LING 101 • Lecture outline W Sept 13

- **Natural classes**
- **Stating allophone environments**
- **Phonological rules**

Background reading:

- *CL* Ch 3, sec 1 and Appendix

0. Course information

- Do you have questions about course material?
  - Come to **office hours**! (or make an appointment)
  - **Review** lecture outline slides and past readings
  - **"Discussion" thread** on Canvas for each topic
    - You are welcome to post questions there
    - Questions may be answered on Canvas or in lecture/recitation
    - You are welcome to answer questions asked by other students

0. Course information

- Do you qualify for **accommodations** from ARS?
  - Remember to send me, and your TA, "**instructor notifications**" through the ARS Hub portal
    → I will email everyone today to confirm that I have your notification
    → If you don't hear from me about this by tomorrow (Th) morning, please double-check that you sent an instructor notification, and contact me ASAP if there is a problem

0. Course information

- Do you qualify for **accommodations** from ARS?
  - 50% (or similar) extended test time and/or low-distraction test setting?
    → Please plan on taking your midterms and final at the ARS testing center
    → Register soon for the **first midterm**!
  - Other accommodations involving accessibility in the classroom, etc?
    → Please email me and/or your TA if you have questions or need us to change things

1. Review: Our model of lg sound structure

In our scientific model of mental grammar:

- The mental sound categories of a language are the _____ of the language
  - Write them using _____ brackets: _ **i** _

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In our scientific model of linguistic knowledge:

- The mental sound categories of a language are the **phonemes** of the language
  - Write them using slash brackets: **/ i /**
- A physical pronunciation of a phoneme is an _____ of that phoneme
  - Write them using _____ brackets: _ **i** _

1. Review: Our model of lg sound structure

In our scientific model of linguistic knowledge:

- The mental sound categories of a language are the **phonemes** of the language
  - Write them using slash brackets: **/ i /**
- A physical pronunciation of a phoneme is an **allophone** of that phoneme
  - Write them using square brackets: **[i]**
- Every phoneme has at least one allophone; some phonemes have more than one allophone

1. Review: Our model of lg sound structure

- Words (morphemes) are stored in the mental lexicon in their **phonemic representation**
- The phonetic (surface, pronounced) forms of words, containing **allophones**, are produced by the mental grammar, which applies **phonological rules** where needed

/ (*stored form of word*) / (with phonemes)
↓ Phonological rules ↓
[(*pronounced form of word*)] (with allophones)

1. Review: Our model of lg sound structure

- To analyze the phonology (grammar) of a language:
  - Propose **phonological rules** as needed

- How do we know when a rule is needed?
  - Determine whether two sounds belong to the **same phoneme** (as allophones) or to **different phonemes**
  - If one phoneme has **multiple allophones**, we need a **rule** to determine which allophone appears where

2. Allophones of a phoneme vs. two phonemes

Last time, we discussed:

- ***How can we tell*** if two phonetically different sounds belong to **different phonemes** or to the **same phoneme** in a language we are analyzing?

  → We have to **look at data** from the language we are analyzing and **make a case** for the status of the pair of sounds **in that language**

2. Allophones of a phoneme vs. two phonemes

Review from last time:

- **Step 1.** Look for a **minimal pair**
  → If we find one, …
  → If we don’t find one, …

2. Allophones of a phoneme vs. two phonemes

Review from last time:

- **Step 1.** Look for a **minimal pair**
  → If we find one, we have **separate phonemes**
  → If we don't find one, we should **go to Step 2**

- **Step 2.** Consider the **environments** where the sounds occur — are they:

  predictable (can be distinguished)? → ***allophones***
  - predictable env. also known as **complementary distribution**

  unpredictable (*not* distinguished)? → ***contrastive***

2. Allophones of a phoneme vs. two phonemes

Step 2. Consider the **environments** where the sounds occur — are they:

- **predictable** (non-overlapping)?
- **unpredictable** (overlapping)?

- If two sounds are allophones of the same phoneme, the mental grammar **chooses** which to use based on their surrounding (sound) **environment**
  - Given the environment, we can reliably **predict** which of the sounds we will see there
- So **predictable** environments are **evidence** that the mental grammar decides which sound to put where: the sounds are **allophones of the same phoneme**

2. Allophones of a phoneme vs. two phonemes

Step 2. Consider the **environments** where the sounds occur — are they:

- **predictable** (non-overlapping)?
- **unpredictable** (overlapping)?

- If two sounds belong to separate phonemes, they are **independent** of each other, so both can occur in (at least some of) the **same** environments
  - Given just the environment, we **can't predict** which of the sounds will appear there
- So **unpredictable** environments are **evidence** that the mental grammar does not determine which sound to put where: **separate phonemes**

2. Allophones of a phoneme vs. two phonemes

Step 2. Consider the **environments** where the sounds occur — are they:

- **predictable** (non-overlapping)?
- **unpredictable** (overlapping)?

- Consider this:
  If we have a **minimal pair** for two sounds,
  are the environments for those two sounds
  predictable or **unpredictable**?
  - [i] vs. [ɪ] [l**i**p] *leap* [l] __ [p] [l**ɪ**p] *lip* [l] __ [p]

2. Allophones of a phoneme vs. two phonemes

- **Step 1.** Look for a **minimal pair** → separate phonemes
- **Step 2.** Consider the **environments** where the sounds occur — are they:

  predictable (non-overlapping)? → allophones
  unpredictable (overlapping)? → separate phonemes

New for today:

- **Step 3.** If you have found that two sounds are *allophones of the same phoneme*, **state the environments** where each allophone occurs

But first, some background on **natural classes**

3. Natural classes

- Which of the sounds of English can be **aspirated**?

  [p] [t] [k]

- Why these sounds and no others?

  → These are the sounds of English that are

  _____

3. Natural classes

- Which of the sounds of English can be **aspirated**?

  [p] [t] [k]

- Why these sounds and no others?

  → These are the sounds of English that are **voiceless oral stops**

- This kind of pattern is not unusual!
  - In the languages of the world, groups of sounds *with some property or properties in common* tend to **behave as a group** in some way

3. Natural classes

- A set of sounds with some *property or properties in common* is called a **natural class**
- Data: Natural classes often **behave as a group** in native-speaker language behavior
- Model: What should we propose to account for this in our **model** of the mental grammar?

3. Natural classes

- A set of sounds with some *property or properties in common* is called a **natural class**
- Data: Natural classes often **behave as a group** in native-speaker language behavior
- Model: What should we propose to account for this in our **model** of the mental grammar?
  - Natural classes are defined by sound properties
  - So, the mental grammar **uses sound properties** to **represent** the sounds of language
    → "Phonetic" properties are **mentally relevant**!

3. Natural classes

- What does it mean to propose this?
  *The mental grammar uses **sound properties** to **represent** the sounds of language*
  - The mental grammar doesn't actually "see" a speech sound like [u] or [t]
  - Instead, it "sees" a **set of properties** that represents each sound
- In the mental grammar…

  [u] is represented as: high back round tense vowel

  [t] is represented as: voiceless alveolar oral stop
  - CL uses "features" to further formalize this concept; we won't!

4. Try it — Natural classes

- Practice: What properties can we use to **describe** each of these groups of sounds as a **single natural class**, while *excluding* other sounds as specified?

(a) [f θ s ʃ h] but not [t z v b]

(b) [p g m d ŋ t] but not [s ej w]

(c) [i ow u ɑ ej] but not [ɪ æ k m]

(d) [i ɪ] but not [æ ow ɛ ŋ ʧ]

4. Try it — Natural classes

- Practice: What properties can we use to **describe** each of these groups of sounds as a **single natural class**, while *excluding* other sounds as specified?

(a) [f θ s ʃ h] but not [t z v b]

voiceless fricatives | *it may take >1 property to describe a class*

(b) [p ɡ m d ŋ t] but not [s ej w]

stops

(c) [i ow u ɑ ej] but not [ɪ æ k m]

tense

(d) [i ɪ] but not [u ʊ æ ow ɛ ŋ ʧ]

high unrounded

5. Allophone environments as natural classes

Returning to the topic of allophones:

- **Step 3.** If you have found that two sounds are *allophones of the same phoneme*, **state the environments** where each allophone occurs

- Since putting the allophones of a phoneme in the right places is the job of the **mental grammar**
  - and the mental grammar **represents sounds** in terms of their **properties**

  → **we <u>always</u> state the environment of an allophone in terms of sound properties**

5. Allophone environments as natural classes

- Back to our Canadian Raising example…

(modified from Table 3.3 in CL, p 74)

[ʌjs]	‘ice’	[ajz]	‘eyes’
[lʌjs]	‘lice’	[lajz]	‘lies’
[tɹʌjt]	‘trite’	[tɹajd]	‘tried’
[tɹʌjp]	‘tripe’	[tɹajb]	‘tribe’
[flʌjt]	‘flight’	[flaj]	‘fly’
[lʌjk]	‘like’	[tajm]	‘time’
[nʌjf]	‘knife’	[fajv]	‘five’

Can either environment (or both) be **stated as a natural class**?

5. Allophone environments as natural classes

Can either environment be stated as a natural class?

[ʌj]	
[#	s]
[l	s]
[ʇ	t]
[ʇ	p]
[fl	t]
[l	k]
[n	f]

[aj]	
[#	z]
[l	z]
[ʇ	d]
[ʇ	b]
[fl	#]
[t	m]
[f	v]

- [ʌj] appears before [s, t, p, k, f] in this data set
  - These sounds are all **voiceless** | *this is a natural class!*

5. Allophone environments as natural classes

Can either environment be stated as a natural class?

[ʌj]	
[#	s]
[l	s]
[ʧ	t]
[ʧ	p]
[fl	t]
[l	k]
[n	f]

[aj]	
[#	z]
[l	z]
[ʧ	d]
[ʧ	b]
[fl	#]
[t	m]
[f	v]

- [aj] appears before [z, d, b, m, v, #] (# = edge of the word)
  - No shared properties (because of #)
  - But this list does **not** include any **voiceless** sounds

5. Allophone environments as natural classes

Can either environment be stated as a natural class?

[ʌj]	
[#	s]
[l	s]
[ʇɹ	t]
[tɹ	p]
[fl	t]
[l	k]
[n	f]

[aj]	
[#	z]
[l	z]
[ʇɹ	d]
[tɹ	b]
[fl	#]
[t	m]
[f	v]

- Our analysis of the environments of these diphthongs:
  - [ʌj] appears before **voiceless** sounds
  - [aj] appears **elsewhere**

5. Allophone environments as natural classes

- **Step 3.** If you have found that two sounds are *allophones of the same phoneme,* **state the environments** where each allophone occurs

  Now we can expand on this:

  - **At least one** of the two allophones should have an environment that is statable as a **natural class** using **properties** of sounds

  - If one allophone has an environment that is "wherever the other allophone *doesn't* occur", we can state its environment as **elsewhere**

6. Writing a phonological rule

- So far, we have made the following proposals to account for sound-related language behavior:
  - **Phonemes** are mental sound categories
  - One phoneme may have multiple **allophones**
  - In that case, some factor in the **environment**—described in terms of **sound properties**—determines which allophone appears
- Next: How does the **mental grammar** make sure that the correct allophones appear in the correct environments? → **Phonological rules**

6. Writing a phonological rule

- When one phoneme has multiple allophones, we write a **phonological rule** (or rules) to determine where each allophone appears
- Remember how our model works:
  - The phoneme appears in its basic form in the mental lexicon
  - When it needs to be changed into a *different* allophone, a phonological rule applies to make that adjustment
  - Phonological rules are part of the **mental grammar** of a native speaker

6. Writing a phonological rule

- How to write a phonological rule:

(1) Choose one allophone as the **basic** one

- If one allophone has the environment '**elsewhere**', pick this one as basic
- Otherwise, if one allophone has an environment that is a **more general natural class**, pick this one as basic (this is NOT about which allophone appears "more often" in the data set!)
- If *no* allophone has a more general environment, just pick any one as the basic one (here, more than one analysis is equally insightful)

6. Writing a phonological rule

(1) Choose one allophone as the **basic** one

- For Canadian Raising, which allophone is basic?

[ʌjs]	‘ice’	[ajz]	‘eyes’
[lʌjs]	‘lice’	[lajz]	‘lies’
[tɹʌjt]	‘trite’	[tɹajd]	‘tried’
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- [ʌj] appears before **voiceless** sounds
- [aj] appears **elsewhere**

6. Writing a phonological rule

(1) Choose one allophone as the **basic** one

- For Canadian Raising, which allophone is basic?

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- [ʌj] appears before **voiceless** sounds
- [aj] appears **elsewhere** ← **basic allophone**

6. Writing a phonological rule

(2) The **basic** allophone is the “name” of the phoneme (what to put inside the / /)

- This is the allophone we will get when *no* phonological rule applies — the **default** option

6. Writing a phonological rule

(2) The **basic** allophone is the "name" of the phoneme (what to put inside the / /)

- This is the allophone we will get when *no* phonological rule applies — the **default** option
- For Canadian Raising, we can now say that the phoneme that has allophones [aj] and [ʌj] is **/aj/**

6. Writing a phonological rule

(3) For each **non**-basic allophone of the phoneme, write a **phonological rule**

A phonological rule must state:

- the **segment** or **class of segments** it applies to
- the **properties** that need **changing**, in order to turn the basic form of the phoneme into the appropriate allophone
- the **environment** in which it applies

6. Writing a phonological rule

(3) For each **<u>non</u>**-basic allophone of the phoneme, write a **phonological rule**

- For Canadian Raising, we need the rule to…
  - apply to /aj/
  - change the *low* part of this diphthong to *mid*
  - apply in the environment “before a *voiceless* sound”

6. Writing a phonological rule

- Conceptually, a **phonological rule** says, “When phoneme /P/ appears in the designated context, ***change it*** into allophone [Q].”
- Reminder: It is **sound properties** like “voiced” or “nasal” that the mental grammar manipulates, ***not entire individual speech sounds*** like [m]
  - Changing [m] to [b] means ***changing*** “nasal” to “oral”, <u>not</u> replacing one sound with another
  - Therefore: Always write your phonological rule in terms of **sound properties**, even when only one sound is affected!

7. Rule notation

- Here is how we will state phonological rules in our model of mental grammar:

A → B / X _ Y

A The sound(s) affected by the rule
B The property(ies) that the rule **changes**
/ 'In the environment of'
_ Where the affected sound(s) are located with respect to the context
X Preceding context, if any
Y Following context, if any

*** **Always** state A, B, X, Y in terms of **properties** ***

7. Rule notation

- For the Canadian Raising example:
  - We haven't specifically talked about how to represent diphthongs with sound properties, since they have two parts
  - Proposal: Describe a diphthong primarily in terms of its first part (with second part in parentheses)
  - /aj/ is therefore described as:
    low central unrounded (to palatal glide) diphthong

7. Rule notation

- Rule for the Canadian Raising example:

Affected sound:		*Changed property:*		*Environment:*
low central unrounded (to palatal glide) diphthong	→	**mid**		**/ _ voiceless**

  - Describe the affected sound in enough detail to identify it
  - Indicate only the changed property (don't simply state *all* the properties of the outcome, [ʌj]—focus on the *change*)
  - Use _ to show where the affected sound is located with respect to the relevant environment

8. Some key points to remember

Why are we going through all this?

- To analyze the phonology (grammar) of a language:
  - Propose **phonological rules** as needed

- How do we know when a rule is needed?
  - Determine whether two sounds belong to the **same phoneme** (as allophones) or to **different phonemes**
  - If one phoneme has **multiple allophones**, we need a **rule** to determine which allophone appears where

8. Some key points to remember

- Our **model** of the mental grammar can **represent natural classes** *because* it represents sounds in terms of **properties**
- **Natural classes** are essential in stating allophone distributions or phonological rules
  - The **environment** of a rule is often a natural class
  - An entire class may also **undergo** a rule
- Every part of a rule is stated in terms of **properties**, even if only one sound is involved. Why?
  - → This is how the mental grammar **represents** sounds
  - → Phonological rules are part of the mental grammar