- **Phonology: Sound categories in the mental grammar**

Background reading:

- *CL* Ch 3, sec 1; focus on 1.1–1.3

0. Course information

- **HW #2 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

1. The science of speech sounds

- Review: Consonant and vowel symbols
  - The better you know sound **symbols** and **properties**, the more quickly you will master **phonological rules**

[ɪf ju kn̩ ɹid ðɪs
ɹejz jɻ̩ hænd]

- Note: *Syllabic consonants* are indicated with [̩] below the consonant symbol, as in [n̩] and [ɻ̩] above
  - We're not asking you to know this, but you might see it

1. The science of speech sounds

- How can we investigate the sounds of language?
  - **Phonetics**: The **physical** articulation (and acoustics, and perception) of speech sounds
  - **Phonology**: How speech sounds are classified and modified by the **mental grammar**

- From the perspective of science:
  - Our **data** will be
    - *Phonetics* — physical aspects of sounds
    - *Phonology* — how sounds pattern
  - We will build a **model** of the mental grammar

2. When are two speech sounds “different”?

- A very important point to remember:

  Two speech sounds that are

  phonetically (physically) different

  are **NOT** always treated as

  two different **contrastive sound categories**

  in the **mental grammar** of speakers of a particular language

2. When are two speech sounds “different”?

- Are the “p”-sounds in the English words *pout* and *spout* the same sound?
  - Physically/phonetically: **no**
    (see discussion of *aspiration* in *CL* Ch 2, sec 5.5)
  - Native speakers of English: Before you took this course, what would you have said?

2. When are two speech sounds “different”?

- Speech-analysis software demo: **Hindi** vs. **English**

Hindi:	[pʰal]	[bal]	[pal]
	‘knife blade’	‘hair’	‘take care of’
English:	[pʰawt]	[bawt]	[spawt]
	‘pout’	‘bout’	‘spout’

  - Observe how these three categories are **phonetically (physically) distinct** from one another — in both languages

  - More Hindi examples are available from Peter Ladefoged’s web site for the book *Vowels & Consonants*

2. When are two speech sounds “different”?

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	‘pout’	‘bout’	‘spout’

- Both lgs **use** the three phonetically distinct sounds
- *But:* The way these sounds are **classified by the mental grammar** is **different** in the two languages
  - In contrast vs. predictable — now we’ll look at each case

3. Sounds in contrast

- Every language has an inventory of speech sounds that are **in contrast**
  - This means: Native speaker behavior shows that they are treated as different categories in the speakers' mental grammar

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- A mental sound category is called a **phoneme**
  - Note: it's not "phenome"; ***phone*** = 'sound'

contrasting sounds = separate mental categories
= separate **phonemes**

3. Sounds in contrast

- If two sounds are **in contrast**, we can often find a **minimal pair** of words for those two sounds (see *CL* Ch 3, sec 1.2)

  A **minimal pair** consists of:

  - **two words** that
  - **differ** in only **one sound** and
  - are otherwise **identical** (including the *order* of the sounds in the word)

3. Sounds in contrast

- A **minimal pair** consists of:
  - **two words** that
  - **differ** in only **one sound** and
  - are otherwise **identical** (including the *order* of the sounds in the word)
- *Try it:* Is each pair of words below a minimal pair? If so, what sounds does it show to be in contrast?

(a) *Sue, zoo*

(b) *leap, lip*

(c) *I've, vie*

(d) *boat, both*

Hint: **Transcribe** these words (in IPA) to analyze them

3. Sounds in contrast

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(a) *Sue, zoo*
[su] [zu]

(b) *leap, lip*
[lip] [lɪp]

(c) *I've, vie*
[ajv] [vaj]

(d) *boat, both*
[bowt] [bowθ]

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(b) *leap, lip*

[lip] [lɪp]

(c) *I've, vie*

~~[ajv] [vaj]~~ ×

(d) *boat, both*

[bowt] [bowθ]

3. Sounds in contrast

- If two sounds are **in contrast** in a language, then they ***must*** belong to **different mental categories**
  - A speaker couldn't use two sounds to *distinguish* words if the mental grammar didn't treat them as *distinct* categories

3. Sounds in contrast

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- Data: If I say [lip] and [lɪp], an English speaker knows those two words mean different things (and which is which)

3. Sounds in contrast

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- Data: If I say [lip] and [lɪp], an English speaker knows those two words mean different things (and which is which)

- Our model of mental grammar: We propose that the mental grammar of an English speaker classifies /i/ and /ɪ/ as two *different* categories
  = two *different* **phonemes**
  and can use them to distinguish between words

3. Sounds in contrast

- *Try it:* Are [p^h] [b] [p] in contrast in Hindi?
  - How should our model reflect the status of these consonants with respect to **phonemes** in Hindi?

Hindi:	[p^hal]	[bal]	[pal]
	‘knife blade’	‘hair’	‘take care of’

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Hindi: [p^hal] [bal] [pal]

‘knife blade’ ‘hair’ ‘take care of’

- These three sounds are *all* **in contrast** in Hindi
  - Data: **Minimal pairs** observed here for

[p^h]/[b] [p^h]/[p] [b]/[p]

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Hindi:	[p^hal]	[bal]	[pal]
	‘knife blade’	‘hair’	‘take care of’

- These three sounds are all **in contrast** in Hindi
  - Data: **Minimal pairs** [p^h]/[b], [p^h]/[p], [b]/[p]
  - Model: Because they are all in contrast, they must all be **separate phonemes** in Hindi

4. “Same” and “different” sounds again

- There is a sense in which [p] and [p^h] *are* “the same” to a native English speaker, because they belong to the **same phoneme**
  - There is one **mental sound category** /p/
  - It is *pronounced* as [p] in some contexts and [p^h] in others (more on this idea in a minute)

- When people think *consciously* about sounds, they tend to think at the phoneme level
  - Data: Many English speakers report that these two sounds are “the same”

4. “Same” and “different” sounds again

- What we have seen:
  - A Hindi speaker hears [p] and [p^h] as “different”; we propose they belong to **different phonemes** in Hindi
  - Many English speakers hear [p] and [p^h] as “the same”; we propose they belong to the **same phoneme** in Eng.
- Your phonology controls your brain!
  (that is, it influences your speech perception)
  - The phonological system of your **mental grammar** has a big effect on how you mentally categorize a phonetic/physical speech sound

4. “Same” and “different” sounds again

- Many people find it ***hard to believe*** that…
  - two sounds that belong to the **same** phoneme for them (“the same sound”) could *possibly* be **separate** phonemes (“different sounds”) in another language
  - two sounds that are **separate** phonemes for them (“different sounds”) could *possibly* belong to the **same** phoneme (“the same sound”) in another language

→ Evidence for **mental grammar**!

4. “Same” and “different” sounds again

- Watch the video “German Coast Guard - Lost in Translation” (YouTube, 0:40 sec)
  - What happened?

  - What do we conclude about mental grammar?

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    English speaker said *sinking*

    German speaker understood this as *thinking*

  - What we conclude about mental grammar:
    - Which language has [s] and [θ] belonging to **different** phonemes?
    - Which language has [s] and [θ] **not** belonging to different phonemes?

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  - What we conclude about mental grammar:
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    - Which language has [s] and [θ] **not** belonging to different phonemes? | German

5. Phonemes and allophones

In our model of mental grammar, we propose:

- **phoneme** → **mental** sound category **(/ /)**
- **allophone** → **physical** realization of a phoneme **([ ])**

5. Phonemes and allophones

- **phoneme** → **mental** sound category **(/ /)**
- **allophone** → **physical** realization of a phoneme **([ ])**
- Some phonemes have ***multiple*** allophones
  (see more examples from English in *CL* Ch 3, sec 1.1 & 1.3)

Hindi:

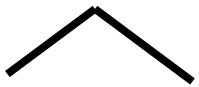
/ p / / p^h /

| |

[p] [p^h]

English:

/ p /



[p] [p^h]

phonemes

allophones

5. Phonemes and allophones

In our model of mental grammar, we propose:

- Words (morphemes) are stored in the mental lexicon in their **phonemic representation**
  - What this means: Every speech sound in the word (morpheme) is stored in terms of its mental sound category

5. Phonemes and allophones

In our model of mental grammar, we propose:

- Words (morphemes) are stored in the mental lexicon in their **phonemic representation**

- The phonetic/surface/pronounced forms of words are produced by the **mental grammar**, which applies **phonological rules** as needed
  - When a phoneme has *more than one* allophone, phonological rules determine *which one appears*

  → More about rules in the next lecture

6. Determining the status of two sounds

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

- **Important:** Just because two sounds do, or don't, belong to the same phoneme in a language you know does NOT guarantee that all languages will classify them the same way
  - 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**

6. Determining the status of two sounds

Overview of our analysis procedure (more next class)

- **Step 1.** Look for a **minimal pair**
- **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***

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

7. What "predictable environments" look like

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

- **predictable** (can be distinguished)?
- **unpredictable** (*not* distinguished)?

- 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**

7. What “predictable environments” look like

- **Where should we look** for predictable environments? These are useful to examine:
  - preceding context (what occurs right before?)
  - following context (what occurs right after?)
  - (for vowels) other nearby vowels
  - preceding & following contexts together

7. What “predictable environments” look like

- Try it: “Canadian Raising” example
  (modified from Table 3.3 in CL, p 74)

  Examine the diphthongs [ʌj] and [aj] in the data set (next slide)

  - Are their environments **predictable**, or **unpredictable**?

7. What "predictable environments" look like

- Try it: "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'

  - Environments **predictable** or **unpredictable**?

7. What “predictable environments” look like

- Try this **“T-chart” format** to find each sound’s environment
  - Write each word in the chart to **line up** the sounds occurring *before* and *after* the sound we’re looking at
  - # indicates the edge of a word—don’t forget these!

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

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

7. What “predictable environments” look like

- Does looking at the **preceding environment** help us predict whether [ʌj] or [aj] will appear?

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

[aj]	
[#	z]
[l	z]
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[t	m]
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- Does looking at the **preceding environment** help us predict whether [ʌj] or [aj] will appear?

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

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

- **No** — the preceding environments are **not distinct**
- [l], [ɹ], and # occur before ***both*** [ʌj] and [aj]

7. What “predictable environments” look like

- Does looking at the **following environment** help us predict whether [ʌj] or [aj] will appear?

[ʌj]	
[#	s]
[l	s]
[t ɹ	t]
[t ɹ	p]
[f l	t]
[l	k]
[n	f]

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

7. What "predictable environments" look like

- Does looking at the **following environment** help us predict whether [ʌj] or [aj] will appear?

[ʌj]	
[#	s]
[l	s]
[t ɹ	t]
[t ɹ	p]
[f l	t]
[l	k]
[n	f]

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

  - **Yes** — [ʌj] only appears before a **voiceless** sound
  - [aj] appears **elsewhere** (before voiced sounds or #)

7. What "predictable environments" look like

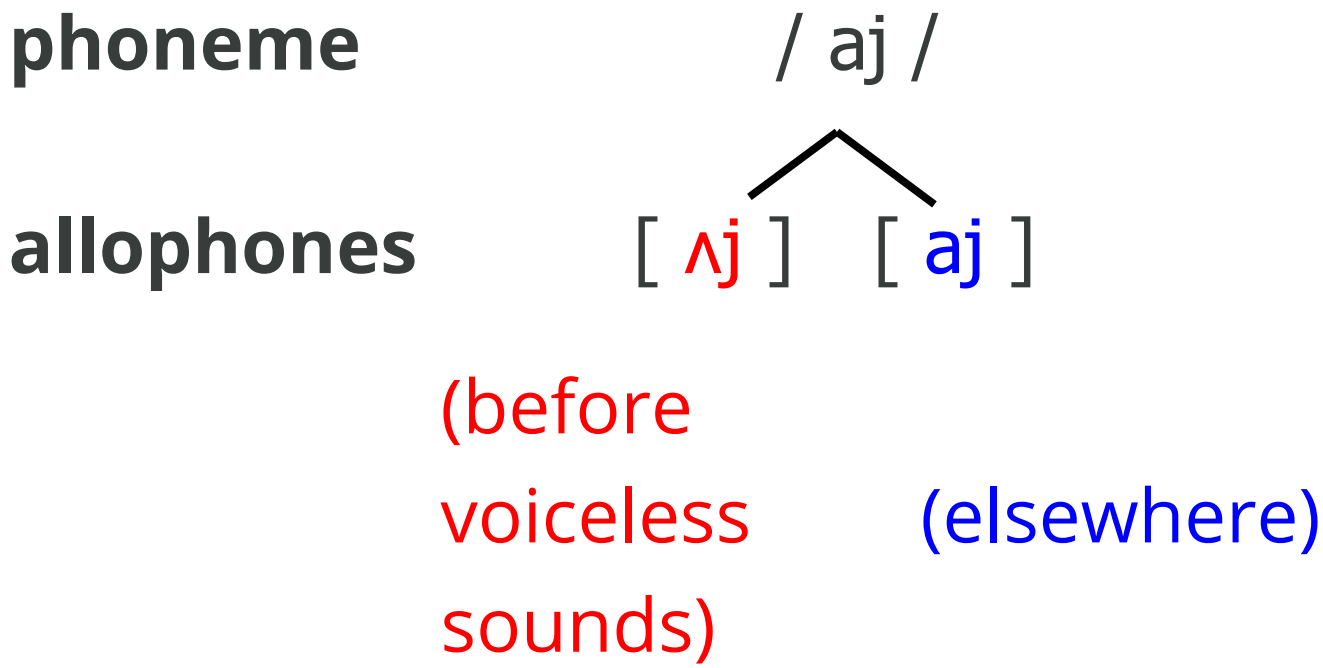
- The environments of [ʌj] vs. [aj] are predictable

- **Predictable** environments are **evidence** that the mental grammar decides which sound to put where: the sounds are **allophones of the same phoneme**
  - Predictable environments are also known as: non-overlapping environments, complementary distribution

- If the environments of two sounds are **predictable**, then by definition, the two sounds are ***not*** **in contrast** — they can *never* be used to distinguish two words

7. What “predictable environments” look like

- Our analysis of the mental grammar of a speaker of this variety of English will look like this:



8. For next time

- Prepare: Do the assigned reading
  - Recommended: Review the reading due today
- Next time, we will
  - Practice more with **identifying** predictable environments
  - Learn how to **describe** environments and rule undergoers using **phonetic properties**
  - Learn how to **propose phonological rules** for our model of the mental grammar