INTD0112
Introduction to Linguistics

Lecture #8
March 13th, 2007

Announcements

➢ Comments on homework #1.
➢ Scores are posted.
➢ Class drop deadline is this Friday.
➢ Due dates will never fall on a Saturday again. Either a Friday or a Monday.
➢ Any questions on homework 3?

Phonology: One piece of the puzzle

➢ Remember that our goal in linguistics is to answer the following question:
   "What is it that we know when we know a language?"
➢ The study of phonology is one step towards this goal: It reveals to us the kind of subconscious knowledge that native speakers have about the sound system of their language (e.g., English speakers' knowledge of the phonological rules for aspiration of voiceless stops and nasalization of vowels).

Phonology: One piece of the puzzle

➢ We have also seen how phonological rules represent phonological processes mapping abstract phonemic underlying forms to their physical phonetic surface forms.

Phonological rules revisited

➢ We represented the rules in terms of the following notation:
   $X \rightarrow Y / \underline{\quad} Z$
➢ At least as far as X and Y are concerned, we treated them as variables ranging over segments.
➢ There is good evidence, however, that the input and output to phonological rules are not segments, but features. Let's see why.

Aspiration revisited

➢ For one thing, we have been already using features.
➢ Consider the rule for aspiration of voiceless stops in English:
   [voiceless stop] $\rightarrow$ [aspirated] / σ $\underline{\quad}$
➢ Notice here that the input and output of the rule are not really segments, but features. Why did we do that?

Aspiration revisited

> Well, if we don't, then the alternative would be this:

$$/p/ \rightarrow [p^h] / \sigma \ \_\_\_$$
$$/t/ \rightarrow [t^h] / \sigma \ \_\_\_$$
$$/k/ \rightarrow [k^h] / \sigma \ \_\_\_$$

> Any problem with that?
> Right. Economy. "Less is more" in scientific analysis, aka *Occam's razor*.

Vowel nasalization revisited

> Same holds for the rule for vowel nasalization:

$$V \rightarrow [nasal] / \ \_\_\_ \ [nasal]$$

> The variety of English that most of you speak has 15 vowels. If we do not use features, we end up having 15 such rules. Not pretty.

/l/ devoicing revisited

> We have already formulated a rule for /l/ devoicing in English after syllable-initial voiceless stops:

$$/l/ \rightarrow [l̥] / \sigma \ [voiceless \ stop] \ \_\_\_$$

> But this same devoicing process happens to the other liquid /ɹ/ as well as the two glides /j/ and /w/.
> Having a separate rule for each is again non-economical and ugly.

Cross-linguistic evidence

> But there is stronger evidence for the use of features in phonological rules from our study of the phonological systems of several human languages.
> Let's look at a few examples.

Arabic

> The definite article prefix in Classical Arabic is /al/:

/al+ba:b] → [alba:b]	"the door"
/al+kita:b/ → [alkita:b]	"the book"
/al+qamar/ → [alqamar]	"the pen"
/al+ʕasal/ → [alʕasal]	"the honey"

Arabic

> But now consider these further data:

/al+tamr] → [attamr]	"the dates"
/al+ʃams/ → [aʃʃams]	"the sun"
/al+rab/ → [arrab]	"the god"

> So, what's going on here?
> Exactly. Assimilation of the /l/ to the initial consonant of the noun in place of articulation.

Arabic

- To make a long story short, here's the rule:
  - "Assimilation of the /l/ of the Arabic definite article takes place when the initial consonant of the following noun is alveolar or alveopalatal."
- But how can we formulate a rule like that formally?
- We'd probably end up with two different rules, one for each class of consonants, which is obviously non-economical.
- So, is there a way out?

French

- Now consider some data from French:
  - /petit tablo/ → [peti tablo]
  - /petit ami/ → [petit ami]
  - /petit wazo/ → [petit wazo]
- So the rule is something like this:
  - "Final consonants are deleted in French at word boundary unless the following word starts with a vowel or a glide."
- Again, the question is: How do we express that formally?

English

- In fact, why don't we go back to English? Consider:
  - "books"   [bʊks]
  - "rats"   [ræts]
  - "seeds"   [sidz]
  - "bags"   [bægz]
  - "kisses"   [kɪsɪz]
  - "batches"   [bætʃɪz]
- Any ideas on what's going on here?

English

- The rule is something along these lines:
  - "English plural "-s" is pronounced [s] if the noun ends with a voiceless consonant, [z] if the noun ends with a voiced consonant, and [ɪz] if the noun ends with [s], [z], [ʃ], [ʒ], [tʃ], or [dʒ]."
- But again, how can we represent that in formal rule notation?

Features and natural classes

- The key to solving all these puzzles is:
  - **FEATURES**
- And the key to understanding features is to understand the concept of *NATURAL CLASSES*.
- Let's explain that.

Features and natural classes

- Natural classes are classes of sounds that share a feature or features and that pattern together in sound systems.
- There are four types of features: *major class features, manner features, laryngeal features*, and *place of articulation features*.
- Features are typically binary and their presence or absence is represented as "+" and "-", respectively.

Major class features: [±consonantal]

➢ [±consonantal]: Sounds that are [+consonantal] are produced with a major obstruction in the vocal tract. Stops, fricatives, affricates, nasals, and liquids are all [+consonantal]. Vowels and glides are [-consonantal].

Major class features: [±syllabic]

➢ [±syllabic]: Sounds that can function as syllable nuclei are [+syllabic]. These are vowels and so-called syllabic consonants such as nasals and liquids. All other consonants are [-syllabic].

Major class features: [±sonorant]

➢ [±sonorant]: All and only those sounds that are singable are [+sonorant], i.e., vowels, glides, nasals, and liquids. All other consonants are [-sonorant], aka obstruents.
➢ To see how such features help us distinguish between sounds, let's see table 3.22 in your textbook (p.77).

Manner features: [±continuant]

➢ [±continuant]: Sounds produced with free or nearly free airflow through the oral cavity are [+continuant], i.e., vowels, glides, liquids, and fricatives. Oral and nasal stops, by contrast, are [-continuant].

Manner: [±DR], [±nasal], [±lateral]

➢ [±DR] = [±delayed release]: Affricates are [+DR]. All other consonants are [-DR].
➢ [±nasal]: Sounds produced with a lowered velum such as nasal stops and nasalized sounds are [+nasal]. All other sounds are [-nasal], i.e., oral.
➢ [±lateral]: All and only varieties of "l" are [+lateral]. All other sounds are [-lateral].

Laryngeal features

➢ [±voice]: All voiced sounds are [+voice]; all voiceless sounds are [-voice].
➢ [±SG] = [±spread glottis]: All aspirated consonants are [+SG]; all other consonants are [-SG].
➢ [±CG] = [±constricted glottis]: All sounds made with a closed glottis are [+CG]; all other are [-CG]. The glottal stop [ʔ] is [+CG].

Place of articulation features: [LABIAL]

- [LABIAL] sounds are those produced with involvement of one or both lips.
- [±round]: [LABIAL] sounds produced by protruding the lips are [+round], e.g., rounded vowels and the glide [w].

Place of articulation features: [CORONAL]

- [CORONAL] sounds are those produced with involvement of the tongue tip or blade raised.
- [±anterior]: [CORONAL] sounds produced in front of the alveopalatal region (i.e., interdentals and alveolars) are [+anterior], whereas [CORONAL] sounds produced at or behind the alveopalatal region (i.e., alveopalatals) are [-anterior].
- [±strident]: All "noisy" [CORONAL] fricatives (i.e., [s], [z], [ʃ], [ʒ], [tʃ], or [dʒ]) are [+strident], whereas the "quieter" fricatives and affricates (i.e., [θ] and [ð]) are [-strident].

Place of articulation features: [DORSAL]

- [DORSAL] sounds are those produced with involvement of the body of the tongue.
- [±high]: [DORSAL] sounds produced with the tongue body raised from a central position are [+high]; these are all vowels and velar and palatal consonants. Sounds produced with a lowered or neutral tongue body are [-high].
- [±low]: Vowels produced with the tongue body lowered from a central position are [+low]. All other vowels are [-low].

Place of articulation features: [DORSAL]

- [±back]: [DORSAL] consonants or vowels produced with the tongue body behind the palatal region are [+back]. Sounds produced with the tongue body at the palatal region are [-back].
- [±tense]: Vowels that are tense are [+tense]; vowels that are lax are [-tense].
- [±reduced]: The vowel schwa [ə] is a lax and exceptionally brief vowel and is therefore [+reduced]; all other vowels are [-reduced].

Representing sounds with features

- Let's look at tables 3.23 and 3.24 in your textbook for examples of how sounds can be represented using features (pp.80-81.

Now, back to the earlier puzzles

Arabic /al/ assimilation revisited

> Here's the rule to remind you:
>> "Assimilation of the /l/ of the Arabic definite article takes place when the initial consonant of the following noun is alveolar or alveopalatal."
> Now given what you know about features and natural classes, can you restate the rule?
> Yes. The key feature is "coronal".

French final consonant deletion revisited

> Here's the rule again:
>> "Final consonants are deleted in French at word boundary unless the following word starts with a vowel or a glide."
> What is the key feature here?
> Right. [±consonantal].

Representing rules with features

> The input to phonological rules is thus not a segment as we have been assuming until this point; rather, it is a feature matrix. The output of the rule is whatever change happens to that input feature matrix.
> For example, the French rule for final consonant deletion can now be formalized as follows:
>> [+consonantal] → Ø / ___ # [+consonantal]

Representing rules with features

> As a matter of fact, we can now reformulate all our previous rules for English phonological processes in terms of features.
> Aspiration of voiceless stops:

$$\begin{bmatrix} -syllabic \\ +consontntal \\ -sonorant \\ -continuant \\ -voice \\ -DR \end{bmatrix} \rightarrow [+SG]/\sigma \underline{\quad} \begin{bmatrix} -consontntal \\ +stress \end{bmatrix}$$

Representing rules with features

> Devoicing of liquids and glides after voiceless stops:

$$\begin{bmatrix} -syllabic \\ +sonorant \\ +voice \\ -nasal \end{bmatrix} \rightarrow [-voice]/\sigma \begin{bmatrix} -syllabic \\ +consontntal \\ -sonorant \\ -continuant \\ -voice \\ -DR \end{bmatrix} \underline{\quad}$$

Vowel nasalization

$$\begin{bmatrix} +consonantal \\ -syllabic \end{bmatrix} \rightarrow [+nasal]/\underline{\quad} \begin{bmatrix} +consonantal \\ +sonorant \\ +nasal \end{bmatrix} \sigma$$

[l] epenthesis

$$\varnothing \rightarrow [\text{+reduced}] \: / \: [\text{+lateral}] \:\underline{\hspace{1.5em}}\: \begin{bmatrix} + consonantal \\ - syllabic \end{bmatrix} \sigma$$

Syllable structure

➢ The **syllable** is a phonological unit larger than the phoneme. It must contain a **nucleus** (typically a vowel) and may also contain consonants before or/and after the nucleus.
➢ The consonants before the nucleus vowel are called the **onset** of the syllable, whereas the consonants after the vowel are referred to as the **coda** of the syllable. The nucleus and coda are also assumed to form one unit called the **rhyme**.
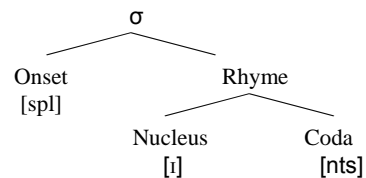
Syllable structure

➢ We may represent the syllable structure as in the following diagram:

```
              σ
          /       \
      Onset       Rhyme
                 /     \
            Nucleus    Coda
```
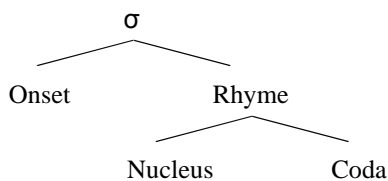
Syllable structure

➢ For example, a word such as *splints* [splɪnts] has [ɪ] as nucleus, [spl] as onset, and [nts] as coda. We can represent this syllable linearly as CCCVCCC, and hierarchically as below:

```
              σ
          /       \
      Onset       Rhyme
      [spl]      /     \
            Nucleus    Coda
              [ɪ]      [nts]
```

Syllable structure

➢ Native speakers' knowledge of syllable structure is manifest in several ways.
➢ They can count the number of syllables in a word.
➢ They know where to draw syllable boundaries.
➢ The rely on syllabification in rhyming and in games like Pig Latin.

Syllable structure

➢ All languages have syllables. The shapes of these syllables are governed by various constraints. Some universal tendencies are observable though. For example,
  (a) Syllable nuclei usually consist of one vowel.
  (b) Syllables usually begin with onsets.
  (c) Syllables often end with codas.
  (d) Onsets and codas usually consist of one consonant.
➢ Given these tendencies, the most common syllable structure in human languages is CV and CVC.

Phonotactics

➤ When languages allow consonant clusters in onset and coda positions, there are typically constraints on the kind of consonants that occur in these clusters. We call such sequential constraints on the occurrence of consonants **phonotactics**.

➤ But Languages differ in what is regarded as a permissible combination of consonants in each. English, for example, does not allow words to start with [ŋ], whereas Vietnamese does.

Phonotactics

➤ English may have up to three consonants in onset position (as in [sprej]), but Arabic does not allow that.

➤ In fact, in English, there's a further restriction in the case of a three-consonant onset that the first consonant has to be [s], the second has to be a voiceless stop (i.e. [p], [t], or [k]), and third has to be a liquid or a glide (i.e. [l], [r], [j], or [w]).

➤ Compare that with Russian onsets in the following words:
    [fslux]   "aloud"   [mgla]   "fog"

Phonotactics

➤ Another example of phonotactic constraints in English is the impossibility of words like [*btol*], where two stops occur initially.

➤ Knowledge of phonotactics is part of your subconscious knowledge of your native language.

➤ This knowledge allows native speakers to distinguish between what is a possible word in their language and what is an impossible word.

➤ This phonotactic knowledge is also the reason why native speakers syllabify words correctly.

Next class agenda

➤ Syllabic phonology

➤ Morphology: chapter 4.