Phonetics and Phonology: A broad overview
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Lecture 18
Psychological Reality of Phonemes

Welcome to this NPTEL Massive Open Online Course and this course is on Phonetics and Phonology: a broad overview.

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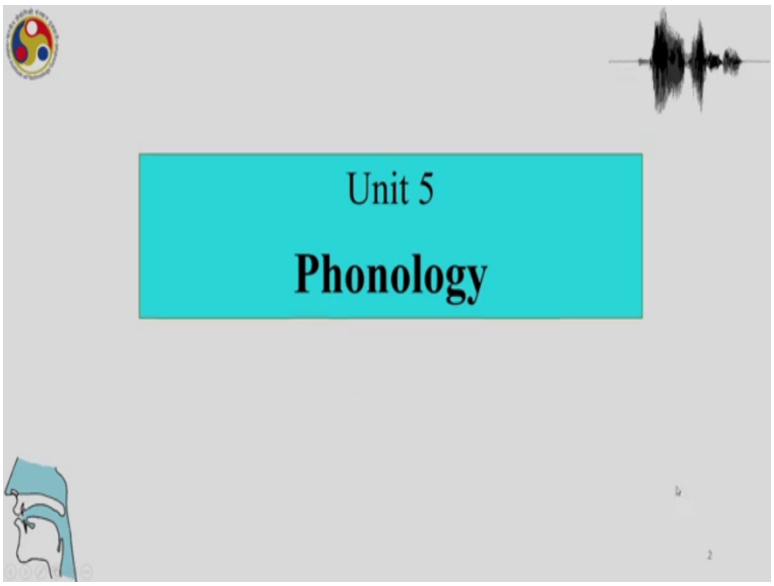

We have been talking about phonology the fifth unit of this course.

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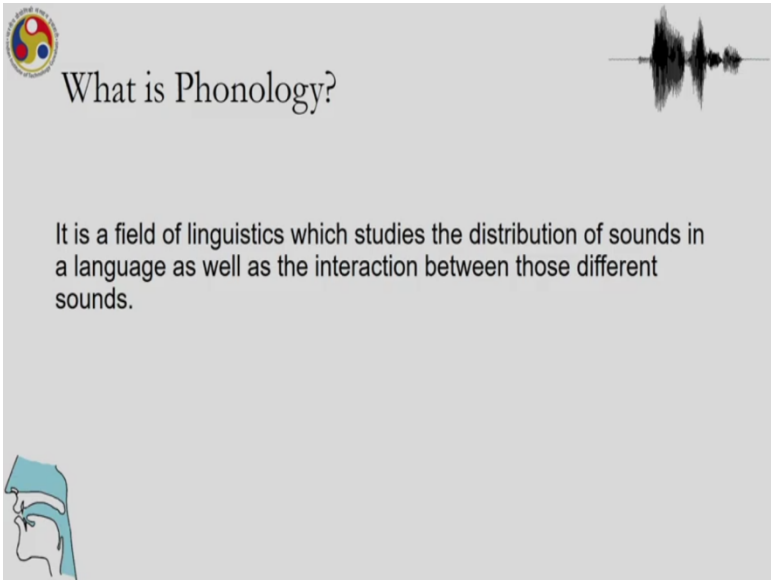

And in the last two lectures we talked about what is phonology and we have now gone through the basic aspects of the field and we now know that it studies the distribution of sounds in a language as well as interaction between sounds.

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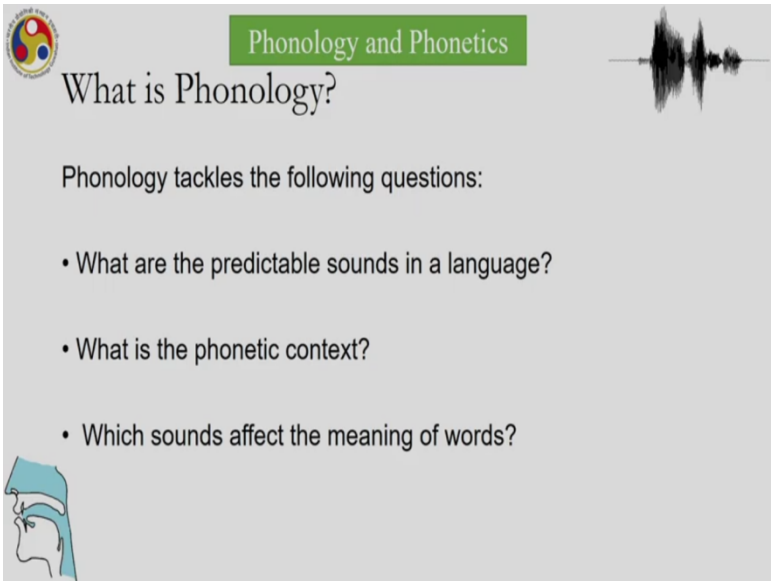

And phonology tackles questions such as what are predictable sounds in the language? What exactly do we mean by predictability also? And what is the phonetic context? And which sounds affect the meaning of words?

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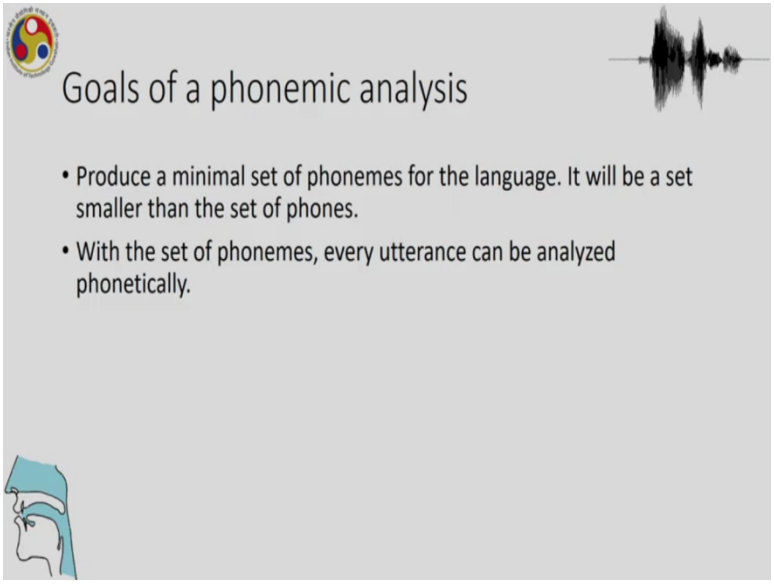

And we also have been talking about a certain type of analysis called phonemic analysis and the goal of the phonemic analysis to produce a minimal set of phonemes for the language and it will be the smallest set of sounds in that language. With the set of phonemes, every utterance can be analyzed phonetically.

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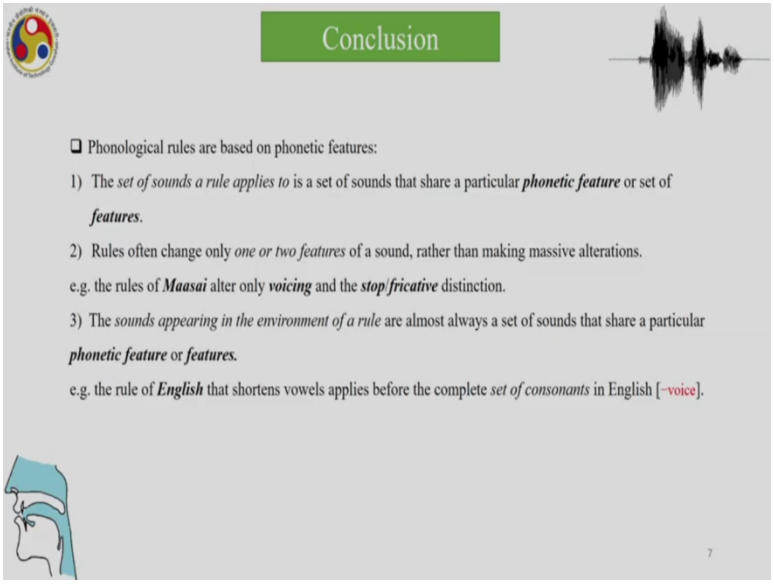

And, we also looked at phonological rules in the last lecture and we looked at the set of sounds that a rule applies to and particular phonetic feature or a set of features.

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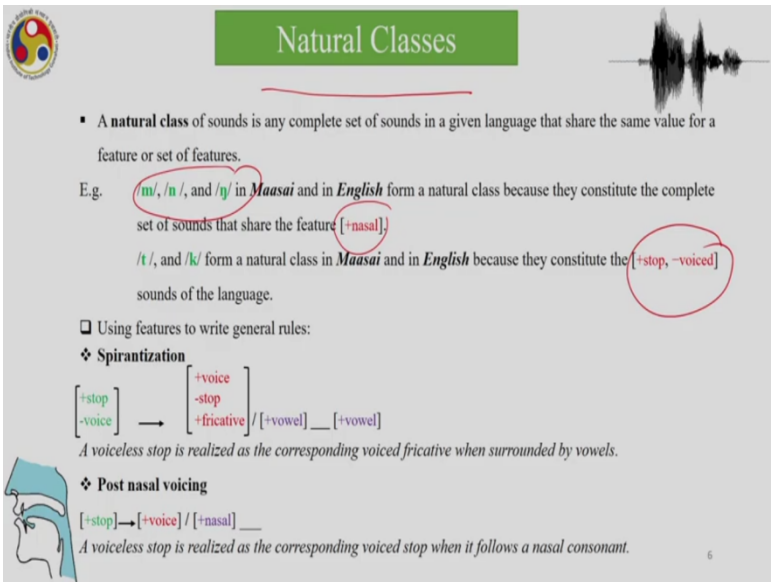

And we also looked at something called natural classes which we will be repeating in the next few classes and try to understand natural class in greater detail. A natural class of sounds is any complete set of sounds in a given language and that share the same value for a feature or a set of

features. And suppose a language has three nasals, then the feature will be plus nasal because they constitute the complete set of sounds in that language.

That language may be either Maasai or English and t and k form a natural class in a sign in English because they constitute stop and plus stop and minus voice sounds. So, this idea of natural classes is very important in phonology and we will require this idea for all types of phonological analysis and in this lecture we will not particularly deal with natural classes and features, although that is important to be kept in mind and in the next lecture we will deal with this particular idea, the concept of natural classes in greater detail.

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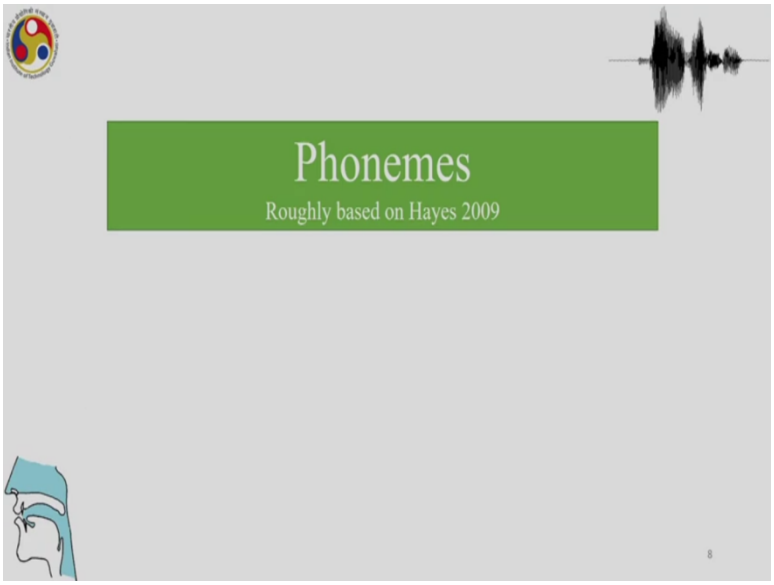

So, let us now look at phonemes something which we looked at in the last lecture and we are continuing with that.

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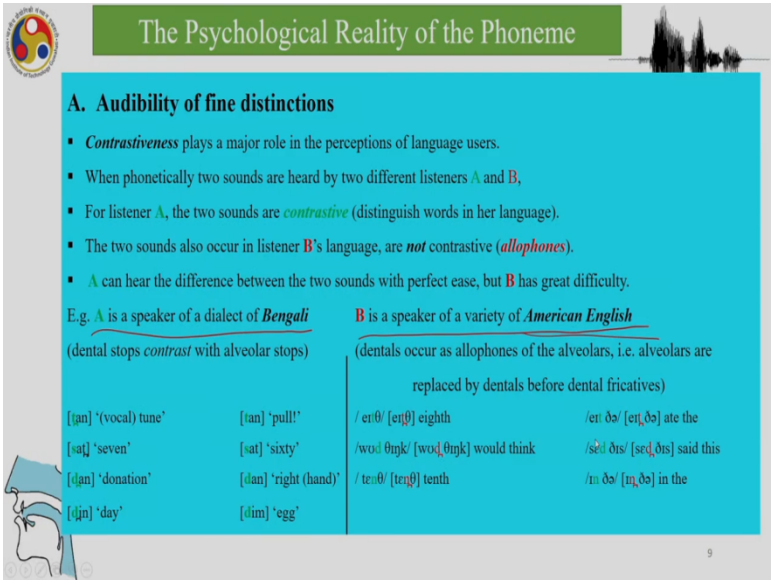

So, we talked about the psychological reality of the phoneme. We talked about contrastiveness, how a contrast in one language if it is there as a phonemic contrast in one language and an allophonic contrast in another language or if the contrast is there among different consonants then that may not suppose dentals and alveolars in English.

English as dental fricatives but English does not have dental stops. But suppose there is a language x maybe this is a dialect of Bengali which is both dental and alveolar sounds and both dental and alveolar stops. So, if an English speaker who sometimes produces dental stops because of an environment hears these distinctions then they will not be able to make out the contrast.

Even though allophonically those sounds may appear in her dialect, suppose a variety of American English and hence, speaker A has a contrast which is there in the language phonemically and that is why the speaker hears the distinction. Speaker B has those sounds in the language but they appear allophonically but the speaker will not be able to distinguish the two sounds.

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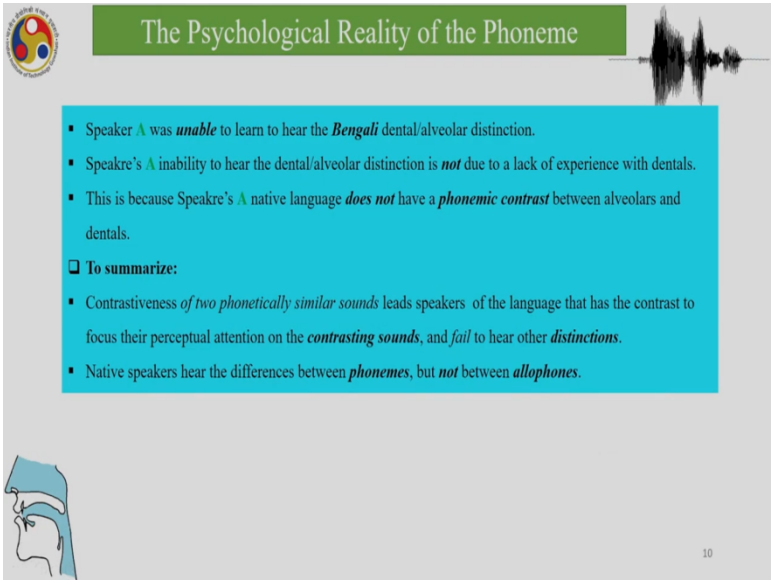

So, this is the psychological reality of phonemes, the phonemes are psychologically real not the allophones. So, speaker A was unable to hear the Bengali dental alveolar distinction because speaker A native language does not have a phonemic contrast between alveolars and dental stops. So, they are pretty much the distinction is inaudible even though the speaker might speak it in her variety as an allophonic variant the sound may be there.

So, contrastiveness of two phonetically similar sounds leads speakers of the language to focus their perceptual attention on the contrasting sounds and fail to hear other distinctions which the speaker may produce allophonically. Native speakers hear the differences between phonemes but not between allophones.

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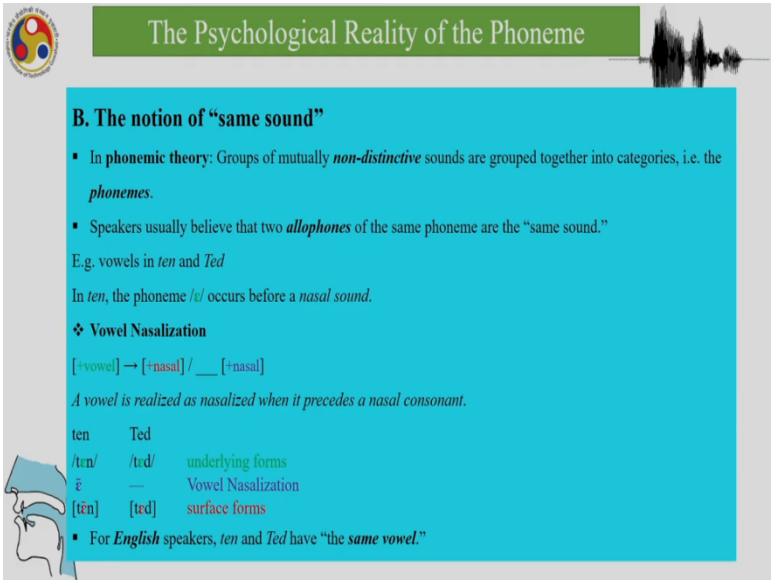

This idea of the same sound of the psychological reality of phonemes is can be seen in other examples as well, so groups of mutually non-distinctive sounds are grouped together into categories, that is the phonemes. So, speakers usually believe that two allophones of the same phoneme are the same sound. So in English in ten, the phoneme a occurs before a nasal sound and that is why we have distinction between ten and ted. And then vowel nasalization is a rule in English. So, for English speakers then, a and a however, they are the same vowels.

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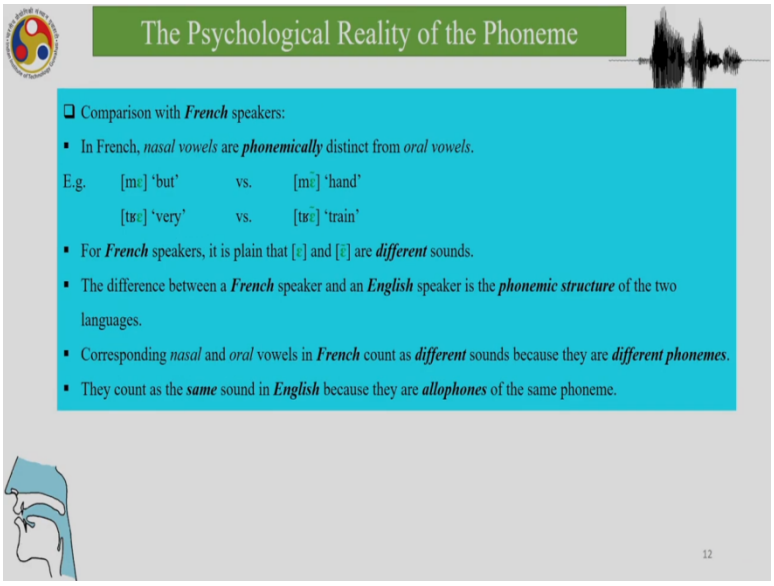

However, it may not be so in French. And this much we have seen in the last lecture.

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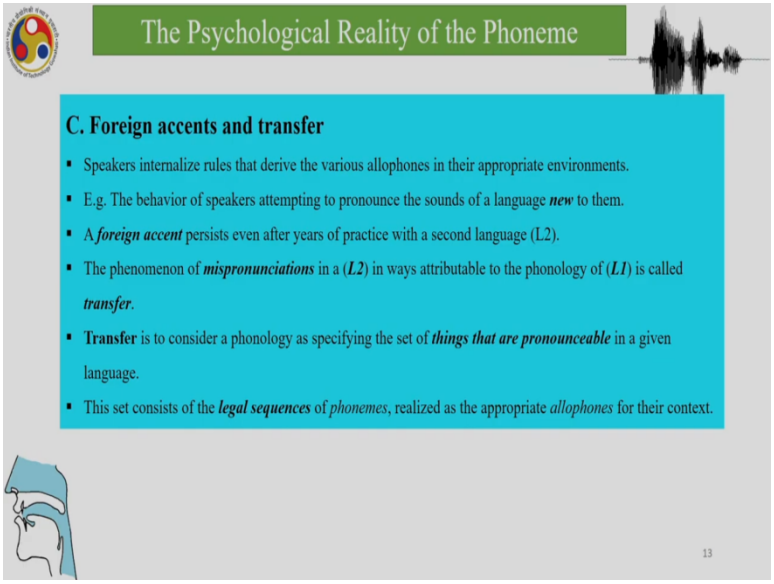

And now talking about foreign accents and transfer, we also said that we will look at foreign accents. So what happens when a speaker internalize rules that derive the various allophones in their appropriate environments? The behavior of speakers attempting to produce the sounds for language new to them, a foreign extent persists even after years of practice and the phenomenon of mispronunciations in ways attributable to phonology is always called transfer. Transfer is to consider phonology as specifying the set of things that are pronounceable in a given context.

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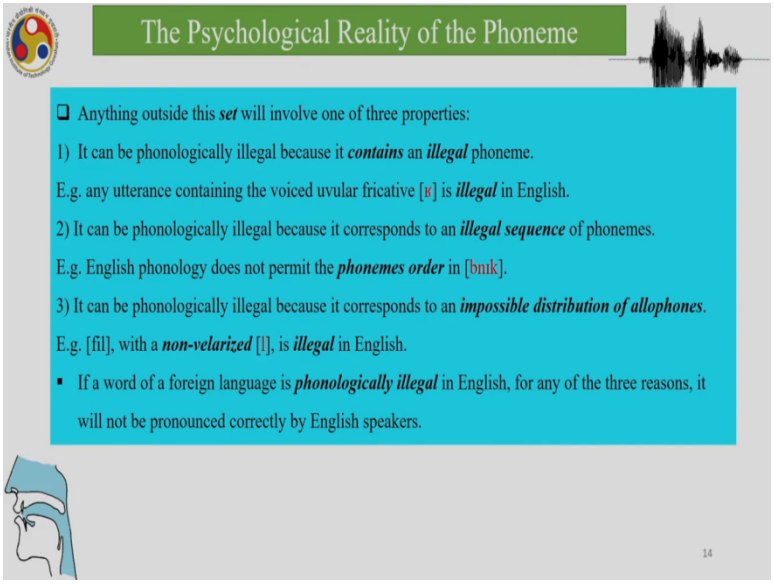

So, this set consists of legal sequences of phonemes realized as the appropriate allophones for the context. So, in the last lecture we looked at what is illegal sequence in English and if a word of a foreign language is phonologically illegal in English for any of the reasons that we had discussed in the last lecture, so it will not be pronounced correctly by English speakers.

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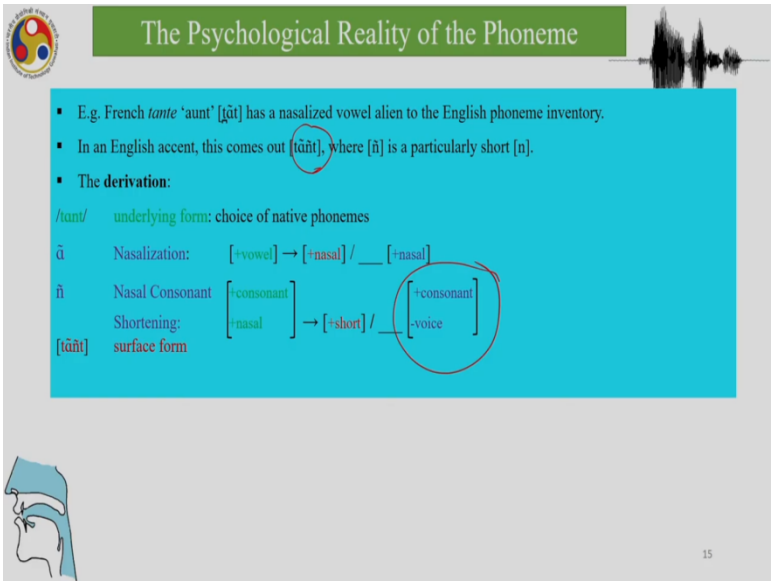

So, hence we have this derivation of nasalization if a native speaker encounters a nasal vowel in a language like French in an English accent, so both the vowel and the consonant here as we saw

in tant where n is particularly short and we would hear what we hear hearing is that English speaker producing the French word in such a way that it is in sort of a sequence of allophones of the particular language that is English and not exactly the way that a French speaker would hear would consider that to be a phoneme.

So, now we can express these derivations as such so vowel becomes nasal if there is a following plus nasal and this particular aspect of nasal consonant shortening which comes along with the fact that the vowel is nasalized in the English accent what exactly happens there if a consonant is nasal, it becomes short in the environment where there is a voiceless consonant, this is the environment where in English the nasal is shorter because there is a following voiceless consonant and we therefore we have the sequence of allophones in the English accent and not exactly what is to be found in French.

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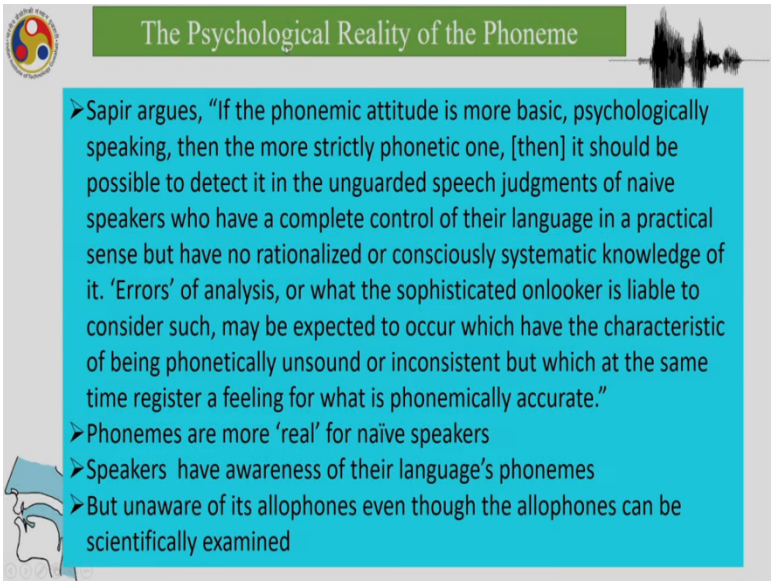

So, the idea of psychological reality of the phoneme comes from this paper exactly with the same name, The Psychological Reality of the Phoneme written by Sapir and Sapir argues that the phonemic attitude is more basic psychologically speaking than the most strictly phonetic one, then it should be possible to detect it in the unguarded speech judgments of native speakers, naive speakers who have a complete control of their language in a practical sense but have no rationalised or consciously systematic knowledge of it.

Errors of analysis or what the sophisticated onlooker is liable to consider such may be expected to occur which have the characteristic of being phonetically unsound or inconsistent but which at the same time register a feeling for what is phonemically accurate. So, what does this mean? This extended quote means standard phonemes are more real for the native speakers, which means the linguistically untrained speakers. Speakers have awareness of the languages phonemes but they are unaware of its allophones even though the allophones can be scientifically, objectively examined.

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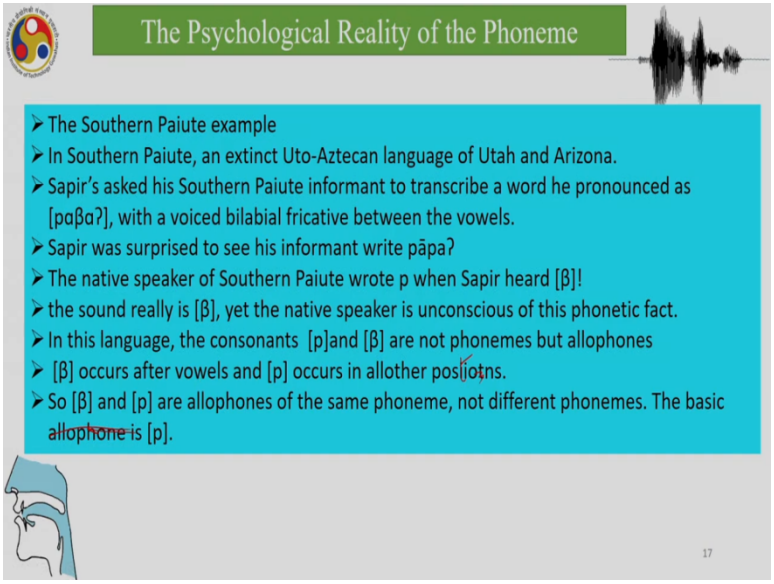

Now, another example that a Sapir gives from his field work is that of this if is the Southern Paiute example. In Southern Paiute, an extinct Uto-Aztecan language of Utah and Arizona, Sapir asked a Southern Paiute informant to transcribe a word he pronounced as a papa with a voiced bilabial fricative between the inter-vocalically. Sapir was surprised to see his informant write the word as papa and the speaker of Southern Paiute wrote p when Sapir heard v.

Why exactly was that so? The sound really is v, yet the speaker is unconscious of this phonetic's fact. The speaker pronounces the word the sound in a certain way but transcribes it in another way. Why is this so? In this language, the consonants p and v are not phonemes but allophones of p. V occurs after vowels and p occurs in all other positions. So, v and p are allophones of the same phoneme not different phonemes. So, the basic phoneme is b.

Now here is another example of a psychological reality phoneme like the dental alveolar example that we had given before, that the speaker of a language cannot hear distinctions which are not there phonemically. Here the speaker cannot hear even the allophones produced by himself in his own language.

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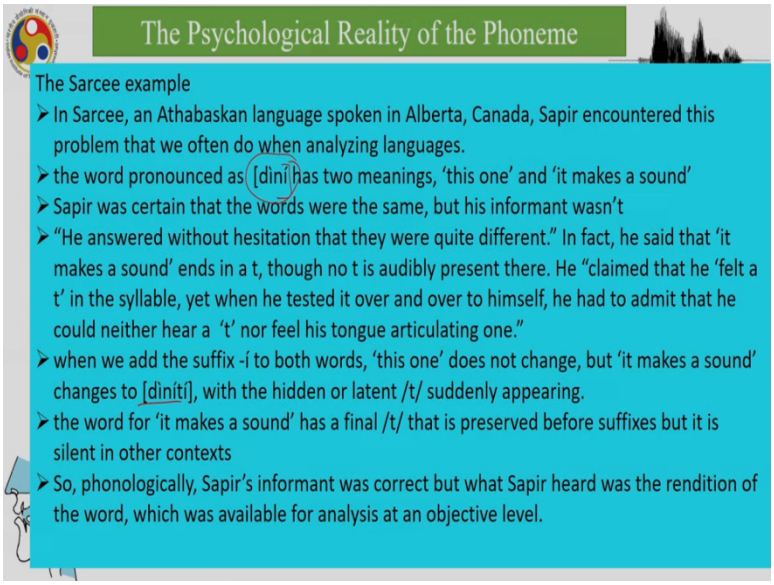

And then we have also Sapir gives another example of Sarcee, an Athabaskan language spoken in Alberta, Canada and Sapir encountered a similar problem that we often do when analyzing languages, the word pronounced as dini has two meanings and this one and it makes a sound. Sapir was certain that the words were the same but his informant wasn't sure that the words were the same and his informant kept on saying that these are different words. And in Sapir's own words "he answered without hesitation that they were quite different".

In fact he said that the sound ends in a t though no t is audibly present there. He "claimed that he felt a t in the syllable yet when he tested it over and over to himself he had to admit that he could neither hear a t nor field is done articulating one". And when we add the effects e to both words this one does not change but it makes the sound changes to d e t with the hidden or latent t suddenly appearing. The word for it makes a sound as a final t that is preserved before suffixes but it is silent in other context.

And so phonologically, Sapir's informant was correct but what Sapir heard was the rendition of the word which was available for analysis at an objective level. So, the two words dini has two meanings but for the speaker of the language, these are two different words the t that we do not hear at all or is not even produced by the speaker is actually in the speaker's organization mental organization that sound is there, even though it is not produced.

So phonologically Sapir's informant was correct but what Sapir heard was also correct and but these are two different levels that we keep talking about one is the phonetic, level one is the phonological level of the mental organization of sounds.

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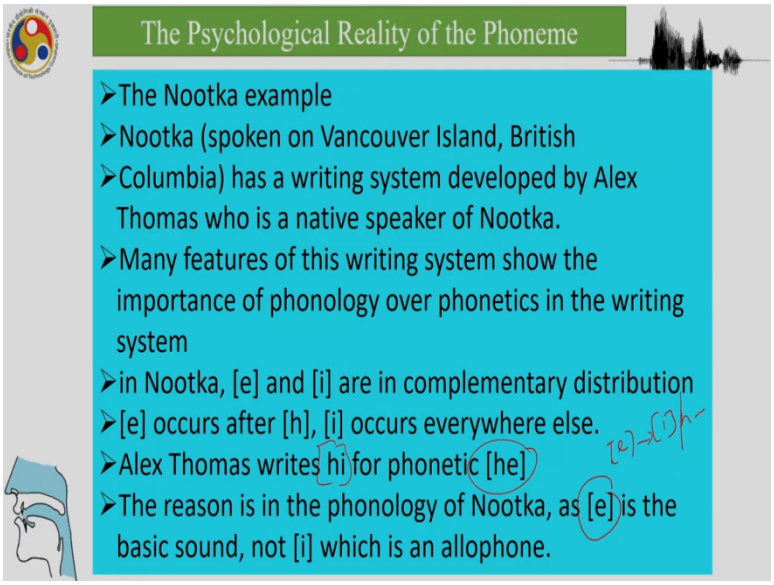

And the Nootka example, Nootka spoken on Vancouver island, British Columbia has a writing system which was developed by Alex Thomas who is the native speaker of Nootka and many features of this writing system show the importance of phonology of phonetics in writing systems which generally happens.

In Nootka, a and e are in complementary distribution and a occurs after h and e occurs everywhere else. So, Alex Thomas writes e for a, that is the rule is a goes to e in the environment where there is a preceding h. So, basically you know the underlying form is hi and then which becomes he because of the preceding h.

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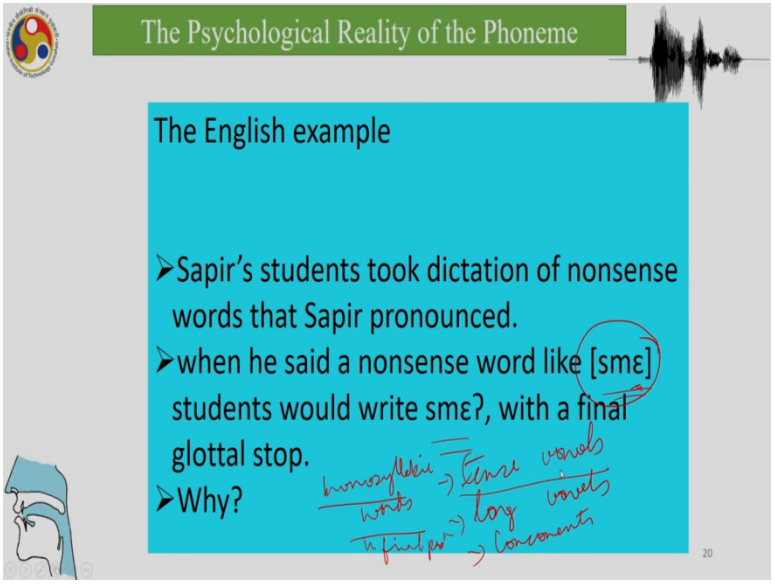

There is also an English example from Sapir's paper on the Psychological Reality of the Phonemes. Sapir's students took dictation of nonsense words that Sapir pronounced when and these are English speaking students. When he said a nonsense words like sme students would write it down as me with a final glottal stop. Why? The reason is in the phonology of English. In English, lax vowels like a do not occur in final position.

So in English either tense vowels, long vowels or consonants occur in final positions in monosyllabic words. Of course in disyllabic words the phonotactic rules are different. So in monosyllabic words either tense vowels in final position there are either tense vowels, long vowels or consonants. Lax vowels in monosyllables never occur in English.

So, we have vowels like t or c etc. long vowels or tense vowels or consonants like sit or bit etc. but a lax vowel like a or o short o, lax will never occur in English in that position. So, in the phonology in the speaker's phonology this is not a possible word and hence, even when Sapir says the words may this the writer would hear it as meh because it is not possible to have a relaxed final vowel in English.

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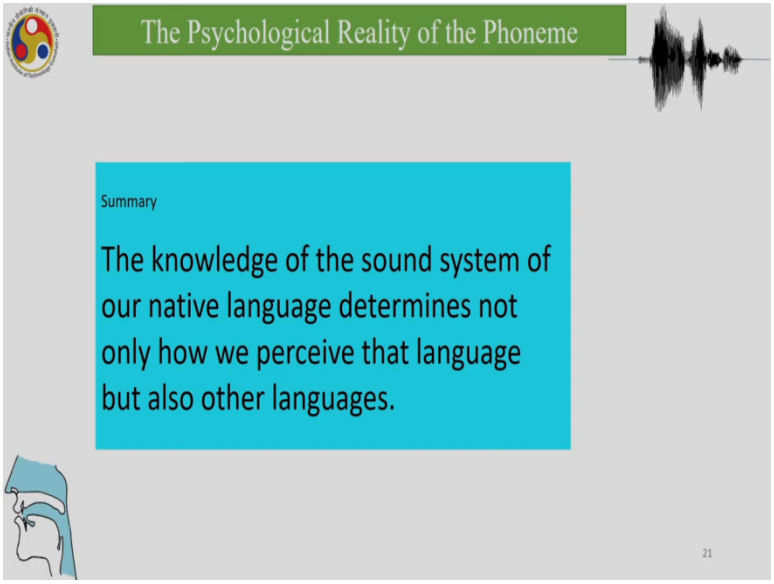

So, the knowledge of the sound system of our native language determines not only how we perceive that language, but also other languages and also extends to everything that we hear around us, we use the phonology of our languages to hear the sounds around us.

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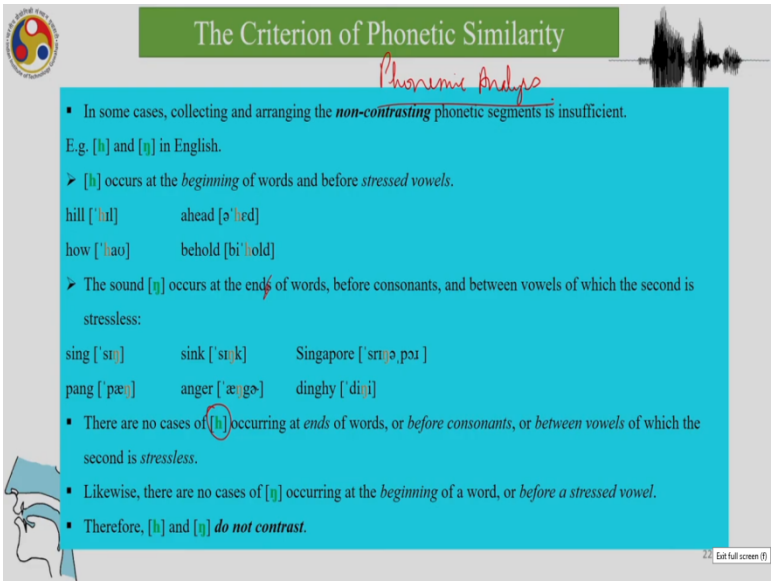

Now that we have understood a bit about phonemes, the phonological organization sounds in our minds the psychological reality of phonemes, let us also look at some other things concerning

phonemic analysis. The criterion of phonemic phonetic similarity, in some cases collecting and arranging the non-contrasting phonetic segments is insufficient as in h and n in English.

So a h occurs, now we are looking at phonemic analysis which we have been looking at, the idea that phonological analysis for language involves finding out the phonemes of that language. So let us look at a few things regarding phonemes and the problems that we have in a phonemic analysis. So now h and n in English, h occurs in the beginning of words and before stress vowels, the sound n occurs at the end of words, before consonants and between vowels of which the second is restless. So we get a sing or sink or pang or anger or dingy or Singapore.

Now there are no cases of h occurring at ends a word, so before consonants or between vowels of which the second is stressless. So, basically we do not find the kind of contrastive distribution that we are talking about to find phonemes. Likewise there are no cases of n and g occurring at the beginning of word or before a stress vowel.

Therefore, if we look at the distribution of h and n, they do not contrast. So, given that why is this important given that our idea of our understanding of phonemic analysis is that contrast is the most basic aspect of this analysis of this type of analysis so but we have now phonemes in a language like English, which we understand because it is widely studied. We now see that from very commonly occurring words that h and n do not contrast.

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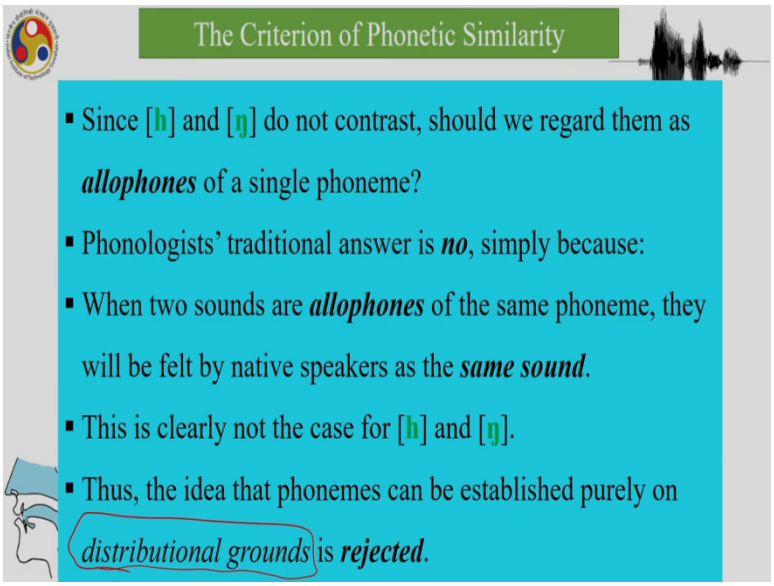

And since h and n not contrast should we regard them as allophones of a single phoneme and so from the phonologies traditional answer would be no simply because when two sound allophones the same of the same phoneme, they will be felt by native speakers as the same sound and which we now know clearly from that part of the lecture where we looked at the psychological reality of phonemes. And this is clearly not the case for h and n and those idea of phonemes can be established purely on distributional grounds is rejected.

So, on distributional grounds h and n cannot be considered to be phonemes but for all other purposes for all other intents and purposes, h and n are phonemes. They are not the same sound, so speakers will reject them in the same sound and how do we come to the conclusion that they are not allophones but phonemes and it does not come from distributional grounds, it comes from the speaker's intuition.

So, the basic idea that we had initially, said that we have to find phonemes from the distribution. We have to find the complementary distribution gives us allophones that is not correct. So, if we look at complementary distribution then these h and n, the two sounds are not found in to contrast at all.

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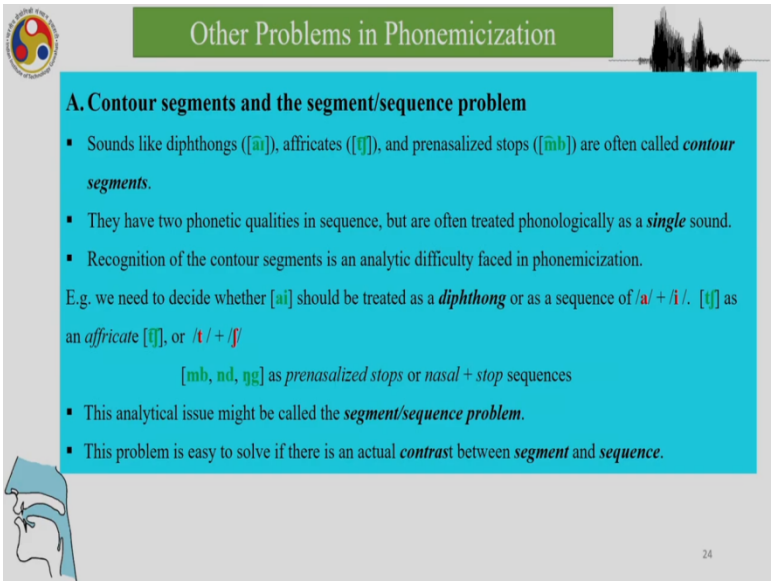

Contour segments and the segment sequence problem sounds like a diphthongs, fricatives and prenasalized stops are often called contour segments. And another, this is another problem in

phonemicization that double sounds or contour segments, they have two phonetic qualities in sequence but often treated phonologically as a single sound.

A recognition of contour segments is analytic difficulty faced in phonemicization. So, we need to decide whether I should be treated as diphthong or as a sequence of irony and ch as an affricate as ch or d and sh and prenazalized stops as nasal plus stop sequences. This analytical issue is called the segment sequence problem and this problem is easy to solve if there is an actual contrast between segment and sequence.

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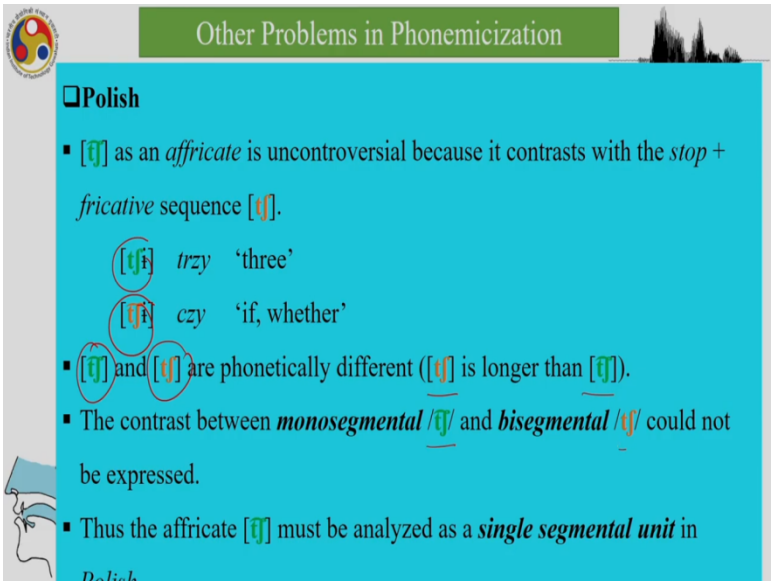

And ch as an affricate is uncontroversial because it contrasts with the stop plus, a fricative sequence ch. So, in Polish, chi as a tree or the other fricative sequence, this one is affricate and this is a fricative sequence. And in Polish they are phonetically different. So, this is the affricate and this is the sequence and they're phonetically different and ch is longer than this ch.

The contrast between monosegmental ch and bisegmental ch could not be expressed. So thus the affricate ch must be analyzed as a segmental single segmental unit in Polish. So polish has both the monosegmental and the bisegmental and this is another problem because it is difficult to tease apart these two parts in the inner phonemicization approach.

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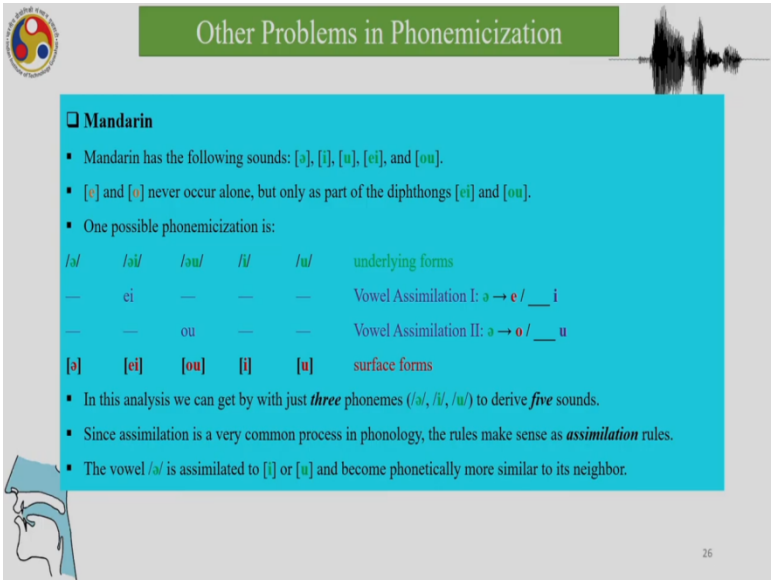

And Mandarin has the following sounds a, e, o, u, a and o and a never occur alone but only as a part of the diphthongs a and o. So, one possible phonemicization is that, these are the underlying forms and because of vowel assimilation a goes to a in the context where there is a following e and then vowel simulation too goes to o in the context where there is u and then we have the surface forms a o u. In this analysis we can get by just three phonemes to derive five sounds, since our simulation is common process in phonology this rule makes sense as a simulation rules. The vowel a is simulated to i or u and becomes phonetically more similar to its neighbor.

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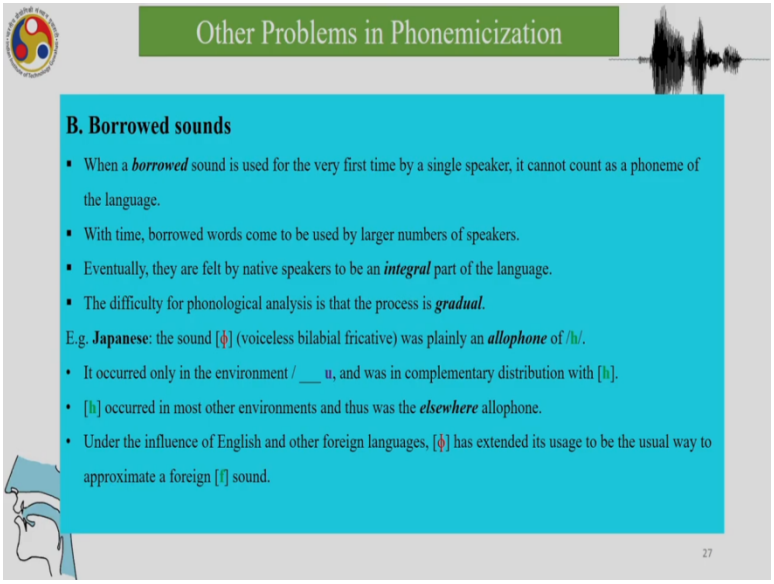

And when a borrowed sound is used for the very first time by a single speaker, it cannot count as a phoneme of the language. With time, borrowed sounds come to be used by a large number of speakers and eventually they are felt by native speakers to be an integral part of the language. The difficulty for phonological analysis is that the process is gradual and in Japanese for instance, the voiceless labial fricative was plainly an allophone of h, it occurred only in environment followed by u and was in complementary distribution with h.

H occurred in most other environments and thus was the elsewhere allophone. Under the influence of English and other foreign language h has extended its usage to be the usual way to approximate a foreign f sound and this is the issue with regard to borrowed sounds and by very first time by single speaker then it cannot count as a phoneme but gradually larger number of speakers use this and it may gain the status of phoneme but that is an in-between stage which is a problem for phonemicization.

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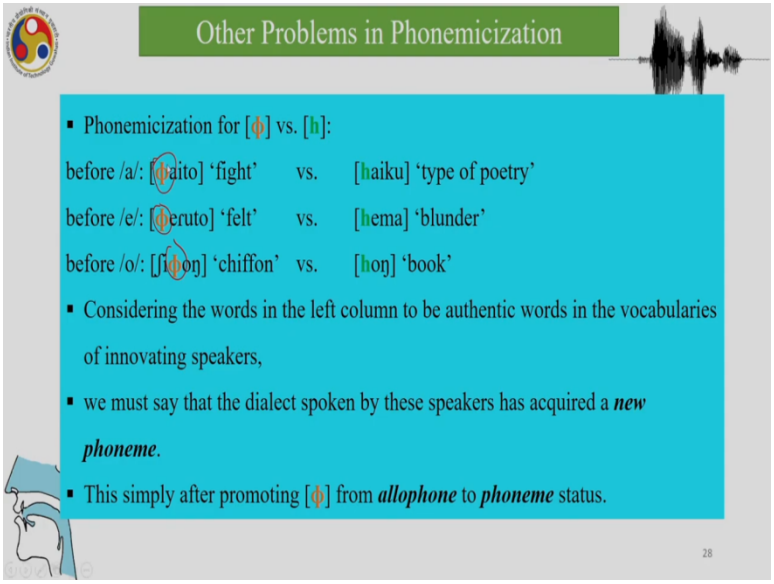

Phonemicization for p versus h, before a ,we have faito for fight versus haiku and we have feruto and we have a chiffon and considering the words in the left, so these words with the f and to be the authentic words in the vocabularies of innovating speakers, you must say that dialect spoken by these speakers is quite a new phoneme. This simply after promoting f from allophone to phoneme status. So, hence there can be those in-between stages where an allophone can slowly gradually move to a phoneme status.

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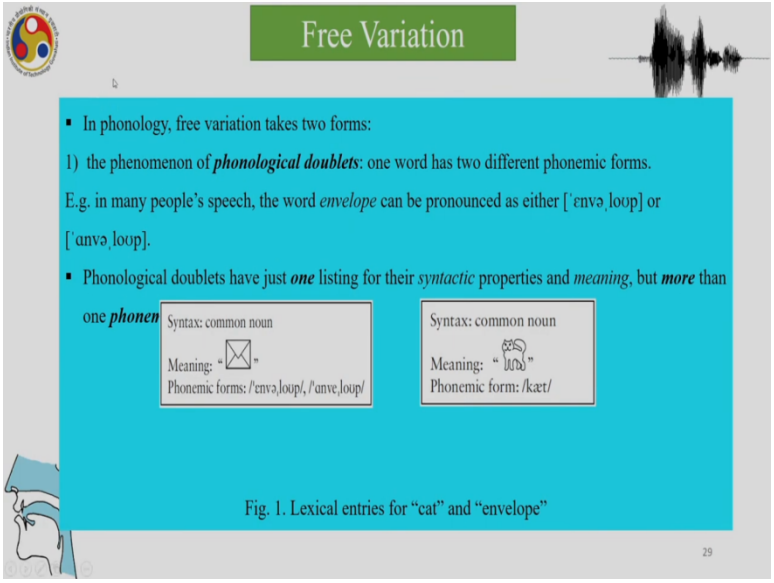

In phonology free variation takes two forms the, phenomenon of phonological doublets. One word has two phonemic forms example in many people's speech, the word envelope can be pronounced as either envelope, envelope or envelope. Phonological doublets have one listing for their syntactic properties and meaning but more than one phoneme.

So, we have now phonological doublets. One word has two phonemic forms and we have this kind of free variation which as we know is not determined by context. So, phonological doublets also occur increasing the problems in phonemic analysis, where we have the same meaning and two sounds which are not determined by the context.

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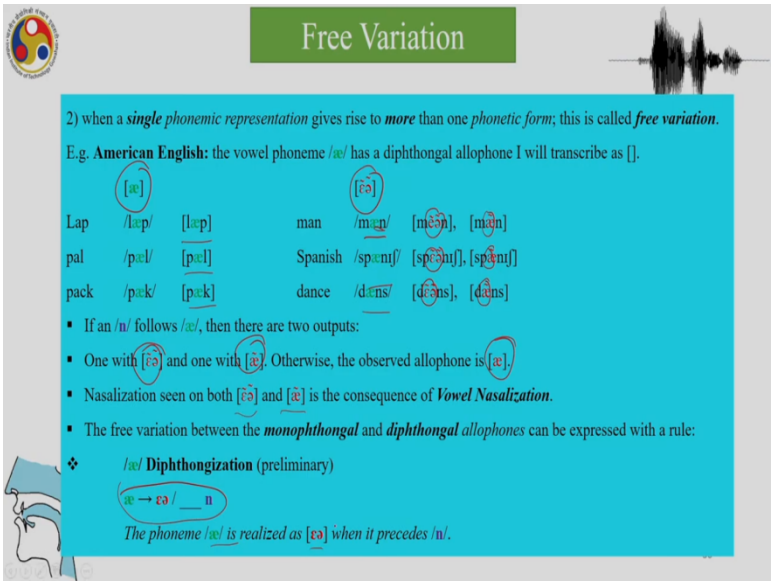

When a single phoneme representation gives rise to more than one phonetic form, this is called free variation. In American English the vowel phoneme a has a diphthong allophone which are these. So let's see the diphthong allophone, we have the a and ae, so in lap versus lap and pal and pack versus man and Spanish and dance.

We have two types of ways in which you are pronouncing the allophone the nasalized allophone and in one it is a diphthong allophone and the other it is a singleton allophone. So if an n follows ae, there are two outputs. So, one is this and the other is this. So, otherwise allophone is just ae. So nasalization is seen on both this and this as a consequence of vowel nasalization.

The free variation between monophthongal and diphthongal allophones can be expressed with a rule which says that ae can become a when there is a following n the phoneme is realized as ae when it precedes n.

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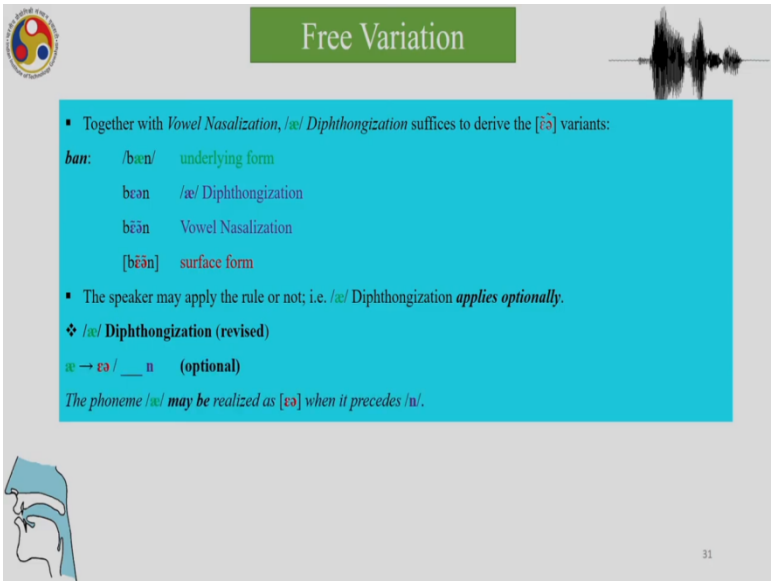

Together with vowel nasalization and diphthongization suffices to derive these variants. The speaker may apply the rule or not and diphthongization applies optionally. So what we have to remember is that because of free variation, this is not always pronounced exactly the context does not always determine that this is exactly the way it is going to pronounce and hence it applies optionally.

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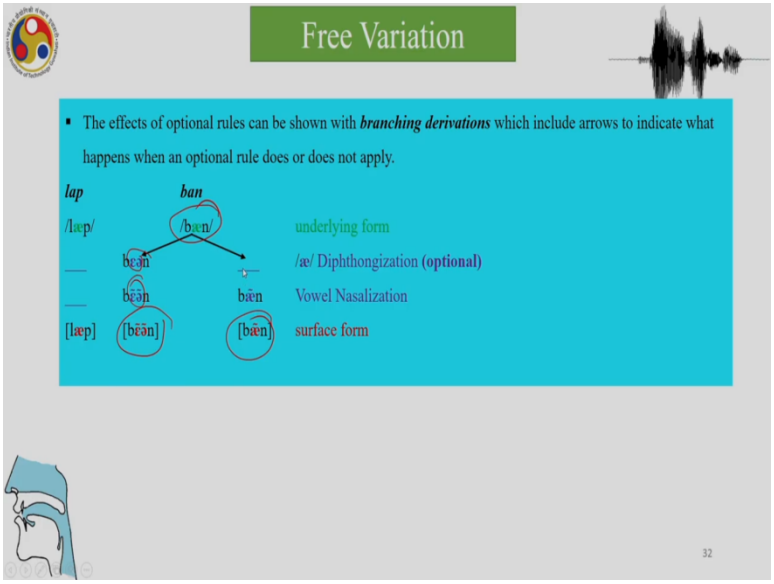

The effects of optional rules can be shown with branching derivations which include arrows to indicate what happens when an optional rule does or does not apply. So, we have this form of vowel nasalization, so this it could be either this or this as a two surface forms of ban. Okay. So, if there is diphthongization and then we have nasalization and then we have this form and if you are not having diphthongization we just have vowel nasalization in these two forms. So, these optional rules can be shown like this.

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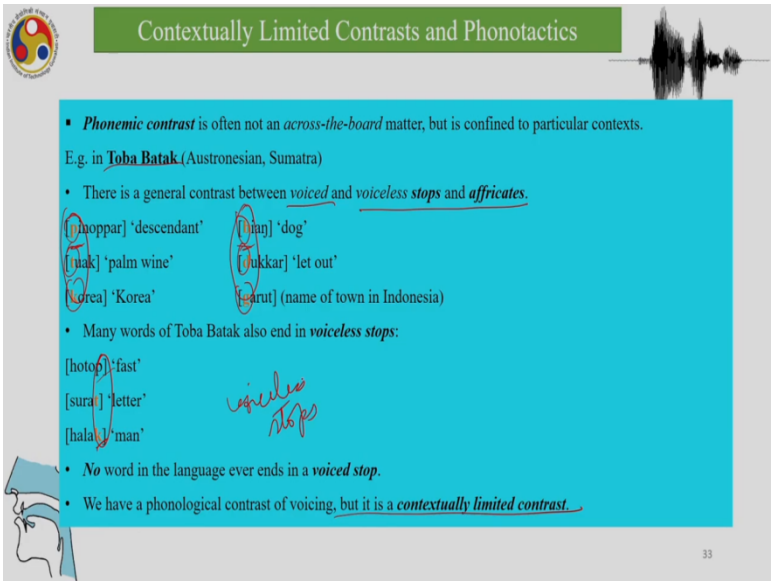

Other examples are related to phonemic contrast as we can see in this example from Toba Batak. So, phonemic contrast is often not an across the board matter but it is gone fine to a particular context. So we have pinoppar, this is Toba Batak. We have a contrast between voice and voiceless stops and affricates and we see these voiceless stops and we see these voice stops.

So and occurring in exactly the same position, so we have tuak versus tukkar, we have Korea versus garut, we have pinoppar versus bian, so in similar environments we have both p and b, t and d and k and g. So, giving us the idea that these are phonemes, many words of Toba Batakk also end in voiceless stops. So, we have p, we have surat letter and halak for man. No word in language ever ends in a voice stop.

So we have a phonological contrast for voicing as we saw from these examples but p, t, k and b, d and g is contrasting but it is a contextually limited contrast, which means that this contrast is limited to a context. It can only occur in this word initial position or immediate word medial position. In word final position, we will always get voiceless stops. So this is called the contextually limited contrast and that's another aspect of phonotactics.

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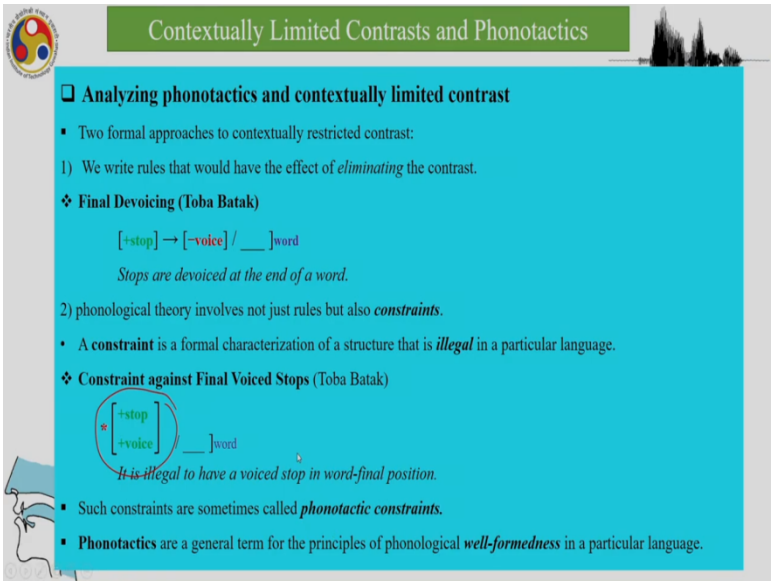

And how do we analyze such contextually limited contrast of this is called final devoicing, so we can express it as stop becoming voiceless in the word final position. Stops are devoiced at the end of a word and phonological theory involves not just rules but also constraints which we will

not study, not look at in the lectures so much but it is one of the very standard approaches in phonology of using constraints instead of rules.

A constraint is a formal characterization of a structure that is illegal in a particular language. So a constraint against final voiced stops, it says that it is you cannot have a voice stop in a word final position. And such constraints are sometimes called phonotactic constraints. What are phonotactic constraints? Phonotactics are a general term for a principle or phonological well-formedness in a particular language.

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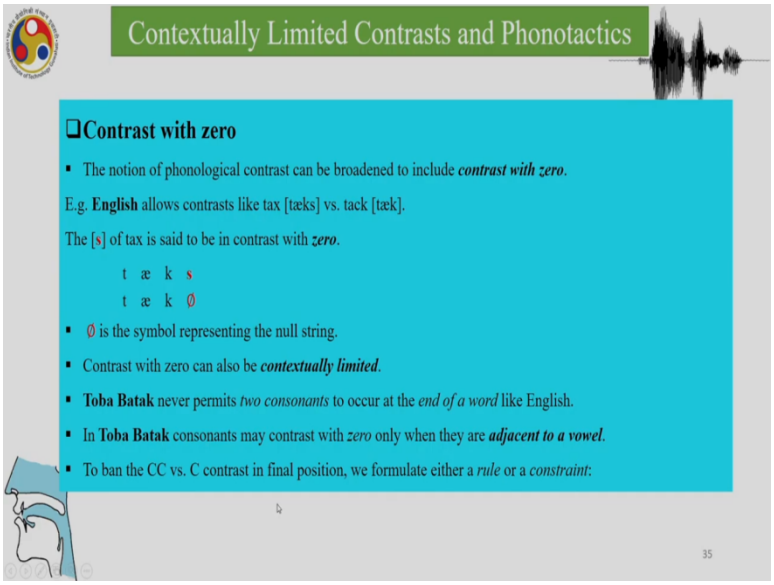

And contextually limited contrasts and phonotactics show a few other things also like contrast with zero, the notion of a knowledgeable contrast can be broadened to include contrast with zero English, allows contrast like tax versus tack. So the s of tax is said to be in contrast with zero because zero null is a symbol representing the null string.

So, contrast with zero can be contextually limited. In Toba Batak, never permits two consonants to occur at the end of a word like English in the example given here, in Toba Batak, consonants may contrast with zero only when they are adjacent to a vowel. To ban CC versus C contrast in final position we formulate either a rule or a constraint.

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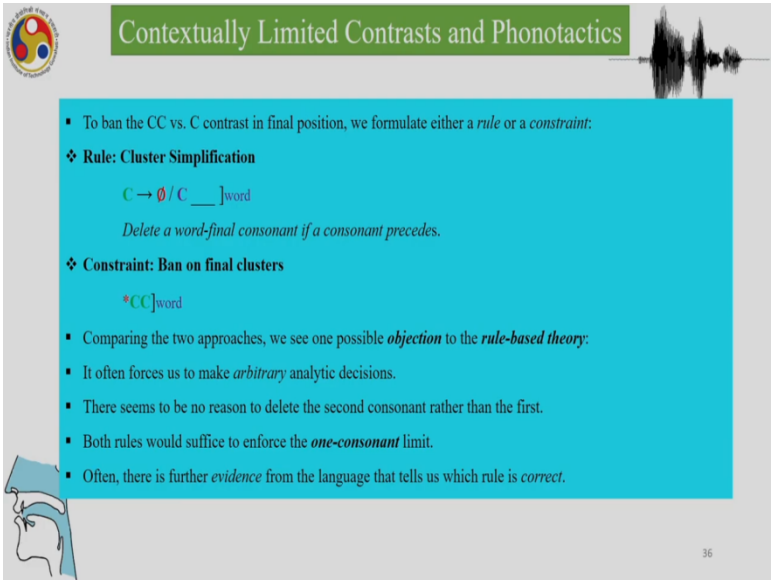

And continuing it phonotactics which looks at the organization of sounds in a language to ban the consonant cluster versus consonant singleton consonant, contrast in final position we formulate either a rule or a constraint. Now look at the rule given here which says c goes to null if it is in the final position, delete a word final consonant if a consonant proceeds. Ban on final clusters do not have clusters, delete them if they occur finally.

Comparing two approaches we see one possible objection to the rule-based theory, it often forces us to make arbitrary analytic decisions. There seems to be no reason to delete the second consonant after the first. Both rules would suffice to enforce the one consonant limit. So often there is further evidence from the language that tells us which rule is correct. There is no need for the two rules. So, now we can see that apart from rules, we also need constraints in a language and the constraint that we see here is a constraint saying ban on final clusters.

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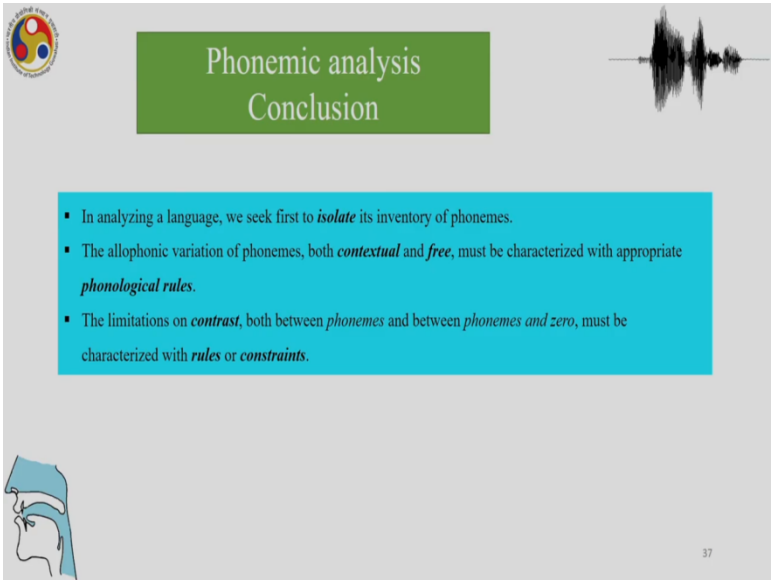

In analyzing a language we seek first to isolate its inventory of phonemes. The allophonic variation of phonemes, both contextual and free must be characterized with appropriate phonological rules and the limitations on contrast both between phonemes and between phonemes and zero must be characterized with rules or constraints and we saw the rules we also saw constraints like avoid ban on final consonant clusters and both rules and constraints are have been used in phonological analysis and they have been approaches which use only constraints, they have been approaches which use only rules and all that is a part of the formal phonological theory.

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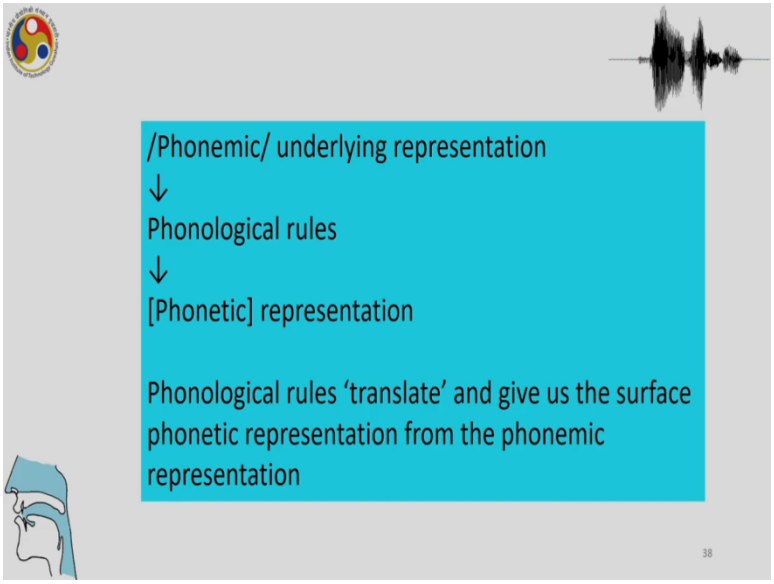

Now let us look a bit at one of the standard approaches of in rule-based approaches of analyzing a phonemic problem, a phonological problem. So this is how things proceed that first we have a phonemic underlying representation which undergoes phonological rules and then we have a phonetic representation as a result of the application of those rules. Phonological rules translate and give us the surface phonetic representation from the phonemic representation.

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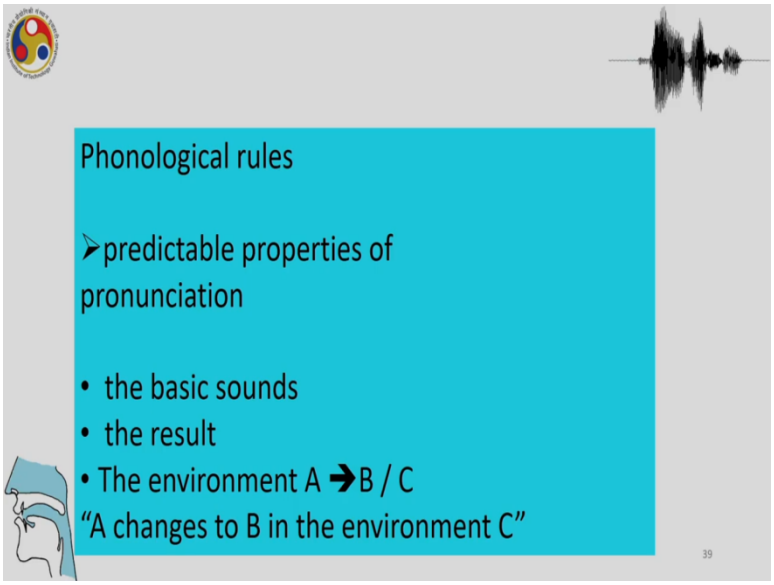

And phonological rules show predictable properties of pronunciation, it shows first we have to find the basic sounds then once the rule is applied, we get the result of the application of the rule and finally the environment that a goes to b in the context c, a changes to b in environment c which we actually saw in the beginning of this lecture on phonemes.

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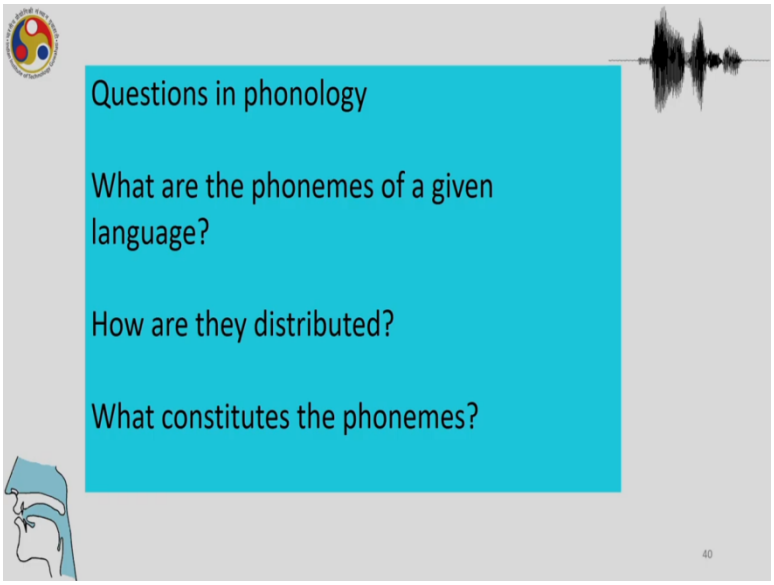

So, what are the important questions in phonology? Now that we have had a quite a bit of introduction to the field, so what are the phonemes of a given language? That is a very important question. How are they distributed? What constitutes the phonemes? Almost most questions in phonology are based on these simple questions.

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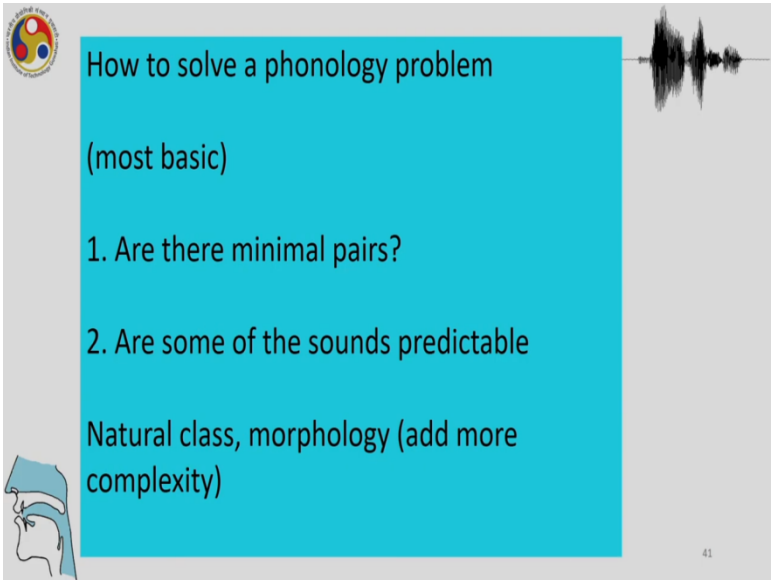

And how to solve a phonology problem? So look at a very basic phonological problem and we will look at more complicated examples in the next few classes. We will look at natural classes etc. but for the time being we will look at a basic analytical problem. So, are there minimal pairs? Are some of the sounds predictable? Natural class and morphology add more complexity to the questions that are asked in the phonological problem but for the time being we will look at only a simple problem.

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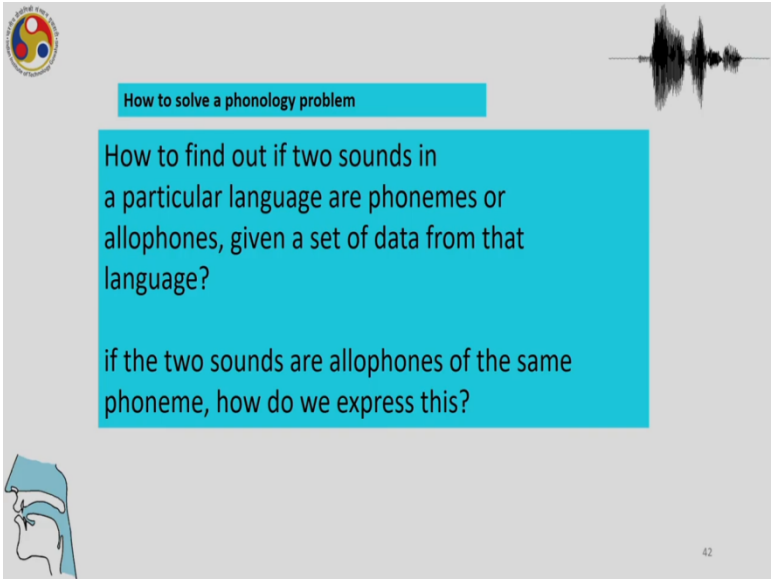

So how to solve a phonology problem? How to find out if two sounds in a particular language are phonemes or allophones given a set of data from that language? If two sounds are allophones of the same phoneme how do we express this? And we have already seen that actually in the beginning of this lecture but we will go through this again and see the step-by-step analysis to see how we analyze a phonological problem.

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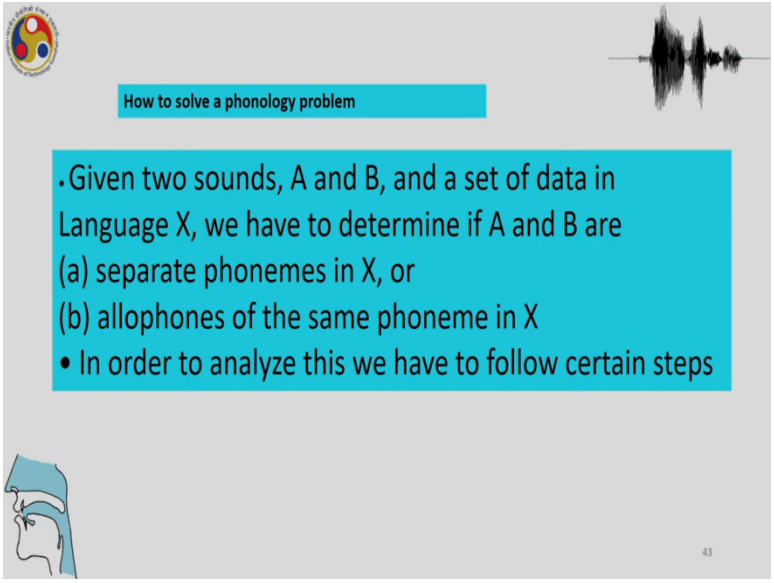

So given two sounds, A and B and a set of data in language X, we have to determine if A and B are separate phonemes in X or allophones of the same phoneme in X. In order to analyze this, we have to follow certain steps. So we have two sounds A and B and we have a set of data and we have to determine if a and b are phonemes or allophones. So what do we do when we are given that problem?

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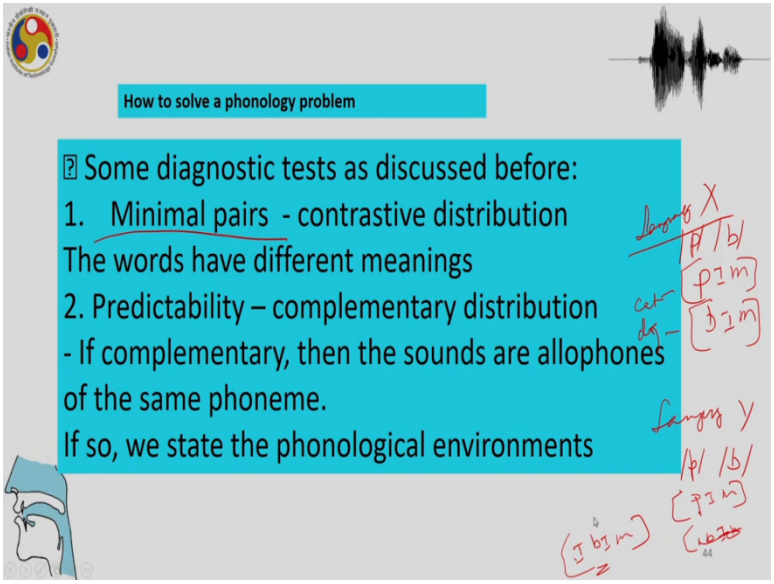

Some diagnostic tests as discussed before in the last lecture also these were discussed but we will proceed step by step to see a problem first hand now. So minimal pairs, first thing that we have to look at is minimal pairs. Contrastive distribution is what we are trying to find. So we're trying to find minimal pairs that is two words which have different meanings and which are contrastive for the given sound.

So suppose we have a language X and we have two, we are asked to find out if p and b are two allophones in this language of phonemes and we have two words in this language one is pim and one is bim, so we have found our minimal pair. We can be sure that these two and suppose pim means cat and bim means dog, this is language X. Then in this language we are pretty much sure now that p and b are two phonemes.

So that is minimal pairs and predictability complementary distribution if complementary, then the sounds are allophones of the same phoneme. Suppose in language, there is language Y and we asked to find out if p and b are phonemes or allophones and we have two sounds here, we have pim and we have we do not find bim in this language, instead we find that in this language we find ibim, which is in this context in the word initial position we do not find b at all in this language.

So, this complementary distribution is then obvious, if this contrastive distribution is not there then we find this the distribution is complementary and then if the sound if complementary then the sounds are allophones of the same phoneme. If so we state the phonological environments.

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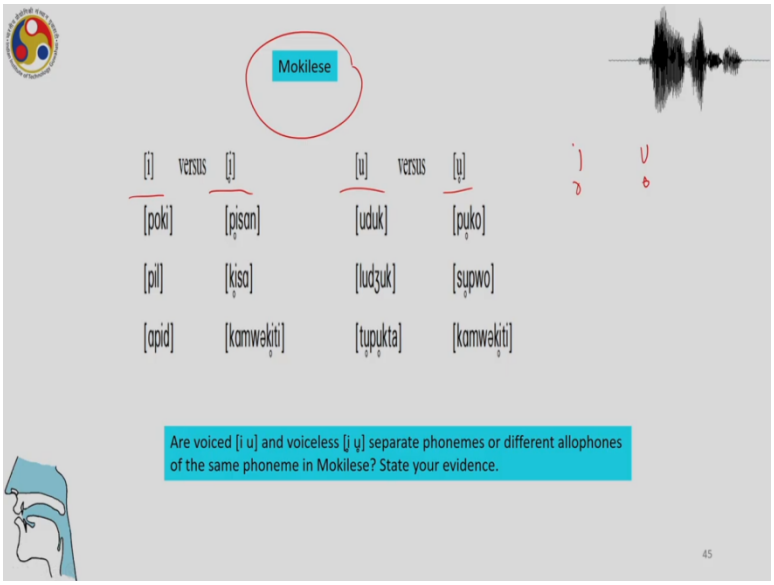

And so let us look at some data here from a language called uh Mokilese and the data is between voice and voiceless vowels, two high vowels one voice one voiceless, one voice one voiceless the voiceless shown with the diacritic right below the vowel. So we have now poki versus pison, we have pill versus kisa, we have apid versus kamwakiti, we have uduk versus puko and we have lujuk versus supo, we have tupukta versus kamwakity. Now, what do we do first? First our e and o voiced and voiceless of separate phonemes or different allophones of the same phoneme in Moliles states your evidence.

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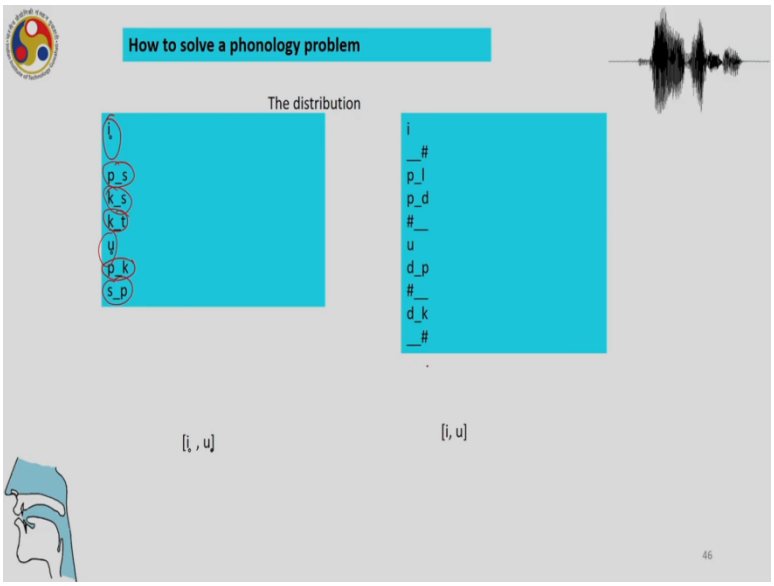

So this is our distribution for e and u for the voiceless and so it is it occurs between p and s and k and t, u between k and p and k and s for u we find all these diverse environments. Now, what is the commonality in this environment that we find the voiceless vowel in?

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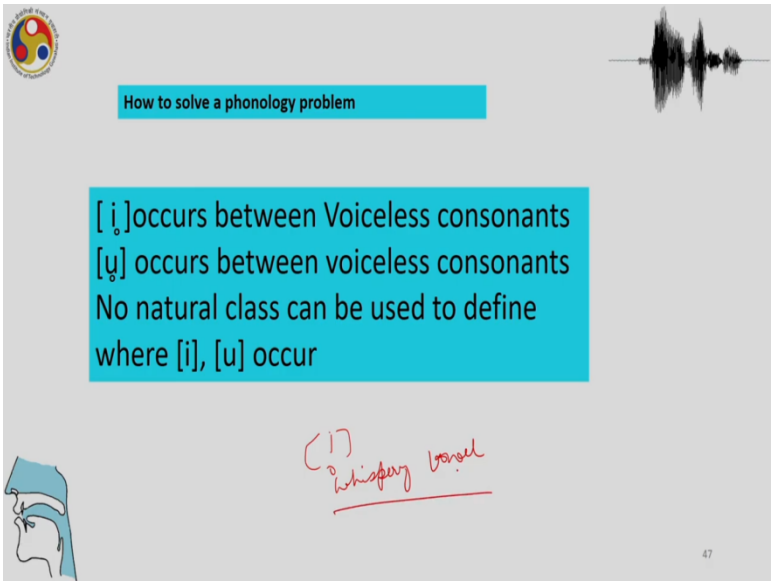

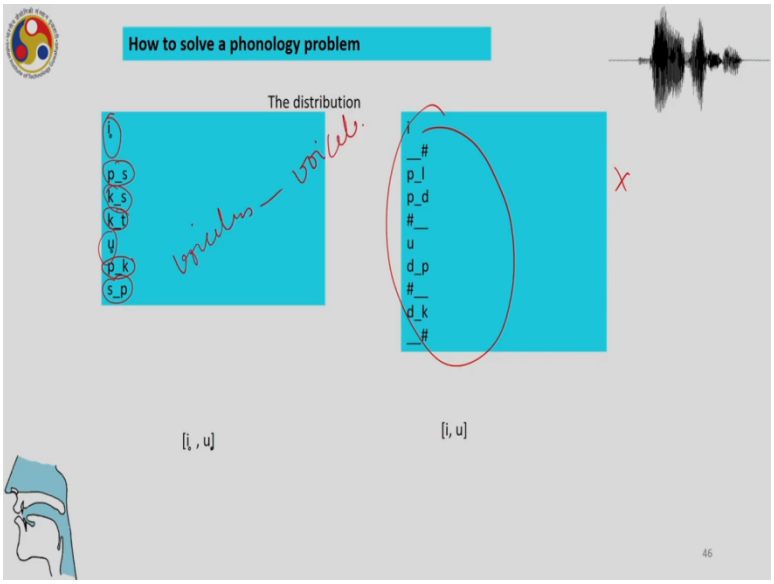

i, as you can hear the way I say it is a whispery vowel, i occurs between voiceless consonants and u occurs between voiceless consonants so no natural class can be used to define where e and u occur. So this cannot be defined in natural, this is however voiceless and voiceless.

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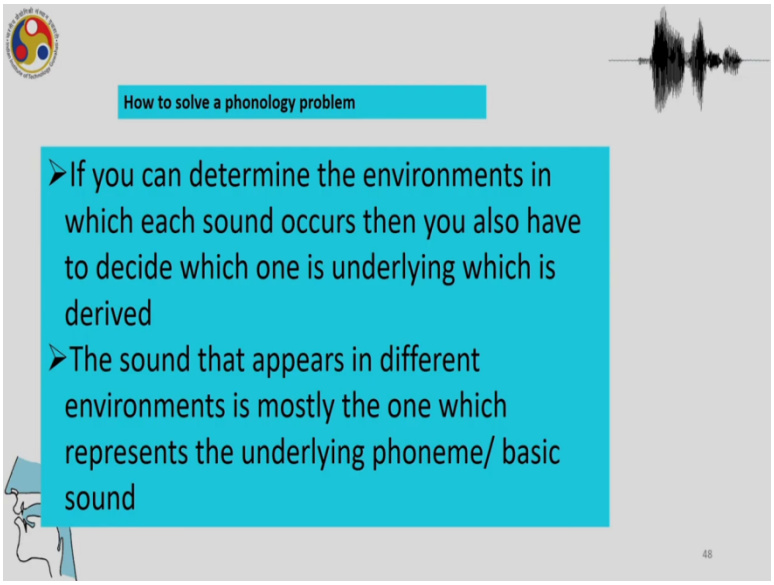

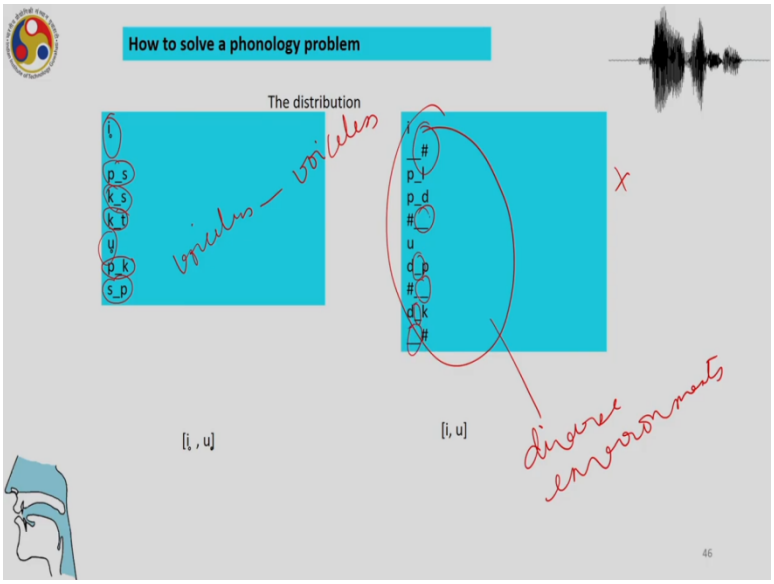

If you can determine the environments in which each sound occurs then you also have to decide which one is underlying, which is derived. The sound that appears in different environments is mostly the one which represents the underlying phoneme or the basic sound. This is where we find the diverse environments and as you can see the diverse environment is word final between consonants one voice one voiceless, word initial between voice and voiceless, word initial between voice and voiceless and word final. These are diverse environments unlike this where it is consistently between two voiceless sounds.

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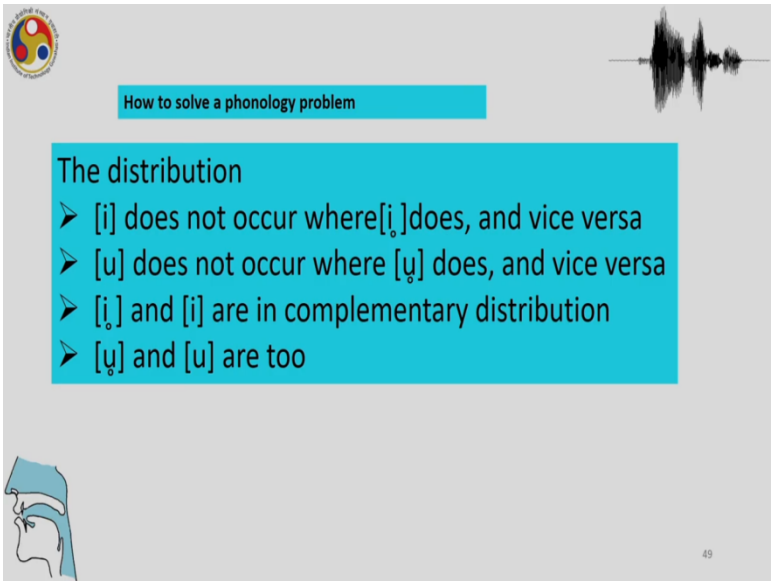

So e does not occur where i does and vice versa u does not occur uh does and vice versa. So why does u does not occur uh occurs who occurs between voiceless consonants, i occurs between voiceless consonants that is in those contexts e and u never occur. So, they are in complementary distribution, i and e are in complementary distribution and uh and u are too.

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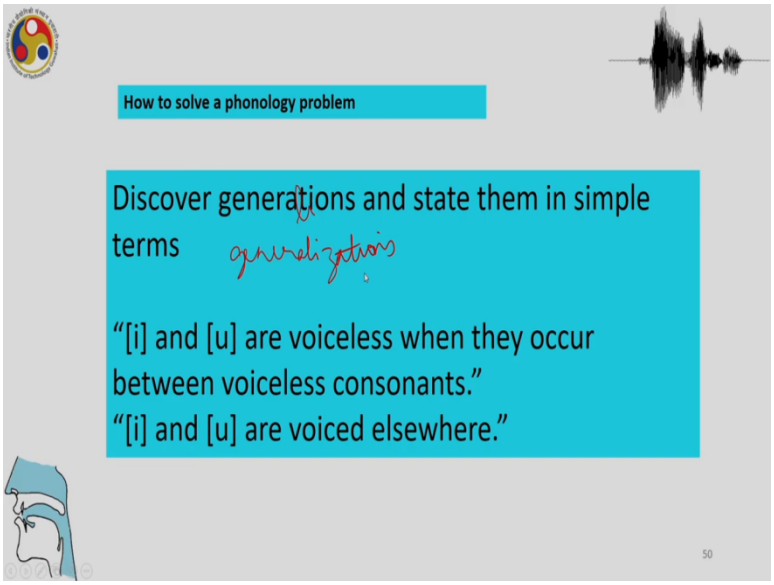

And the third step now we discover generalizations. We discover generalizations and state them in simple terms e and u are voiceless when they occur between voiceless consonants. e and u are voiced elsewhere.

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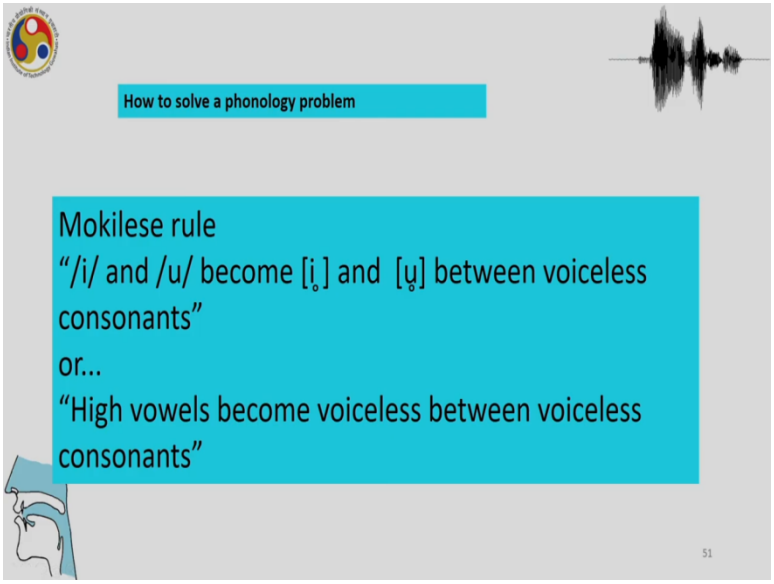

So what is the Mokilese rule? The Mokilese's rule is that e and u become i and uh between voiceless consonants or we can simplify it further and say that high vowels become voiceless between voiceless consonants.

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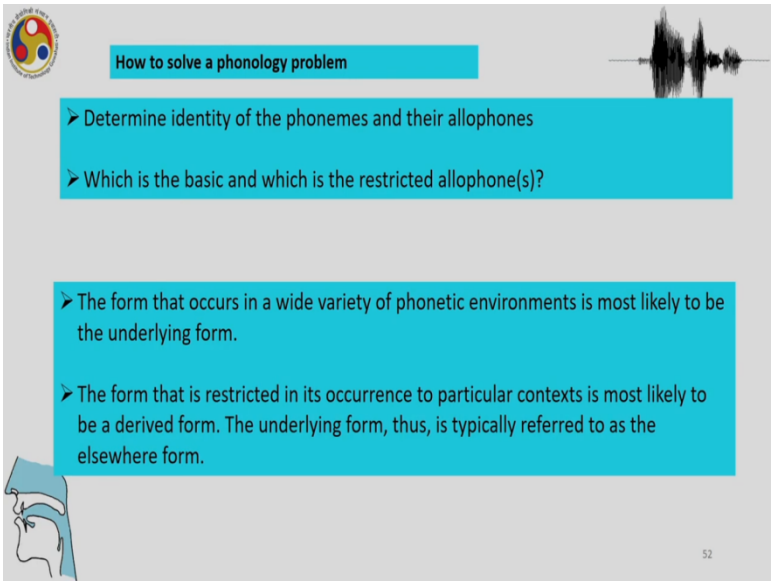

So to end this lecture on phonology where we started with the idea of the psychological reality of phoneme we discussed phonotactics, we discussed how some constraints are needed sometimes

instead of rules and we also discussed some issues with regard to the phonemic analysis. Finally we see a step-by-step analysis of a phonology problem.

So, what do we do phonology problem? We determine the identity of the phonemes and the allophones. What is the basic sound and which are the restricted allophones and the form that occurs in a wide variety of phonemic environments is most likely to be the underlying form. And the form that is restricted in its occurrence to particular context is the derived form, the underlying form does is typically referred to as the elsewhere form.

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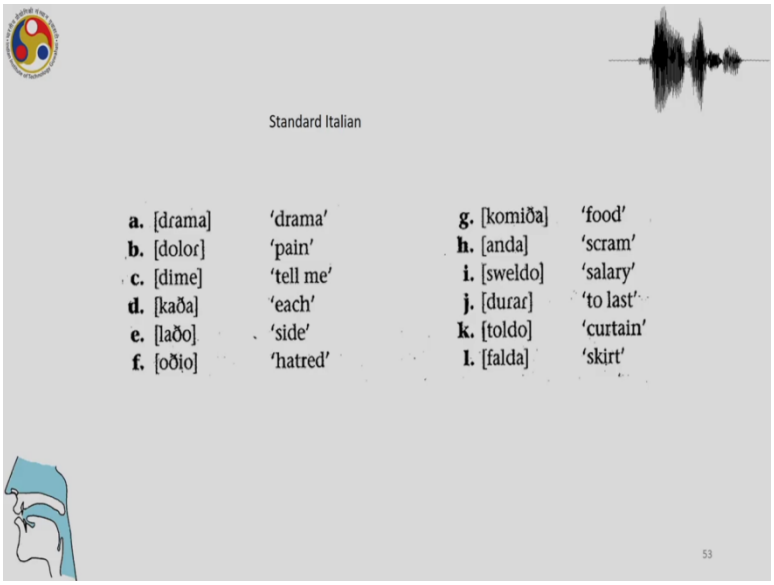

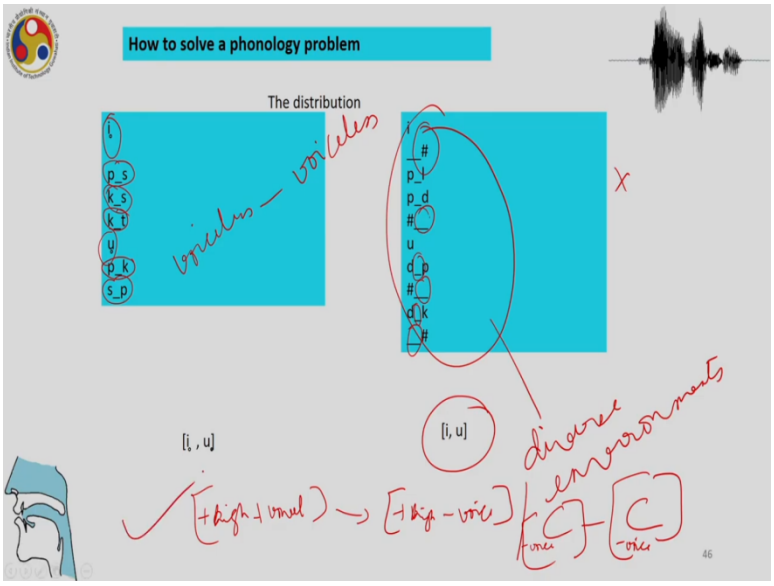

So here hence what occurs in the diverse environments here are the voiced vowels and therefore, we can state our rule as plus high, plus high vowels become voiceless, minus voice in the environment where there are two minus voice consonants in both sides. So this is how we write a rule, this is how we analyze phonological problems. Thank you for your attention and we will continue with more issues in phonology in the next class. Thank you.