Phonetics and Phonology: A broad overview
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Lecture 17
Problems in phonemic analysis, context and phonotactics

Welcome to the third lecture on phonology in this course NPTEL MOOC Course on Phonetics and Phonology: A Broad overview.

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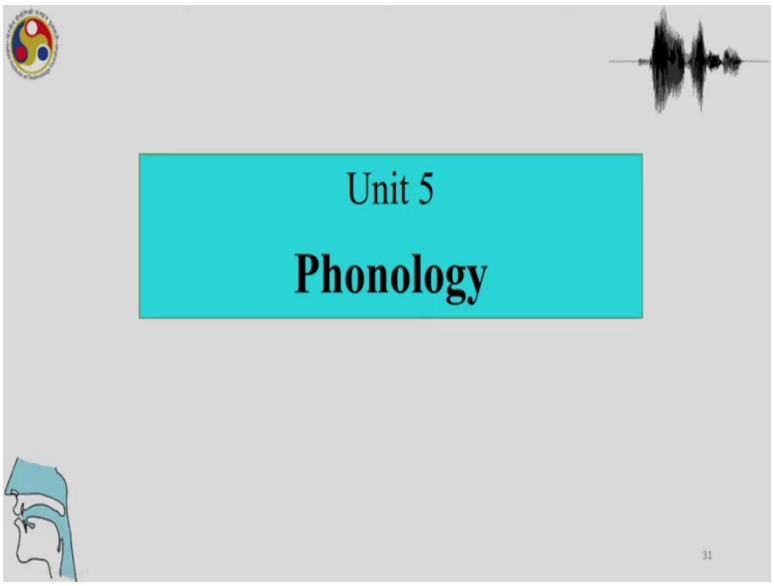

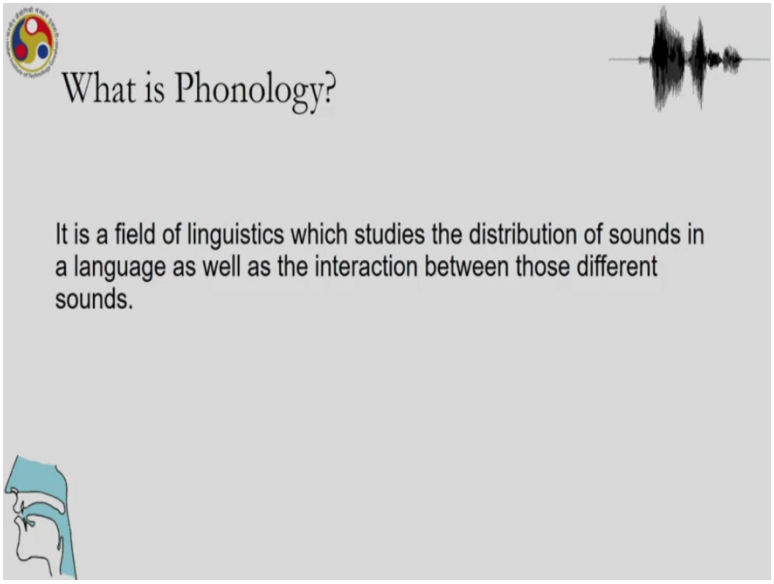

So, continuing with unit 5 phonology, let us recap the things that we studied in the last class. So, we now know that phonology is a field of linguistics which studies the distribution of sounds in a language as well as the interaction between those different sounds.

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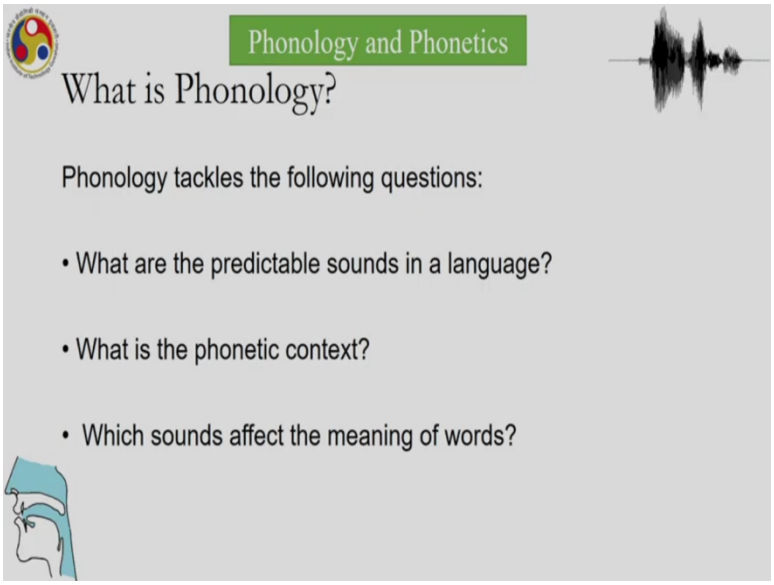

And also phonology tackles the following questions. What are the predictable sounds in a language? What is the phonetic context? And which sounds affect the meanings of words? And these are more or less the most important things and we saw in great detail as to phonetic context. We saw how English consonants can be different, based on the environment how alveolar sound and alveolar sound will be dental if there is a following dental fricative like a l can be pronounced as a velarized dental law as in wealth because of the following dental fricative.

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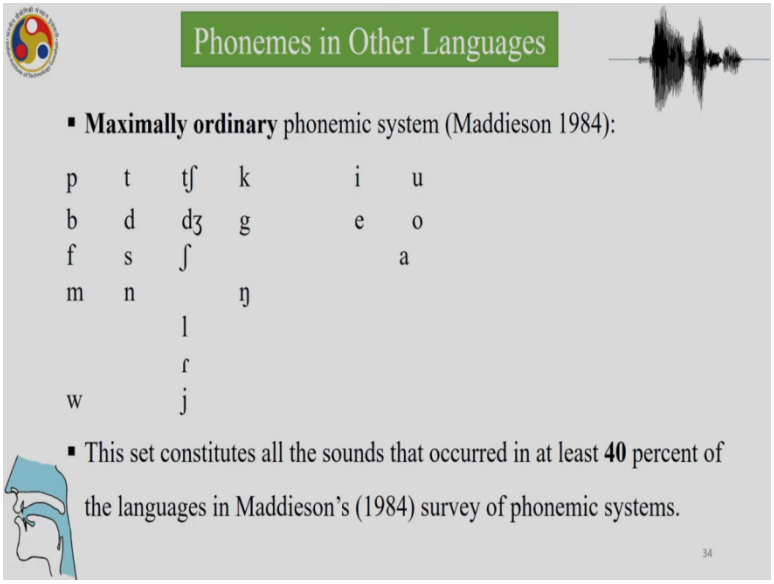

Now, let us look at how phonemes look like in different languages as well. And recall that we have looked in great detail as to consonants in other languages and if you have gone through the previous lectures on sounds of the world's languages, you have seen the great diversity that is available in the languages of world.

Now, when we look at the phonemic system in general, then we see that this phonemic system in Maddieson's sounds of the worse languages 1984 survey shows that this can be constitutes almost the 40 percent of languages in the world. So, what are these? These are the sounds that we have seen a lot, the labial, plosives, the alveolar plosives and these two affricates, post alveolar affricates, the velar stops and then the fricative f, the fricative s, the fricative sh, the nasals m, n, ng and l and y and v.

So, this consonants are quite common in language of the world and also among vowels, the five vowel inventory is quite common in the languages as well. So, generally this is a phonemic system which can be expected but we know from our previous lectures that it may not be so because lot of complexity can exist in the consonant inventories of different languages.

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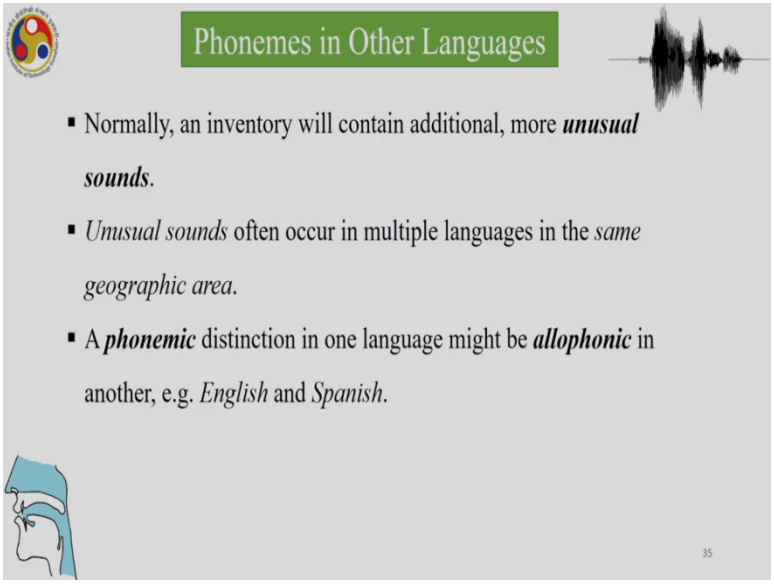

Normally, an inventory will contain additional, more unusual sounds as we already know. So, unusual sounds often occur in multiple languages in the same geographic area. So, that can also happen and a phonemic distinction in one language might be allophonic in another.

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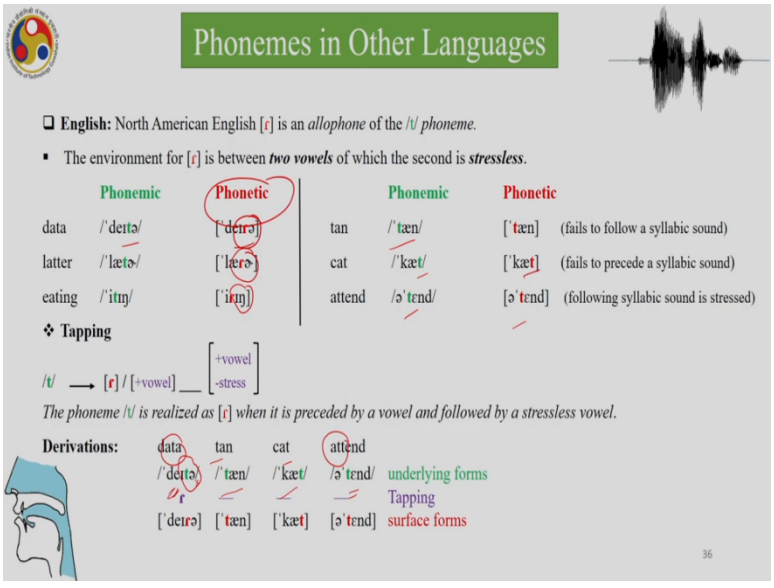

So, now we have the phonemic distinction which is allophonic in another language. We have an example from English and Spanish. And English and Spanish examples that you see here is with

regard to the tap sound that we have here. So in English, varieties of English have a tap sound in this context where it is preceded and followed by vowel sounds in an unstressed position.

Now, that tap in English which is phonetic, the environment is vowels on both sides in an unstressed position in other languages that can be, it can be different. So, in English now if we take the sound t then if in initial and final positions it is the same t. But, the t can change in this environment when preceding and following there are vowels in a stress position. So, t goes with tap when there is a following a preceding vowel and a following vowel which is unstressed.

The phoneme t is realized as a tap when it is preceded by vowel and followed by a stressless vowel. And we can now see a derivation that we had seen previously. So let us see the derivation now. So where do you have vowels between the t in this case and in this case right. And now we have t, a word initially word finally. So, this is our data set. Now additional information about stress, so this vowel is stressed but this vowel is not stressed and all these are monosyllables so they are stressed.

However, this vowel is stressed, the following vowel is stressed in attend. So, now data and attend are two different ways in which t can be pronounced because of the distribution of vowels and the stressless vowel in particular. So, where does the tapping rule apply in this one where it is flanked by vowels on both sides and there is no stress. So, we have data, we have tan, we have cat and we have attend.

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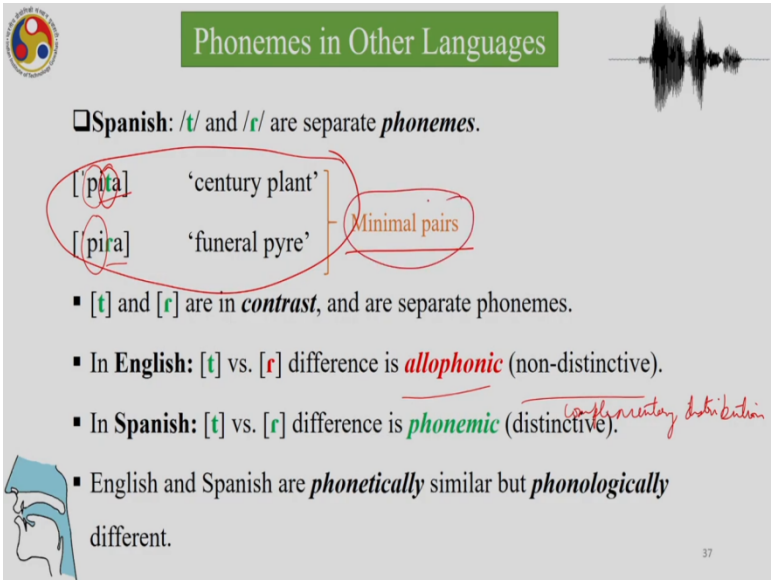

And however, now we have seen that flapping role in English, now we have Spanish where the flapping rule is there is no flapping rule they are just minimal pairs. They occur in exactly the same environment. So the flap is there in contrast and they are separate phonemes. In English t and r difference is allophonic, non-distinctive. Remember that if it is allophonic, it is non-distinctive and it is in complementary distribution and in Spanish t and r, the difference is phonemic, that is distinctive.

So, we could easily establish that in English, that in Spanish these are two separate phonemes because we have a minimal pair. So, what did the minimal pair show, that in exactly the same environment where we have two words, where stress is initial followed by a vowel followed by t and followed by flap here and where this is the stressed syllable is this one, this is the unstressed syllable similarly here stress syllable is this one is unstressed syllable in exactly the same environment t and the flap is occurring whereas in English that is not happening.

In English this t would not have occurred in it would have been the same word because the context determines that in this position, there will be the flat t, as a result we will not get the minimal pair that we are getting in Spanish because in Spanish they are phonemes.

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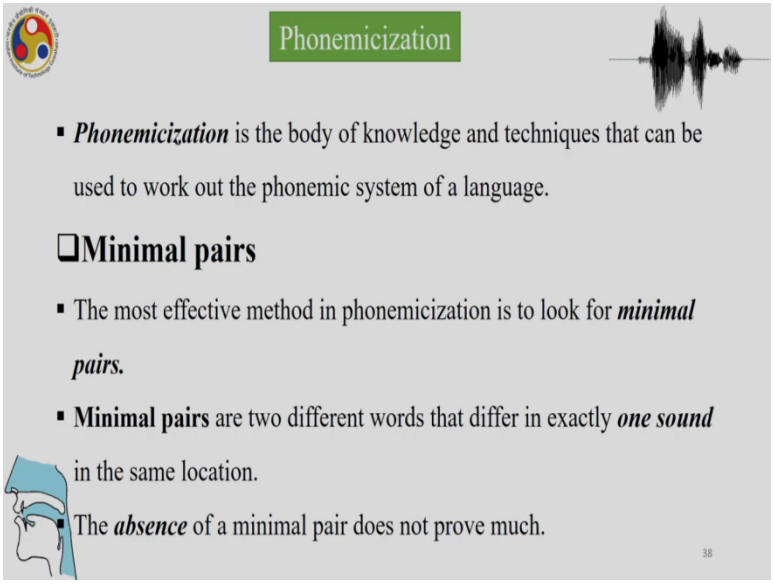

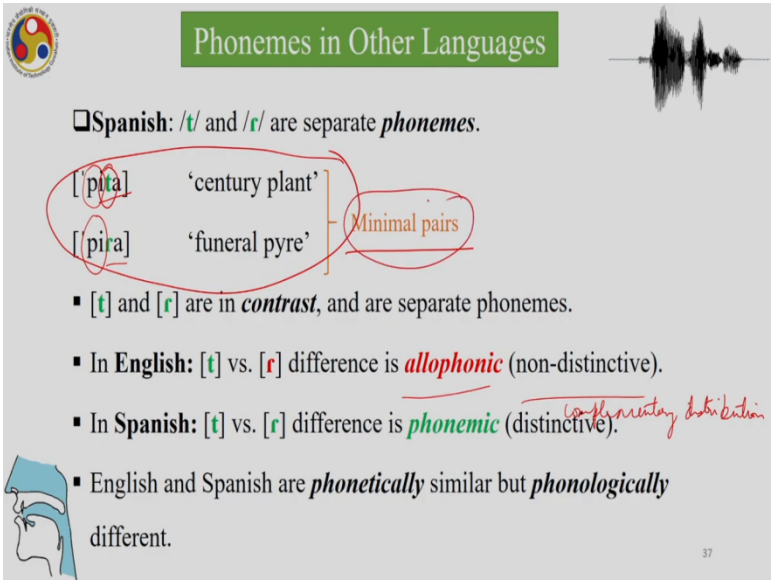

So, phonemicization is the body of knowledge and techniques that can be used to work out the phonemic system of a language. And minimal pairs, the most effective method in phonemicization is to look for minimal pairs. And minimal pairs are two different words that differ exactly and exactly one sound in the same position, exactly the same position as we saw for Spanish, with regard to Spanish that the t and the flap, they are both occurring in exactly the same position and these are two different words with two different meanings.

The absence of a minimal pair does not prove much because there are also phonemes which lack minimal pairs but that is almost the first test that is done to check if they are phonemes. And it is also known to be the most effective method in phonemicization, to look for minimal pairs.

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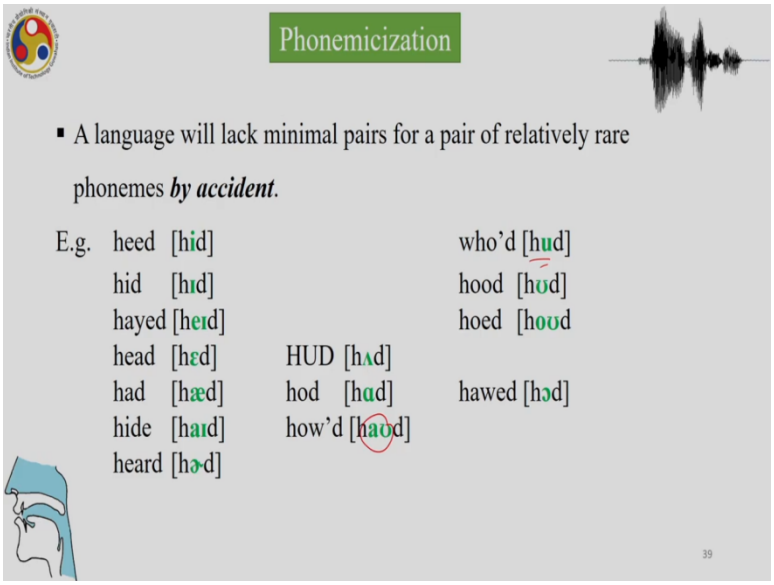

So, a language might lack minimal pairs for a few phonemes by accident. So, if we look at the set of vowels we see that we do not get the entire paradigm of h and d in the context where they are always occurring. So, what happened here, we had for this one we had to use how'd and who'd so which are not really minimal pairs but these are contractions criticized and as a result we get these words and those kind of things might always happen, we may not find exact minimal pairs but we can see that they are still phonemes.

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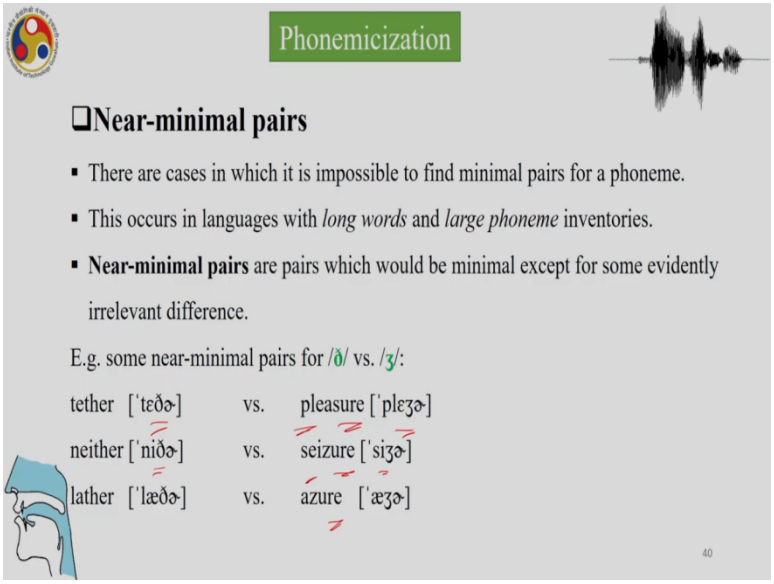

Then in phonemicization, we also find near-minimal pairs. There are cases in which it is impossible to find minimal pairs for a phoneme and this occurs in languages with long words and large phoneme inventories. And near-minimal pairs are pairs which would be minimal, except for some evidently irrelevant difference.

So, some near minimal pairs for d and z. So, we have tether and pleasure. We have neither and seizure. So are these exact minimal pairs? No, they're not exact minimum pairs because for tether we do not have tezure. For neither we do not have neizure. For lather, we do not have lazure. So why are these near-minimal pairs?

Because the following context is the same but the preceding is not exactly the same. So for instead of nei, we have sei, here neither seizure and instead of la we have a here. So these are called near-minimal pairs. So, if there are large phoneme inventories then we may not find too many minimal pairs and near-minimal pairs are almost minimal pairs but some not so important difference is always it can be seen in near-minimal pairs.

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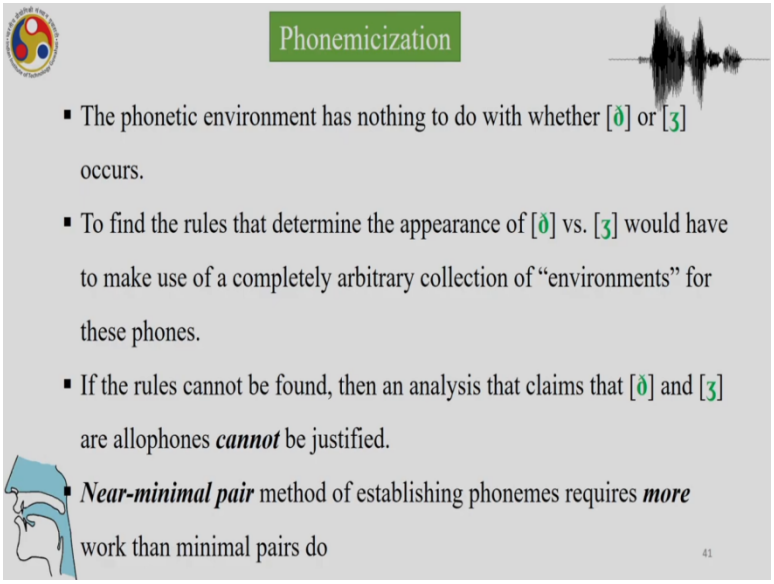

So, the phonemic environment has nothing to do with whether d or z occurs the phonetic environment and to find the rules that determine the appearance of d versus z, would have to make use of a completely arbitrary collection of environments for these phones. And if the rules cannot be found, then an analysis that claims that d and z are allophones, cannot be justified. So, we do not have rules for the appearance of d and z as allophones.

And hence, we cannot collect environments for these phones and if the rules cannot be found in analysis that claims that d and z are actually occurring in complementary distribution, it cannot be justified. So, obviously minimal pairs, it is the most straightforward method to establish phonemes and also near-minimal pairs require much more work because there is a little difference there between the pairs.

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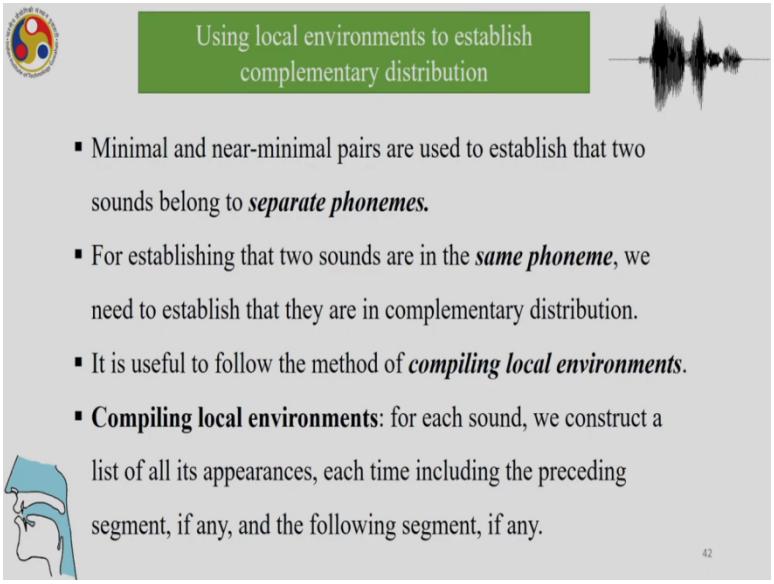

And minimal and near-minimal pairs are used to establish that two sounds belong to separate phonemes just like minimal pairs. And for establishing that two sounds are in the same phoneme, we need to establish that they are in complementary distribution. So if they are variants that they are different manifestations of the same phoneme, we have to establish that they are in complementary distribution.

And also it is useful to follow the method of compiling local environments. And compiling local environments for each sound, we construct a list of all its appearance each time including the preceding segment and if any and the following segment if any. For any given data set, it is important to do this work to establish whether two sounds are in an allophonic relationship or if there are different phonemes.

So, the method of finding out complementary distributions is to compile local environments and for each sound we construct a list of all its appearances each time and including the preceding segment, the following segment and follow the data carefully to do this.

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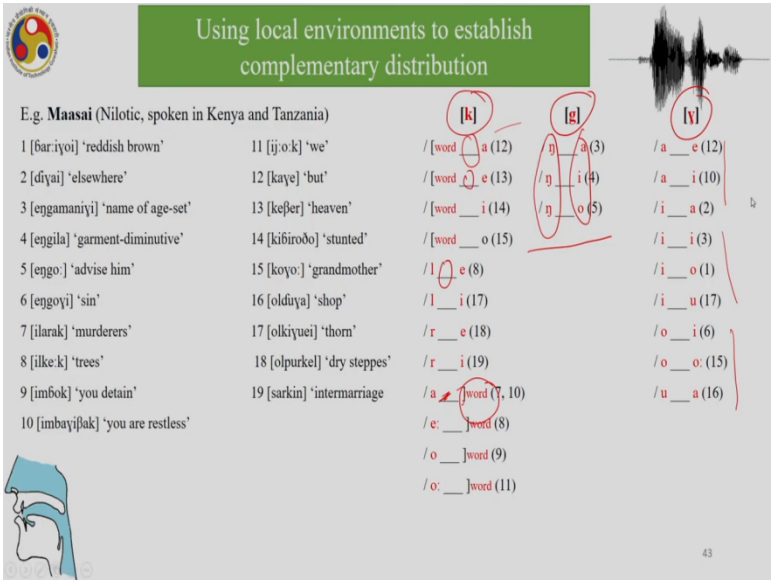

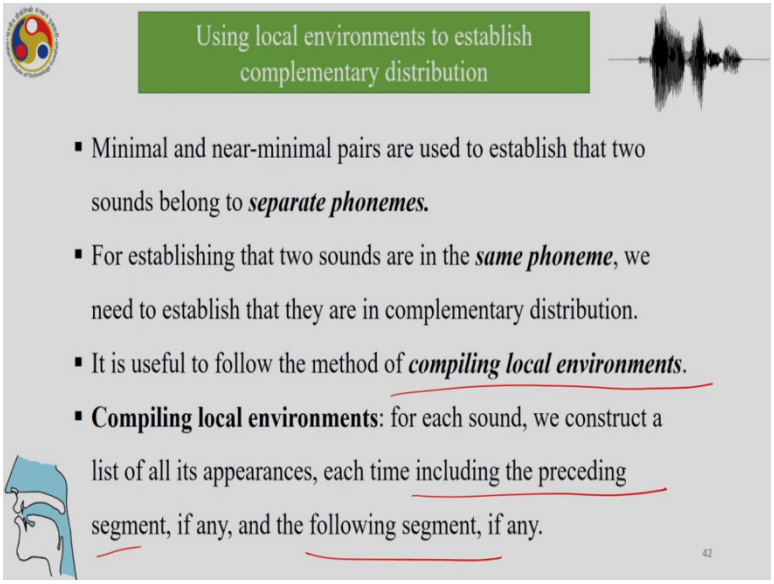

So, we can look at this Maasai data from Hayes, 2009 Phonology Introduction. And we can look at these three consonants, k, g, h and you notice that they are all back wheeler and while these two are stops and this is a fricative and the voiced fricative and we compile their environment so this is what is meant by compiling local environments.

So, when you compile local environments we look at the preceding and the following segment. So, this is what is being done here. So, we have compiled the local environments here and we have found these. Now look at k, you can see that k occurs in a variety of environments, word

initially when it is so in a medial position after the word, initial bracket and this is how we represent that and between a consonant and a vowel and also word finally as this is shown, this is the word final position, this is the boundary and in preceding that also you will get k.

However, we do not get all these different word, initial word final and vowel and consonant environments for g. For g, we see it is very consistently following a nasal and a vowel. Also, for the velar fricative, we see consistently throughout the data set in nine examples. We see that it is always occurs when it is flanked by two vowels on both sides. Now, this is fairly clear that there is some complementary distribution at work here because we see clearly that k is occurring in all these different environments whereas g and h are very restricted.

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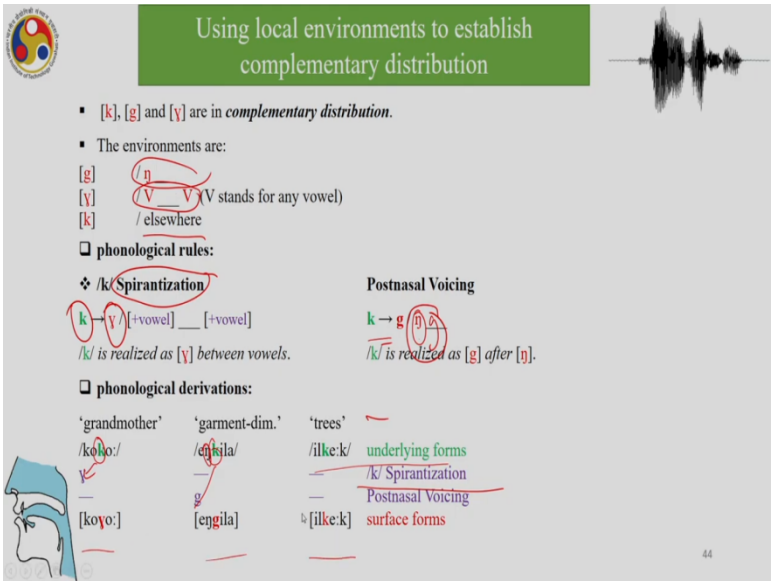

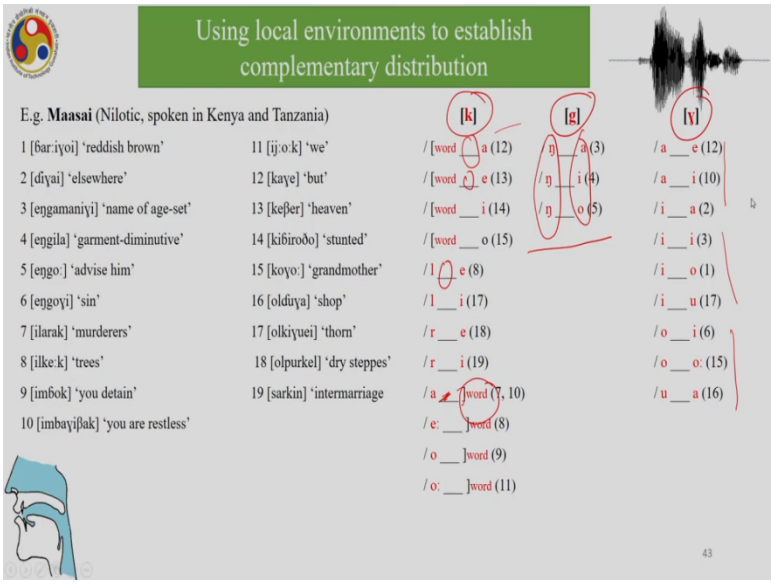

And we saw the complementary distribution at work here and the environments are very clearly what we saw is that g, when g occurs it is always n and then for h, there is always two vowels flanked and k, we cannot write an environment for k because it occurs in so many diverse environments and would not have any uniform environment which can be written in a simplistic manner. Now that is one established way in which we decide complementary distributions and therefore, find phonemes in a language.

So, one important thing that we see here is that of spirantization. So what does spirantization mean? It means that when a stop changes to a fricative, so it becomes a softer, it is called as weakening or hardening also. So stop becomes a fricative, this process is called spirantization and what is to stop which changes to a fricative here. It is a velar stop which becomes a velar fricative and between two vowels, when it is flanked by two vowels, k changes to h and also, we find postnasal voicing, that is when k and g becomes g, there is always n preceding it.

And whenever there is a nasal, the k becomes g in this context because of the preceding nasal, it takes a feature of voiced and that is called postnasal voicing. So, if we look at the derivation here now, we see that we have the two words there koko which is grandmother and garment diminutive is enkila and trees is ilke:k. Now, if we have k spirantization, what happens in k spirantization, k becomes a fricative.

So, it becomes h and then which will happen in this environment, k will become h, so koko will become khokho and then we have g here postnasal voicing because the preceding nasal the k becomes g here, so it will be angular and now from our underlying forms here, we see that the surface forms are Koho angular and this one is ilke:k and there is no change because we do not have the particular environments required for the change.

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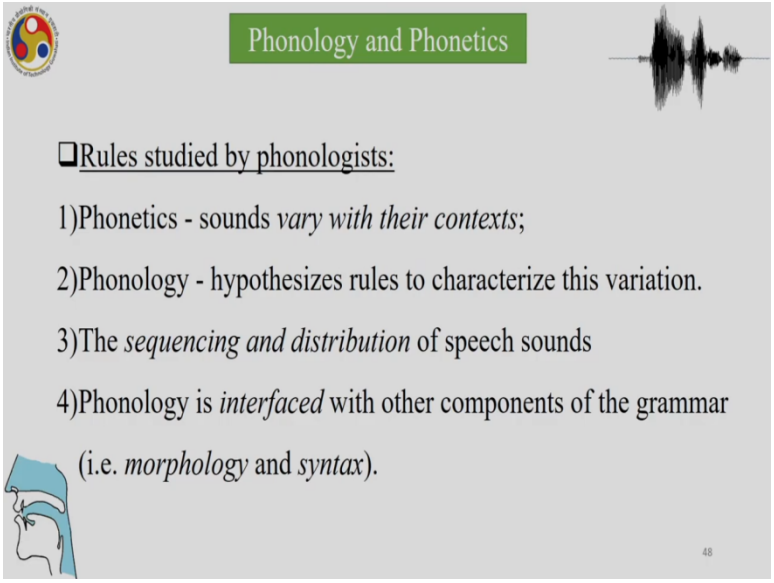

So, as we had talked about this in the previous class, that phonology hypothesizes rules to characterize the variation. So whereas phonetics sounds vary with the context, phonology we study the rules and you have seen quite a few rules in the previous class as well as in this lecture. And also you have an idea now about what we mean by varying with the context and what we mean by rules and what we mean by sequencing and distribution and of course some other things related to phonology we will cover in the following lectures.

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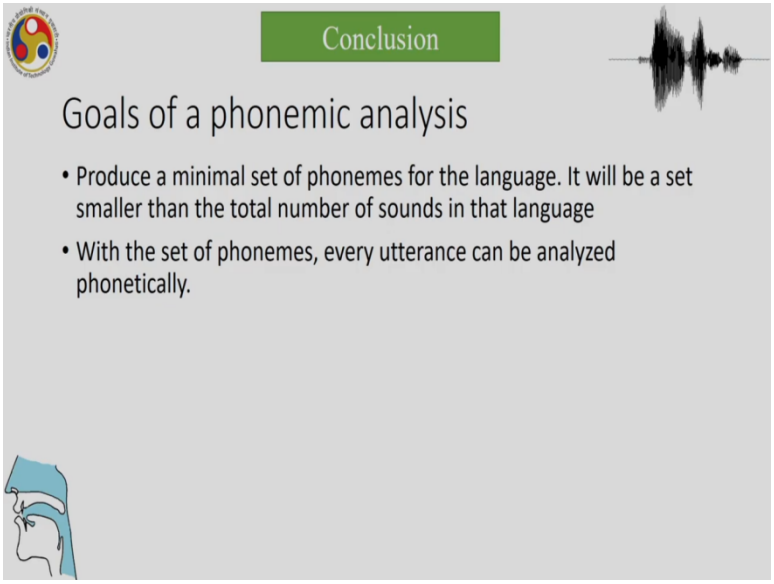

Now, the goal of a phonemic analysis is to produce a minimal set of phonemes for the language. And it will be a set smaller than the total number of sounds in that language and with the set of phonemes every utterance can be analyzed phonetically. So, when once we have the phonemes and we understand the rules governing the occurrence of the phones, we can analyze, we can predict the environments in which it will change its shape.

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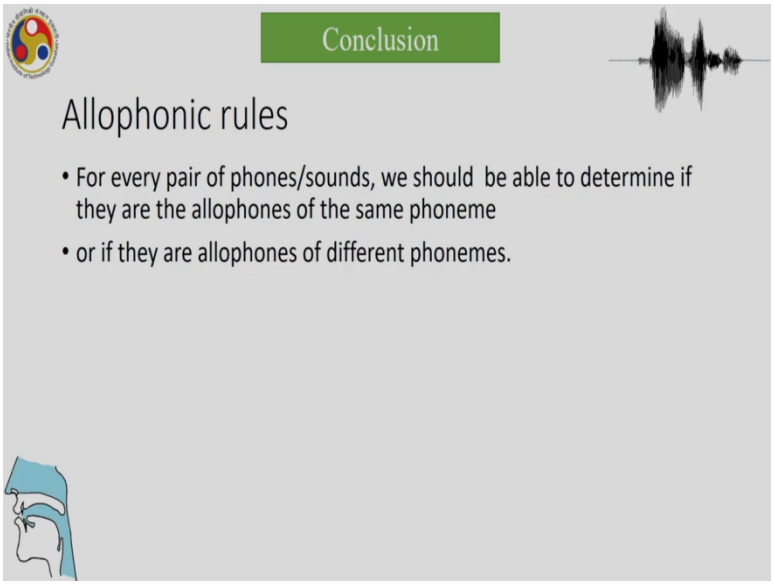

And for every pair of sounds, we may be able to determine if they're allophones of the same phoneme or if the allophones of different phonemes.

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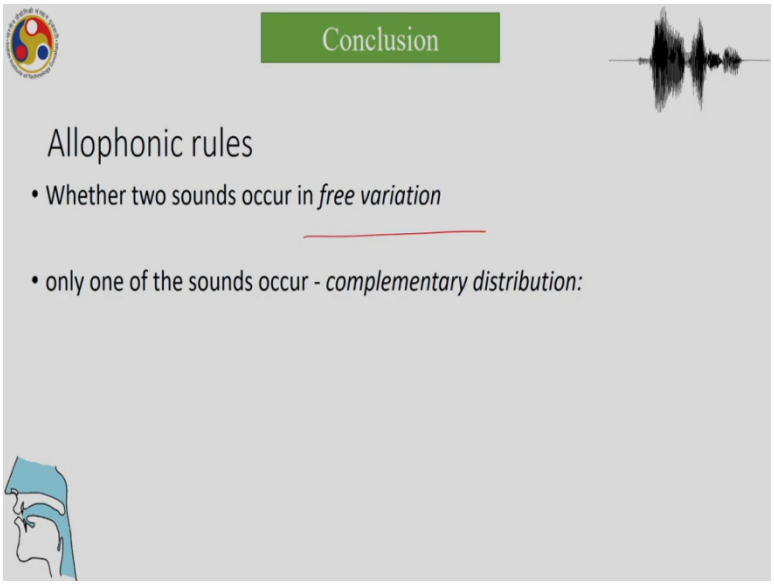

And whether two sounds occur in free variation so as the name suggests when two sounds occur in free variation, then the variation cannot be expressed with rules. So, the variation is free so it can occur in context which cannot be described by rule. But the meanings will not change. Only one of the sounds occurred that is complementary distribution and this can also be expressed with allophonic rules.

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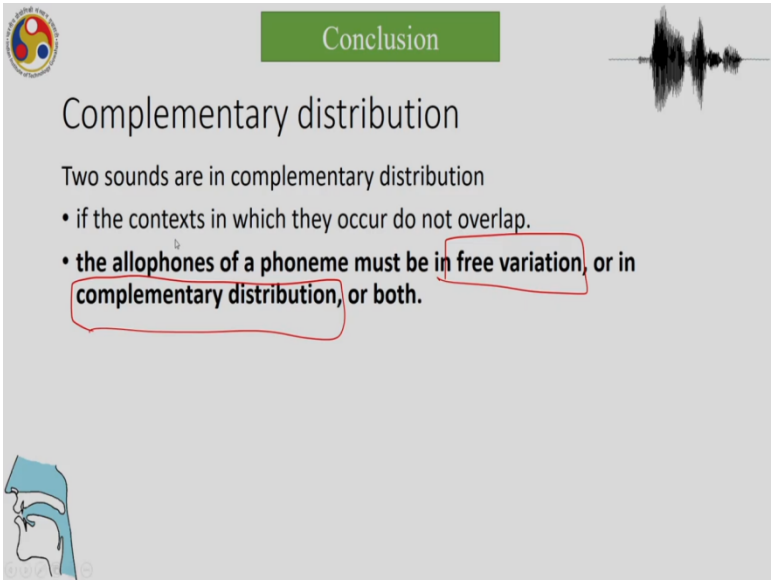

As we have already gone through what is complementary distribution, when two sounds are in complementary distribution then the context in which they occur do not overlap and the allophones for phoneme must be in free variation or in complementary distribution or both. So, as we just heard a free variation and complementary distribution can both exist in a language and in complementary distribution, we know the exact environment in which something will occur. With free variation that kind of rule writing is not possible.

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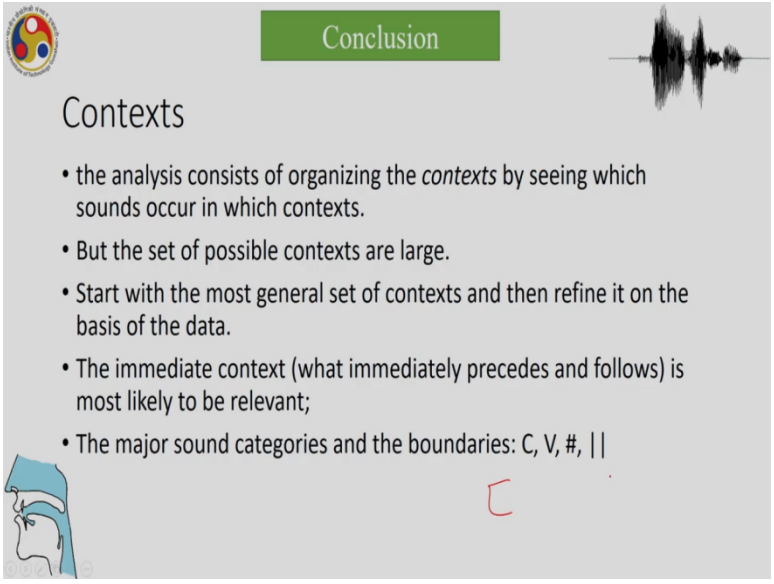

Something which is important and we have studied a lot is the importance of context. The analysis consists of organizing the context by saying which sounds occur in which context. And we have to remember the set of possible contexts are always quite large and we start with the most general set of contexts and then refine it on the basis of data. And what immediately follows and precedes is always relevant and as well as the major sounds in the boundaries of words as you saw, it was expressed with word.

If it is word beginning, then this is how we express it. If it is end of a word, then we express it. This is how boundaries are expressed sometimes it is also expressed with a hashtag, word or if this is the star beginning or if it is the end. So these are various ways of representation of boundaries. And also the square brackets show the beginning and the end of a row.

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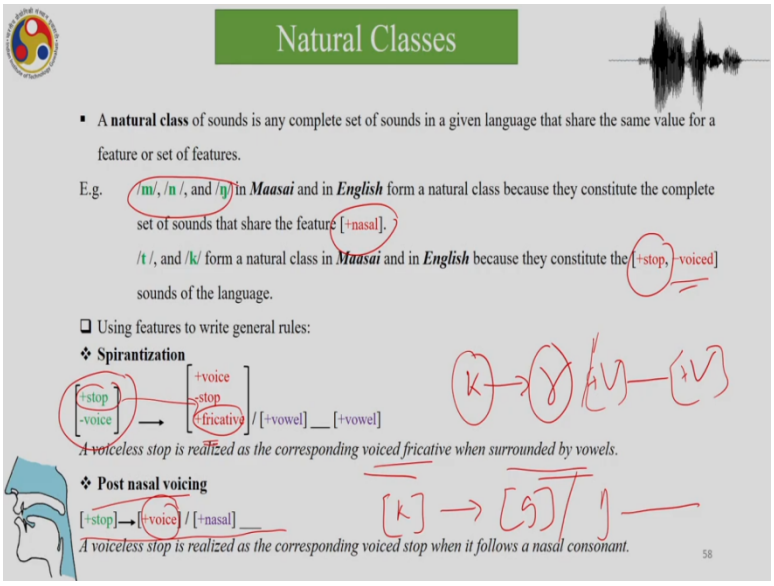

So something we will introduce here is that of the idea of a natural class. And we will study features in more detail but we have to give an idea about what natural classes are. So the idea of natural classes is an idea developed in within generative phonology and natural class of sounds in any complete set of sounds is in a given language that share the same value for a feature or set of features. So, the three nasals m, n and ng in Maasai and in English form a natural class because they constitute the complete set of sounds that share the feature plus nasal.

So, this is a natural class and all three of them share a feature, important feature that is nasal. t and k form of natural class in Maasai and English because they constitute the plus stop minus voice sounds of the language. And note that we are using categories that we have already seen before stop and plosive and voice and fricative, when we actually talk about features then we will see a change in these features. In the following lectures this will become clear.

Now expression of rules in this manner became more and more relevant in generative phonology and here we are showing you a glimpse of that process. So, the process of spirantization where we saw that k goes to g, when it is between two vowels. Okay. So, this is now, this can be now expressed like this, that the plus stop minus voice becomes plus voice minus stop plus fricative in the environment where there are two vowels.

So, this now shows that the stop is not a stop any longer but becomes a fricative and it shows the spirantization process instead of just showing that k becomes g. So, a voiceless stop is realize the corresponding voice fricative when surrounded by vowels. So, this is our rule and now this is being expressed with these features instead of just saying, instead of just putting the phoneme, we are now describing what those phonemes are and also if you recall Maasai, we have another thing happening there that we have postnasal voicing.

So, in postnasal voicing a stop becomes plus voice and that is a minus voiced stop becomes plus voice because there is a following nasal. And a voiceless stop is realized as a corresponding voice stop when it follows a nasal consonant and that is our postnasal voicing and it can be expressed like this instead of just expressing it as k, instead of saying that k goes to g in the environment where there is a n.

This expression shows that there is a change in voice, just like this showed that there is a change from stop to fricative and instead of writing the phonemes, if we add the description then it captures generalizations.

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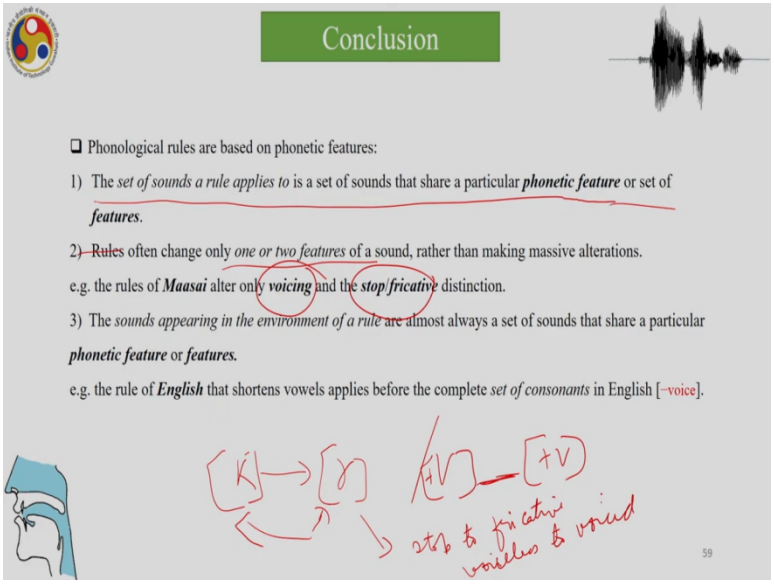

So, phonological rules are based on phonetic features and the set of sounds a rule applies to, is a set of sounds that share a particular phonetic feature or set of features. And rules often change only one or two features of a sound rather than making massive alterations. And the rules of Maasai alter voicing and stop fricative distinctions and you can see that there are only one or two features involved.

And there are one or two features involved and again repeating the first point that the set of sounds a rule applies to, it is a set of sounds that share a particular phonetic feature or a set of features. So, the rule applies to so here the rule applies to k and k becomes g. So, what are the features that they share? They share the feature of place of articulation. So k and h are both velar and they change in this environment, they become both plus voice.

So they become g in the environment where when it occurs in this environment, when k occurs in this environment flanked by two vowels it becomes a h. The important point pointed out here is that they share a particular feature and that is what we're talking about what feature these two share? They share the place of articulation, point number one. Point number two, rules often change only one or two features of a sound and here how many features have changed?

It has changed two features. It has changed from stop to fricative and it has changed from voiceless to voiced. So, we do not find many more featural changes and that is another thing that

is important while noting the environments. The sounds appearing in the environment of a role are almost always a set of sounds that share a particular phonetic feature or features.

So, the rule of English that shortens vowels applies before the complete set of consonants in English minus voice. Now, we have gone through most of the aspects of a phonemic analysis, how to arrive at a set of phonemes, how to put down the local environments, that is, the preceding following. How to write a rule? How we express x goes to y in the environment z? And what are the other things that we have to keep in mind while we are looking for local environments?

How features are important? How we can show that something changed to something else because there were some common features involved or that there are not too many changes and there are always minimal changes involved and also we have talked about complementary distribution and contrastive distribution and also distinctiveness, which is important to find our minimal pairs. We have also seen near-minimal pairs.

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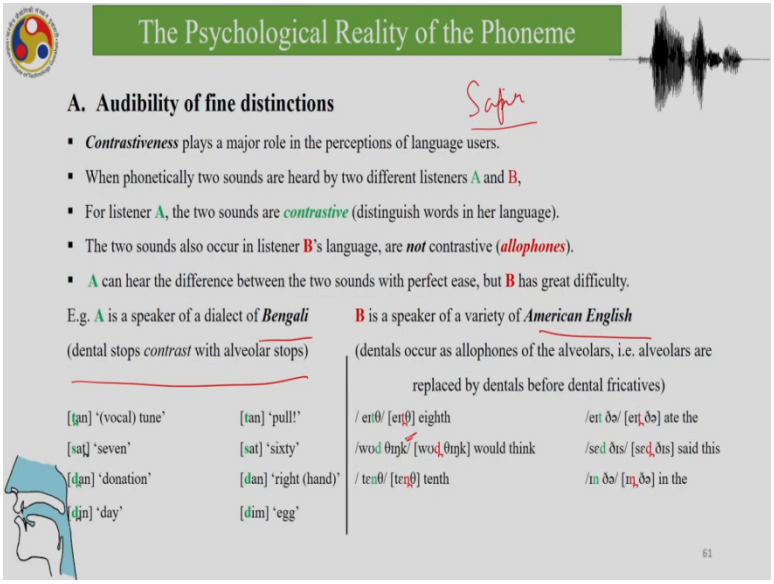

Let us now also look at some more aspects with regard to phonemes. An important idea that can be attributed to Sapir, who wrote a paper by the same name, The Psychological Reality of the Phoneme is exactly that, The Psychological Reality of a Phoneme. So, how are phonemes

psychologically real? We will talk about that in more detail and before that let us prepare ourselves to understand that with a few examples.

So contrastiveness plays a major role in the perception of language users. When phonetically two sounds are heard by two different listeners A and B. For listener A, the sounds are contrastive. Distinguish, they distinguish different words in a language and the sounds also occur in like listener B's language are not contrastive, they're allophones. And A can hear the difference between two sounds with perfect ease but B has great difficulty.

So but remember the sounds occur in both A as well as B's languages. Why is it easier for A to hear the difference and why is it difficult for B to hear that? And, now we have an example from Bengali and American English as given in Hayes, 2009 Introductory Phonology and this shows that in this dialect of Bengali, dental stops contrast with alveolar stops and whereas some are dental and some are alveolar.

As a result, they are contrastive. However, remember that in English, dentals and alveolar stops dental and alveolar stops do not contrast but they can be allophonic, whereas in this language, it is a contrast. So we have tan versus tan and sat versus sat and we have dan versus dan and din versus din. So we have dental and alveolar sounds, whereas in American English also we might find dental and alveolar contrast.

We saw that with the nasal and when we saw nasals and we saw dentalized nasals and dentalized alveolars and that is possible for stops as well when there is a preceding, when there is a following dental fricative. So, ate the could be dentalized because of following dental fricative. Whereas and also as in eighth, the t can be dentalized.

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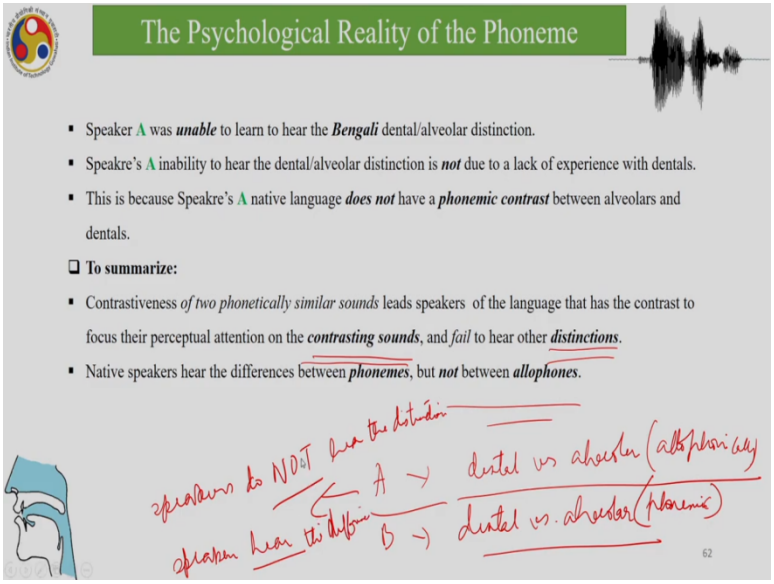

However, not unsurprisingly because speaker A is a speaker of a language where dental and alveolar sounds are not contrastive, speaker A was completely unable to determine to hear the Bengali contrast, and speaker A's inability to hear the dental alveolar distinction is not due to the lack of experience but because speaker A does not have phonemic contrast in her language.

So, this shows something very important to us that is the contrastiveness of two fanatically similar sounds, lead speakers of the language that has the contrast to focus the perceptual attention on the contrasting sounds and they fail to hear the distinctions. And native speakers hear the differences between phonemes but they do not hear the difference between allophones and that is precisely the reason that A could not hear the difference between dental versus alveolar.

Although, it occurs allophonically, whereas in B's language, dental versus alveolar was a phonemic contrastive difference. So, when this happens, speakers do not hear the distinction. And when it is phonemic, speakers tune themselves to concentrate on the difference and they are perceptually tuned to hear the difference.

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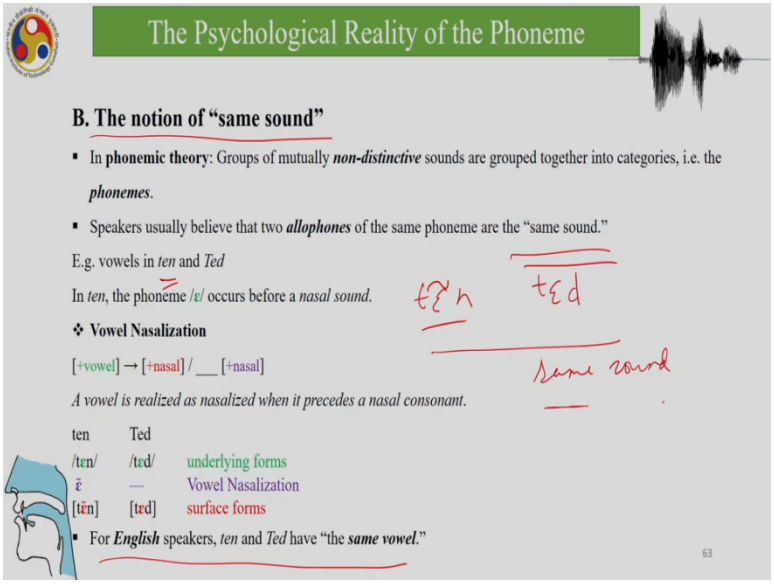

And related to that, is the psychological reality of the phoneme to the idea of the psychological reality of phoneme is the notion of the same sound. So, groups of mutually non-distinctive sounds are grouped together into categories, that is the phonemes. And speakers usually believe that two allophones the same phoneme are the same sound. So this is related to what we said just now that is because do not hear the distinction if it occurs allophonically.

And allophones when speakers utter allophones, they hear them as the same sounds and for example the vowels in ten and ted are different, one is nasalized and the other is not. Because the following nasal in ten, we have a nasalized vowel unlike in ted. So, vowel becomes nasal when there is a following nasal but do speakers here these are different vowels because do not hear these as different vowels because nasalization is not contrastive in English. So what is the notion, the same sound if they exist allophonically then the speakers hear the same sound.

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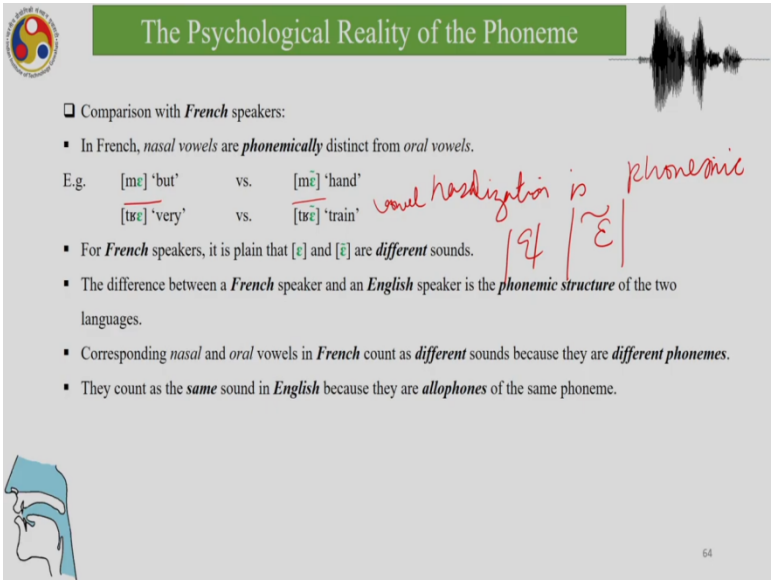

Now extending of that to other languages where nasalization occurs phonemically for instance French. In French, bon bon or me-me are phonemically distinct because their nasalization is contrastive. Vowel nasalization is phonemic which means a and a are two different, since these are phonemic I will use the slanted brackets. So, this is phonemic. As a result, now for French speakers it is plain that a and a are different sounds.

So the difference between a French speaker and an English speaker is the phonemic structure of two languages. So, when they produce a-a in English, speakers will not hear the difference, whereas for French speakers this is a vital difference because it will signal two different, can mean different words. Corresponding nasal and oral vowels in French count as different sounds because they are different phonemes and they count as the same sound in English because they are allophones of the same phoneme.

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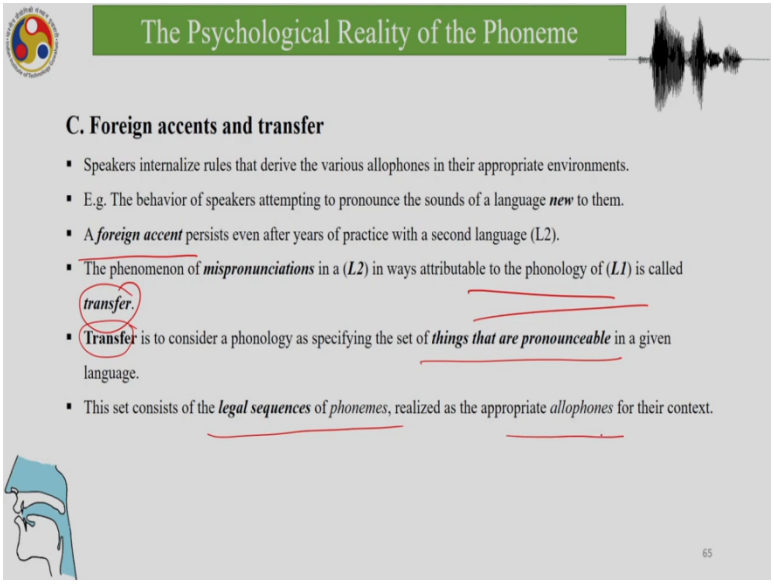

A few brief points about accents and transfer and speakers internalize rules that derive the various allophones in their environments. The behavior of speakers attempting to pronounce the words for language which is new to them, it is called foreign accent and most often it persists after even years of practice with a second language.

And the phenomenon of mispronunciation in second language is always attributable to the phonology of the first language and that is called transfer. So, obviously it is not mispronunciation but speakers use their phonology, second language phonology while speaking their first language.

Now, importantly there can be also other things there, so you can have completely novel things in a second language and that will not be transfer, that will be maybe universal language or some properties which appear, which is not there in the first language of the speaker or the language, the target language and there can be completely novel innovations in a second language context.

So but most of the time there are lot of transfers from the first language to the second language. And transfer is to consider phonology as specifying the set of things that are pronounceable in a given language. So, and the set of things that are pronounceable are the legal sequences of phonemes which are realized as appropriate allophone and the sequences phonemes in one

language can be realized as certain allophones which are appropriate in that context for those speakers learning a second language.

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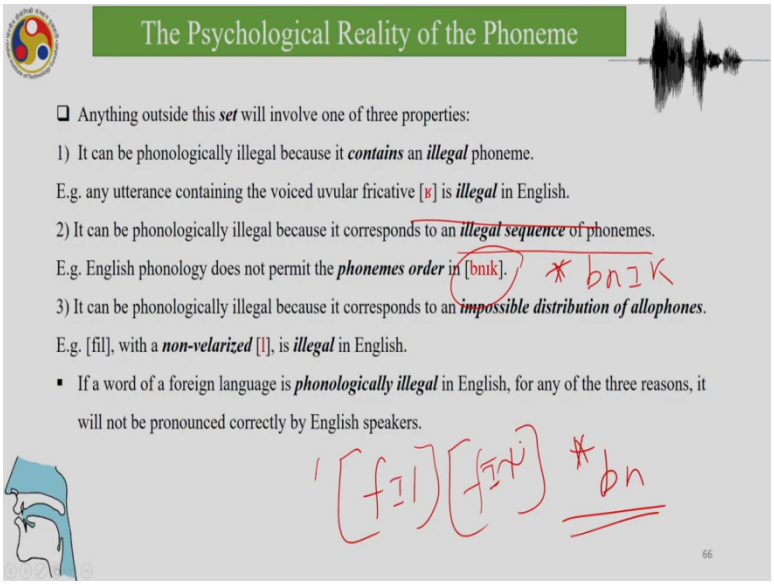

So, anything outside this set will involve one of the three properties. As we just said that there could be other innovations, so it can be phonologically illegal because it contains an illegal phoneme any utter trends containing the voice jugular fricative is illegal in English because that never occurs in English.

It can be phonologically illegal because it corresponds to an illegal sequence of phonemes because that is not allowed in the phonology of language phonology of English and English phonology does not permit the phonemes in certain orders. So, this is not possible in English, this is illegal in English, b, n is completely illegal in English and it can be legal because it corresponds to an impossible distribution of phonemes in English, example, this word is not possible in English.

Why? Because in English, whenever there is a surface form with a final l, it has to be always velarized and it has to be filled. If a word of a foreign language is phonologically illegal, for any of the three reasons it will not be pronounced correctly by English speakers.

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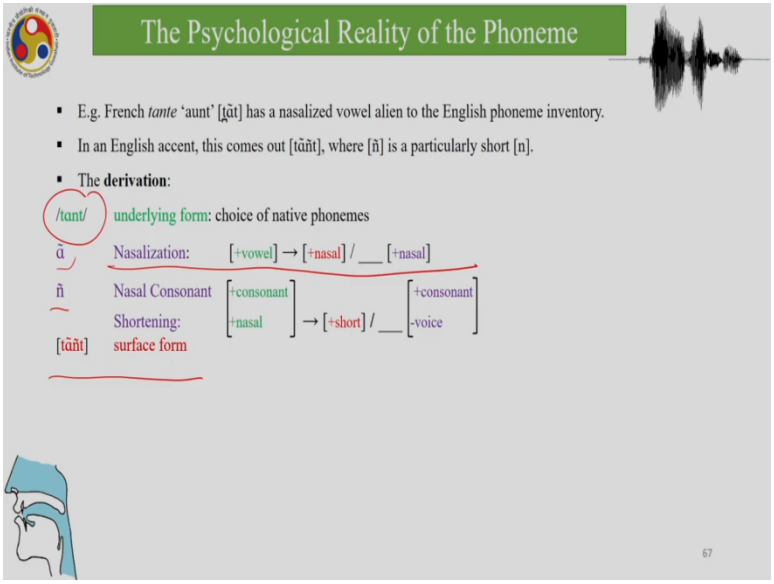

And finally in French tante, has a nasalized vowel alien to the English phoneme inventory. So in an English accent, this comes out as tant where n is particularly short. And now if we do a derivation of our English speakers or French and these are the steps that will involve this. So, we have this underlying form of tant and we have a and we have nasalization which leads to a and then we have nasal consonant which is shortened and as a result we have the surface English form of tant.

And this now shows all these topics show something vital, that we will again discuss the psychological reality of the phoneme. And the phoneme is considered psychologically real because the speakers here only the phoneme did not hear the allophone and this can be extended to various contexts, as in transfers and foreign accents and transfer and illegal sequences in a particular language and how they manifest in another language.

So, when you are learning a second language how the rhotic in French which is not legal, it is not a legal phoneme in English and how it will appear as a certain manifestation of the English rhotic and other things show the psychological reality of the phoneme of the first language that speakers are used to speaking.

So, this brings us to the third lecture on phonology and in the next class we will continue with the psychological reality of phoneme and also look at a big set of examples which show

phonological derivations and we will go through those examples so that we understand all the processes involved in phonological processes and the methods for determining phonemes and how do we arrive at the set of phonemes that are there in a language and how do we analyze different phonological processes which are also there along with the phonemes which exists in that language.

So thank you for listening and we will keep talking about phonology in a couple of more lectures. Thank you.