

# INTD0112

## Introduction to Linguistics

Lecture #6  
March 6<sup>th</sup>, 2007

## Announcements

- Any questions on homework 2?

## Speech production and coarticulation

- So far, we described segments as if they are articulated in isolation. Of course, this is not the case in connected speech. Sounds are typically produced while more than one articulator is active.
- As a result of coarticulation, sounds may get to affect other sounds in speech.
- These are called **articulatory processes**.

## Speech production and coarticulation

- There are two reasons for the existence of articulatory processes:
- **More efficient articulation**, as we noted before for vowel nasalization in English.
- **More distinct output**, as in lengthening a consonant or a vowel to make it distinct:  
“It’s Fred.”  
“Did you say it’s red?”  
“No, I said, ‘**Fff**red.’”

## Articulatory processes

- There are several types of articulatory processes in human language. We discuss a few here. We’ll get back to this issue again, though, when we talk about historical linguistics and language change.

## Assimilation: Regressive

- Assimilation is an articulatory process whereby a sound is made “similar” to a neighboring sound.
- Vowel nasalization in English is an instance of **regressive** assimilation:  
*can’t* [k<sup>h</sup>æ̃nt]

## Assimilation: Progressive

- Assimilation can also be **progressive**, as in Scots Gaelic:

[nē:l]      “cloud”  
[mū:]      “about”

## Assimilation in voicing

- Assimilation may also take place in voicing features. In English, liquids and glides get “devoiced” after voiceless stops. Devoicing is marked by a “̚” underneath the segment:

*please* [plɪz̚]      *proud* [praʊd̚]

- Similarly, voiceless sounds may become voiced in the neighborhood of voiced sounds, e.g., Dutch *af* [af] (“over”) is pronounced with a [v] in the words *afbellen* (=cancel) and *afdekken* (=cover).

## Assimilation in place of articulation

- Nasal consonants typically assimilate to the place of articulation of the following sound. From English:

possible → impossible [mp]  
tangible → intangible [nt]  
complete → incomplete [ŋk]

- Question: Is this a case of regressive or progressive assimilation?

## Assimilation in place of articulation

- Now, let’s look at these German data:

Careful speech      Informal speech

laden [la:dən]      → [la:dn]      “to invite”  
loben [lo:bən]      → [lo:bm]      “to praise”  
backen [bakən]      → [bakŋ]      “to bake”

- What’s going on here?

## Dissimilation

- Dissimilation is an articulatory process whereby two sounds are made less similar. From English:

*fifths* [fɪfθs] → [fɪfts]

## Deletion

- Deletion is a process which removes a segment from certain phonetic contexts. From English:

*suppose* [səp<sup>h</sup>ówz] → [spówz]

- Deletion may also occur as an alternative to dissimilation for some speakers in words like *fifth*:

*fifths* [fɪfθs] → [fɪfs]

## Epenthesis

- Epenthesis is a process that inserts a segment within an existing string of segments. From English:  
*something* [sʌmθɪŋ] → [sʌmpθɪŋ]  
*length* [lɛŋθ] → [lɛŋkθ]
- In Turkish, a sequence of two initial consonants is not allowed. As a result, a vowel is epenthesized to break the consonant cluster:  
“train,” which is borrowed from English, is pronounced as [tiren]

## Metathesis

- Metathesis is a process that changes the order of segments. Children learning English will typically produce metathesis forms, e.g., *spaghetti* is typically pronounced as *pesghatti* [pɛskɛɾi].

## Vowel reduction

- In many languages, vowels in unstressed syllables undergo reduction, typically appearing instead as the weak vowel [ə]:  
*Canada* [kʰæ̃nədə]  
*Canadian* [kʰənejdjən]

## Phonology

- While phonetics studies how speech sounds are articulated, what their physical properties are, and how they are perceived, phonology studies the organization of speech sounds in a particular language.
- As it turns out, while two or more languages may have the same sounds, no two languages organize their sound inventories in the same way.

## [s] and [ʃ] in Japanese vs. English

- In both English and Japanese we hear the sounds [s] and [ʃ]:  
Japanese: [ʃimasu] “do”  
English: [slæʃ] “slash”
- In English, however, the two sounds can distinguish meaning, e.g.,  
[ʃɔɹ] “shore” vs. [sɔɹ] “sore”
- The occurrence of each sound is thus unpredictable in English.

## [s] and [ʃ] in Japanese vs. English

- By contrast, in Japanese, we do not find pairs where [s] and [ʃ] create a difference in meaning.
- Instead, if we know that a Japanese word ends in [-in], we then know that it can only begin with [ʃ], and not with [s].
- The occurrence of each sound is thus predictable in Japanese.

## Phonology

- Phonology addresses these questions:
- Which sounds are predictable in a particular language?
- What is the phonetic context that allows us to predict the occurrence of these sounds?
- We discuss this today.

## Subconscious phonological knowledge

- Native speakers of a particular language typically treat certain sounds as being the same, even when they are phonetically different, e.g.,
  - the [l] in *lay* and *play*
  - the [t] in *top* and *stop*
- But other sounds are considered to be distinct:
  - the [l] and the [r] in *light* and *right*
  - the [p] and the [b] in *pan* and *ban*

## Phonemes vs. allophones

- Phonologists explain the difference by invoking a distinction between **phonemes** and **allophones**.
- A phoneme is a meaning- distinguishing sound, whereas an allophone is a phonetic variant of a particular phoneme.
- As we should expect, native speakers treat different phonemes as distinct sounds, but treat allophones as the same sound.

## Minimal pairs

- But how do we know if two sounds are two separate phonemes, or are simply phonetic variants of the same phoneme?
- Answer: **Minimal pairs**.
- A minimal pair is a set of two words that have the same sounds in all positions except one. If, as a result of the difference of these two sounds, a difference in meaning occurs, then the two sounds are phonemes. If, by contrast, no difference in meaning occurs, then the two sounds must be allophones of the same phoneme.

## Phonemes or allophones?

- So, bearing this in mind, let's go back and look at the examples we discussed earlier.
- Based on the minimal pair *light* and *right*, are the [l] and [r] phonemes or allophones in English?
- Based on the minimal pair *pan* and *ban*, are the [p] and [b] phonemes or allophones in English?

## Phonemes or allophones?

- Based on the minimal pair *shore* and *sore* (remember spelling is irrelevant to phonology), are the [s] and [ʃ] phonemes or allophones in English?
- How about these further minimal pairs:
  - seat* and *sit*?
  - fool* and *full*?
  - sip* and *zip*?
  - leaf* and *leave*?
- More minimal pairs are given in Table 3.1, p. 60, in your textbook.

## Phonemes or allophones?

- Now, let's consider the following minimal pair:  
top: [tʰap] vs. [tap]
- Now, here's the question: Are the two sounds [tʰ] and [t] phonemes or allophones in English?
- Since [tʰ] and [t] are not contrastive in English, they are two allophones of the same phoneme, which we might represent here as /t/ (notice the slash, rather than the square bracket, notation).

## Phonemes or allophones?

- Let's consider another example:  
play [plɛj] vs. [plej]
- Here's the question: Are [j] and [ɨ] phonemes or allophones in English?
- Right. Since they are in **complementary distribution**, then they are allophones of the same phoneme, which we may represent here as /j/.
- Notice that this same allophonic variation happens with [ɹ] as well as the glides [j] and [w].

## Phonemes or allophones?

- How about nasal vowels in English? Are they phonemes or allophones?
- First, find a minimal pair:  
*pin* [pʰɪ̃n] vs. \*[pʰɪn]  
*pit* [pʰɪt] vs. \*[pʰɪ̃t]
- Is the contrast here phonemic or allophonic?

## Distribution: complementary vs. overlapping?

- From all these examples, you should've noticed that different allophones occur in different environments, that is, where one of them occurs, the other doesn't, and vice versa, which is not the case with phonemes.
- We say that allophones occur in **complementary distribution**, whereas phonemes occur in **overlapping distribution**. And this is one main distinction between a phoneme and an allophone.

## So, how do languages differ, then?

- One reason why human languages differ in their sound inventory is that what is considered a phoneme in one language is an allophone in another, and what is an allophone in one language is a phoneme in another.
- So, for example, the aspiration variation is allophonic in English, but not in Thai. Consider these data from Thai:  
[paa] "forest"            [pʰaa] "to split"  
[tam] "to pound"        [tʰam] "to do"

## So, how do languages differ, then?

- Now, consider nasal vowels in French:  
*gars* [ga] "lad"        *gant* [gã] "glove"
- Are they phonemes or allophones?
- How about Akan, a Ghanaian language?  
[ka] "bite"            [kã] "speak"  
[tu] "pull"            [tũ] "den"  
[pam] "sew"        [pãm] "confederate"
- You should be able to answer this by now.

## Phonemes are abstract entities

- To sum up, phonemes are meaning-distinguishing sounds, whereas allophones are phonetic variants of the same phoneme that occur in specific contexts.
- Notice that this means that phonemes are actually abstract entities in your head rather than physical sounds that come out of your mouth. These physical sounds are allophones, the concrete manifestations of the abstract phonemes.

## Phonemes are abstract entities

- The psychological existence of phonemes can be noticed in native speakers' slips of the tongue, e.g., *key chain* [ki tʃeɪn] may come out as [tʃi keɪn], but never as [ti kʃeɪn].
- This shows that [tʃ] is stored in the mind as a single unit, just as [k] is.

## Note on transcription

- Remember the distinction between broad phonetic transcription and narrow phonetic transcription? We can now understand this better in terms of phonemic vs. phonetic transcription.
- In phonemic transcription, only phonemes are represented. In phonetic transcription, the allophones of each phoneme are transcribed. See Table 3.15 in your textbook for examples.

## So, how are phonemes and allophones related?

- But how do we capture the relationship between a phoneme and its allophones?
- Phonologists explain this in terms of a mapping from the abstract phoneme entity to the actual physical allophones of that phoneme.
- To represent this mapping, we use phonological rules.

## Phonological rules

- Informally speaking, a phonological rule takes a segment as **input**, **operates** on it, and produces a segment as **output**. The operation of the rule, however, is subject to a main restriction: it has to occur in a certain phonological **environment**.

## Phonological rule notation

- Abstractly, we can represent this in the following notation:  
$$X \rightarrow Y / \_\_\_ Z$$
- **Basic definitions:** the “ $\rightarrow$ ” means “changes to”; the slash “/” means “in the environment of”; and the “ $\_\_\_$ ” positions the input in the environment (that is before or after the relevant segments that determine the phonological change).
- What this rule simply says is that an input X is changed to Y if it occurs before Z.

### Phonological rule notation

- Suppose instead that we want to say that X changes to Y *after* (rather than *before*) Z. How do we do that?
- Well, a simple change will get us the required result:

$$X \rightarrow Y / Z \_$$

### Phonological rule notation

- Suppose further we want to place a certain restriction on the occurrence of the segment. For example, that it has to occur “syllable-initial” or “at a word boundary”.
- Again, we can come up with two simple notations to indicate this:

### Phonological rule notation

- As in your textbook, we will use “σ” to indicate a syllable boundary, and “#” to indicate a word boundary.
- Now, read the following rules. Can you figure out what they mean?

$$X \rightarrow Y / \sigma \_$$

$$X \rightarrow Y / \_ \#$$

### Phonological rule notation

- In some cases an element in the environment may be optional. How do we represent that in the notation of our rules?
- **Brackets** will do the trick. Consider this rule. What does it mean?

$$X \rightarrow Y / \_ (Z) \sigma$$

### Phonological rule notation

- Sometimes we might have more than one context for the application of a rule. How do we indicate that using our rule notation?
- **Braces** come to the rescue, as in this rule:

$$X \rightarrow Y / \_ \left\{ \begin{array}{l} Z \\ \# \end{array} \right\}$$

- The above rule simply means that “X changes to Y **either** before Z **or** at word boundary.”

- Ok, so why don't we look at some concrete examples to see how this works.

## [ɫ]-devoicing

- Let's start with the rule for /ɫ/ devoicing in English. Informally put, the rule says  
" /ɫ/ gets devoiced when following a syllable-initial voiceless stop."
- How do we represent this in phonological rule notation?  
 $/ɫ/ \rightarrow [ɫ] / \sigma \text{ [voiceless stop]} \_\_\_$

## Aspiration

- How about aspiration of voiceless stops in English?  
"Voiceless stops become aspirated in English when they occur syllable-initially."
- How do we represent that in formal rule notation in phonology?  
 $[\text{voiceless stop}] \rightarrow [\text{aspirated}] / \sigma \_\_\_$

## Vowel nasalization

- Now, vowel nasalization:  
"In English, vowels become nasalized when they are followed by a nasal consonant."
- Rule notation:  
 $V \rightarrow [\text{nasal}] / \_\_\_ [\text{nasal}]$
- Ok, but how about vowel nasalization in Scots Gaelic? Remember the rule?

## Deletion

- How about deletion rules?
- For these, we use the symbol  $\emptyset$  in the output of the rule (i.e., after the arrow).
- For example, English speakers delete the [ə] in an open syllable when it is followed by a stressed syllable, as in *police* [pɒlɪs].
- How do we represent this in rule notation?  
 $[\text{ə}] \rightarrow \emptyset / C_0 \_\_\_ \sigma C_0 V_{\text{stressed}}$

## Epenthesis

- The  $\emptyset$  comes in handy for phonological rules that insert sounds as well. The key difference here is that the  $\emptyset$  will be in the input to the rule.
- For example, in some English dialects, consonant clusters of [ɫ] and another consonant are not allowed in syllable-final position. Speakers of these dialects, therefore insert a [ə] to fix the syllable, e.g., *milk* [mɪlək].
- In rule notation, this would be represented as:  
 $\emptyset \rightarrow [\text{ə}] / [ɫ] \_\_\_ C \sigma$

## Next class agenda

- Features.
- Using features in phonological rules.
- Syllable structure.