I tied to lexical concepts, because the language may have specific words, for those ideas or may not so, then you will need lexicalization, after a set lexical concepts has been activated, levers that correspond to those lexical concepts, become activated so, kick. So, if that if there is a lemma associated, with kick that becomes activated it tells you. Okay? This meaning or this version has to be used.

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- activating lemmas, provides information about the morphological properties of the words, including information about how words can be combined.

- after a set of morphemes has been activated and organised into a sequence, the speech sounds that are required can be activated and placed in a sequence.

  - phonological encoding involves the activation of a metrical structures and syllabification.

  - the outcome of this process is a set of phonological words consisting of a sequence of syllable sized frames.

 Activating lemmas provides information about the morphological properties other words so you kind of need to know. Okay? Because I am going to talk about the continuous version of the word kick I need to have kicking. So, I need to have both of these you know, forms activated so, activating lemmas provides information about the morphological properties, of the words including information, about how words, can be combined. Now after the set of morphemes has been activated and organized into a sequence the speech sounds, that are required to be in that I required, will then be activated after you kind of know which three sounds have to be activated, you go to the phonological encoding part which involves the activation of metrical structures and syllabification then you are out comes this process is a set of phonological words, basically consisting of a sequence of syllable sized frames.

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- During phonetic encoding, the speech production system consults a set of stored representations of specific syllables. The system activates the appropriate syllable representations and places them in the appropriate positions in the frame.

- This representation is used by the motor system to create a *phonetic gestural score*, which is the representation used by the motor system to plan the actual muscle movements that will create the sounds that the listener will perceive as speech.

So, that is what you have after this, you move to what is called,' Phonetic Encoding'. So, during phonetic encoding the speech production system, consults a set of stored representations of specific syllables, how is this element are going to be pronounced, the system then activates, the appropriate syllable representations and places them in appropriate positions in the frame. Okay? So, I have to say you know kicking or escorts or whatever I have to kind of see how exactly I'm going to produce this, what is the exact magnetic sound make up? This representation basically, is now it's basically then going to be used by the motor system, to create what is referred to as a phonetic gestural score and this phonetic gestural score is the representation that is going to be used by the motor system to plan the actual muscle movement so, ess so, there is a particular configuration, of my muscles that will produce ess then core then tuss. So, I have to kind of you know create this program so, that I exactly say escort and not something else. Okay? So, this is,
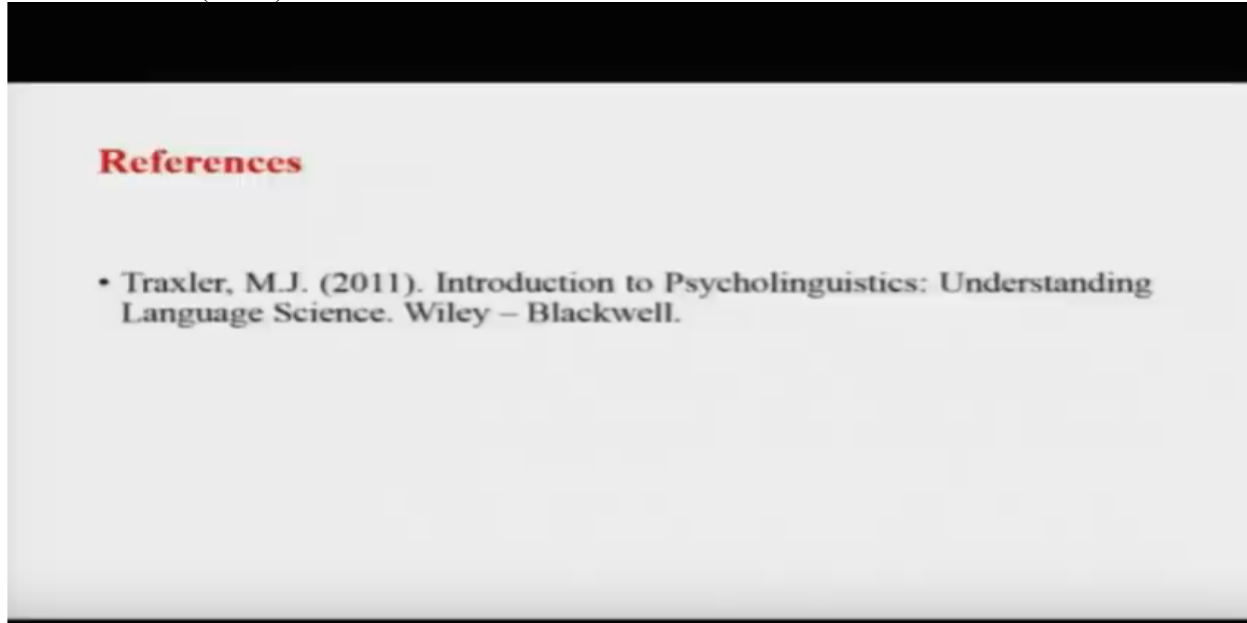
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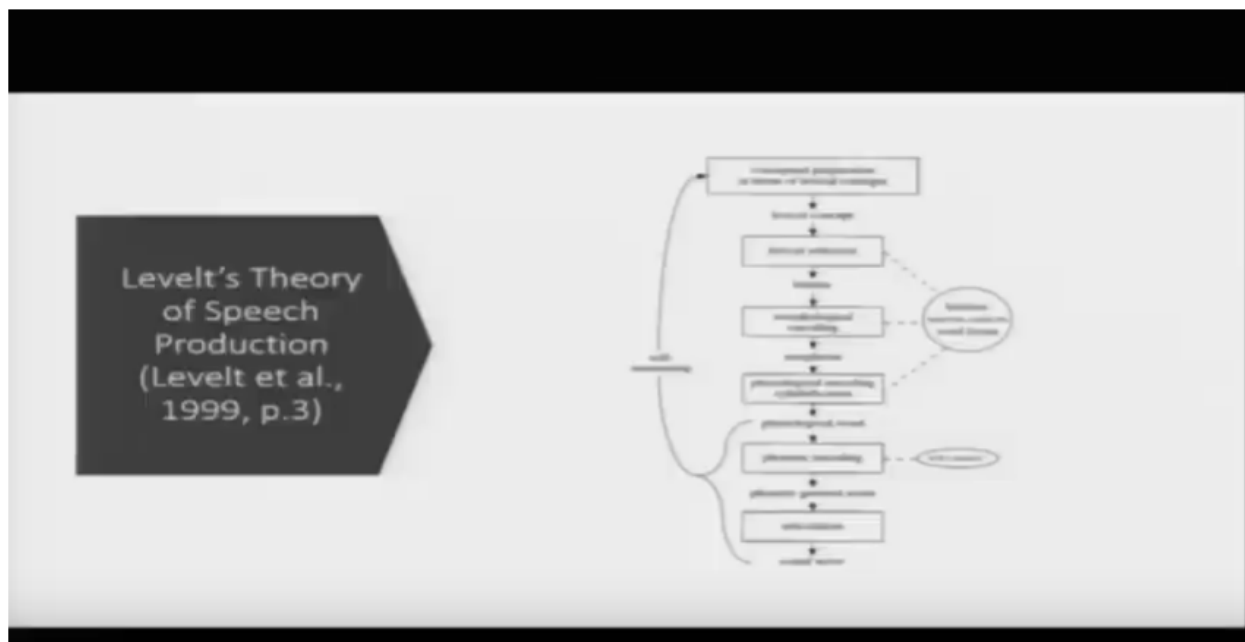
This is pretty much till the phonetic gestural score part again I'm looking at the model, final thing that you have to do is finally say this move the muscles in exactly, that same order that is what articulation is all about, once you said something, you again hear it back that kind of is the start of your feedback loop part of what happens there we will come to in one of the other lectures. So, I hope I discussed the levels model in some detail, I'm sure this was a lot of information to handy in, one go, so, I would say for example you look at it stage, draw your own diagram and maybe go back and forth a few number of times

in order to understand this, but keep this model side, you know besides you in a handy way. So, that when I'm when you're hearing me describe each of these steps you've been kind of mark. Okay? This is what we're this is exactly happening, in this sequential serial sort of a model. Okay? That's all for this lecture I talked to you about a different,

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References

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process in the next class. Thank you