- **Practice with phonological rules**
- **Natural classes in rules**

Background preparation:

- *CL Ch 3: sec 1 and Appendix (pp 107–109)*

- **HW #3 is due**
  - Please put it in the pile on the table that is labeled with your TA's name & recitation number
  - **Make sure your recitation number is visible on your homework paper!**

    Yuhan   (10:10) —601
    Esther   (10:10) —602
    Esther   (11:15) —603
    Yuhan   (11:15) —604

0. Course information

Upcoming schedule:

- W Sept 20 → Child phonology (and implications for our model of human language)

- F Sept 22 (rec), W Sept 27 → We start a new unit
  - This material will be on Exam #2, *not Exam #1*

- M Sept 25 is a well-being day
  - HW #4 (assigned this W) due <u>W</u> Sept 27

- Recitation F Sept 29 → review for Exam #1

- Exam #1 on M Oct 2

1. Review: Same or different phonemes?

- Which are <u>strong</u> evidence that segments (phones) 1 and 2 are **allophones of the same phoneme**?

  a. There is **at least one minimal pair** for 1 and 2 in your data set

  b. There are **no minimal pairs** for 1 and 2 in your data set

  c. The **environments** where 1 vs. 2 occur are **predictable**

  d. The **environments** where 1 vs. 2 occur are **unpredictable**

1. Review: Same or different phonemes?

Step 1. Can you find one or more minimal pairs?

- What do you conclude if the answer is…

YES   →

NO   →

1. Review: Same or different phonemes?

Step 1. Can you find one or more minimal pairs?

- What do you conclude if the answer is…

YES   →   Contrast. **<u>Different</u> phonemes**.

NO   →   *(Not enough information yet. Keep going.)*

Step 2. What is the relationship between the segments' environments?

- What do you conclude if the answer is...

PREDICTABLE →

UNPREDICTABLE →

Step 2. What is the relationship between the segments' environments?

PREDICTABLE → **Allophones of the <u>same</u> phoneme**.

Non-overlapping environments. It is *predictable* from the environment which segment you get, so the mental grammar is responsible.

- Also known as <u>complementary</u> distribution; the allophones are *dividing up* the set of environments

UNPREDICTABLE → Contrast. **<u>Different</u> phonemes**.

Overlapping environments; <u>contrastive</u> distribution;   Not the job of the grammar.

- True or false: The environments of [l] and [ɾ] in this data set are **unpredictable** (overlapping; non-distinct)

[l]		[ɾ]	
ko	a	bee	a
o	ulimi	e	jato
olu	imi	effi	imbi
#	agiɾa	lagi	a
eddwa	iɾo	eddwali	o

These words are from Ganda (Bantu; Uganda)

[ɾ] is a voiced alveolar oral flap liquid

- True or false: The environments of [l] and [r] in this data set are **unpredictable** (overlapping; non-distinct)

[l]		[ɾ]	
ko	a	bee	a
o	ulimi	e	jato
olu	imi	effi	imbi
#	agiɾa	lagi	a
eddwa	iɾo	eddwali	o

- False! The environments are **predictable**

- Is this a **good** characterization of the environments?
  - [l] occurs in word-initial position, and [ɾ] occurs before a glide.

	[l]		[ɾ]
ko	a	bee	a
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2. Practice: Analyzing environments

- Is this a **good** characterization of the environments?

  - [l] occurs in word-initial position, and [ɾ] occurs before a glide. | **No!** (Do you see why not?)

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- Is this a good characterization of the environments?

  - [l] occurs before vowels.

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- Fill in the blanks:

  - [ɾ] occurs after _____ vowels. [l] occurs _____ .

[l]			[ɾ]	
ko	a		bee	a
o	ulimi		e	jato
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2. Practice: Analyzing environments

Some points to note about stating distinct environments for allophones 1 and 2:

- Think carefully about natural classes!

    - [l] and [ɾ] both occur "after vowels" in Ganda

    - But don't give up and conclude the environments are overlapping until you check whether they occur after the *same kinds* of vowels

2. Practice: Analyzing environments

Some points to note about stating distinct environments for allophones 1 and 2:

- To be able to state "1 occurs in environment X"...

  - Environment X must <u>always</u> be true for 1

  - Environment X must <u>never</u> be true for 2

  If these conditions are not met, then the environment you have stated is **not** the crucial factor that determines when allophones 1 and 2 appear — try again!

3. Practice: Phonological rules

- When one phoneme has multiple allophones, the mental grammar must contain **phonological rule**(s) to determine where each allophone appears

(1) Choose one allophone as the <u>**basic**</u> one
   -   Which allophone is basic for Ganda? Why?

(2) The <u>**basic**</u> allophone is the "name" of the phoneme

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

$$A \rightarrow B \ / \ X \_ Y$$

3. Practice: Phonological rules

- Suppose we find the following predictable distribution for two segments we are analyzing:

  - [b] occurs between vowels

  - [p] occurs elsewhere

- True or false: This is a good rule to propose

  /p/ → [b] / vowel __ vowel

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- True or false: This is a good rule to propose

  /p/ → [b] / vowel __ vowel

  - **False**. Rules must be stated in terms of **properties**!

3. Practice: Phonological rules

- **All** phonological rules should be written using properties, even when they only affect one sound

  → Why?

  - *Theory-based reason:* We have proposed that what the mental grammar refers to is not segments, but **properties**; since phonological rules are part of the mental grammar, they must refer to properties

  - But also — Using properties gives us *better insight* into phonological phenomena

- Getting started:

  /p/ → [b] / vowel __ vowel

- /p/ = voiceless bilabial stop

  - It is also oral. Should we mention this?
  - 'Oral' is *not needed* to **uniquely identify** [p] from among the sounds in our data set

- Revise rule:

  voiceless bilabial stop → [b] / vowel __ vowel

  - But how do we write the "→ [b]" part?

3. Practice: Phonological rules

- True or false: This is the best final form of our rule

  voiceless → voiced / vowel __ vowel
  bilabial   bilabial
  stop   stop

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- True or false: This is the best final form of our rule

  voiceless   →   voiced   /   vowel __ vowel
  bilabial   bilabial
  stop   stop

- **False**!

  - What **changes** when /p/ becomes [b]?
  - This change is what our rule needs to specify

- Final form of the /p/-to-[b] rule:

  voiceless bilabial stop → **voiced** / vowel __ vowel

- *Why* only write the changed property (properties)?

    - It's **not** the case that one sound is being *arbitrarily deleted and replaced* with some other random sound; instead, a minor **change** is being made to the sound

    - More evidence, coming right up

- Suppose we find three very similar rules in the same language:

  [p]-[b]   vcls bilab stop   →   voiced / vowel __ vowel

  [t]-[d]   vcls alv stop   →   voiced / vowel __ vowel

  [k]-[g]   vcls velar stop   →   voiced / vowel __ vowel

- Are these really three *separate* rules at all? Or is the *same thing* going on in each case?

4. Generalizing a rule

- Are these really three *separate* rules at all? Or is the *same thing* going on in each case?

- What's actually happening here: A general process is applying to **all voiceless stops**, making them **voiced** when they occur **between vowels**

- We can write one general rule to capture this:

  > **vcls stop → voiced / vowel __ vowel**

  - But this *only works* because rules refer to sound properties!

4. Generalizing a rule

- Suppose the same language also has this rule:

  [s]-[z] rule:

  vcls alv fricative → vcd / vowel __ high vowel

- Can this fricative rule be treated as part of the same general rule as the stops?

  General rule:

  vcls stop   → vcd / vowel __ vowel

4. Generalizing a rule

- The environments
    - General rule: ... / vowel __ vowel
    - [s]-[z] rule: ... / vowel __ high vowel

- The environment for the [s]-[z] rule is currently similar, but more specific
    - Does it have to be?
    - Check the data set: Does our [s]-[z] rule make *wrong* predictions if it says "/ vowel __ vowel"?
    - If not, we can state the [s]-[z] environment in this more general (and insightful?) form

4. Generalizing a rule

- The sounds affected by the rule
  - General rule: vcls stops
  - [s]-[z] rule: vcls alveolar fricative

- Can we state this as a single natural class with shared properties?

  [p t k] plus [s]:   ???

4. Generalizing a rule

- The sounds affected by the rule
  - General rule: vcls stops
  - [s]-[z] rule: vcls alveolar fricative

- Can we state this as a single natural class with shared properties?

  [p t k] plus [s]:   ???
  - What if we state the rule so that it affects <u>all voiceless sounds</u>?
  - As long as there are **no counterexamples** in the data set, this is an insightful approach

Our final analysis would be:

- [p]-[b], [t]-[d], [k]-[g]

  vcls stop → voiced / vowel __ vowel

- [s]-[z]

  vcls alv fric → voiced / vowel __ vowel

Generalized rule:

voiceless → voiced / vowel __ vowel

5. Summary: Rules and natural classes

- Stating rules in terms of properties:

    - highlights what **actual changes** are occurring

    - helps us identify cases with **one general rule** affecting whole **natural classes** of sounds

- Both of these advantages would be lost in a model of the mental grammar that did *not* include sound properties

Techniques to use

- **For phonology:**
  Always be as **general** as possible when you state the properties of a sound or sound class

  - This most effectively emphasizes what's important about a pattern
  - This makes it easier to find generalizations across multiple individual sounds

- <u>**Warning**</u> — This is different than **for phonetics:**
  When asked to **fully describe** a sound, be able to state **all** of its properties (see C, V phonetics slides)

5. Summary: Rules and natural classes

What properties can we use in writing rules?

- C properties (that we learned for phonetics):
    - **voicing, oral/nasal, place, (lateral/retroflex), constriction type**

- V properties (that we learned for phonetics):
    - **height, backness, rounding, tense/lax**
    - *(when relevant)* **voicing, oral/nasal**

- Other useful properties (see *CL,* Ch 2 and Ch 3):
    - **vowel** vs. **consonant**
    - **obstruent** vs. **sonorant**
    - **strident** (or **sibilant**) vs. **non-strident** (**non-sib.**)

6. For next time

Child acquisition — Phonology

- We will look at how children acquiring a native language develop their phonological grammar

- In particular: Can we test our model of the mental grammar by checking its predictions about child phonology?