Indian Institute of Technology Madras
Presents
NPTEL
National Programme on Technology Enhanced Learning
Introduction to Modern Linguistics
Lecture – 9

Functions of Vocal Cords

Prof. Shreesh Choudhury
Dept. of Humanities and Social Sciences
IIT Madras

Good morning. Okay so we will continue with the phonetics part of the language last week we began talking about the structure of natural languages before that you may remember we spoke about design features of natural languages what are those features? What are those characteristics of language? that make them or that makes that make it such a versatile medium of communication so that you know all human beings irrespective of their class caste gender creed can communicate their wishes their fears their desires the poetry their dreams anything.

Okay part of the reason is human being human languages natural languages are designed that way once we have spoken about that let us look at the structure now like any other system like any other natural entity natural languages are also made of units put together small to big very tiny particles coming together to make a block blocks coming together to make a bigger block bigger blocks coming together to make still bigger block you know like we have in the structure of a building we have bricks themselves have been made of clay itself is made up of you know our tiny molecule scent you can go on breaking it as much as you like so in the case of speech or human languages.

Okay they are made up of speech sounds speech sounds come together and make a syllable in India we call them Ochs okay syllable syllables come together and make a word words come together make phrases come together and make a sentence sentences come together and make a discourse or we can go from top down we can start a discourse and start taking things away you know after discourse the smaller unit is sentence after sentence the smaller unit is phrase after phrase the smaller unit is words afterwards the smaller unit is syllable.

After syllable this the smaller unit is speech sounds and you can break a speech sounds further now fill in the blanks I will repeat myself higher than the speech sounds what do we have syllables higher than syllables what do we have words higher than words what do we have phrase is higher than phrases what do we have sentences what higher than sentences what do we have discourse okay in written language we have paragraph in spoken language we have discourse you speak on a topic to people at a place at a time these things together.

There is a social context that is called discourse I'll repeat myself and please answer me lower than the discourse what element do we have sentences discourses are made up of sentences are made up of phrases are made up of words are made up of syllables are made of speech sounds right so we are now looking at how is paid sounds are produced what is this subject or this science called which looks at the production of his paid sounds it is called please remember articulator phonetics right.

We are looking at the production of his speech sounds and I told you the other day that all speech sounds are produced because of either air stream going out of your mouth starting from your lungs or starting elsewhere and going out of your mouth what is that kind of stream called aggressive Airstream or they are produced because of air going into your mouth what is that kind of air stream called ingressive air stream but most sounds in most languages of the world are produced most sounds in most languages of the world are produced with aggressive airstream mechanism.

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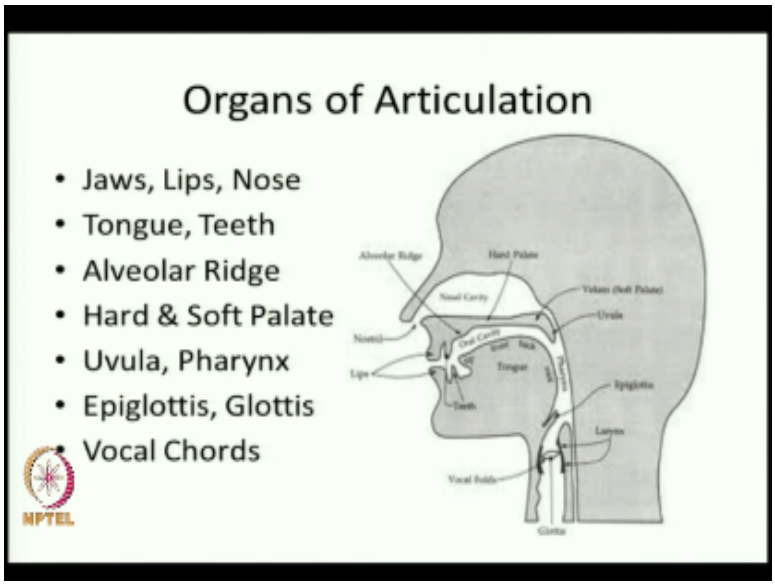

Okay we can produce a variety of sounds you know with I told you the other day we can speak like flies, we can speak like reptiles, we can speak like birds, we can speak like mammals, we can speak in a variety of ways we can produce hisses buzzes what else bangs and glides okay he says bodies banks and glides that because we have a very versatile vocal apparatus what you see is the diagram of the book this is the vocal apparatus the air starts somewhere here below in the lungs and moves up and you know either goes through the nasal cavity or goes through the oral cavity and we produce speech sounds correct.

These vocal apparatus then interact together and manipulate this you know speech air and we get a variety of different kinds of sounds so that we can produce lots of words lots of music lots of corals lots of cooperation and lots of good and bad things what are the organs of articulation we looked at the other day can you close your eyes and name them please the organs of articulation that directly participate in the production of his speech sounds their tongue teeth lips vocal cords jaws uvula palates what kind of palates hard palate and soft palate epiglottis excreta some of them are active articulator.

Some of them move towards the corresponding passive articulate res what are the active articulators lips lower jaw and tongue and uvula and vocal cords some people say pharynx as well because it can expand and contract right these are active articulator z' what are the active articulator z' go from the front of the mouth to the back of the mouth lips lower jaw tongue

uvula and vocal cords some people also count pharynx I will repeat myself this time we will start with vocal cords.

What next what is the next active articulator after vocal cords uvula after uvula tongue after tongue large or after larger lives in some order right these are the active articulator x' they move towards their corresponding passive articulators and we get a variety of songs so far so good any problem please if you have any questions if you have not understood something please come and talk to me i have also given you references to books the plenty of material on the net you just Google what you do not understand yesterday i had some confusion concerning the design of a retinoid cartilage and a Goggled it and get it immediately.

And not having a couple of seconds okay you are the lucky generation you know all you have to do is to ask for it and it is there you know you are all in almost in the Ali Baba and the magic cave right so do look up and there are also our books if you can't find those books please speak to me alright but most of those books are easily available in the Central Library and elsewhere I will encourage you to look them up finally today where you stand in the field of humanities philosophy and Sciences human languages are the next frontier of challenge for all of these fields.

How is it that human beings can understand more than words can understand and put together those words can a machine do that can we design systems which can speak and answer like human beings which can ask and process information like human beings it is not an impossible goal you know the only claim that engineering makes upon human intellect is that there is nothing like impossible what is there in nature can be replicated but this will be the way to replicate to understand how nature works this is how nature works. Today I am going to talk about the functioning of the vocal cords the most basic.

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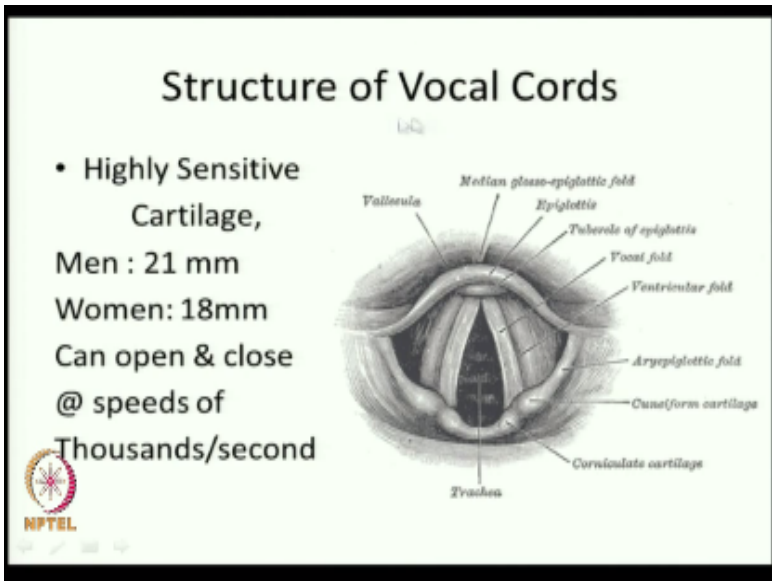

If you want I am not insisting on it you know I expect you to get this design right this diagram right I expect you at the examination you will have a question maybe at the quiz and at the end semester examination as well I will ask you to draw the diagram of vocal apparatus level it name the parts of vocal apparatus underlying the active articulator excreta please get it right okay let it be you know part of your ready knowledge .

The moment somebody takes your soft palate you know what you are talking about the moment somebody says uvula you know what you are talking about okay and the best way to do that is to draw this diagram at least 30 times within this week three or four times a week three or four times a day I am sorry okay and you will find that until the very old age you will be able to teach how to diagrammed to your grandchildren or god-willing great-grandchildren okay it's not difficult at all provided you give some time to it.

Let us move to the next the structure and working of vocal cords please diet.

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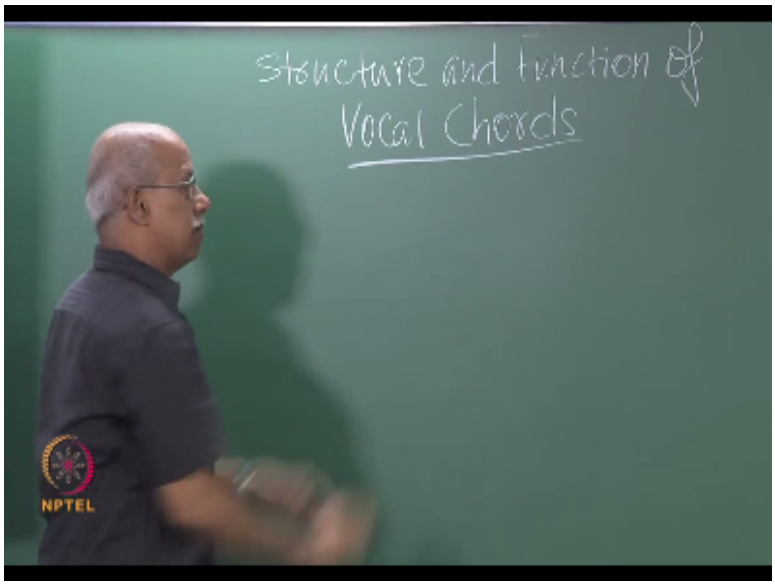

It can be a spelt both with or without an H some people also call it vocal folds okay so I'm going to talk about the structure and function of the vocal cords vocal cords are located here you take your finger to your throat and you see what in lemans language we call Adam's apple okay we in Indian languages have different kinds of names okay in Sanskrit you know things like okay so here this box called glottis houses within the glottis is encased is placed safely this organ called vocal cords okay.

Within the glottis this is the design of the vocal cords take a good look okay I have what I showed you is it is a vertical way but it is not vertical it is not this way it is this way you know actually these are looking sideways if you look at it you know from up above in the throat with a camera it is okay.

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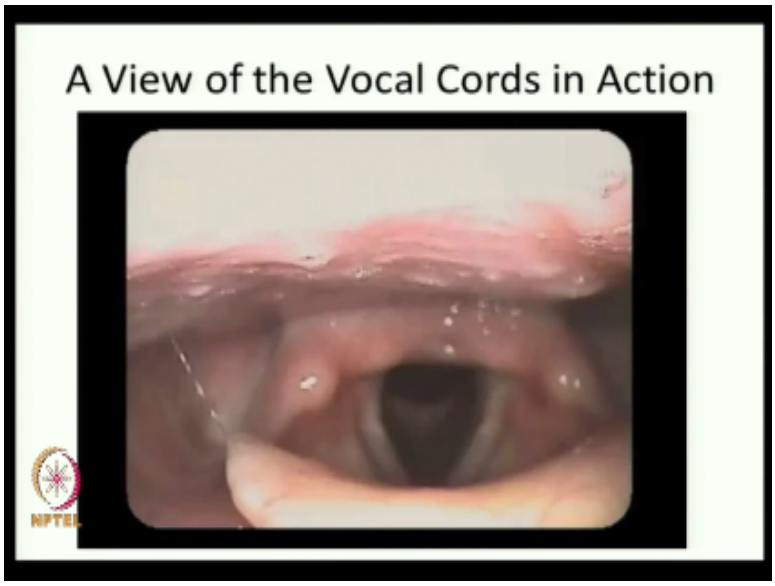

This is the real thing this is the real thing okay this the white thing that you see our courts at the moment vocal cords are wide open you know this is a film I will play it I downloaded it from.

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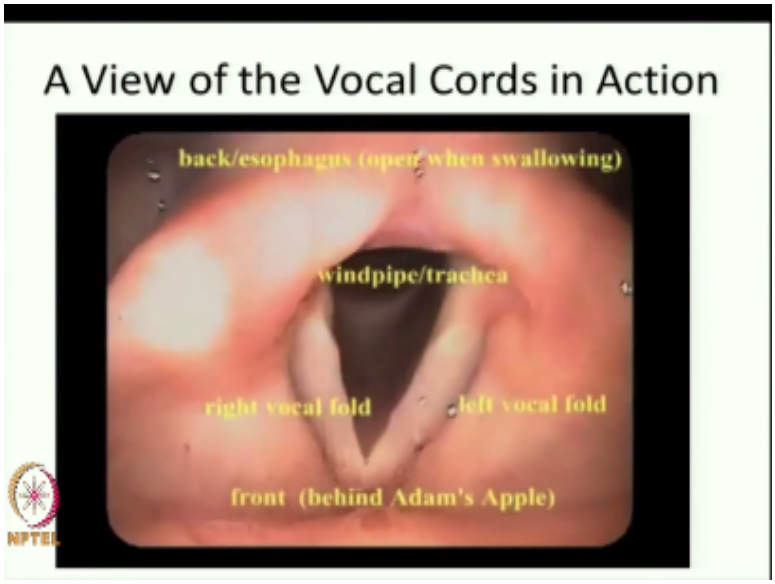

You know you are looking at it from top down you know with the camera through the throat right just a view.

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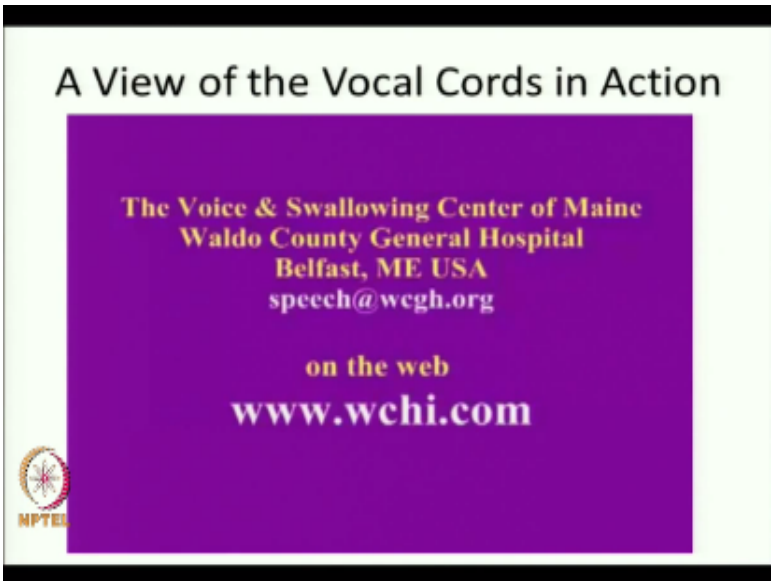

You know just a very short very passing view of the vocal cord this is the most versatile organ of articulation that God or nature has given us what you saw the film that you saw has been taken on a camera where the movement has been deliberately slowed otherwise it is so fast the movement of vocal cords is so rapid that you know if it is taken at the same speed at which it works you and I will not be able to see it move okay to us it will appear to be static with naked eyes but you know they have deliberately slowed.

It is so that we can see how it works let us look at the diagram of the vocal cords or even before we okay it is some kind of a box put within a box so glottis itself is a box and within that vocal cords is a box look at the design there are many different parts there is epiglottis etcetera but the key element the key element of the vocal cords is this thing what we call please write okay maybe better I should bring you to this you see this is epiglottis.

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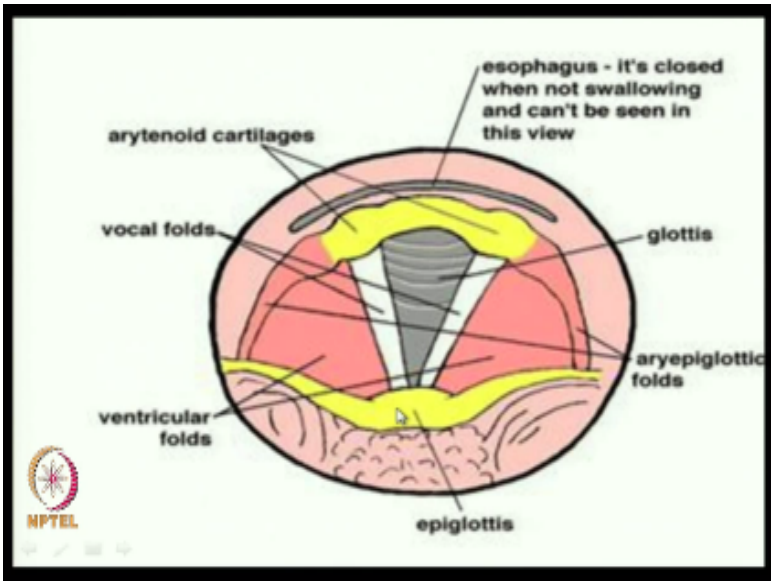

I am looking at it from top down and the other side this yellow thing that you see here okay if you someday have time you know and I am going to send these slides to you through myself you can make your own diagram looking at these then that will give you a much better understanding of how the system works then you see the original cartilage there anybody please yes or no can you see a retinoid cartilage markets a spelling.

Okay right you know it is a Greek word you know it looks like a ladder okay and in Greek it meant ladder like it is this thing really which gives you and me which gives us our peculiar voice this a retinoid cartilage please right of all the things you must remember the spelling and the functioning of this original cartilage controls this white thing called vocal cords if a retinoid cartilage expands vocal cords expand if written or cartilage does not expand vocal cords do not expand okay it is a little note card which like a rope on it which like you know the controlling rope on a curtain you see started sometimes.

You know you have ropes controlled with curtain particularly in theaters of the old style today you have theaters where curtains are electronically controlled but in the old time we had curtains drawn by the stage manager and he drew the curtains or undo the curtains through the rope so it is this rope you know this tug can you see the I am pointing to this yellow thing okay this is the original cartilage now this a retinoid cartilage ordinarily speaking can be.

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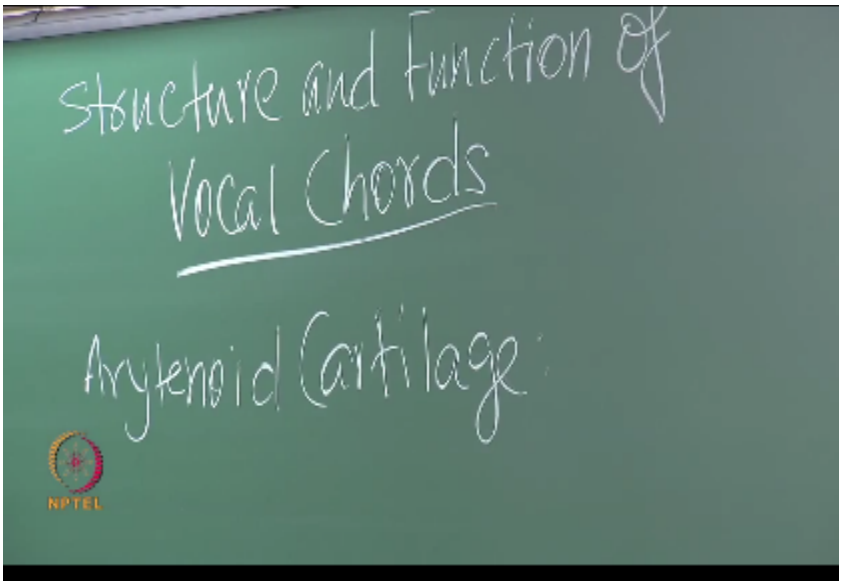

The original cartilage generally speaking but there is nothing like generally in nature. You know each though we are all I have been saying though we are all mass production of God okay we always talk of overcrowded overpopulation overcrowded countries but no two people are alike look at yourselves look at your jaws look at them you know each other please do look at each other do look at each other no two jars are alike no two eyes are alike note by alike I mean exactly alike unlike a mobile phone unlike a pair of shoes unlike a fountain pen unlike a ballpoint pen you know unlike anything.

That man has made nature has mass production yet each piece is custom-made each creature is different from another creature you and I think all bullocks look alike all dogs look alike but those who keep bullocks asked the farmers they know one block from another you and I may have difficulty recognizing twins but mother has no difficulty recognizing twins it is not that she feeds the same child twice or keeps the other child hungry okay so even if everything in nature looks like everything else it is not now keep that in mind and then let us talk about this a retinoid cartilage generally.

Is among men it is 21 millimeters and among adult women generally speaking it is 18 millimeters once again generally speaking it could be 17 point something it could be a teen point something it could be turned to one point something it could be 20 point something those many skewed differences those nanometer differences give us our unique voice please write

vocal cords give us our voice the arytenoids cartilage there gives us our unique voice vocal cords give us all voice you know we will not be able to speak.

You will not be able to hear me as you do now without the vocal cords but within the vocal cords the moment I speak you recognize that is Shree Choudhury speaking or the moment you speak your friends to speak you are able to recognize immediately the moment there is a hello on the phone and you recognize who is speaking a friend or a foe mother or father a relative or a stranger okay and you are able to recognize that uniqueness of voice comes to you from the length of a retinoid cartilage come back to I will come back to the design of the buzz.

Let us begin at the beginning vocal chords are some kind of a muscular fiber you know this white thing that I showed you in the diagram these you know these white rope like things these opening attached to the epiglottis on one end and a retinoid cartilage on the other okay this is a retinoid cartilage this is a big lories okay attached to and then they expand and contract expand and contract the pressure of air coming from inside the lungs or in occasional rare cases pressure of air going from outside through the mouth into the lungs okay forces them to open yet.

Because you know buckle cords have a versatile function yet vocal cords can be either fully open as they are they can be fully shut okay when you eat when we drink okay generally though in India you know and in many other cultures we talk while eating in that case you know if and then vocal chords help us when we talk they let air come out but do not let food particles get in but sometimes when food particles do get in we start choking we start coughing but generally speaking vocal cords were designed to help us perform these functions close the passage this passage.

So that you know food can pass through trachea but when it is open the wind can pass through the windpipe the two pipes there in our throat in our you know and coming to the glottis right so this is the function that they perform the helper seat the helper speak right they are highly sensitive slightest pressure of air can send them by waiting at extremely high speeds opening closing opening closing some people say they vibrate so rapidly that the maximum recorded speech is something like please note 14,000 cycles per second at the rate of opening and closing 14,000 times per second it is unimaginable.

That there can be any part of human body which can work at these speeds okay they almost you know they you know in when you take live movie camera picture you almost don't see them you know moving they are so fast so then they artificially slowed down the camera and then they take the photographs it's highly sensitive slightest pressure of air can change its rate of vibration from zero cycle no movement at all to 14,000 cycles per second the maximum recorded it can vibrate look at the parts of it usually as I said the particular voice the individual voice the unique voice that each of us has is by and large people say the product of the length of the world you know this air it annoyed cartilage if the case of men it is about 21 millimeters long generally speaking a treatment in the case of adult women it is about 18 millimeters long children have it of under 18 millimeters length.

What happens is while we are growing up in the case you know both boys and girls have the same kind of voice in their early childhood but as the boys start getting longer a retinoid cartilage and you know as we say voice breaks you know you acquire this protrusion then you know boys go on to about 21 millimeters that our original cartilage grows among boys up to the length of 21 millimeters but in the case of most girls it just stays at 18 millimeters that is why men and women get different kinds of voices.

But you may have you may perhaps you make possibly know people where men have different kind of voice in women have different kind of voice my favorite is the you know the vocalist oh shout up from Calcutta you know she can speak she can sing like men she can sing like women and many other people who do these caricatures can also do that so this is adaptable some women have longer vocal cords and they talk like men some men have shorter or a smaller vocal cords and they talk like women can you imitate the voice of a woman can anybody please try and can anybody please try.

And imitate the voice of a woman I am not doing caricature for you I'm trying to say how versatile it is come on please let me see if somebody does it this is where you call guts come please okay let me see who does it you know let the camera capture you please talk like a woman yeah come on please plays it plays Benny until very recently or even now in my village you know when we have theater boys play girls okay.

Somebody please okay let me see if some girl can you speak like a boy can you speak like a boy try if you are not very hesitant noted classroom is the only place where you can experiment

and failure also teaches you come on try it talk like a boy seek Jana Ghana Manna like boys hoarse voice okay maybe we'll do it later do it try it in your room you know all of us can do that and all of us can do that because we can control through Illinois cartilage the vibration of true flow of air vibration of vocal cords can be controlled.

Okay they can open and close at extremely rapid speeds let us look at sorry okay a closer view of the vocal cords there are vocal folds there are different kinds of cartilages it's a very complex engineering very complex mechanism yet highly versatile highly dynamic you know I will immediately I will tell you in a few minutes about how it works you know it also controls esophagus it is the doorway to the heirs of Vegas which is closed when you swallow something but open when we speak right okay let us look at the vibration of the vocal cords.

Once again and I will tell you how it what functions does it is the white things that are the vocal cords the other things is good you know glottis this side is epiglottis the other side is far side is a regenerate cartilage yes yeah it is all inside yeah right that pointy thing is here this business is this is epiglottis and this other side is a retinoid cartilage yeah this thing you see this thing is a retinoid cartilage this ladder-like thing that is why the Greeks call it original old oil main shape remains blood okay.

Are you can you know I am going to give you the link and you can download this and many other better you know films of the functioning of the vocal cords the point I'm making is that you and I are able to hear each other that you and I are able to recognize each other by voice even if you close your eyes even when you do not see your a speaker you know who is talking to you okay all this happens because of the unique design of the vocal cords okay. What else does vocal cord? What else do vocal cords do okay I would like you to draw this diagram quickly.

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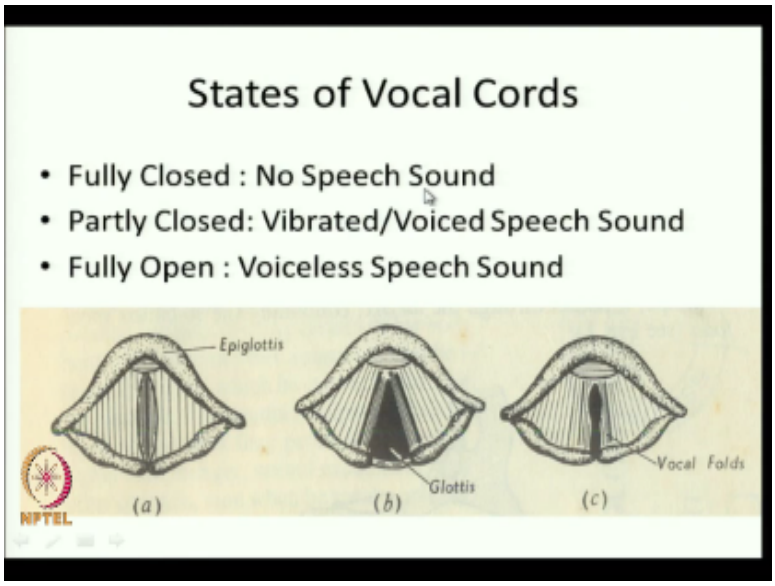

May not be everything you know but use your pencil take a couple of minutes and draw these three positions as fast as you can. A, B and C okay you do not have to take me in the camera for a few minutes lovely that is great can you capture keys please I thought you dispute like a boy not to play a part in stage plays do it fast yeah that is great yeah that is good can you capture my friends notebook have you ever acted in place to try now good come to the front come on quick yeah that is marvelous that is great I wish you a city in the front so that I could ask my friends to capture.

New Donna on camera have you never acted in this have you never acted in place why did not you talk sigh so quick whatever reversed roles today okay right ok finished ok please you know I anyway I am going to mail these slides to you and there will be there on the NPTEL website you can look them up and there are plenty of these things on the net anyway linguists say connotations say that primarily are basically vocal cords can be in one of the three stages a where they are fully closed when they are fully closed no Spade sound is possible you know this happens when you eat or when you drink excreta okay.

When you are swallowing something so fully closed position a position be fully open air goes out or comes in freely okay as in B but as in C but it partly closed or gently closed so that the passing air the passing speech air can send it vibrating all the speech sounds are possible you know that we are able to hear one another it is possible because of the vocal cords being in the

position C okay when it is in position a no speech sound is possible when it is in position B speech sounds not possible but people at a distance cannot hear this speaker okay.

Say for example I am talking now but last benches perhaps cannot hear can you hear me maybe you can but people on the last benches cannot hear me because vocal cords are not vibrating this is how we whisper to each other keep your finger here and whisper to each other in terms not at the same time okay now keep your finger there and switch the voice on say the same thing with voice on say it aloud to your friend do you hear it vibrating do you feel it is vibrating okay another way of doing the same thing is just say produce.

This sound no vibration now say do feel something is vibrating okay so you know depending on the state of vocal cords we say number one as it hardly participates in the production of speech sounds there are some speech sounds in some languages which are produced through ingressive airstream mechanism and there are speech sound so when you produce a sound like click do it the vocal cords are in position a air does not go in it rebounds and you hear the sound okay.

In my village the farmers produce this sound to drive the cattle okay or drive the bullock cart but in Swahili this is the speech sound in English in cockney English particularly in this English that is spoken by working-class people in London and its suburbs again this is a speech sound okay so it depends but very few very few speech sounds are possible through a mostly speech sounds are produced when vocal cords are in position either B or please complete C please write when the vocal cords are in position B we produce voiceless speech sounds vocal cords wide open voiceless sounds.

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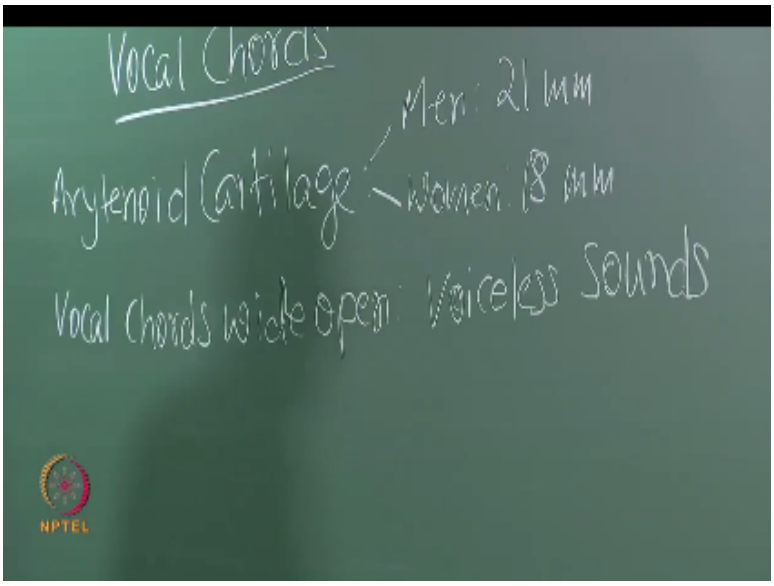

Okay vocal cords gently together not tight shut voiced sounds okay these are the speech sounds mostly speech sounds in most languages of the world are produced when vocal cords are in the position B or C so for example we get as in sip and as in zip because vocal cords are vibrating or not vibrating okay so we get voiced sounds and voiceless sounds because of the vibration or the absence of vibration of the vocal cords besides the fact that they carry voice of the speaker to the ears of the listener they also produce other kinds of sounds. What are the other kinds of sounds? They produce.

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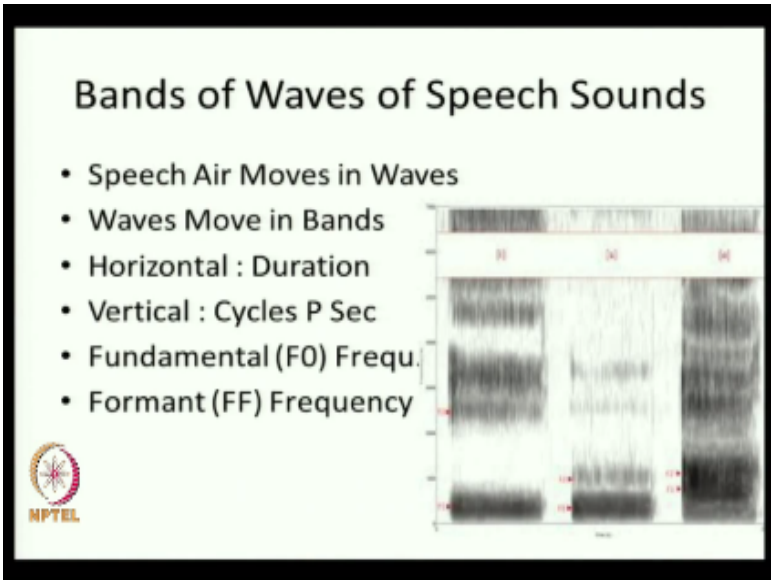

You know different kinds of vibration produces different kinds of waves okay when talking about acoustic phonetics the other day I told you that each wave each speech wave has its own characteristics they have their own formant frequencies they have their own fundamental frequency they start vibrating at a certain rate that terminate at a certain rate when you saw the when you know we just now saw the a film of the vocal cords in action and the speaker produces a sound which go from low to high see this once you know when this says low to high just see this is just one continuous production of zone.

You see when we sing they are not talking about that this is national anthem of a country can you tell right you know this has been taken as I told you can look at the you know from a medical research center their public website and I just downloaded it from there you can see more there they have taken a clipping from American national anthem they are taking a clipping from people shouting you know the low to high so all of these functions you know I've just taken less than a minute it is a few seconds clipping you know I encourage you to spend a few minutes at you know this Google website and see how it works what are the different kinds of functions. It does but one of the most important functions of the vocal cords is.

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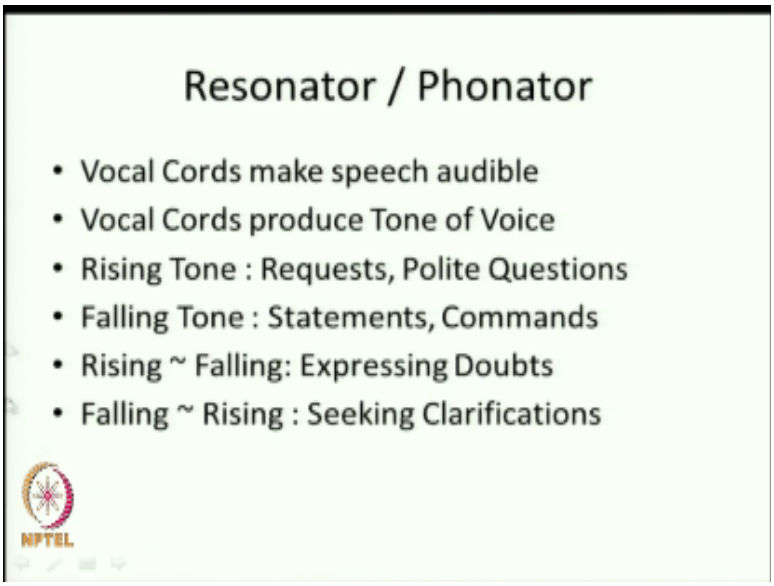

To give you know it makes the speech audible the second function is it produces a tone of voice okay it says you know the presenter here said from low to high many people say that meaning is not there in words meaning is there in tone you can say the same words in a bad tone right

somebody asks you for a mobile phone can I use your mobile phone and you can say yes gladly by all means and somebody says can I use your mobile phone and you can say okay.

If that person has any self respect you know any sense of self respect he would not use your mobile phone or anything so you know the meaning some people say is not in words it is in tune what is tone is nothing please right but it but the rate of change in the vibration of vocal cords okay I will explain myself and then close the class today all right what is tone is nothing write but the rate of change or change in the rate of vibration of the vocal cords.

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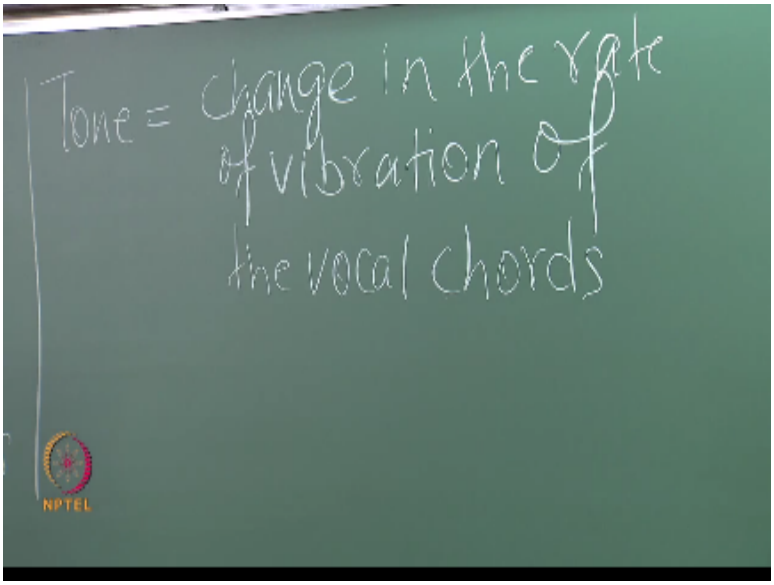

What is tone change in the rate of vibration of the vocal cords? imagine you began speaking at a at the rate of you know vocal cords vibrating at the rate of let us say thousand cycles per second thousand times closing opening closing opening closing opening but then it started declining it came to 500 it came to 300 it came to 200 so you start on high-income to low this is what happens when you give commands.

When you give orders a parade commander says stand at ease he starts at a very high rate of vibration maybe something like 6000 cycles per second and comes to zero that is where to declare when you shout on the other hand you can start at a very slow rate very low rate of vibration they start at 200 cycles per second okay and go on to high thousand cycles per second can I borrow your pen please so when you when you ask a question when you make a request you know then you start at a low rate of vibration and move to the higher item rate of vibration.

So you know you can say can you borrow your pen please okay the five you know the vocal cords are started in low rate and go at the high rate so you can have low to high rising vibration you can have high to low falling vibration in other words you can have falling tone rising tone.

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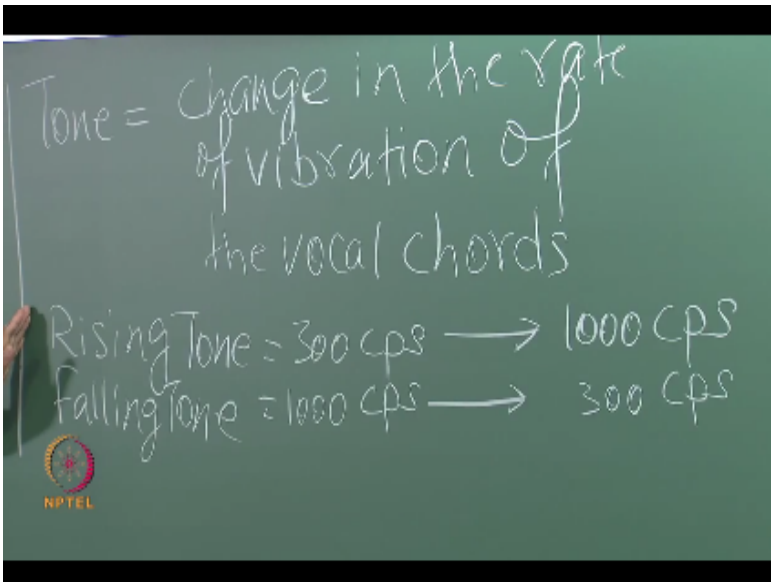

You can have in between you know lots of in-betweens are possible you can have doubtful tones should we call him to the party on Saturday he is a nice guy but he gets drunk okay now this explicit doubt so what is doubt it began on a high note comes to the low note and goes to the high again fall rise fall or rise fall rise okay please write so you can have depending upon you can have rising tone what is rising tone it has starts at a low rate and goes at a terminates at a high rate you can start at the rate of let us say 300 cycles per second and close at maybe a thousand cycles per second correct on the other hand there can be falling tone.

The other way around you can start at thousand cycles per second and you can close at 300 cycles per second usually rising tone is used to make requests ask polite questions can I take this seat please may I come into the class please okay etcetera or falling tone is generally used to give orders make declarations the king is dead tomorrow is a holiday IIT is the greatest Institute okay you can me or sometimes you can have.

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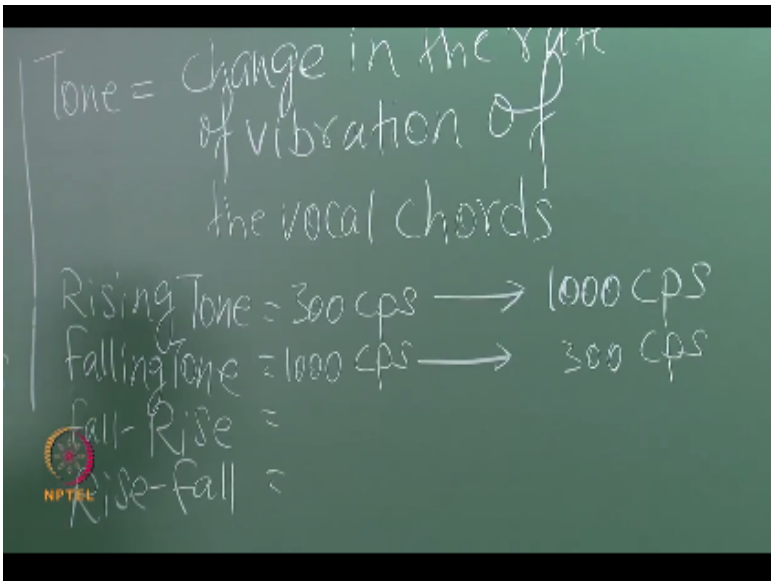
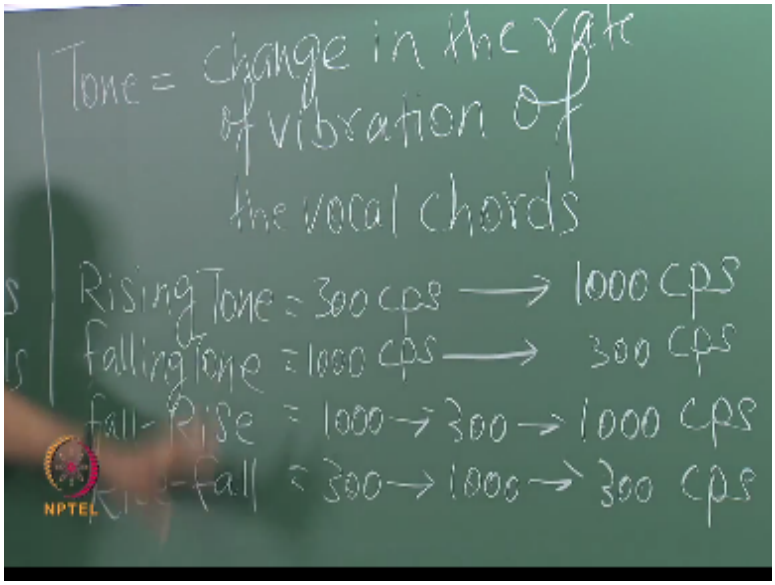


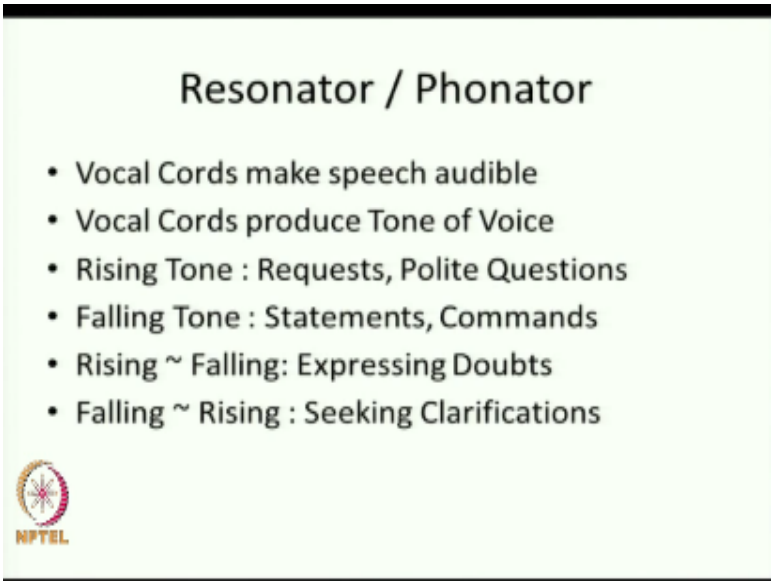
Fall rise or the counterparties rise fall all of these things at various permutations various combinations are used to express so for example when you have fall rise it starts at 1000 goes to 300 goes to 1000 cycles per second when you have rise fall you will start at 300 go to and a start come back to 300 cycles person there can be various combinations.

(Refer Slide Time: 49:02)



A whole lot of permutation combinations depending upon the kind of thing we said the voice we used we kind of following rising falling and various kinds of tones okay.

(Refer Slide Time: 49:15)



In other words vocal chords perform a variety of speech related and social functions the attitude the meaning etcetera are conveyed through tones and tones are possible because vocal chords vibrate in the particular manner I will forward these slides to Mahesh you can look at them again it is also they are also going to be there on the website of the NPTEL but do look up books thank you have a good day.

Online Video Editing /Post Production

K.R.Mahendra Babu

Soju Francis
S. Pradeepa

S. Subash
Camera

Selvam
Robert Joseph
Karthikeyan
Ramkumar
Ramganesh
Sathiaraj

Studio Assistants

Krishnakumar
Linuselvan

Saranraj

Animations

Anushree Santhosh
Pradeep Valan .S.L

NPTEL Web & Faculty Assistance Team

Allen Jacob Dinesh
Bharathi Balaji
Deepa Venkatraman

Dianis Bertin
Gayathri
Gurumoorthi
Jason Prasad
Jayanthi

Kamal Ramakrishanan
Lakshmi Priya
Malarvizhi
Manikandasivam
Mohana Sundari

Muthu Kumaran
Naveen Kumar

Palani
Salomi
Senthil
Sridharan
Suriyakumari

Administrative Assistant

Janakiraman .K.S

Video Producers

K.R Ravindranath

Kannan Krishnamurty

IIT Madras Production

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