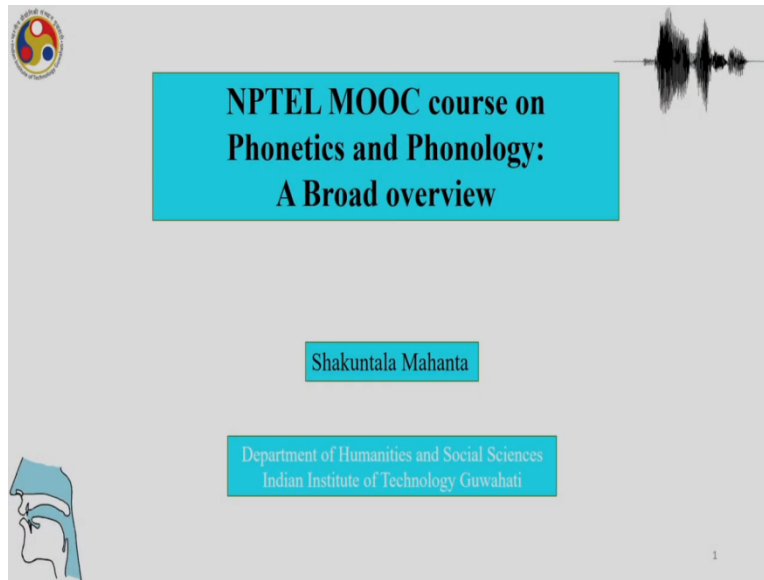**Phonetics and Phonology: A broad overview**
Professor Shakuntala Mahanta
Department of Humanities and Social Sciences
Indian Institute of Technology Guwahati
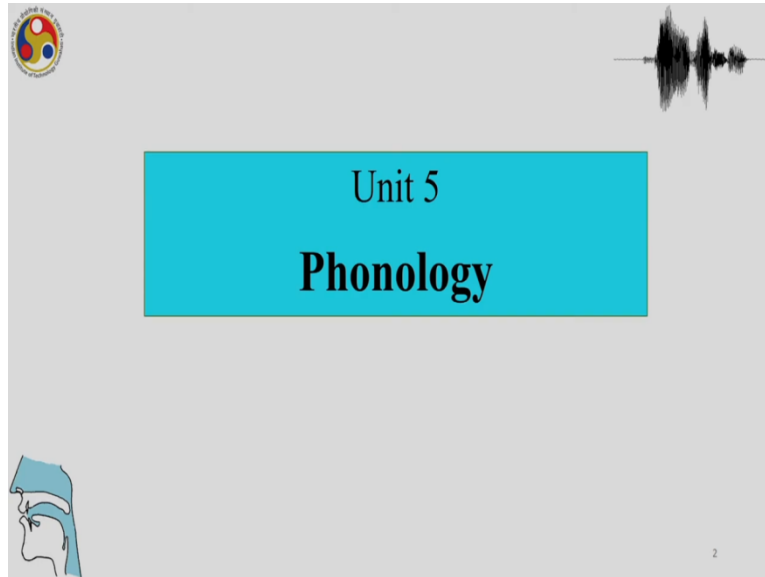**Lecture 16**
Phonemes as categories, phonemes in different languages, allophonic rules
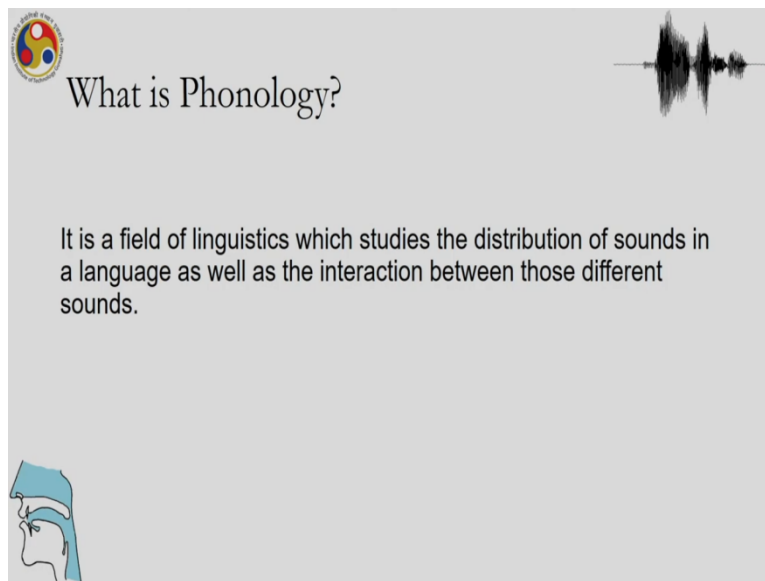
(Refer Slide Time: 00:28)

Welcome to this NPTEL MOOC Course in Phonetics and Phonology: A broad overview. And we are continuing with our phonology class. So, in the last lecture we looked at the history of the field and we had an overview of how certain things developed in phonology and how structuralist ideas gave way to the generative ideas and during that time we developed the idea of phoneme and features and many of the path breaking ideas in phonology.
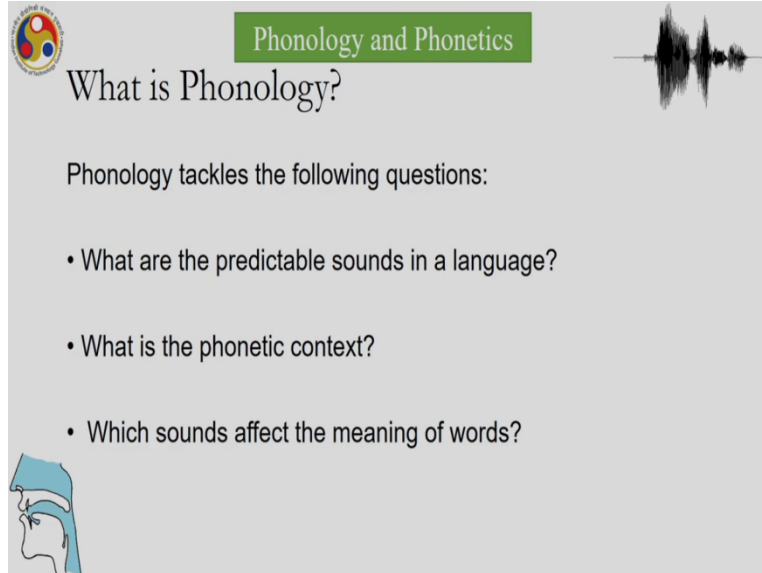
(Refer Slide Time: 01:10)

So this is the fifth unit and the second lecture of the fifth unit of phonology.

(Refer Slide Time: 01:20)

So, broadly what is phonology? Phonology is a field of linguistics which studies the distribution of sounds in a language as well as interaction between those different sounds.

And phonology tackles the following questions. What are the predictable sounds in the language? And if they are not predictable and if they occur unpredictably then is there any meaning in them? So what are the sounds which affect the meanings of words? And if they are predictable what is their phonetic context?
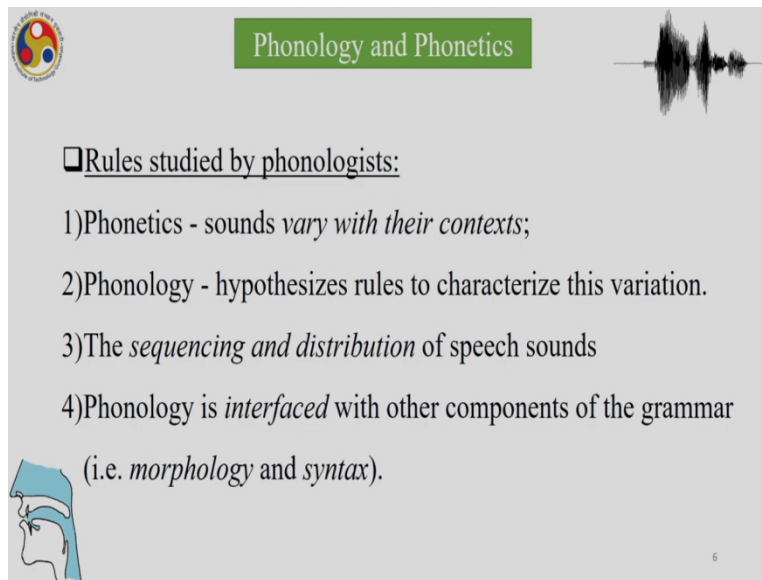
Phonetics as we saw in our three units before this, we looked at articulatory phonetics, we looked at acoustic phonetics and we saw in detail how speech sounds are produced, their physical

properties and how they are interpreted. We also looked at perception to understand that. And finally now we are looking at phonology, one of the crucial parts of this course. Phonology studies the organization of speech sounds in a particular language. Now, that does not sound very difficult but a lot of analysis is involved in understanding that organization of speech.

(Refer Slide Time: 02:40)
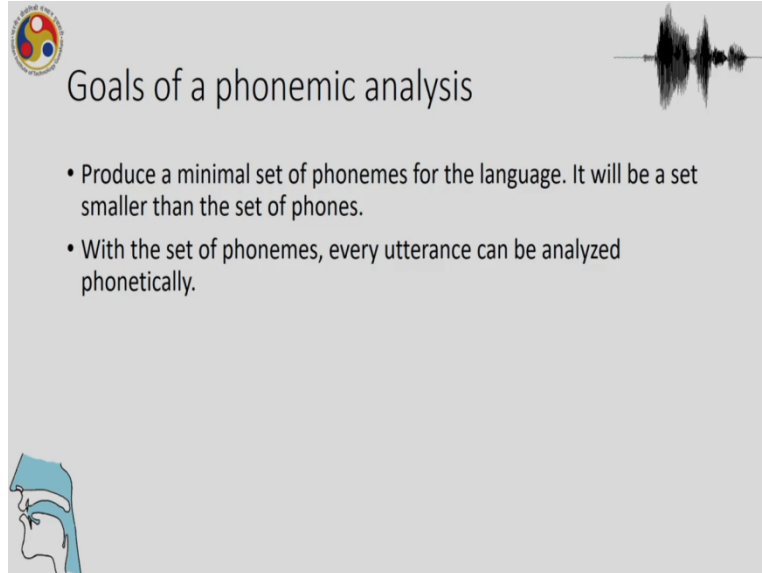
And what do phonologists do? They study rules. Rules are studied by phonologists, phonologists hypothesize rules to characterize this variation. And what is phonetics? As we know sounds vary with their context. We had detailed understanding of phonetics and how context is extremely important in phonetics and in phonology; the contexts are expressed with the help of rules. And in phonology also the sequencing and distribution of speech sounds is also important.

That is, which sounds can occur with which sounds. What is the sequence that they prefer? Are those properties universal or are they language particular properties? And phonology is also interfaced with the other components of grammar that is morphology and syntax.

(Refer Slide Time: 03:37)
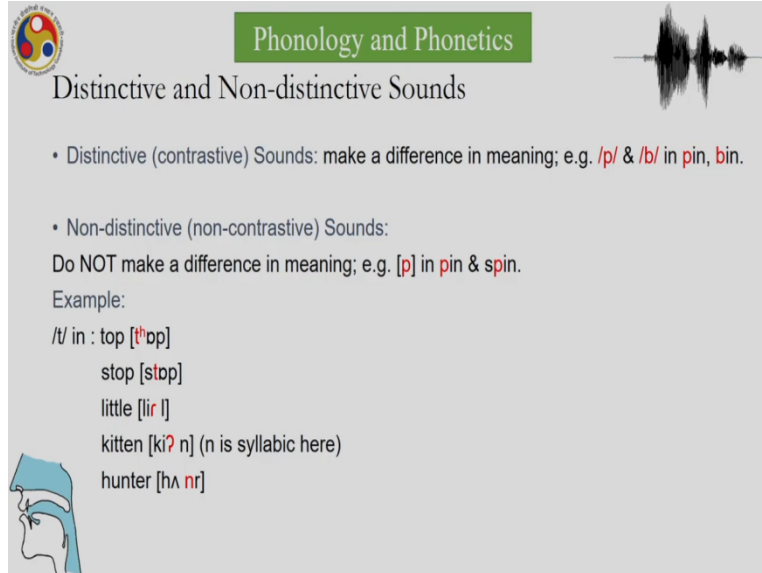
This particular lecture will be particularly about phonemic analysis. We will look at phonemic analysis. What is phonemic analysis? The goal of phonemic analysis is to produce a minimal set of phonemes for any language. So, it will be set smaller than the phones which are the sounds that you hear in a language. So, basically this abstract set of sounds which are there and which generate the ones that you hear, determining that set is the goal of a phonemic analysis.

And once we have the phonemes with us, we can analyze utterances phonetically. We can determine their context, we can predict which sounds can occur in which context and we can also see if a certain sound will vary because of a certain context and which are the sounds which will not change their shapes very much.

(Refer Slide Time: 04:47)

So, distinctive and non-distinctive sound, so the property of distinctiveness is very important in phonology. So, sounds make a difference in meaning. So in p and b, pin bin are two words because uh p and b are contrastive in this language, let us say, English. And some sounds are not contrastive. So, for instance, t in top and t in stop and t in little and kitten and hunter.

So, in all these different contexts, the way the t manifests is different. And now one has to be aware that it is still the t, it is not another sound and that is why phonology is important because we intuitively know that it is the same sound but they will be different based on their context.

(Refer Slide Time: 05:53)

Phoneme and Allophone

- A phoneme: a class of speech sounds that are identified by a native speaker as the same sound; e.g. /t/; unpredictable (given "in" in pin like the example above we CANNOT predict which sound can come before it like tin, din, kin, gin, fin, thin, sin, shin, chin)

- A phoneme is an abstract representation & cannot be pronounced (it is not a speech sound)

- A phone: the actual phonetic segment produced by a speaker & has been classified as belonging to some phoneme; e.g. [tʰ]; predictable

- An allophone: a variant of a phoneme, e.g. /t/ = [ʔ], [ɾ]

Phonology and Phonetics

Distinctive and Non-distinctive Sounds

- Distinctive (contrastive) Sounds: make a difference in meaning; e.g. /p/ & /b/ in pin, bin.

- Non-distinctive (non-contrastive) Sounds:
Do NOT make a difference in meaning; e.g. [p] in pin & spin.
Example:
/t/ in : top [tʰɒp]
       stop [stɒp]
       little [liɾ l]
       kitten [kiʔ n] (n is syllabic here)
       hunter [hʌ nr]

Phonology and Phonetics

❑Rules studied by phonologists:

1)Phonetics - sounds *vary with their contexts*;

2)Phonology - hypothesizes rules to characterize this variation.

3)The *sequencing and distribution* of speech sounds

4)Phonology is *interfaced* with other components of the grammar

  (i.e. *morphology* and *syntax*).

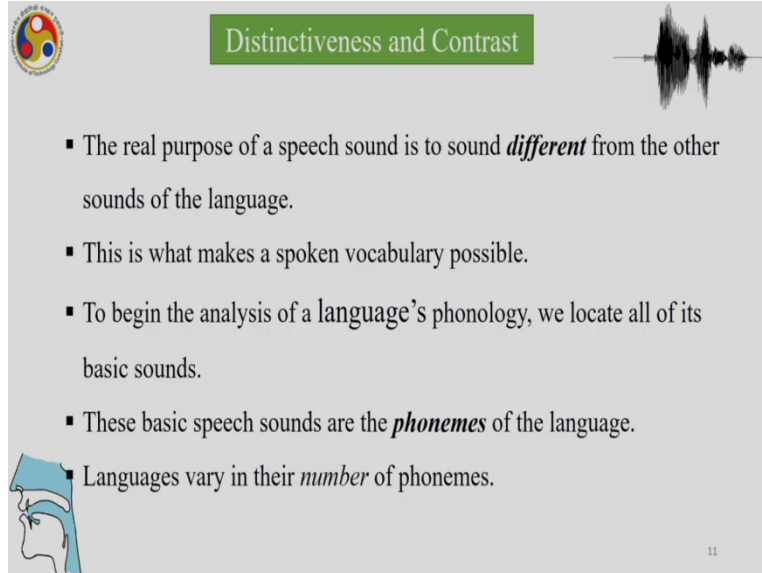So, in a way phoneme is also a class of speech sounds that are identified by the natives because the same sound that is despite the wide variation that we saw in the pronunciation of t, native speaker will identify them as the same sound even though they manifest differently. So, a phoneme is an abstract representation and it is not a sound which is produced by the speakers. So, it is what is there beneath the surface manifestation of sounds.

An important term used by phonologists is also phone, that is the actual phonetic segment produced by the speaker and which has been classified as belonging to some phoneme and whereas an allophone is an actual variant of a phoneme. So, now part of the goal of phonology is to hypothesize this variation to find ways to characterize this variation. And, in order to do so, as we have already seen the sounds vary with the context and the sequencing and distribution of speech sounds have to be studied by phonologists and also phonology interfaced with other components of the grammar.

(Refer Slide Time: 07:11)

So, the real purpose of a speech sound is to sound different from the other sounds of the language. We can assume that much of the communication which happens is because there is some difference between the vowels and consonants that make up the words and that is what makes spoken vocabulary possible.

Otherwise if they are all the same then we would have just a series of vowels and consonants or just b b b and p p p and we would not have many words to make up the vocabulary which will give us the necessary terms to express things in a language. To begin the analysis of a language's phonology, we locate all of its basic sounds.

So, that is one of the primary goal of a phonologist to know what all the basic sounds in that language is. These basic sounds are the phonemes of the language. And importantly languages vary in the number of phonemes. It is not predetermined which language will have how many phonemes.

(Refer Slide Time: 08:31)

So, there can be a wide variety, so they can be as low as 11 in Rotokas. It can be as high as 160 in Xoo or around 37 to 41 in English. And, if any two words of a language are pronounced differently, they must differ in at least one phoneme. So, if there are two different words that pronounced differently they must differ in at least one phoneme. So, time versus dime, this is a minimal pair and we can see that they are the differences between just between t and d. So, a minimal pair is the most effective way to show that two sounds are distinct phonemes.

(Refer Slide Time: 09:19)

Ways to say two sounds are separate phonemes. So sounds t and d are in contrast or they are phonemically distinct as we already saw, contrastive and distinctiveness are basically can be used interchangeably and when t and d are contrastive, they are also phonemically distinct. And, that is why the difference between them is called distinctive.

And, we can also extend our sets of minimal pairs and from pairs we can also get triplets or quadruplets. So we have time, dime and here we can see lime and we can say mime or other you know we can create these sets which are distinctive with regard to only one phoneme. So t, d are distinct phonemes.

(Refer Slide Time: 10:13)

In any language, there are many pairs of sounds that do not contrast. So example, length of vowels in English. So save in English and we have safe and we have made the two verbs there and then we have two other words which are related save and safe and then we have made and mate and importantly the adjective safe and the verb save, they have the same vowel but for an English speaker, they would hear the two words differently, not just because of the difference between v and f, also because there is difference in length between the two a's.

So the one which is voiced, the v, will lengthen the previous vowel. So, save is longer than safe. And similarly with again made versus mate and we will hear that the a is longer in made than in mate. Although a and a are audibly different, they are not separate phonemes, they are in

complementary distribution. So, we saw contrastive distribution before this. Now, we are seeing complementary distribution and these are very important concepts in what is known as phonemic analysis.

(Refer Slide Time: 11:51)

Two sounds are said to be in complementary distribution, if one sound never occurs in the environments in which the other occurs. So a occurs when next sound in the word is voiced and the shorter one occurs in next one, next sound in the word is voiceless.

(Refer Slide Time: 12:10)

Phonemes as Categories

- Speakers intuitively accept [eɪ] and [ĕɪ] as being the "*same vowel*."
- Phonologists hypothesize that sounds [eɪ] and [ĕɪ] form an abstract phonological *category*, i.e. the *phoneme* /eɪ/.
- The concrete, observable sounds [eɪ] and [ĕɪ] are called the *allophones* of /eɪ/.

16

Sounds that Do Not Contrast

- Two sounds are said to be in *complementary distribution* if one sound never occurs in the environments in which the other occurs.
- [eɪ] occurs when next sound in the word is *voiced*.
- [ĕɪ] occurs when next sound in the word is *voiceless*.

15

So, speakers are known to have intuitively accepted that a and a are the same vowels even though they hear that they're different. And phonologists hypothesize that a and a form an abstract phonological category that is the phoneme a or the diphthong a in English. The concrete observable sounds a and a are called allophones. So, now allophones are the ones which are in complementary distribution unlike phonemes which are in contrastive distribution.

Distinct, they are distinct they lend meaning and categories called allophones or the term allophone is something which is in complementary distribution. So, as you saw this before, if one sound never occurs in the environment in which the other occurs. So, that is why a and a are

mutually exclusive and when one occurs the other will not occur in that environment and that is called complementary distribution.

(Refer Slide Time: 13:25)
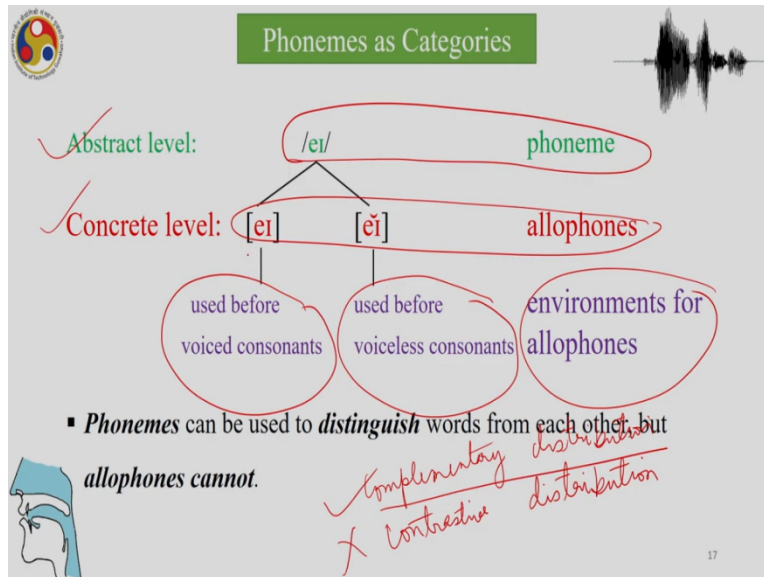
So, at the abstract level, now there is one a at the concrete level, we have two a's which are allophones and a is used before voiced consonants and longer a is used before voiceless consonants. So, this one at the abstract level is the phoneme. This one at the concrete level is allophone and this is a particular context, this is the environment that is before voiced consonants and this is the environment that is before voiceless consonants.

And these are the environments for allophones and these are in complementary distribution. And this is not contrastive distribution. So, phonemes can be used to distinguish words from each other but allophones cannot because allophones are in complementary distribution. They occur in a position where the other cannot and in that particular environment, this one cannot occur and in this environment where this occurs, this one cannot occur. So they are exclusive.

Now, another example from English, alveolar and dental, n and we have know and tenth here annoy and month and onion and panther. So, what is the context for each of these verses what is the context for each of these? So, without thinking about this too much, we can immediately see that for each of these words on your right hand side there is a remember that this is the English dental fricative which is also produced as interdental in some dialects.

So, this is the English dental fricative and therefore the preceding n has the symbol of a dental nasal. Now, from what we know about English, we have never seen dental nasals in English. So, if you recall the consonant inventory of English, English had only three nasals.

One labial, one alveolar and one velar and we never encountered a dental nasal in English. So, why do we have this gentle nasal? What we noticed immediately was the one marked in was that the t is marked in red and recall that t is a dental fricative in English. So, we mean what we see is we see a context for the occurrence of a dental n in English.

(Refer Slide Time: 17:04)

So, at the abstract level then, English has only one alveolar nasal and it has two other nasals, labial and velar but it has only an alveolar nasal. And then at the concrete level, we have now two allophones n and n. And as we had noticed, when we saw the data in precisely exactly where the dental nasal is occurring, what do we see immediately following that we see a dental fricative and if we again look at the environments here, we see that these environments are varied, unlike this environment which is consistently always followed by a dental fricative.

So, now we see that there is varied environment here and what are those? This is n initial, stress position initial n, followed by a vowel and then we have medial n, flanked by vowels on both sides and then we have a final n. So initial, final medial, three context and preceded by vowels, followed by vowels and also final which is preceded by vowel initial which is followed by vowel, medial which is flanked by vowels on both sides.

So, we do not have in terms of boundary, we do not have any consistency there in the environment that we see, unlike that we see here that there is a consistent environment of the dental fricative in all the words here. Hence, we can say the concrete level so if this dental n is used before a t which is a dental fricative.

So, in English, if we have a dental fricative, so how do we now express this? So in English, if there is a following dental fricative, the preceding nasal is also dental. Now, the preceding dental is also nasal does not mean that the preceding nasal is a dental nasal phoneme. As we know, that has to be an allophone and now there is a context for the occurrence of the dental nasal.

What is the context? This is the context. So the context is that in English, if there is a following dental fricative the preceding nasal is also dental. Now, what about the alveolar nasal then which we thought is alveolar nasal and we never talked about the dental nasal in our classes before? So, now we know that if this underlying abstract nasal which is alveolar, most probably alveolar, it can change its place, depending on its environment and we have seen on environment now, it can become nasal if there is a following nasal sound.

But in all other places, it will be the same. And in all other places it will appear as an alveolar nasal. So, now for the alveolar nasal we have two manifestations, two ways that they appear in and one is a dental, the other is alveolar and this is how we understand environments. Let us also talk about the English l. More context here and more complexity in the data.

So, the English l is alveolar and that is how we studied the consonant inventory of English, that is what we saw in the consonant inventory of English that the English lateral is alveolar. Now, we see that depending on the context we see various ways in which the l can be pronounced. So here we have sort of a devoiced l, here we have velarize or dark l and then we have which is also called sometimes called clear l.

So, now we have a velarized or dark l here. We have a devoiced l here and we also have a dental and velarized, two ways that it is different from this one which is the alveolar clear l. Now, we have four different ways in which this vary. Now if you recall the nasal data that you saw previously, then you see that context is very important what is the consistent context here so you can see that l is final what is the context here l is preceded by a voiceless consonant.

Here l is followed consistently by a voiceless dental fricative and here in all the context either appears initially or it is preceded or followed and followed by vowels. So, now this we see more varied environments here and we see a consistent environment here the dental fricative the voiceless consonant and the word final position so now for the English l, we have its velarize form the darker form and the final position when we have a voiceless l when it follows voiceless consonants and then we also have a velarized as well as a dark so both.

So, the symbol here showing that it is velarized and this symbol showing that it is gentle, two features are added there because it is followed by a consonant. There are two contexts here that is why we have two changes, one is that it is followed by a consonant and the second feature is that particular consonant is dental and those two properties lend these two features these two characteristics to l here and l appears as the clear l in other positions.

(Refer Slide Time: 24:58)

Phonemic Transcription

- **Phonemic transcription:** sequences of phonemes of the words recorded by the linguist.
- **Phonetic transcription** includes allophonic details.
- **Orthographic transcription:** words are written down using the customary spelling system (orthography) of the language.

So, we have gone through these aspects of phonetics and phonology before and that is transcription which is very important where you string together the sequences of phonemes and you put them in their symbolic representation so we have talked about the IPA symbols which are considered standard by linguists all over the world.

And phonetic transcription includes allophonic details, so these are the allophonic details that we saw just now all the allophonic details that we have here of the darker l and the dental these are allophonic details and this is called phonetic transcription. If we do not add the phonetic details of the environment then we have a phonemic transcription and also graphic transcription where words are written down using the customary spelling of the language.
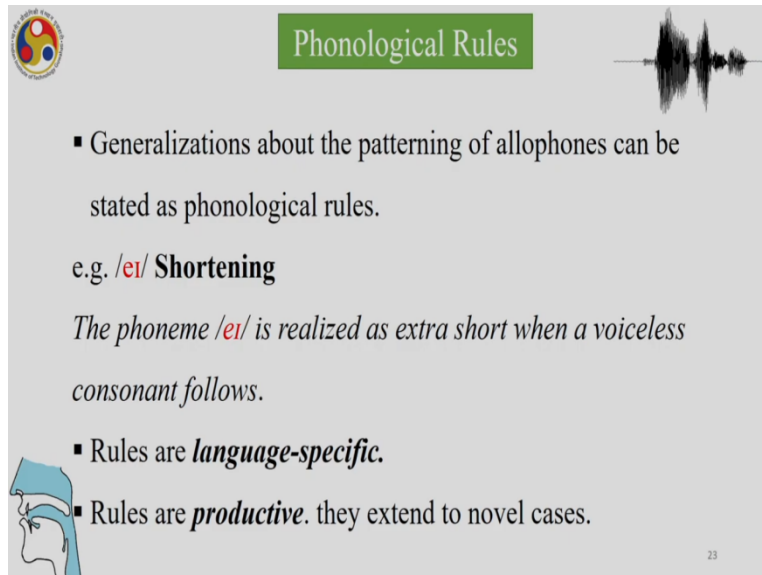
So this sentence here is an orthographic transcription this is how you write this sentence in English this is an orthographic transcription. Now, if you have to use your phonemic transcription, then you will use the particular symbols for t or e and then you will mark the stress marks. So, as you see this is an orthographic transcription but this is a phonemic transcription, so and here is transcription and whereas I am saying transcription and these are the symbols that we have already gone through in our previous lecture.

And this is a phonetic transcription, so we can see a lot more symbols in the phonetic transcription. So, this is a phonetic transcription we get a lot of information about the phonetics of this whether the here is preceded by d because of the stress and this is a phonemic, phonetic transcription and here we see the phonetic the insertion of a glottal stop in English and then we have this particular flap here which will be the American pronunciation.

And the way transcription will be pronounced so there will be aspiration as well as additional differences depending on the sound here, so this will be an affricate and aspirated one and then we have nasal symbols and then we have another nasal symbol here because of the following nasal these will be pronounced ae, so transcription and also we see that the final the vowel here is different from the vowel here because of the position in which it occurs it will be slightly different.

So the phonetic description will carry far more information about the surface forms of the sounds that you will have, that will pronounce and the phonemic information transcription will only tell you about the phonemes that are there in that sentence.

(Refer Slide Time: 28:44)

So, phonological rules tell us about generalizations about the patterning of allophones and they can be stated as phonological rules. So, the phoneme which we saw before is realized as extra short when a voiceless consonant follows and these rules are language specific. So, allophonic rules are always considered to be language specific and they can be productive they can be extended to new novel words that are borrowed to the language and they can always apply to new forms.
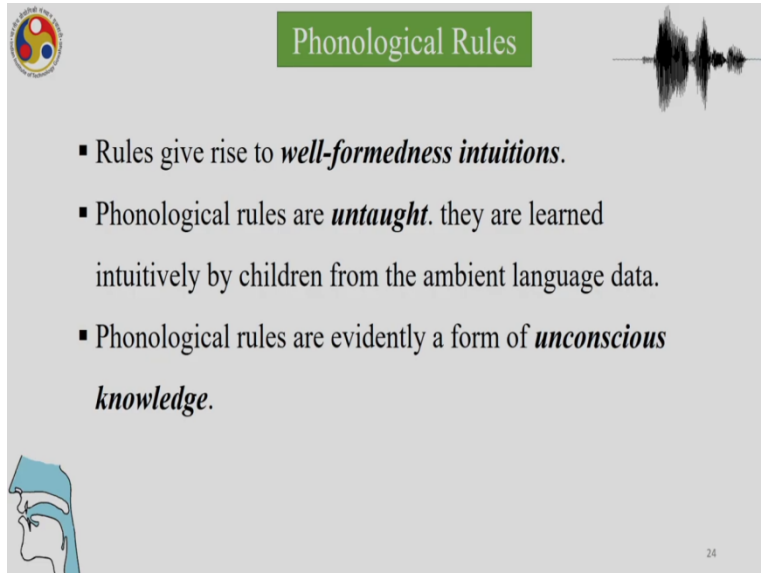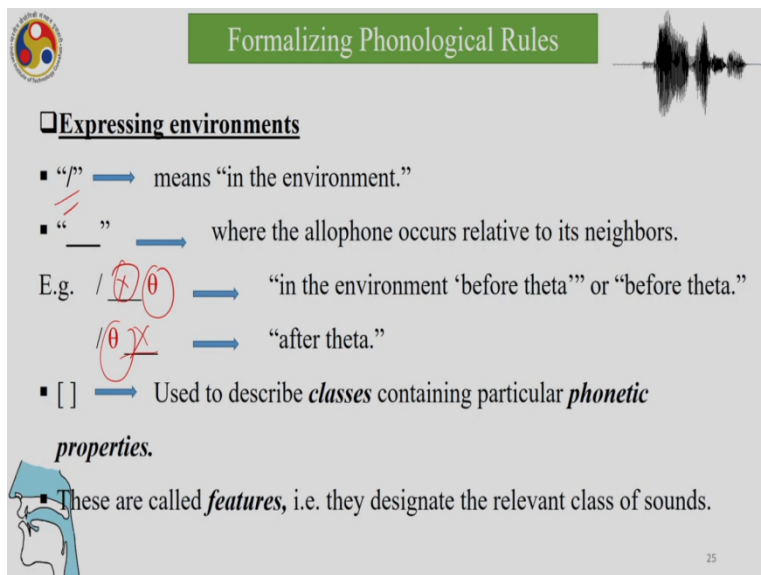
(Refer Slide Time: 29:17)

And rules give rise to well-formedness intuitions and phonological rules are also untaught. They are always learned when the when children are learning languages and the ambient language data information will always inform the language learner to form their roles. And phonological rules are evidently a form of unconscious knowledge because they are untaught and they are learned by language learners, children using whatever tools are available to us as language learners.

(Refer Slide Time: 29: 54)

So, what are the formal means that we use to express these rules, that is a slash which means in the environment. So, you see the forward slash and a dash it means where the allophone occurs relative to its neighbors and then if we have something like this a forward slash and a dash followed by a sound then it means that the allophone occurs here in this context where this is followed and again this dash means the allophone occurs here in the context where this is preceded by this consonant.

And then we have the square brackets. They are used to describe classes containing particular phonetic properties. These are called features and they designate relevant class of sounds.

(Refer Slide Time: 30:52)

And we also use plus and minus before feature names to mean that a segment either has or does not have the phonetic property that the feature designates. So, plus consonant means consonant minus voice means voiceless and again boundary is shown with the help of similar means, with a dash. So, dash following it means at the end of a word and then if it is before the starting of the rule, then it will mean at the beginning of a word.
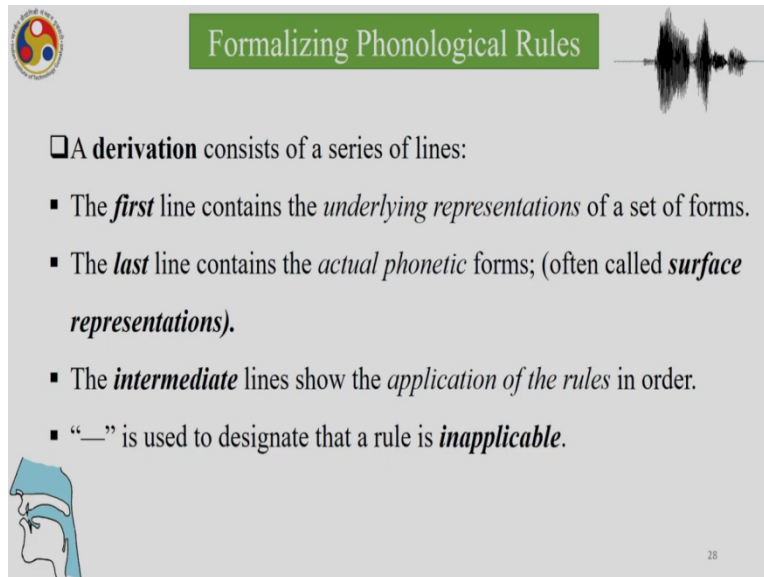
Now, moving on to underlying representations, underlying representations characterize the phoneme by setting up an abstract level of representation also called the phonemic representation, the underlying form or the base form. Now, recall the English devoicing, partial devoicing and that happens if there is a preceding voiceless consonant. It devoices, partial devoices after a voiceless consonant.

And l dentalization, l is rendered as velarize and dental for t which you had seen before and velarization only if it is preceded, only if it is final in a word. So, this will then show that this is word final, this will show that there is a following consonant and this will show the preceding environment because the dash follows the environment and if the dash precedes the environment it will show a preceding environment. Similarly, if the dash precedes the word boundary it will mean that it is a final environment.

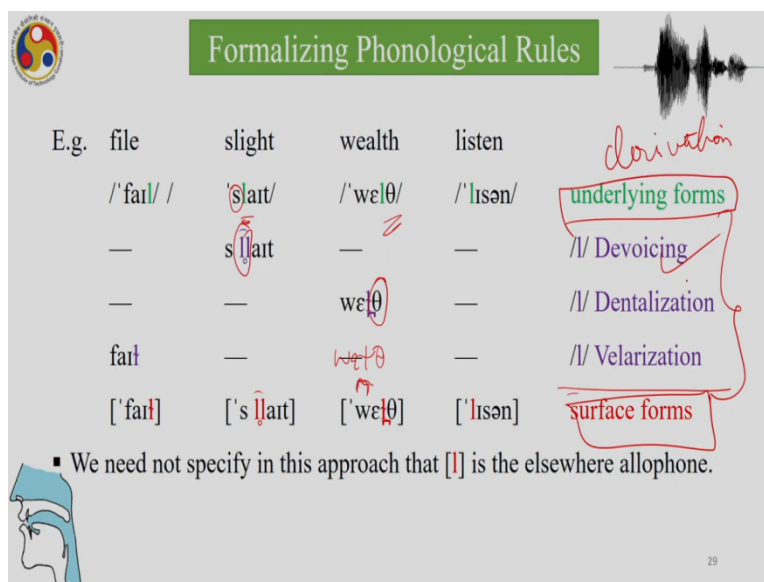So, a phonological derivation shows how the rules apply. The first line contains the underlying representations of a set of forms and the last line contains the actual phonetic forms often called surface representations and the intermediate line showed the application of the rules in this order and dash is used to designate that rule is inapplicable.

Now let us look at a proper derivation of data set that we have seen before. Now, these are the words that we had seen before fail, slight and then wealth and listen. Okay. So, fail and slight and

wealth and listen are the underlying forms. The derivation will show when the rules will apply. So, first we have our devoicing rule and the devoicing rule will only apply if there is a preceding voiceless consonant.

Now which law has a preceding voiceless consonant? Only this one, so the rule of l devoicing applies and we have partial devoicing here. Now we have a second rule of l dentalization, when l dentalization occur if there is a following dental fricative and which l has a following dental fricative, only this one, so the rule applies.

Alveolarization says that final l has to be velarized so it will be fail and then we have our surface forms and alveolarization also involves velarizing preceding consonant and as a result we have we have wealth, we have slight, we have fail and we have listen and we do not need to specify in this approach that l is the elsewhere allophone.

So, we just see we see that this is the derivation when these four and these three rules are applying and as a result we get from the underlying forms, we get the surface forms. And this is the end of our second lecture on phonology and we will continue discussing these aspects in the next class on phonology. Thank you for listening.