LNGT0101
Introduction to Linguistics

Lecture #16
Nov 9th, 2015

Announcements

• A talk on translation by Ellen Elias-Bursać: *Translating Evidence and Interpreting Testimony at a War Crimes Tribunal: Working in a Tug-of-War* (at 7:30pm in RAJ conference room)

• Start thinking about a topic for your paper. On Wednesday, I’ll give out some general guidelines.

Announcements

• Additional session to answer any questions on the midterm or otherwise tomorrow at 4:30-5:30 in Library room 201.

• Demo for IPA symbol insertion: [http://westonruter.github.io/ipa-chart/keyboard/](http://westonruter.github.io/ipa-chart/keyboard/)

• Ambiguity question.

How many vowel sounds do you know?

Presentations

• Presentations on Wednesday on first language acquisition:
  • [http://www.theatlantic.com/international/archive/2015/10/words-mom-dad-similar-languages/409810/](http://www.theatlantic.com/international/archive/2015/10/words-mom-dad-similar-languages/409810/)

Ambiguity again!
Phonology

• Introducing phonemes and allophones.
• How to figure out if two or more sounds are separate phonemes or allophones of the same phoneme in a given language. (An algorithm for solving phonology problems).
• Doing some phonology problems (problem-solving skills)

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. Let’s look at an example.

[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”

[s] and [ʃ] in Japanese vs. English

• In English, however, the occurrence of each sound is unpredictable.
• Given [ʃʊz], which sound do you think should occur in the blank?
• Either one can, giving us two words with two different meanings:
  [ʃʊz] “shore” vs. [sʊz] “sore”

[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.
• Given [ʃimasu], and a choice of [s] and [ʃ], which sound may occur in the blank in Japanese?
• Only [ʃ]: [ʃimasu] “do”.
• Similarly, if we have [ʃan], we predict that only [s] may occur in the blank: [ʃan] “three”
• If we make the wrong choice in the blank, we get a nonsense word. Japanese cannot have [simasu] or [ʃan]. These are just impossible words in Japanese.
[t] vs. [tʰ] in English

- Given [ _ɪm], which of these two sounds can occur in the blank: [t] or [tʰ]?
- Given [ s_ɪm], which of these two sounds can occur in the blank: [t] or [tʰ]?
- Aspiration of voiceless stops is predictable by rule in English.

Phonology

- Phonology addresses questions related to the sound system of a given language. Basically:
  1. Which sounds are predictable and which sounds are unpredictable in a given language?
  2. What are the rules regulating the occurrence of predictable sounds?

Phonological knowledge is subconscious

- 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 different even when they sound the same:
  - [ɹɑɹ] ‘rider’ and [ɹɑɹ] ‘writer’

Phonemes vs. allophones

- Phonologists explain the difference by invoking a distinction between phonemes and allophones.
- A phoneme is a sound that distinguishes meaning in a language, whereas an allophone is a phonetic variant of a particular phoneme that does not affect meaning.
- Phonemes are non-predictable, whereas allophones are predictable by rule.

Minimal pairs

- Phonemes create words that differ in meaning. Hence, they are contrastive.
- But how do we know if two sounds are contrastive in a particular language?
- Answer: Minimal pairs.
- A minimal pair is two words with different meanings that are identical except for one sound that occurs in the same place in each word, e.g.,
  - seed [sid] and seat [sit]

Phonemes or allophones?

- So, bearing this in mind, let’s consider more examples from English.
- Based on the minimal pair light [laɪt] and right [raɪt], are the [l] and [r] phonemes or allophones in English?
**Phonemes or allophones?**

- How about these further minimal pairs?
  - *seat* [sit] and *sit* [sɪt]
  - *fool* [ful] and *full* [fol]
  - *sip* [sɪp] and *zip* [zɪp]
  - *leaf* [lɪf] and *leave* [lɪv]

**Phonemes or allophones?**

- How about these further minimal pairs?
  - *seat* [sit] and *sit* [sɪt] → [i] & [ɪ] are phonemes.
  - *fool* [ful] and *full* [fol] → [u] & [ʊ] are phonemes.
  - *sip* [sɪp] and *zip* [zɪp] → [s] & [z] are phonemes.
  - *leaf* [lɪf] and *leave* [lɪv] → [f] & [v] are phonemes.

**Aspiration in English**

- Now, let's consider the following (made-up) minimal pairs:
  a. tar: [tʰaɹ] vs. *[tæɹ]
  b. star: [stɹ] vs. *[sʰtɹ]
- 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 /f/.  
  *(Notice the slash, rather than the square bracket, notation.)*

**Aspiration in Thai**

- But now consider aspirated and unaspirated voiceless stops in Thai.
  - *paa* “forest”  
  - *pʰaa* “to split”  
  - *tam* “to pound”  
  - *tʰam* “to do”  
  - *kat* “to bite”  
  - *kʰat* “to interrupt”
- Are these sounds phonemic or allophonic in Thai?

**Nasal vowels in English**

- How about nasal vowels in English? Are they phonemes or allophones?
- First, let's try to find (or construct) a couple of minimal pairs:
  a. *ban* [bæn] vs. *[bæn]*
  b. *bat* [bæt] vs. *[bæt]*
- Is the contrast here phonemic or allophonic?

**Nasal vowels in French and Akan**

- Now, consider nasal vowels in French:
  - *beau* [bo] “pretty”  
  - *bon* [bɔn] “good”
- Are they phonemes or allophones?
- How about Akan, a Ghanian language?
  - *ka* “bite”  
  - *kɔ* “speak”  
  - *tu* “pull”  
  - *tʊ* “den”
Distribution: contrastive vs. complementary

- Different allophones occur in different environments: Where one of them occurs, the other doesn’t.
- We say that allophones occur in **complementary distribution**, whereas phonemes occur in **contrastive distribution**.
- And this is the key way to distinguish between a phoneme and an allophone in a given language.

Phonemes are abstract entities

- So, 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 the actual sounds that your vocal tract articulates.

Phoneme: /t/

| Allophones: [t] [tʰ] [ɾ] |

So, ...

- **Phonemes** are meaning-distinguishing sounds. They are abstract entities. They are unpredictable. They stand in contrastive distribution.
- **Allophones** are phonetic variants of the same phoneme. They are the physical sounds we say and hear. They are predictable. They stand in complementary distribution.
- Phonemes become allophones via phonological processes (e.g., aspiration, devoicing, nasalization, etc.). These processes are represented by phonological rules.

Two main questions in phonological analysis

- **First**, how do we know if two (or more) sounds in a particular language are phonemes or allophones, given a set of data from that language? For this, we follow the **step-by-step** procedure.
- **Second**, if the two sounds turn out to be allophones of the same phoneme, how do we express this fact? For this, we write a **phonological rule**.

Steps for solving phonology problems

- Given two sounds, X and Y, and a set of data in Language L, the task is to determine if X and Y are
  (a) separate phonemes in L, or
  (b) allophones of the same phoneme in L.
- To do that, we proceed methodically.
Minimal pairs?

• **Step 1:**
  See if there are any **minimal pairs** in the data where the two sounds in question are in **contrastive** distribution. If yes, then the two sounds are phonemes. If not, then proceed to step 2.

Overlapping or complementary?

• **Step 2:**
  Find out if the two sounds are in overlapping or in complementary distribution.
  - If **overlapping**, then the two sounds are most likely two different phonemes (but we cannot be sure).
  - If **complementary**, then the sounds are allophones of the same phoneme, in which case we state the phonological contexts in which each allophone occurs and then move to step 3.

Which is underlying, and which is derived?

• **Step 3:**
  Once you determine the contexts in which each sound occurs, it is time to determine which one is the **underlying** form and which one is **derived**. In most cases, the sound that appears in more phonological contexts can be taken to represent the underlying phoneme.
  - For example, in English oral vowels occur initially, finally, as well as before non-nasal consonants. Nasal vowels, by contrast, occur only before nasal consonants.

Write a rule!

• **Step 4:**
  Now, you are in a position to write a phonological rule that shows the process whereby the allophones are **derived** from the **underlying** phoneme.
  • **Note:** For this class, we’ll be content with the informal representation of phonological rules. If you want to know more about the ‘formal’ rules, please read the slides at the end of these lecture slides.

So, which form is derived from the other?

• The rule of thumb is this: The form that occurs in a larger number of phonological contexts is most likely to be the underlying form.
• The form that is restricted in its occurrence to particular contexts is most likely to be a derived form. The underlying form, thus, is typically referred to as the **elsewhere** form.
  • **Note:** A ‘larger number of contexts’ does not mean ‘a larger number of words in the data.’

Some phonology problems
Some phonology problems: Finnish

- Consider the following Finnish words:
  1. [kudot] “failures”
  2. [katot] “roofs”
  3. [kate] “cover”
  4. [kade] “envious”
  5. [madon] “of a worm”
  6. [ratas] “wheel”
  7. [maton] “of a rug”
  8. [radon] “of a track”

- Question: Are [t] and [d] two different phonemes or two allophones of the same phoneme in Finnish?

Some phonology problems: Tagalog

- Now, consider these Tagalog words:
  1. [datiŋ] “to arrive”
  2. [dami] “amount”
  3. [dumi] “dirty”
  4. [daratŋ] “will arrive”
  5. [mandurukot] “pickpocket”

- Question: Are [d] and [r] phonemes or allophones in Tagalog?

Sindhi

- Are [p], [ph], and [b] separate phonemes or different allophones of the same phoneme in Sindhi? State your evidence.

  a. [panu] “leaf”
  b. [vdu] “opportunity”
  c. [jeki] “suspicious”
  d. [jado] “dull”
  e. [doru] “door”
  f. [pando] “hood of snake”
  g. [zaru] “bottom”
  h. [kato] “sour”
  i. [badu] “run”
  j. [banu] “forest”
  k. [batu] “be safe”
  l. [jyadu] “judge”

Standard Italian

- Are [n] and [ɲ] separate phonemes or different allophones of the same phoneme in Standard Italian? State your evidence.

  a. [minta] “die”
  b. [trina] “tent”
  c. [danda] “dance”
  d. [neda] “black”
  e. [stonte] “people”
  f. [spone] “soap”
  g. [tjorgo] “I dye”
  h. [brjorgo] “I keep”
  i. [korgo] “mushroom”
  j. [tjorga] “white”
  k. [arka] “also”
  l. [lorgo] “mud”

Standard Spanish

- Are [d] and [ð] separate phonemes or different allophones of the same phoneme in Standard Spanish? State your evidence.

  a. [drama] “drama”
  b. [doloc] “pain”
  c. [dime] “tell me”
  d. [kaða] “each”
  e. [lado] “side”
  f. [oðio] “hatred”
  g. [komibda] “food”
  h. [anda] “scram”
  i. [swellda] “salary”
  j. [durai] “to last”
  k. [toldo] “curtain”
  l. [taiða] “skirt”

Russian

- Are [a] and [a] separate phonemes or different allophones of the same phoneme in Russian? State your evidence.

  a. [atom] “atom”
  b. [dva] “two”
  c. [dar] “gift”
  d. [mas] “ointment”
  e. [na’aq] “mink”
  f. [upol] “he felt”
  g. [daj] “he gave”
  h. [palcja] “stick”
  i. [stolb] “she stole”
  j. [brat] “he took”
Mokilese

• Are voiced [i, u] and voiceless [ɪ, ʊ] separate phonemes or different allophones of the same phoneme in Mokilese? State your evidence.

| a. [p̪̪̪ʃan] | "full of leaves" |
| b. [dup̪̪̪ka] | "bought" |
| c. [pi̪̪̪ɔa] | "basket" |
| d. [ki̪̪̪a] | "we two" |
| e. [sup̪̪̪ɔ] | "firewood" |
| f. [lawko̪̪̪ɔ] | "to move" |
| g. [sul̪̪̪a] | "flash" |
| h. [ka̪̪̪a] | "to throw" |
| i. [po̪̪̪i] | "to strike something" |
| j. [pə] | "water" |
| k. [p̪̪̪ʃə] | "outtrigger/support" |
| l. [bud̪̪̪a] | "to tackle" |

Next class agenda

• Language acquisition by children. Chapter 9, pp. 394-424.

The formalization procedure:
Representing phonological knowledge in formal rules

(additional slides for your reference)

Phonological rules

• Informally speaking, a phonological rule takes an underlying form as input, operates on it, and gives a derived form 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 relation to other elements in the phonological environment (e.g., before or after).
• What this rule simply says is “An input X changes to Y when 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 in rule notation?
• Well, a simple change will get us the required result:
  \( X \rightarrow Y / Z ___ \)
An example: Vowel nasalization in English vs. Scots Gaelic

- English vowel nasalization:
  "In English, vowels become nasalized before a nasal consonant."
- Formal rule: $V \rightarrow \text{[nasal]} / \text{[nasal]}$
- But now, how about vowel nasalization in Scots Gaelic, where vowels become nasalized after nasal consonants. How do we express that in rule notation?
  $V \rightarrow \text{[nasal]} / \text{[nasal]}$

Phonological rule notation

- Suppose further we want to place a certain restriction on the occurrence of the input sound. For example, that it has to occur "syllable-initially" or "at a word boundary."
- Again, we can come up with two simple notations to indicate either environment.

Phonological rule notation

- By convention, we will use "$" to indicate a syllable boundary, and "#" to indicate a word boundary.
- Now, read the following abstract rules.
  $X \rightarrow Y / $ ___
  $X \rightarrow Y / ___ $
  $X \rightarrow Y / ___ #$
- Can you figure out what each means?

Aspiration

- Let’s consider the rule for 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}] / $ ___
- Now, in which of these words does aspiration take place?
  $\text{tone, stone, maintain, intimidate}$

Challenging the aspiration rule

- But now, consider this:
  Usain Bolt runs $\text{[fæs.tə]}$ than any other human being.
- Why no aspiration here?

/l/-devoicing

- Consider now the rule for /l/ devoicing in English. Informally put, the rule says:
  "/l/ gets devoiced when following a syllable-initial voiceless stop."
- How do we represent this in phonological rule notation?
  $/l/ \rightarrow [l] / $ [voiceless stop] ___
- Now, in which of these words does /l/-devoicing take place?
  $\text{place, pile, claim, booklet, meatloaf}$
Vowel length in English

• Remember the rule for vowel length in English?
  “Vowels are lengthened before voiced consonants.”
  bad [baːd]  bat [bæt]
  leave [liːv]  leaf [liːf]
• How would the rule look like in formal notation?

Revisiting vowel nasalization

• There is no vowel nasalization in the pronunciation of the word phonetics [fənətɪks], contrary to our earlier rule:
  \( V \rightarrow [\text{nasal}] / \_\_\_\_\_ [\text{nasal}] \)
• Can you now figure out why?

Word-final devoicing

• Suppose a language has the following rule:
  “A voiced stop gets devoiced if it occurs at the end of a word.”
• How do we represent this in phonological rule notation?
  [voiced stop] \( \rightarrow [\text{voiceless}] / \_\_\_\_\_ # \)
• German Bad ‘bath’ is pronounced [baːt].

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?
• **Parentheses** will do the trick. Consider this rule. What does it say?
  \( X \rightarrow Y / \_\_\_\_\_ (Z) \)

Vowel nasalization ‘at a distance’

• Suppose a language has a rule like this one:
  “Vowels become nasalized before nasal consonants in coda position, even if there is another consonant intervening.”
• So, in such a language, the following holds:
  lam [læm]  latm [lætəm]
• How do we represent this in phonological rule notation?
  \( V \rightarrow [\text{nasal}] / \_\_\_\_ (C) [\text{nasal}] \)
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:
  
  \[ X \rightarrow Y / \_ \_ \left\{ Z \right\} \_ \_ \# \]
  
  - The above rule simply means that “X changes to Y **either** before Z or at word boundary.”

Deletion

- How about deletion rules? For these, we use the symbol **Ø** in the output of the rule (i.e., after the arrow). What does the following rule say?
  
  \[ C \rightarrow \emptyset / \_ \_ \] #

Deletion in multiple contexts

- Suppose a language has the following rule:
  “A consonant deletes if it occurs at the end of a word, unless the next word starts with a vowel.”
- How do we represent this in phonological rule notation?
  
  \[ C \rightarrow \emptyset / \_ \_ \# \]
- French: *les garçons* versus *les amis.*

Deletion in multiple contexts

- Suppose a language has the following rule:
  “Do not pronounce /r/ if it is followed by a consonant in coda position or if it is word-final.”
- How do we represent this in phonological rule notation?
  
  \[ /r/ \rightarrow \emptyset / \_ \_ \]

Epenthesis

- The **Ø** comes in handy for phonological rules that insert sounds as well. The key difference here is that the **Ø** will be in the input to the rule.
- For example, in some English dialects, consonant clusters of [l] 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* is pronounced [milak].
- In rule notation, this would be represented as:
  
  \[ \emptyset \rightarrow [ə] / [l] \_ \_ \_ \_ \ ː \]
- Predict how speakers of these dialects say *elf* and *milky*?