Lecture 13
Speech Production 3

Hello and welcome, to the course, introduction to, the psychology of language. I am Dr. Ark Verma from IIT, Kanpur and we are in the third week of this course then this week. We are going to talk about speech production and comprehension. This is the third lecture in the series where we are discussing speech production. In the last two lectures I talked to you about the WEAVER plus, plus model, that was labeled model for speech production, which kind of curves out the whole process from conceptualization to articulation into small mental processes component shall' mental processes and kind of tells us how each of these processes might be happening or how each of these things might be happening in a very

systematic sophisticatedly detailed way. Okay? In the last lecture I talked to you a little bit about some of the evidence and where these evidences are coming from and what do these evidences in terms of you know speech errors or say, for example the tip of the tongue phenomena or also from say, for example normal participants doing the picture word interference tasks or the picture naming, naming tasks tell us about this speech production process. In today's lecture, I will discuss with you an alternative model a different way of thinking about the speech production process and that is by using the spreading activation model speech production, which was proposed by Dell in around 1990's 1986 I guess. Okay? So, let's talk a little bit about that models. Well, now if you compare this what we have seen in the earlier model , the Viva plus basically is that model assumes a specific kind of flow of information as people go from activated concepts down towards the phonetic gestural score. Okay?

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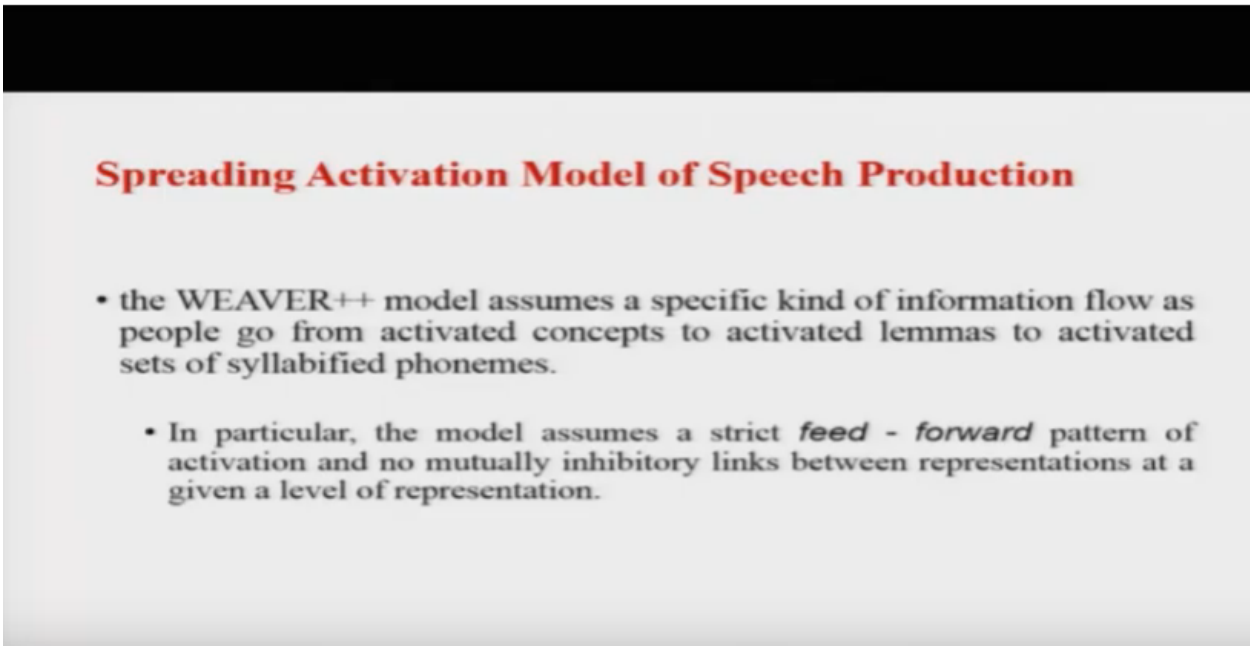

In particular, what really is happening is that , a strict feed-forward pattern step one then step two then step three then step four . No feedback from four to three or three to two and something like that so as a model assumes a strict feed-forward pattern of the activation of each of these and there are no mutually inhibitory links between these particular representations at any given point so , this is one of the things

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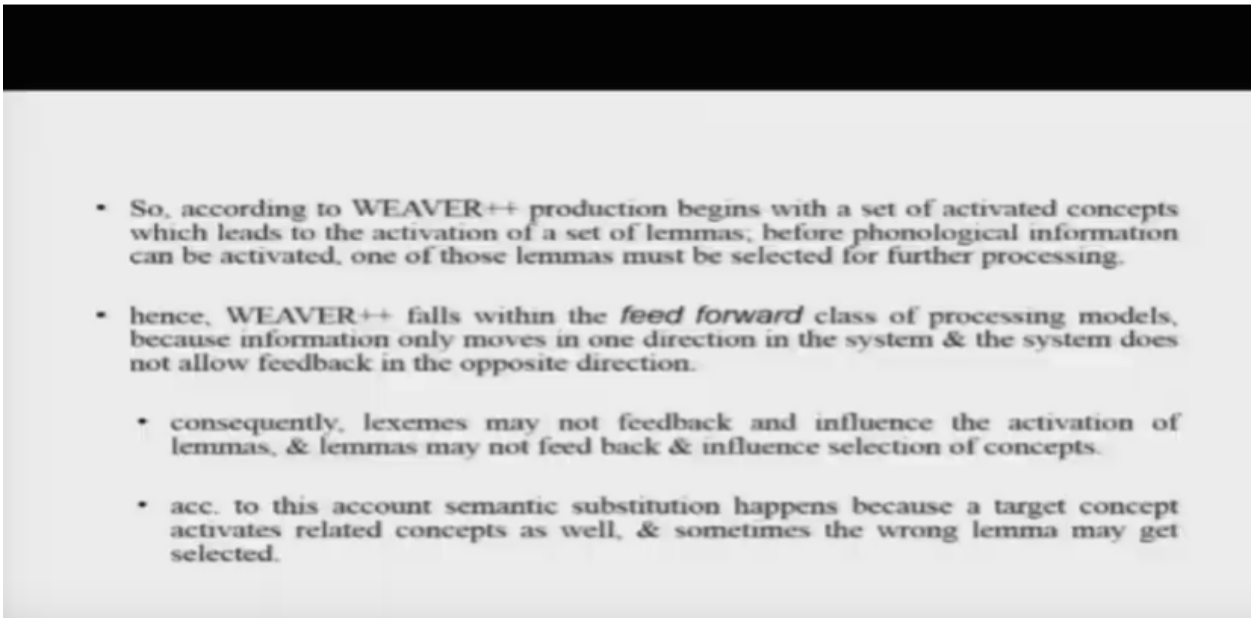

So, according to the WEAVER plus, plus production begins with a set of activated concepts which leads to the set of activated lemmas before phonological information can be activated and one of these and so, before phonological information can be activated one of the lemmas need to be selected then you will go on to activate the phonological information for that specific amount so this is the flow of information there .Hence WEAVER plus, plus falls within the category of feed-forward class of processing models because information only moves in one direction in this model and the system does not allow feedback to happen . Okay , so lower level sin this chain will not be able to feedback or give information back to higher levels in the chain so that is not happening , that's not happening in there where we were plus was model given by levels. Consequently what happens is that lexemes may not feedback and influence the activation of lemmas and lemmas may not feedback and influence the selection of concepts also according to this account semantic substitution basically would happen because a target concept activates related concepts as well and sometimes the wrong lemma maybe selected and that's why the entire process.

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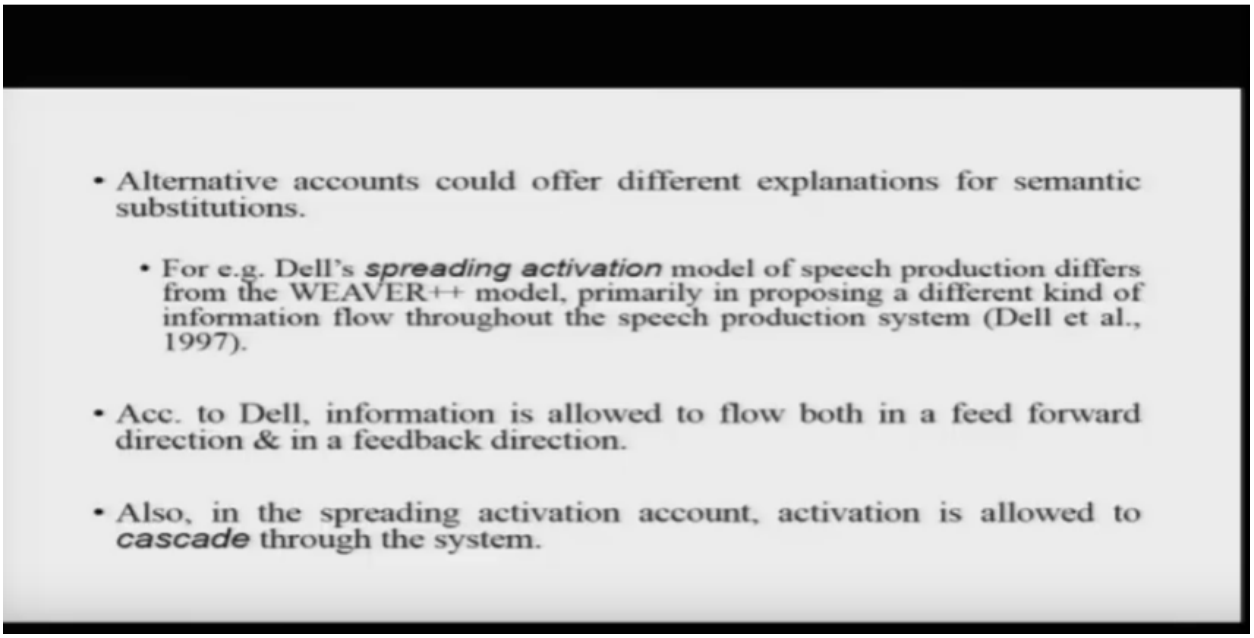

Alternative accounts however could offer different explanations for semantic substitutions let us look at this for example the dells spreading activation model or speech production differs from the WEAVER plus, plus model in saying that you know it proposes a different kind of information flow. Altogether it proposes two things in dell's model information is allowed to flow both in the forward and in the backwards direction so there is feedback that is possible within this model . Secondly in the spreading activation model that Dell proposes activation is also allowed to cascade through the model. What this cascading mean it's almost like a drip kind of a thing so ,once there is activation in the first level there can also be some dripping activation ,the second level and some dipping activation , the third and the fourth levels as soon as you see activity here you can see some residual partial little bit of an activity in the lower levels as well this is the cascaded model in the levels model once the activation is here everything will get completed here the activation will come here everything will get completed here and then the third and then the fourth level.

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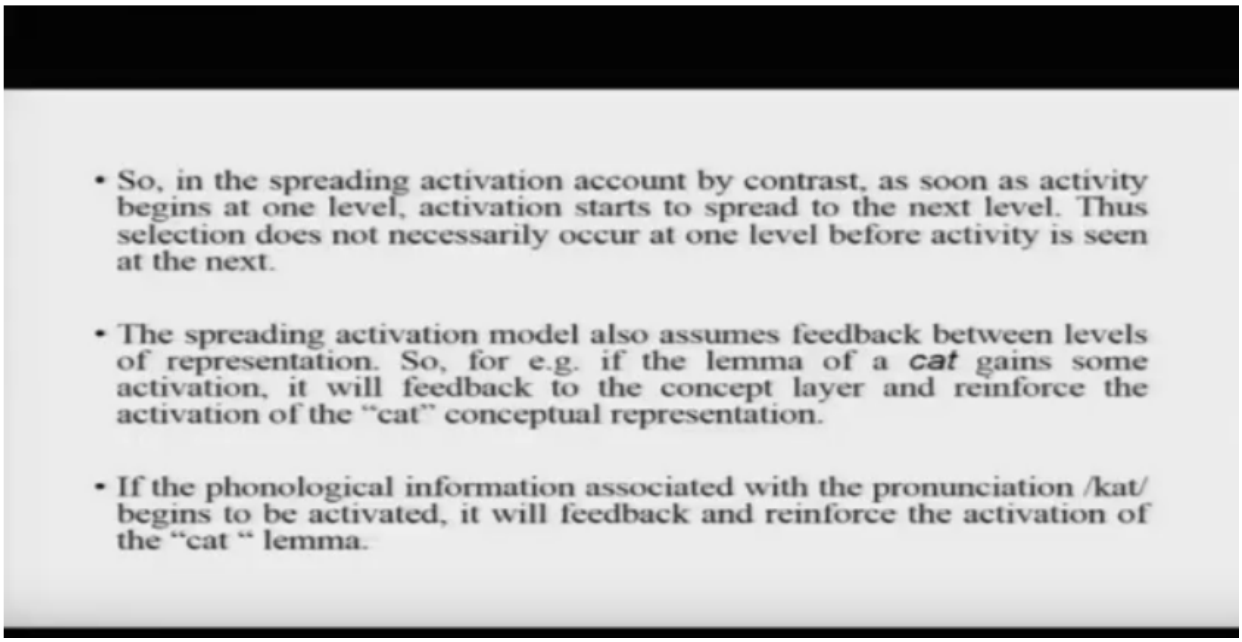

So in the spreading activation account by contrast what will happen is that as soon as activity begins at one level activation starts to spread at the next level thus selection does not really necessarily occur at one level already maybe you selected something at the different level maybe you know you selected to something you committed , the mistake at the last level something like that the spreading activation model also assumes feedback between levels of representation say for example if the lemma of CAD gains some activation it can feedback the concept layer and reinforce the activation of the concept of cat in turn strengthening its own activation if the phonological information associated with the pronunciation of Cat co enter its slot starts to be activated if you feedback and reinforce the limb of the cat which really it feedback and for the concept of the cat so this kind of feedback can be very helpful if you see encountering or putting out some of the activity of the competing on sis we've talked we've talked in the last class about competing concepts . Okay so, you want to you are looking at a picture of the cat but also the word that is written rad and both of them are competing with each other this kind of model probably fire gives you a way of saying that because cat started to get activated Chi received alot of reinforcement upwards and then back downwards that's why a rat could very easily be lost .Okay , now what are the implications of this kind of a model.

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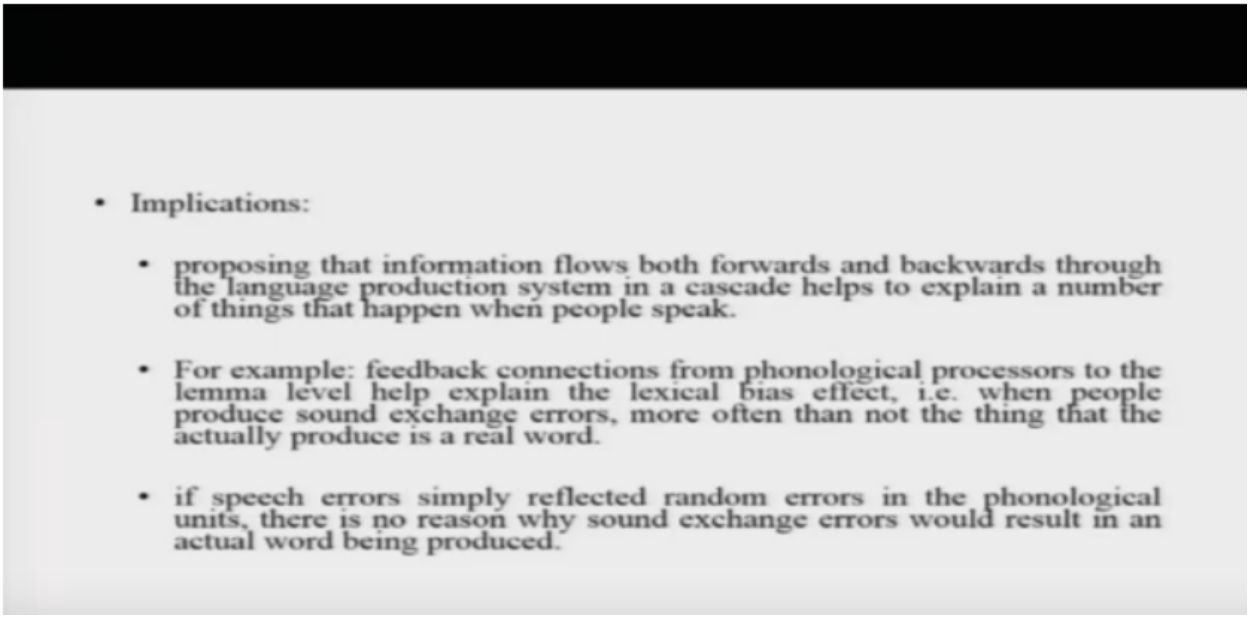

Let us look at it proposing that information flows both forwards and backwards through the language production system and in a cascaded manner it could help us to explain a number of different things that happen when people speak one of the things that can be explained from this is basically you could say that feedback connections from phonological processes to the lemma level they help explain the lexical bias effect , you know lexical bias effect is that out of all the speech errors that you would produce sound exchanges of word exchanges you're more likely to produce actual words as part of speech errors as compared to nonsensical words in other words you are more likely to do sound exchange on field as compared to big horse because , fig in beach when you do the sound exchange are both words asking to do Hagan . Boss which are both non words very rarely somebody would kind of do a sound machine between big and horse however people really do fairly regularly the sound exchange between big feet. Okay ,now why is this happening so speech is really reflected random errors in the phonological units there is no reason why there will be large amount of sound exchange errors that would result in an actual word being produced ,fig beat if the errors were purely.

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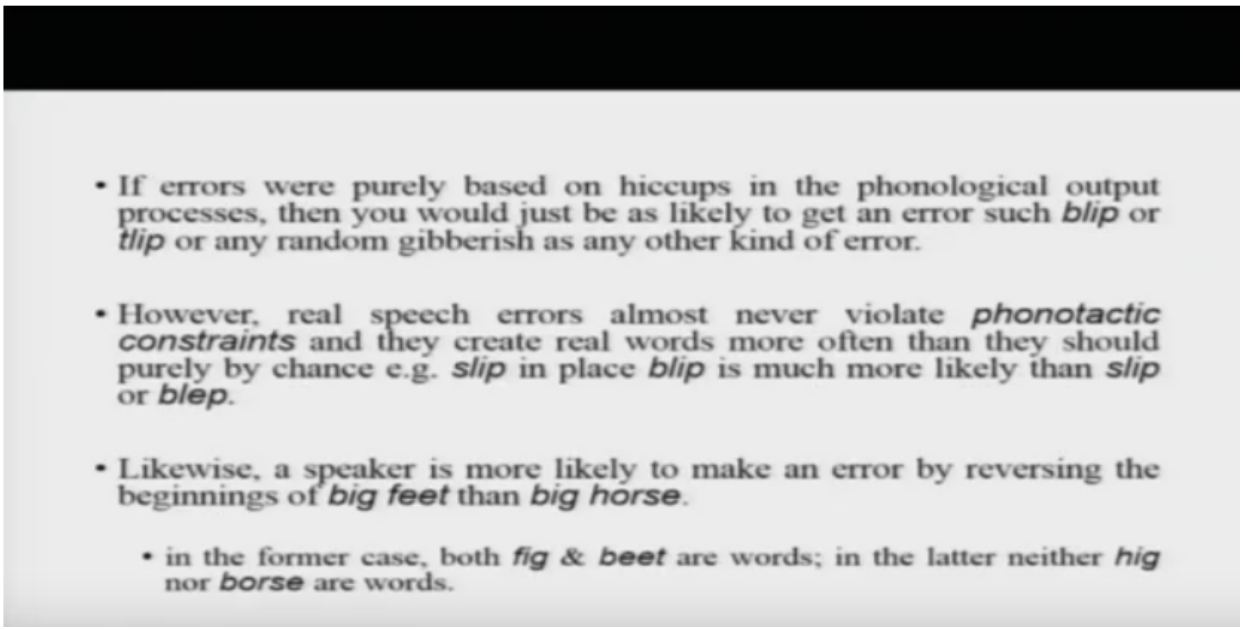

So that's the assumption that if these errors are purely based on hiccups in the phonological input then you could kind of create any guys off errors. Okay, but what has been actually seen in the data is that real speech errors almost never violate phonotactic constraints what is for no tactical knowledge if you remember from the last chapter for not tactical is the knowledge about canonical beginnings and endings of words in the language so for example that there is no word called high and boss , I mean you know that this is not really a canonical word and that's why it is less likely that you'll come up with such a you know output as compared to fig and beet because both of them are real words now interactive spreading activation accounts basically you know help.

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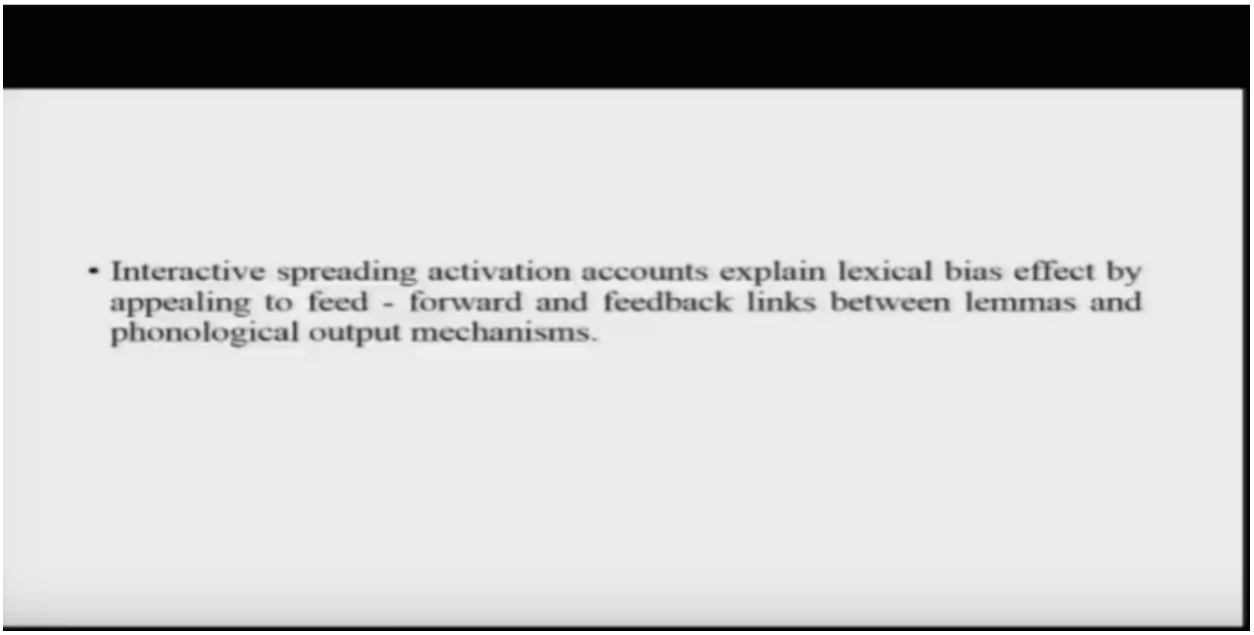

If you're trying to explain this lexical bias effect by appealing to feed-forward and feedback links between lemmas and phonological output mechanisms. Let us look how this is the model you can look at, at the top level.

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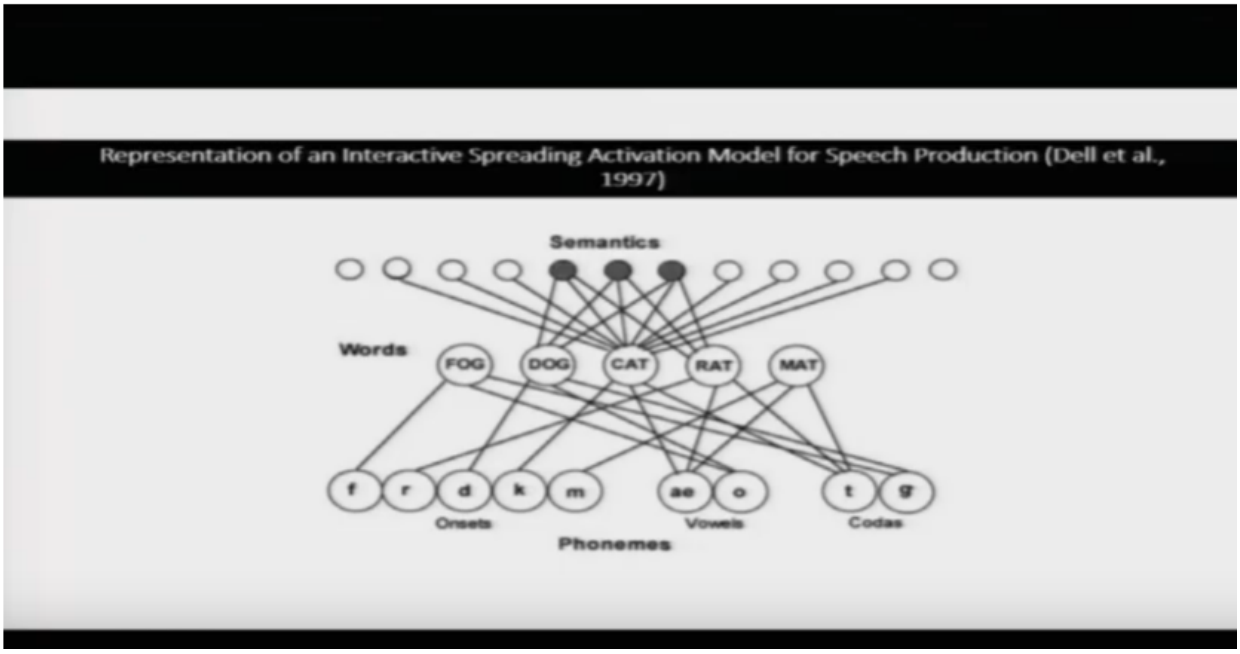

There is semantics then ,there is these words and the words are coming from onsets bubbles and coders so onset bubbles and go does not mind basically make syllables

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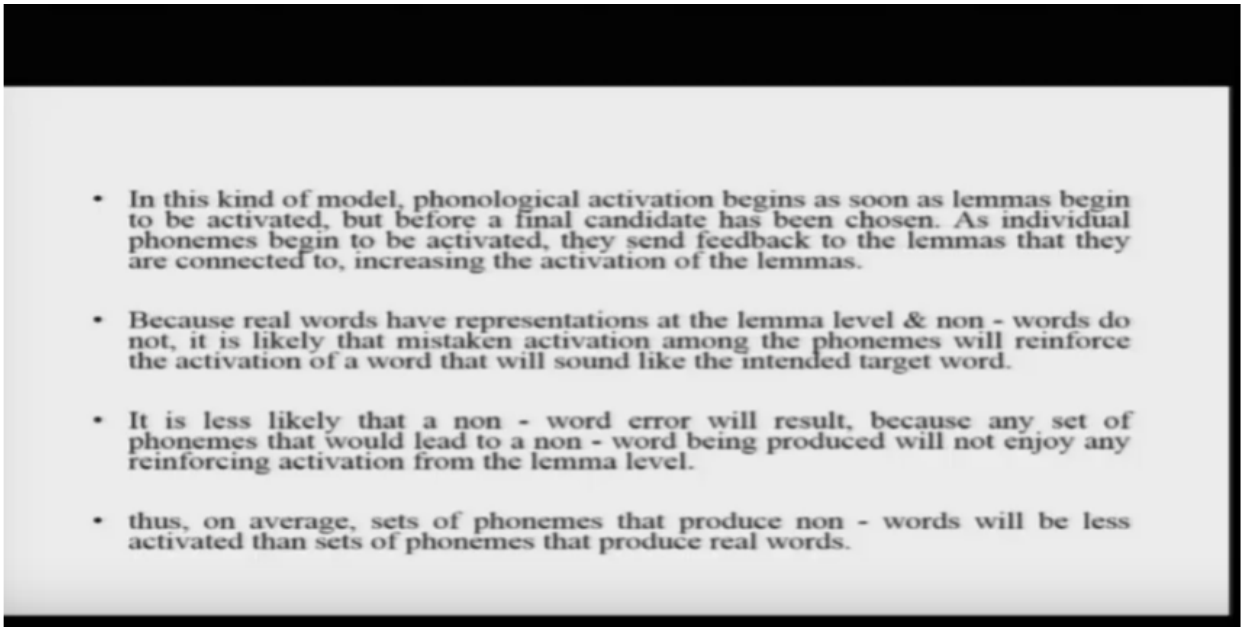

in this kind of model phonological activation begins as soon as the lemmas starting to get activated but before a final lemma candidate has been chosen , as phonemes begin to be activated they send feedback to the lemmas that they are connected to increase in the activation of those lemma. So , it's like as soon as

you know the this lemma you're kind of evaluating the sounds are being evaluated as well and they're kind of feeding back because real words have representations at the lemma level they have a higher chance to get strengthened but non words do not have any representations at the level every. So they will not get stranded so more often than not you will end up not producing finally the non words but you have an equally likely chance of producing you know speeches that will incidentally given word as an output .Okay that's basically the thing that's happening so it is less likely that an onward error will result because any set of phonemes that would lead to unknown word being produced will not have enjoyed any real forcing activation from the lemma level nothing goes back . Thus on average sets of phonemes are produced non words will be activated less than the sets of phonemes that produce real words that's basically how the lexical bias effect goes,

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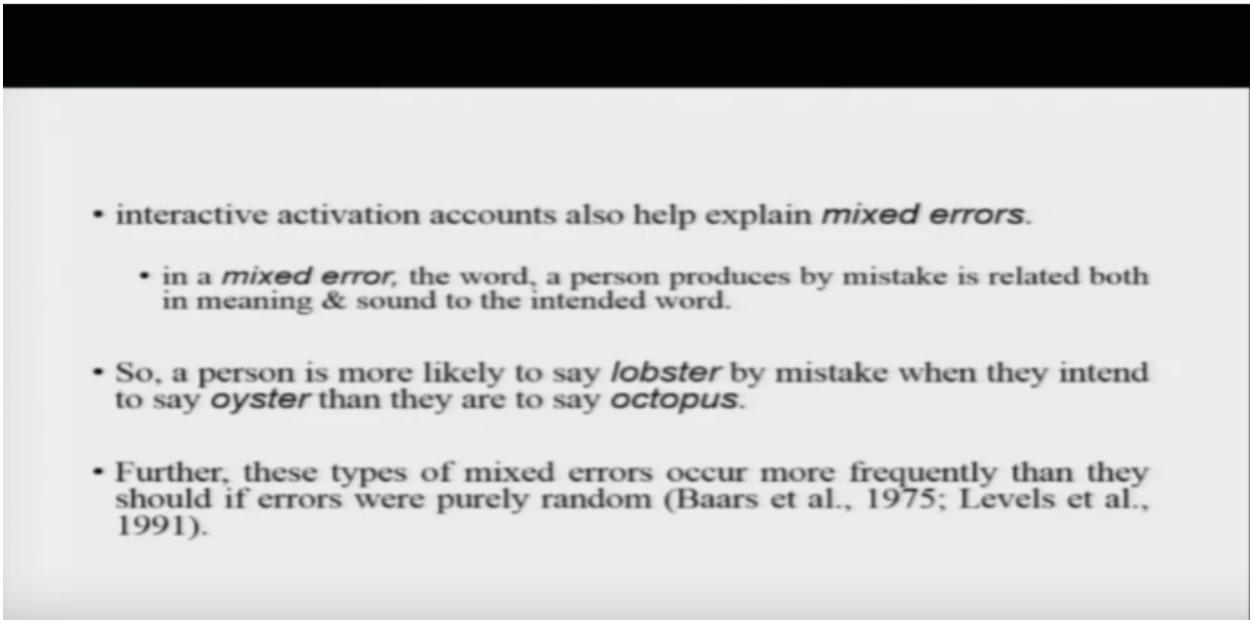

also these interactive activation accounts in the ones given by levels can also help explain mixed errors what a mixed errors in a mixed error the word a person produces by mistake is related both semantically and phonologically to the intended word . Ok, so semantics wise and phonology wise both relations are there let us say an example So a person was you know is more likely to say lobster by mistake when they intend to say oyster then they are to say octopus lobster an oyster for know logically very similar semantically very similar as well octopus and Lawson maybe semantically similar but phonologically are not really similar. Ok ,these type of mixed errors are found to occur more frequently than they should ,if this was happening in a purely random sense as was the case in the lake city by event how is this happening let us look at in more detail.

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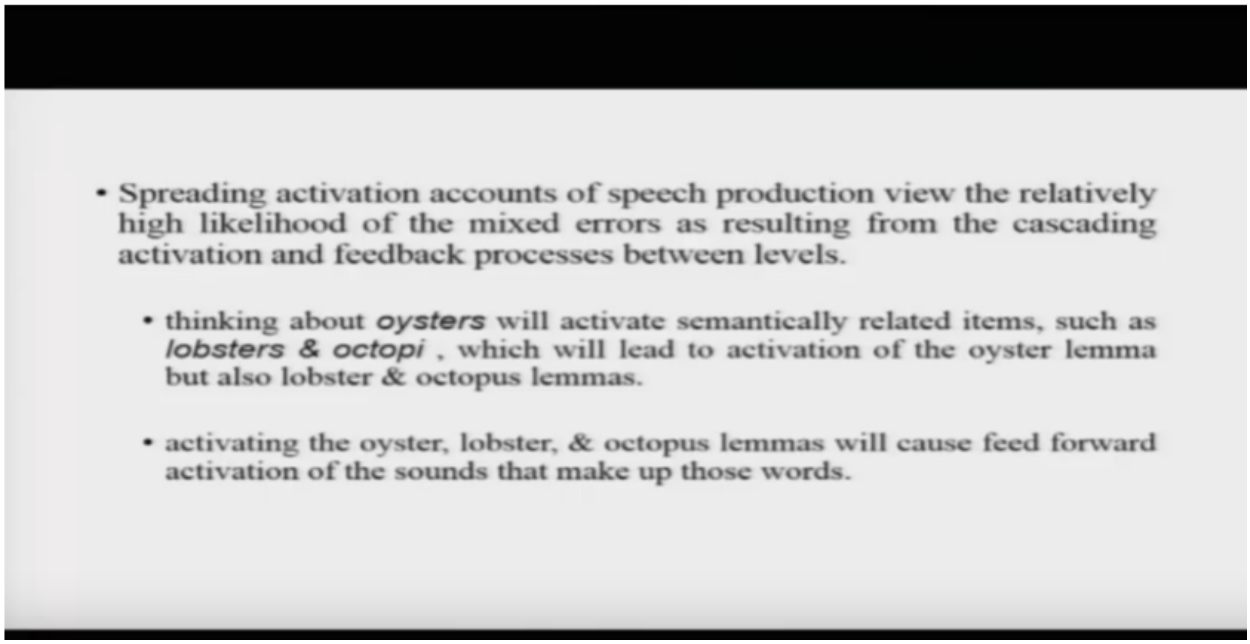

Spreading activation accounts of speech production view the relatively high likelihood of the mix errors as resulting from again the cascaded flow of information .Ok , feed-forward and B feedback connections thinking about oysters let's look at in more detail how more specifically thinking about oysters will activate semantically related items such as lobsters and octopi which will lead to an activation of the oyster lemma but also the lobster lemma and the oyster and octopus lemma activating the oyster lobster and octopus lemurs will also feed forward you know the activation of the sounds that make up those words so the connection is going further down

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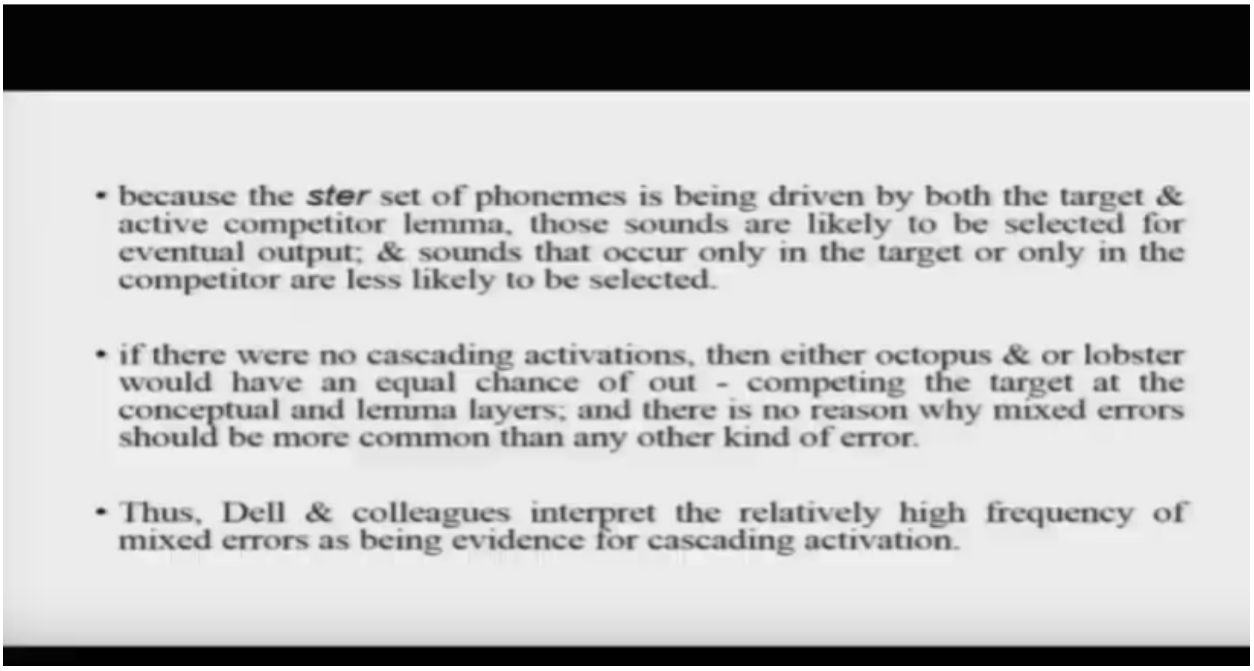

but because this set of phonemes is being driven by both the lobster and the oyster it receives a little bit of more juice let us say use a little bit of more strength and so that is why in the eventual output you have a higher chance of producing even if you are going to make a mistake it's a high chance that you will make a mistake which kind of ends with the stir as compared to octopus at the first part because ,this is receiving less activation as compared to stud because third is receiving activation from both lobster and oyster that's basically what is happening however if there were no cascading activations then either octopus or laughter should have had equal chance of out competing the target at the conceptual and lemon layers and there is no reason why mixed errors should be more common than any other kind of error. So , this is basically the explanation so, Delon colleagues basically interpret the relatively high frequency of mixed errors as being evidence of cascading activation because activation at one level is also feeding down the activation at the lower level snow. We have been talking about the lemma quite a bit we have talked about the lemma with respect to levels model we've talked a little bit about dilemma with respect to the you know Dells model as well . However, it has been seen in recent past not released very recent. Oh! That the lemon level is has come under a lot of criticism from various accounts. Let us look at some of the criticism that has been leveled at the lemma theory. Why is lemma a bit of a problem now?

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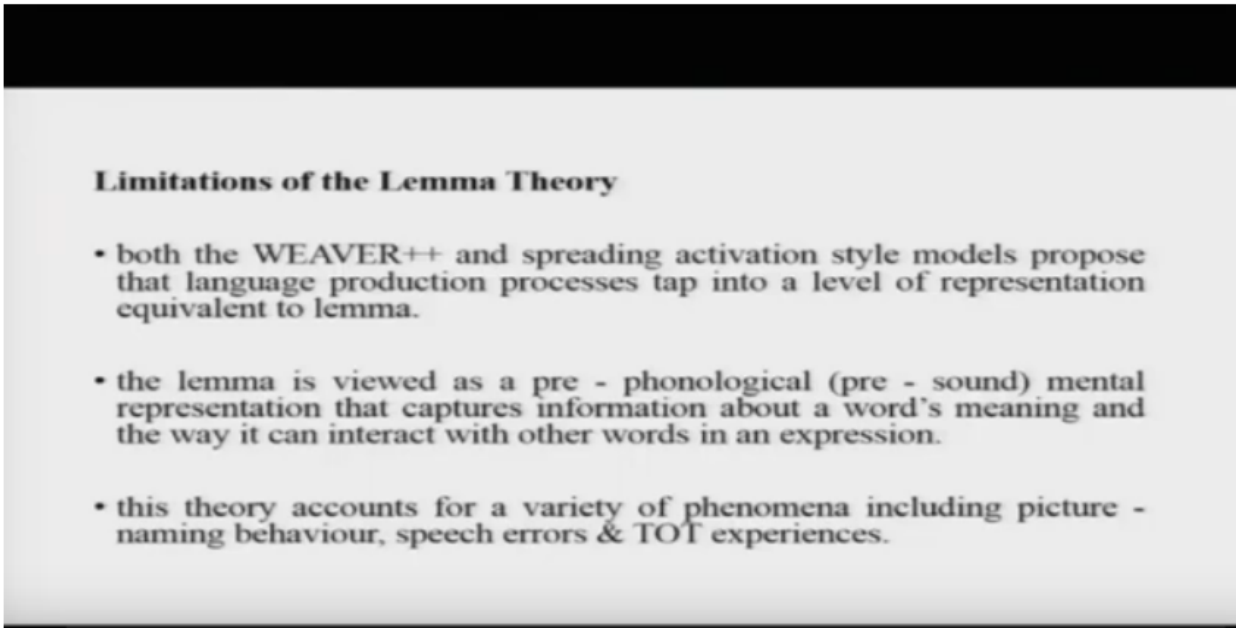

Both the WEAVER plus, plus as I was saying in the spreading activation style models they proposed that , language production processes tap into a level of representations which is lemma just to remind you lemma had meaning information as well as syntax information so lemma has been viewed as a pre phonological mental representation that captures information about the words meaning and also the information about how it can interact with the other words in the given representation that's a syntactical part this theory accounts for a variety of phenomenon including picture, naming behavior ,speech errors , tip-of-the-tongue experiences and so on . So it has been a very important conceptual tool so to speak which people have been using in speech production literature for a long time

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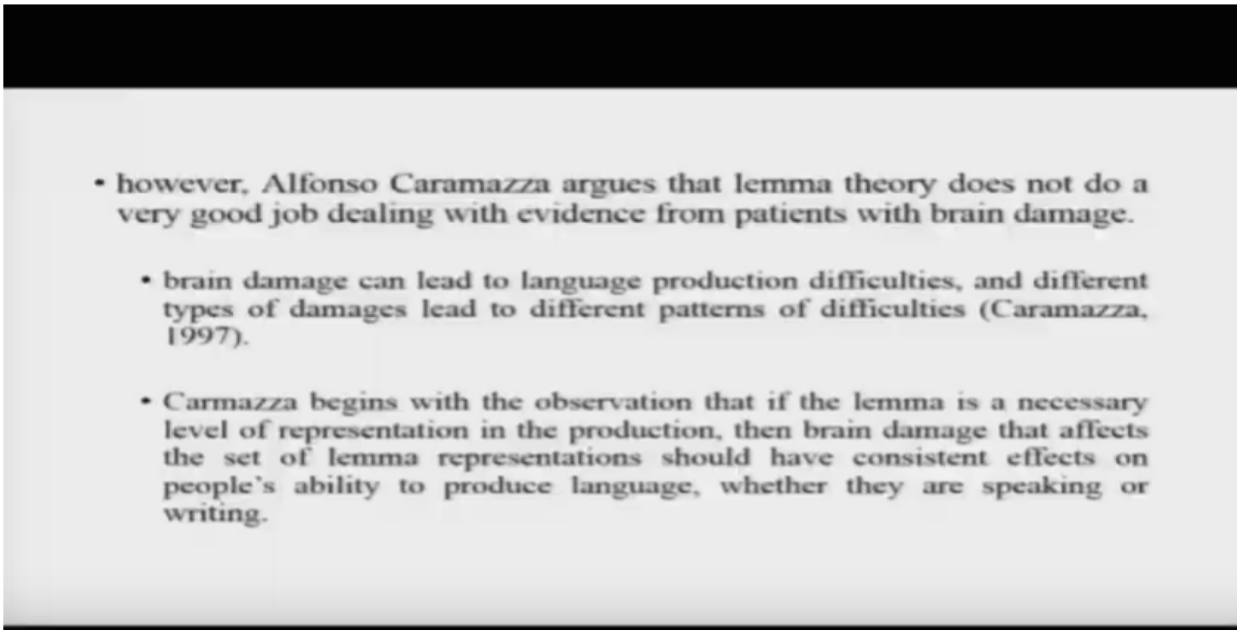

however, Alfonso Caramazza argues that the lemma theory does not do a very good job of dealing with evidence from patients with brain damage. See in psychology or any science which deals with behavior one of the things that you will also have to do is ,if you have to have a good theory ,the good theory should hold with cases of neuropsychological deficits , brain injuries, brain damage so on ,.So ,if you have this theory that this is how I produce speech if somebody has brain damage you have to have a corresponding deficiency in this sequence of steps. Lemma Theory Kalamazoo says does not really match up very well if you start looking at evidences in speech production errors which come from brain-damaged patients. Let us look at this more closely Quran Allah says , brain damage can lead to language production difficulties and different types of brain damage can lead to different kinds of difficult ,different patterns of difficulties that's all right. Caramazza begins with the observation that if lemma were a necessary level of are presentation for production then brain damage that affects the set of lemma representations should have consistent effects for people's ability to produce language whether they were speaking or writing . Okay? So, if lemmas for a particular set of concepts is damaged then I should not be able to invoke or produce those set of concepts . If I am speaking or even if I am writing. Okay? So, just pause it, listen it back.

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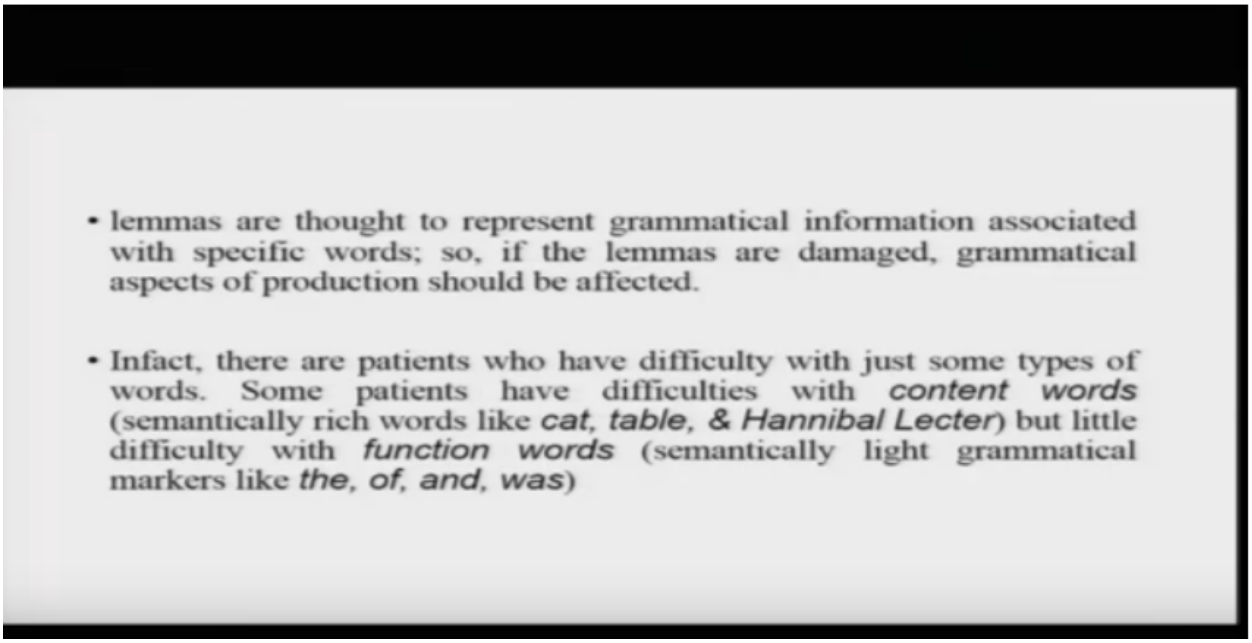

And then move forward if lemmas are thought to represent grammatical information associated with specific words so , if the lemmas are damaged grammatical aspects of production both in writing reading should be damaged in fact there are patients who have difficulty with just some types of words. Okay so, that is one source of evidence some patients have difficulty with content words but little difficulty with function words okay so, contain words like these noun sin works care table Hannibal Lectern's soon and so forth as compared to function words like articles and prepositions and so on. Now the lemma theory would explain that a patient like that who has some kind of brain damage for that particular patient lemmas for the content words are selectively damaged as compared to lemmas for the function or so something like that but as knows that notes that there are patients who have the opposite patterns of deficits as well so depending upon how they are producing the words so they can say for example ,if they are pretty or writing one pattern will appear if they are speaking another pattern will appear .Let's take an example one pattern of problems can occur with speech while the opposite pattern can occur in written language within the same patient so it could be that a given patient could have trouble with function words in writing but , with content words in speaking , in speaking function words is alright in writing content words is alright how is this happening , if the lemma for content words were damaged then the person should have difficulty in both writing and speaking the content words if lemma for function words were damaged person should have difficulty in both speaking and writing the container so that is that is the where there is this problem is really coming in,

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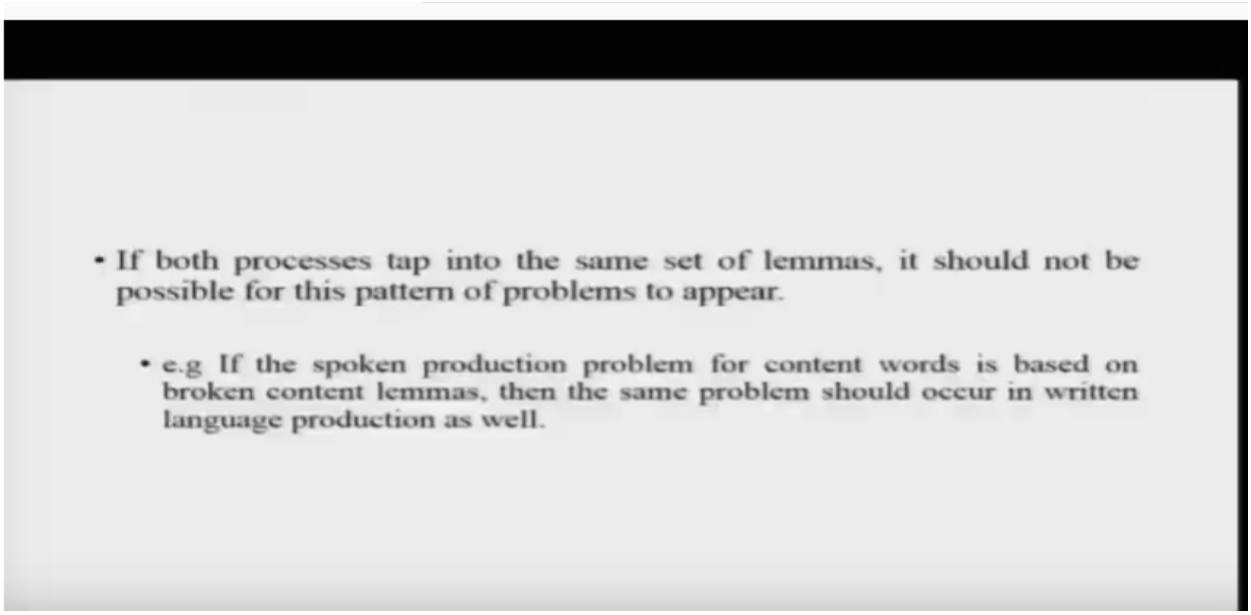

if both processes tap into the same set of lemmas it should not be possible as I was saying for this pattern of problems to appear so that's what saying if the spoken production problem for content words is based on the broken content lemmas then they should manifest imil early in both modalities this is one set of evidence further there is evidence against the lemma hypothesis from,

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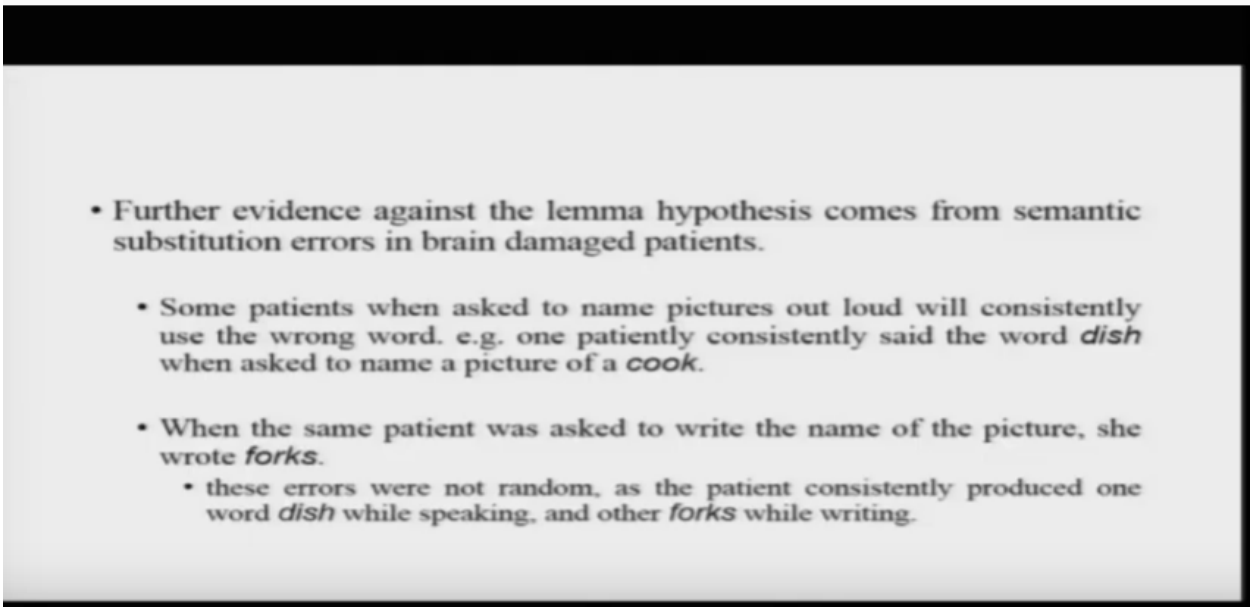

the semantic substitution errors that the brain-damaged patients - yes look more closely Some patients when they are asked to name pictures out loud will consistently use the wrong word the one patient consistently you said the word dish when the first when they were asked to name the picture of the word cook when the same patient was asked to write the name of the picture she wrote folks so you see the pattern of the error is different okay these errors were not random and the patient consistently produced one word dish while speaking by the other words folks while writing so there's also if the same if there are damages of the same kind the output at least in the speech errors should have been very similar that is not the case now. Further Caramazza

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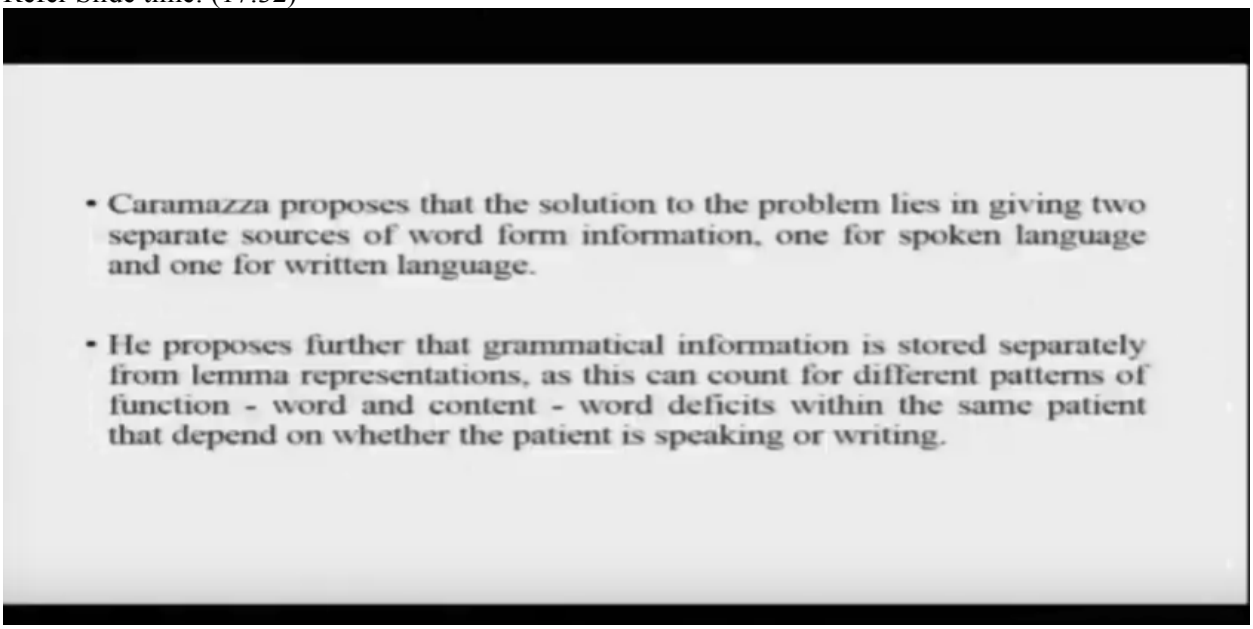

Proposes that the solution to the problem lies in giving two separate sources of word in word form information one for spoken language , one for written language she says , there should be different sources of information for spoken verses for written language so visual processing was auditory processing. He also proposes that the grammatical information should be stored separately from lemma representations as this can account for the different patterns of function word and content word deficits that we just saw,

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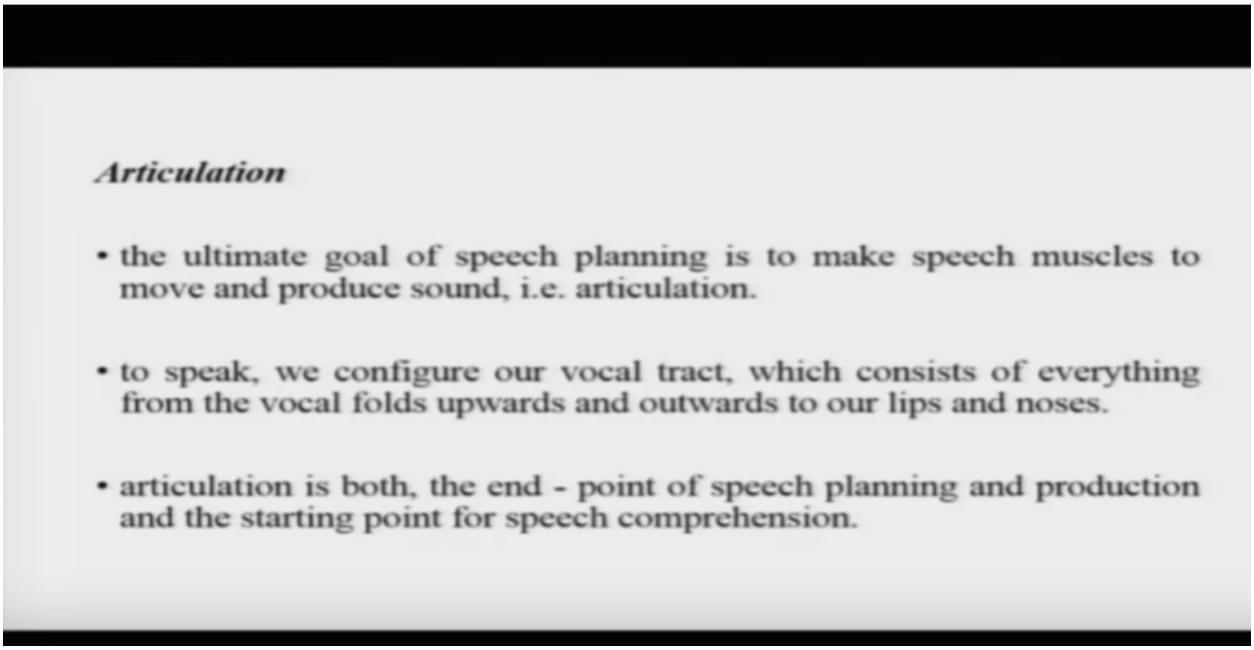

now this is a little bit of a problem with the lemma .So that's why you will see that people have kind of stopped really using lemma as a concept in more recent theories of speech production in comprehension now this was all about production till let me talked about WEAVER plus, plus and we talked about Dells .Now let us move on a little bit more closely into the articulation part, into the production part this will be the last aspect of production .You see ,you come from the top from one sepsis is where you have the finite existence code then you have the articulation .Let us look at articulation in a bit more detail now obviously the ultimate goal of speech planning was to make speech muscles to move and produce sounds that is articulation to speak we configure our vocal tract which consists of everything from the vocal folds. Here upwards and outwards to our lips and nose and noses you know all of this is part of the vocal tract articulation is also both of the end point of speech planning and the production and the starting point for speech comprehension that's also known. You know that's where this is this feedback loop kind of helps us now. There are some accounts of articulation that classifies speech sounds according to the way the articulator move the article actors include the lips ,the tongue tip ,the tongue , body ,the velum which is the soft part in the back of your palate .

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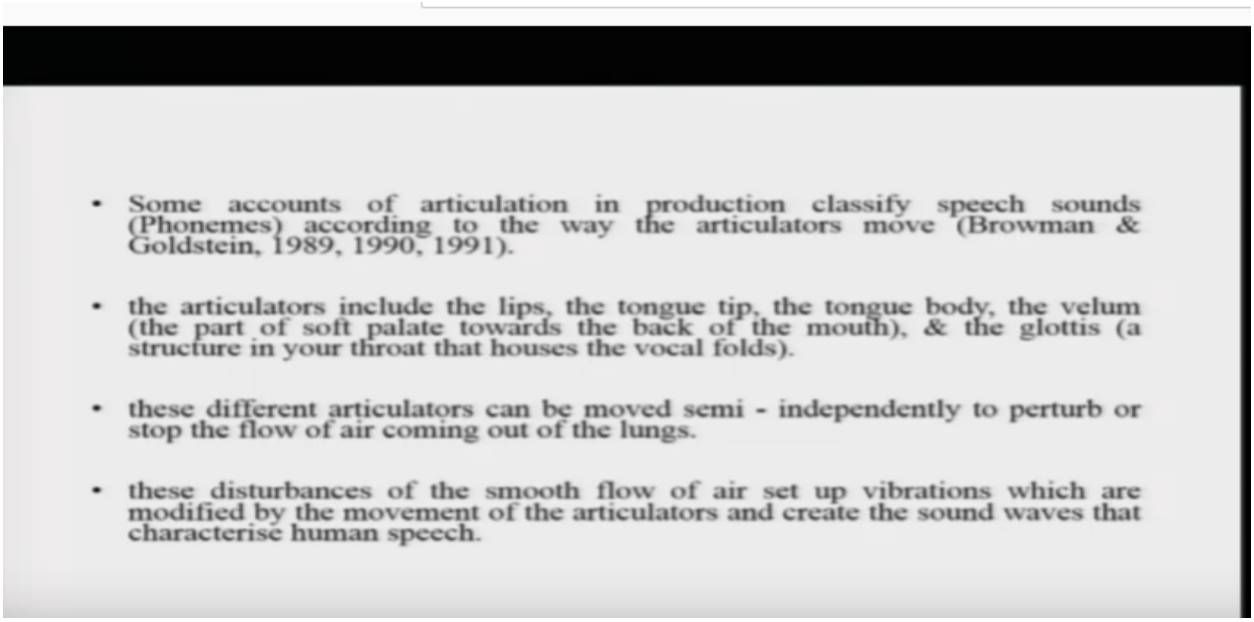

The glottis you know all of this is your article you know,is their vocal tract these different articulate errs can be moved semi independently to perturb or to stop the flow of air coming out of the lungs so for example, I have to say ba I'm completely stopping the flow of air versus I have to say sir I'm kind of letting air partially through the teeth and you know and the tongue. These disturbances of the smooth flow of air they basically set up vibrations which are modified by the movement of the article letters and this is what creates sound so as I'm going to say ba it creates a different pattern of violations as comedy when ,I am saying dour or tug or sir okay so ,the constriction of the flow of air is kind of modified by the movement of these articulate errs and is then eventually producing different kinds of vibration patterns , different kinds of waves .Let us say that are coming out of the mouth.

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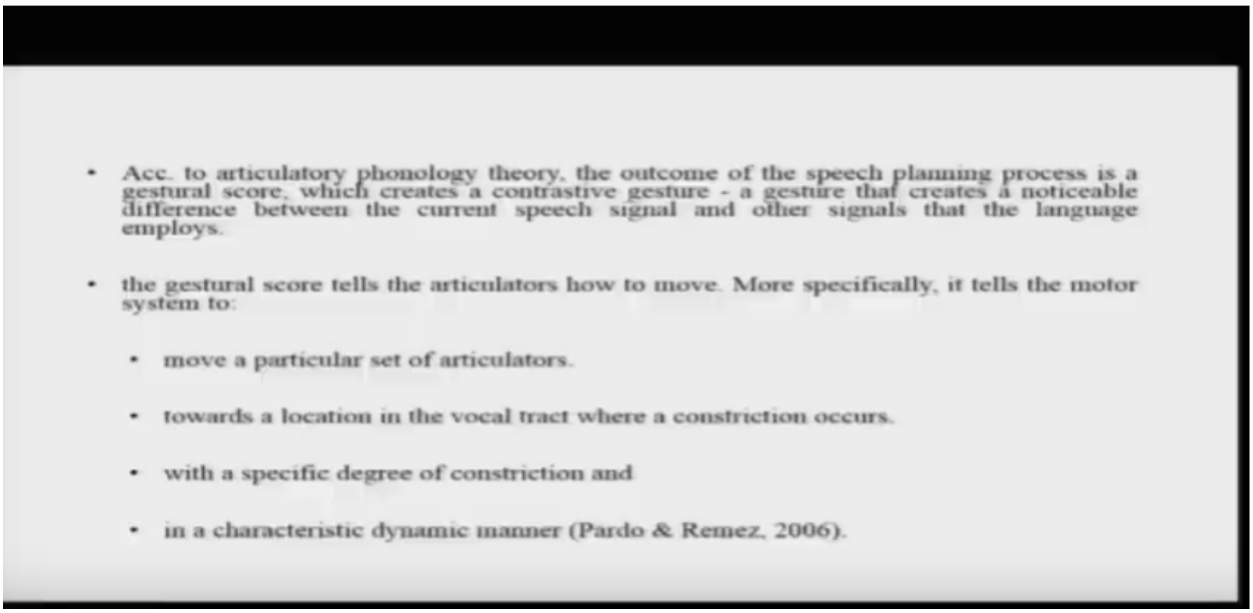

According to the articulatory phonology theory, a theory that attempts to describe how location art really happens, the outcome of the speech planning process is a gestural score. It's a sort of a program or an algorithm of how each of these things we move which creates a contrastive gesture so this basically creates a gestural score which basically you know is a gestural score which creates a contrastive gesture a gesture that creates anoticeable difference between the current speech signal and the other signals as the language of so the whole point is that each sound can be uniquely identified by its gesture. Score so to speak broadly the gestural score what does it do it tells ,the article it is about how to move more specifically it tells, the motor system a few things what all let us see to move this particular set of a degree so if for example , if you study phonetics in more detail or if you study speech and hearing in some detail then you'll come across which particular sound ?Say for example ,you have dental slave your dentals you have alveolaretcetera sounds are classified by which articulate a czar moved in producing those sounds that is one towards the location in the vocal tract where a construction occurs so where the flow of air was blocked that's also one very important thing with the specific degree of restriction it was partially stoppedor completely stopped .Sieber is completely stopped what sister it's partially stopped and in acharacteristic dynamic manner so, this basically is going to so these are these are all meaning instructions so to speak again ,I'm kind of over simplifying this but it's the gestural Skol creates a set of mini instructions in order for the system to know how to produce these specific sounds so ,that's basically the aim

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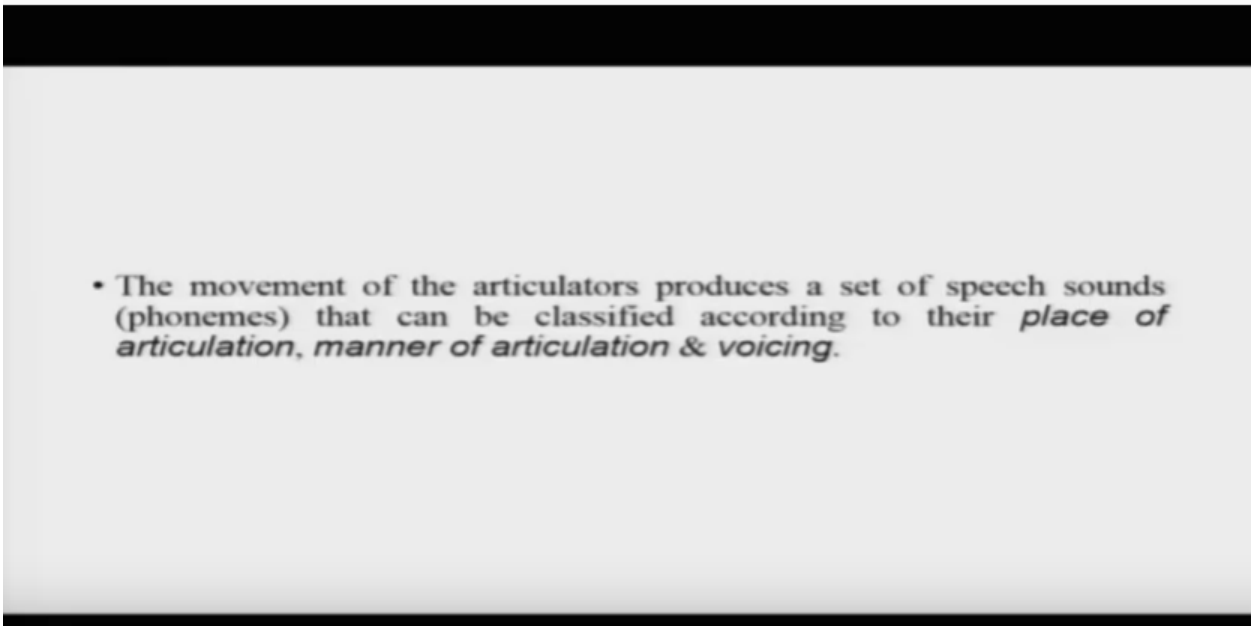

the movement of the articulator is produce a set of speech sounds that can be classified according to three things .First is the place of articulation ,second is the manner of articulation and third is whether this is voiced or unvoiced .What I will do is I'll also say for the reference section with the slides add for you a couple of reference videos wherein all of these things have been ,you know very, very detailed in a very detailed way described and that will basically help you understand this in, in some more detail it's probably outside the scope of this discussion so that's why ,I'm not really going to a lot of detail about this but I'll put some of the links of the videos that talk about place of articulation manner of articulation and YC .Okay ,now moving further also note that we do not really produce isolated phonemes so you know we do not,

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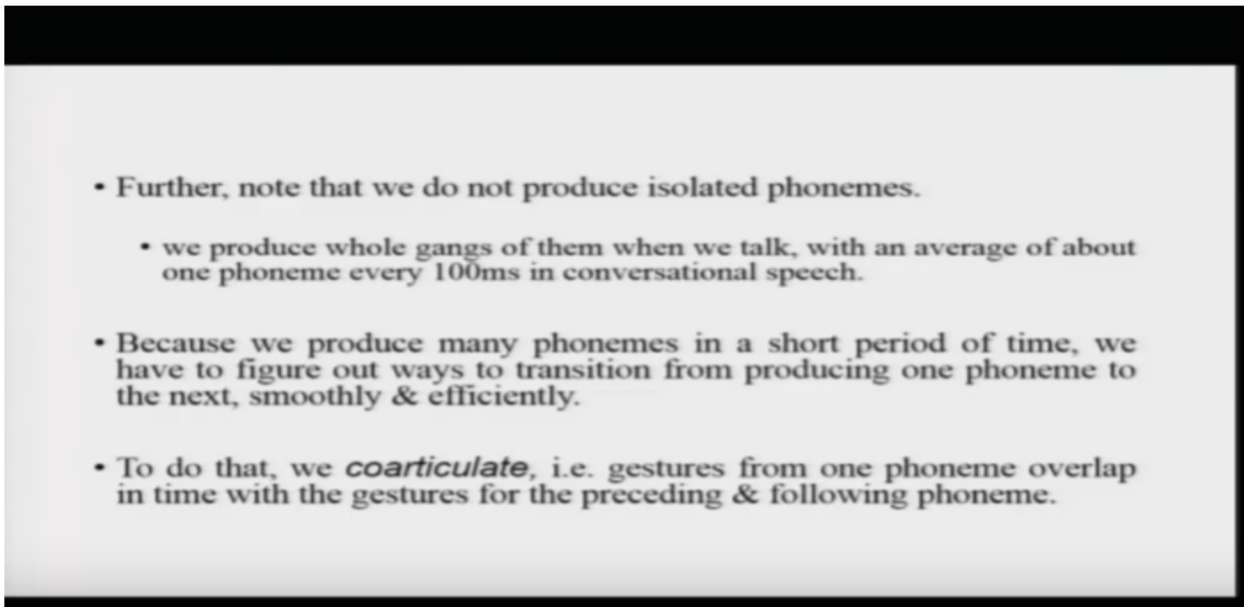

produce sounds in isolation that is also something that happens. We produce whole gangs of them you know when you're speaking a sentence you're producing so many sounds one after the other .Okay?
Way and with an average of about one phone in every 100 milliseconds so one phoneme is coming, coming out as one tenth of a second from my mouth because we produce so many phonemes in a very short period of time we have to figure out ways moving from saying one sound to another sound okay and the way we move from one sound to the other sound kind of has effect of one phoneme on the other and effect of one phoneme on the second one you monitored so this you know interaction between phonemes also happen while we're speaking and this probably could be different from different speakers , different from different languages all of that is possible all of those you know crazy kind of interactions are possible too and this phenomena of this interaction is referred to as Co articulation ,you know we are kind of not speaking in isolation ,we are Co articulating a lot of these sounds so that is also something important what is Co articulation .Let us just try and define this gestures from one phoneme overlap in time with the gestures from the preceding and following funny this is basically what will lead to Co articulation effects kind of coming up .Let us look at this in a little more detail,

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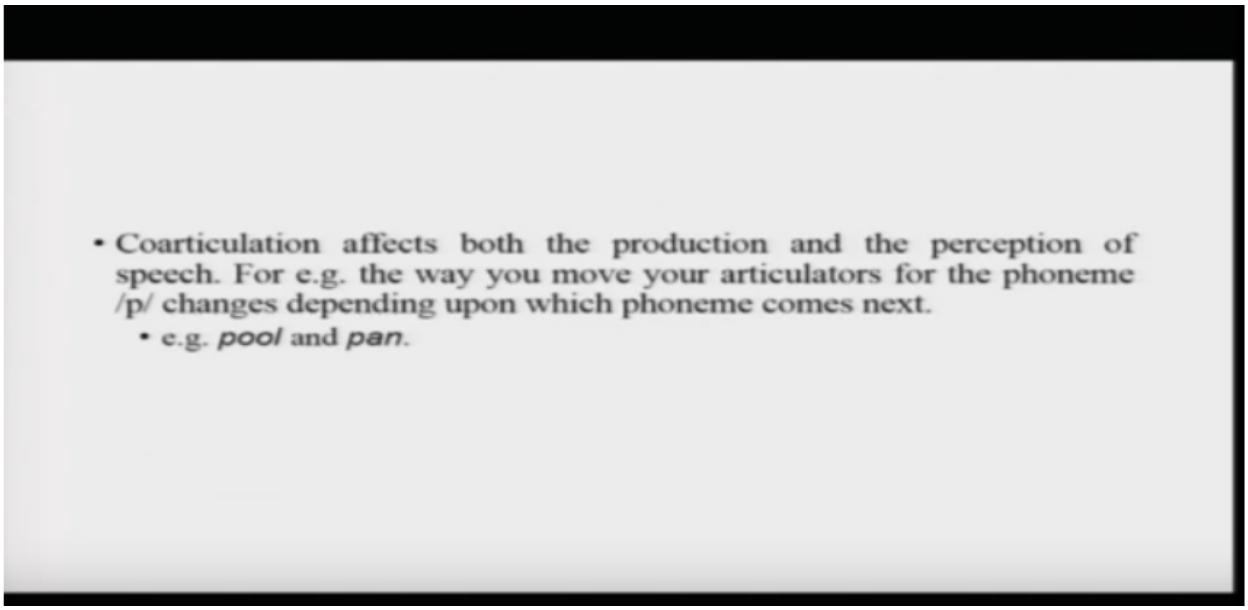

co articulation affects both the production and perception of speech. So the way you produce is also affected and the way somebody hears it is also going to be affected if a phoneme is produced in combination with a following and a proceeding more funny okay say for example ,the words pool and pan pool and pan basically are basically the same phoneme but ,per init said with P and O and then this is said with P and a and if you look at the physical signatures and also how people listen to this both of them kind of are slightly different than each other .Okay so, this is ,this is so P changes in both of say for example P now an old kind of comes out differently versus P in pan kind of comes out differently that's basically a demonstration of how Co articulation kind of you know changes the way we speak also probably , changes the way somebody hears us speak .Okay so, this probably was the last point in the speech production Lit lectures, that I was planning to give. This is all about speech production and this was the end of the third lecture, of the week and the remaining two lectures, I will talk to you, about speech comprehension. Thank you.