Week 1: Introduction, phonemes

Readings: Hayes (APS reader) Chapter 1 (for review) and Chapter 2
Homework: Homework 1 will be due on Wed. April 4/12 before lecture (there is a typo on the syllabus).

I. Introduction

1. *How many sounds are the following words made up of? What are they? Are they all the same sounds just in a different order?*

lips	**slip**	**spill**	**pills**	**lisp**

2. *Speaker knowledge of phonology is unconscious/tacit/ (cognitive knowledge)*

- What does it mean to "know" English phonology?
- Phonologists are scientists: they arrive at hypotheses about sounds systems, by observing the data, and then test hypotheses by seeking additional data that allow us to test the predictions.

3. *Phonological questions/hypotheses suggested by 'lips' vs. 'slip' data*

- When do speakers use "light" vs. "dark" *l*'s, or aspirated vs. unaspirated stops?
- Can these conditions be generalized to a larger class of sounds:
- Are the patterns unique to English, are they shared by all languages (universal), or just some languages?

II. Phonetics vs. phonology

4. *What is phonetics? (What did you learn in Ling 103?)*

- Articulatory phonetics: how speech sounds are produced in the vocal tract
- Acoustic phonetics: how speech sounds are transmitted (through the air)
- Speech perception: how sounds are perceived and interpreted by listeners

5. *What is phonology?*

- Part of grammar that governs the sounds patterns of a language
- Grammar: Set of rules, principles, constraints that produce only the possible structures of the language
- The systematic way that sounds are organized and vary both within a single language and across languages.

i. Phoneme inventory:

Which sounds are possible in English?		
a. [f] labio-dental fricative	c. [ɣ] velar fricative	e. [t] alveolar stop
b. [g] velar stop	d. [m] bilabial nasal	f. [l] lateral approximant

ii. Distribution of sounds:

Which words are possible in English?		
a. *hlep*	c. *plask*	*e. bick*
b. *ptari*	d. *tlam*	*f. bnick*

iii. What are the principles, constraints, or rules that govern the distribution of sounds

Which words are possible in English?		
Syntax	Morphology	Phonology
a. *a good dog*	c. *dog+s(pl.)*	e. *help*
b. **a dog good*	d. **s+dog*	f. **hlep*

6. Who needs phonology?

- Understanding the systematic variation in the realization of sounds is one of the primary goals of phonology: Is the /p/ in *pills* and *spill* the same sound? [p] vs. [p^h]

This is interesting and relevant because:

- Phonology interacts with other components of the grammar: syntax, morphology, phonetics, etc.
- The phonology is part of the implicit (unconscious) grammatical knowledge that you have of your language
- Child language acquisition: How do you know that *hlep* is not a possible word.
- Second language acquisition:
- Computer speech recognition, speech synthesis:

III. Phonemic Analysis

7. Why would most English speakers say that "lips", "slip", "spill", "pills", and "lisp" comprise the "same sounds" in different orders?

- Native speakers feel that phonemes are "the same sound".

*8. Basic terminology that you **MUST KNOW** – key concept of entire course!*

- **Phoneme**: "basic sound unit of a language" [abstract mental/psychological representation]
- **Allophone**: "phonetic variant(s) of a phoneme" [physical instantiation (production/perception) of the mental representation]
- **Phonological rules:** generalized statements defining the conditions for the appearance of the particular phonetic realization (allophones) of a phoneme

9. Some formal conventions

- / / **:** Slant brackets enclose phonemic representations: /pɪl/ 'pill'
- [ ] : Square brackets enclose phonetic forms, allophones: [p^hɪ̚ɬ]
- x → y / __ z : "x is realized as y in the environment before "z"
- x → y / z __ : "x is realized as y in the environment after "z"

*10. **Phonemes- sounds that contrast**: a basic speech sound that is distinctive (from Greek "phoni"=sound)*

- Speech sounds are meaningless.
- Phoneme: the smallest sound unit in a language that is capable of conveying a distinction in meaning.
- English voicing distinction:
  - i. /p/ and /b/ **are distinctive** in English, therefore two different phonemes: capable of conveying a difference in meaning.
  - **ii.** Other ways to say the same thing: /p/ and /b/ **contrast**, /p/ and /b/ **are in contrast**, /p/ and /b/ **are phonemically distinct**

English minimal pairs (written between //)

/p/ vs. /b/		/t/ vs. /d/		/k/ vs. /d/	
a. /pɪl/	*pill*	c. /tɪp/	*tip*	e. /kot/	*coat*
b. /bɪl/	*bill*	d. /dɪp/	*dip*	f. /got/	*goat*

- Korean aspiration: Aspirated and unaspirated stops are distinctive in Korean:
  - i. [p^h] and [p] are distinctive in Korean; they are **two different phonemes** /p/ and /p^h/

Korean aspirated vs. unaspirated consonant phonemes (written between //)			
Aspirated		Unaspirated	
a. /p^{h}ul/	*grass*	d. /pul/	*fire*
b. /t^{h}əlda/	*shake off*	e. /təlda/	*reduce*
c. /k^{h}ɨn/	*big*	f. /kɨn/	*a pound*

11. ***Minimal pairs****: a pair of words that differs in exactly one sound in the same place in the word and have different means*

- English: /pɪl/ and /bɪl/, *pill* and *Bill* have different meanings
- Korean: /p^{h}ul/ and /pul/, *grass* and *fire* have different meanings.

12. ***Minimal sets****: The term can generalize to as many minimally distinctive words you can find*

English minimal triplet

/p/		/t/		/k/	
a. /taɪm/	*time*	c. /daɪm/	*dime*	e. /laɪm/	*lime*

English minimal set of 13 [14 in my dialect]

a. /pɪn/	*pin*	e. /dɪn/	*din*	i. /ʃɪn/	*shin*	m. /θɪn/	*thin*
b. /tɪn/	*tin*	f. /tʃɪn/	*chin*	j. /lɪn/	*Lynn*	**n. /mɪn/ my dialect**	***men***
c. /kɪn/	*kin*	g. /dʒɪn/	*gin*	k. /wɪn/	*win*		
d. /bɪn/	*bin*	h. /sɪn/	*sin*	l. /fɪn/	*fin*		

13. ***Allophones- sounds that do not contrast****: contextually determined variants of phonemes*

- Two kinds of voiceless stops in English
  - **i.** Aspirated - [p^{h}, t^{h}, k^{h}]: word-initially, beginning of stressed syllable
  - **ii.** Unaspirated stops – [p, t, k]: elsewhere

14. ***Complementary distribution – two sounds that never occur in the same environment*** (Clark Kent and Superman)*: Aspirated and unaspirated stops are restricted to mutually exclusive environments (contexts)*

iii. Sounds in complementary distribution are considered by speakers to be the "same sound." English speakers are not consciously aware of the difference
iv. [p^{h}] and [p] are not distinctive in English; they are **allophones** of the **phoneme** /p/

English allophones of voiceless stops (written between [])			
Aspirated		Unaspirated	
a. [p^{h}ɪn]	*pin*	d. [spɪn]	*spin*
b. [t^{h}oʊn]	*tone*	e. [stoʊn]	*stone*
c. [k^{h}eɪt]	*Kate*	f. [skeɪt]	*skate*

v. The rule that governs the distribution of aspirated and unaspirated stops is language specific
vi. The distribution holds for all words of English
vii. Rule may be transferred to foreign languages

English accent in Spanish and Italian

Italian		Spanish		English accented Spanish or Italian
a. [tu]	*tu 'you' sg, informal*	b. [tu]	*tu 'you'sg, informal*	c. [t^hu]

- English Learners of Korean have to learn that /p/ and /p^h/ are different sounds in Korean.
- English speakers must learn to suppress the aspiration rule if they speak Korean.

English speakers need to learn the Korean contrast.

English		Korean	
a. [p^hɪɬ]	*pill*	c. [p^hul]	*grass*
b. [spɪɬ]	*spill*	d. [pul]	*fire*

15. ***A phoneme is an abstract psychological category/representation*** *[with various contextual realizations, allophones]*

- **Phonemes**: Two sounds that are perceived by listener as being clearly different from each other:

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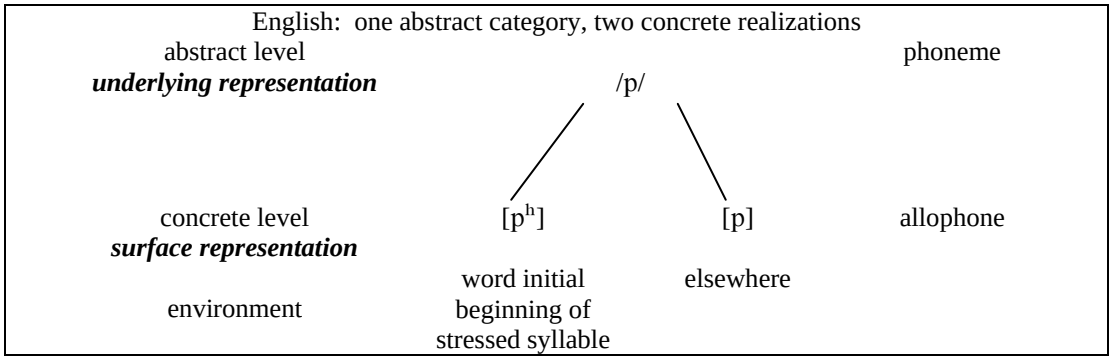
	English two abstract categories		
abstract level	/p/	/b/	phoneme
	/pɪn/	/bɪn/	
	pin	*bin*	

	Korean: two abstract categories		
abstract level	/p^h/	/p/	phoneme
	/p^hul/	/pul/	
	grass	*fire*	

- **Allophones**: The difference is not real to speakers: two sounds belonging to the same phoneme (abstract psychological category) are perceived as being the same, even thought they are quite distinct physically:
  - **i.** English [p^h] and [p] are physically just as different as /p/ and /b/.
  - **ii.** The difference between /p/ and /b/ is psychologically real to native speakers of English.
  - **iii.** The difference between [p^h] and [p] is not psychologically real

16. Two levels of representation: abstract leve – phoneme; concrete level = allophon or surface realization

English: one abstract category, two concrete realizations



Korean: two abstract categories, two concrete realizations

abstract level			phoneme
underlying representation	/p^h/	/p/	
	|	|	
concrete level	[p^h]	[p]	allophone
surface representation			
environment	word initial beginning of stressed syllable	elsewhere	

17. Phonetic vs. phonemic transcription

Phonetic (detailed) transcription []		Phonemic transcription //	
a. [p^hɪn]	*pin*	d. /pɪn/	*pin*
b. [t^hoʊn]	*tone*	e. /toʊn/	*tone*
c. [k^heɪt]	*Kate*	f. /keɪt/	*Kate*

IV. Using local environments to determine complementary distribution

18. English [n] and [n̪]

- Distribution: Identify the preceding and following sounds
  i. Do they contrast? [e.g. minimal/near minimal pairs]

English [n] and [n̪]

alveolar		dental	
a. [nó]	know	e. [tɛ́n̪θ]	*tenth*
b. [ənóɪ]	*annoy*	f. [mʌ́n̪θ]	*month*
c. [ʌ́njən]	*onion*	g. [pǽn̪θɚ]	*panther*
d. [nʌ́n]	*nun*	h. [kɹəsǽn̪θəməm]	*chrysanthemum*

- American English phonemes = 24 C, 16 V ; English allophones = thousands - All English phonemes have allophonic variation; taking this variation into account we would find not several speech sounds [as we do with phonemes], but thousands of sounds
- Complementary distribution is just a description of the distribution
- A phonological analysis is a psychological model of what a speaker knows about speech categories, including what sounds occur where.

V. Phonological Rules

19. Phonological rules: generalizations about the patterning of allophones

- Give each rule a name, that describes the rule [not "rule 1, rule 2, etc.]

- Dentalization: "The phoneme /d/ must be realized as [d̪] before the /θ/".
  Formalization: /n/ → [n̪] / __ θ

20. Phonological derivation: Mapping between phonemes(underlying representation) and allophones (surface realization)

Underlying phoneme → Rule application → Surface allophone

Underlying Representation	/tɛ́nθ/	/nɔ́/
rule application	n̩	**n/a**
Surface allophone	[tɛ́n̩θ]	[nɔ́]

- Underlying form is the prototype

- The sound to the left of the arrow is the underlying phoneme, to the right of the arrow is the surface allophone:
  - **i.** x→ y / ___ z
  - **ii.** underlying form → surface allophone / environment

21. Whole classes of sounds, not just single sounds, are often the target of phonological rules.

- "[]" square brackets contain the phonetic properties (features, Ch. 4); essentially means "and"
- Aspiration: "The phoneme /p/ must be realized as [p^h] in word initial position": /pil/ → [p^hɪl]
  Formalization: /p/ → [p^h] / [$_{word}$___
- Aspiration: "Consonants that are stops and are voiceless must be realized as aspirated in word initial position"
  $\begin{bmatrix} \text{consonant} \\ \text{stop} \\ \text{voiceless} \end{bmatrix} \rightarrow [\text{aspirated}] \ / \ [_{word}$___

  "if it is a consonant, and it is a stop, and it is voiceless, then it must be realized as aspirated in the environment word initial".

- "+" or "-" indicate whether a property is present or not

  $\begin{bmatrix} +\text{consonant} \\ +\text{stop} \\ -\text{voice} \end{bmatrix} \rightarrow [+\text{aspirated}] \ / \ [_{word}$___

22. Rules are language specific, and must hold for the entire language

- Korean, Spanish and Italian do not have aspiration this rule.
- Not a principle of speech articulation
- Rules are part of the implicit/unconscious knowledge of native language, that you learned as a child.

VI. More English Allophonic Variation

23. English [l], [ɬ], [ɬ̪], [l͡l̥]

- [l] = alveolar lateral approximant
- [ɬ] - velarized, high back tongue body position
- [ɬ̪] - velarized but also dental, instead of alveolar
- [l͡l̥] - [l] that starts out devoiced and ends voiced

English [l], [ɬ], [ɬ̪], [l̥͡l],

words with [ɬ]		words with [l̥͡l]		words with [ɬ̪]		word with [l]	
[fáɪɬ]	*fail*	[sl̥͡láɪt]	*slight*	[wɛ́ɬ̪θ]	*wealth*	[lísən]	*listen*
[fúɬ]	*ful*	[fl̥͡láɪt]	*flight*	[hɛ́ɬ̪θ]	*health*	[lúz]	*lose*
[ɑ́ɬ]	*all*	[pl̥͡láʊ]	*plow*	[fíɬ̪θi]	*filthy*	[əláʊ]	*allow*
[bɑ́ɬ]	*ball*	[kl̥͡lɪŋ]	*cling*	[stɛ́ɬ̪θ]	*stealth*	[əglɔ́]	*aglow*
[fɛ́ɬ]	*fell*	[dɪɪsəpl̥͡lɪn]	*discipline*			[blɛ́nd]	*blend*
[fĩɬ]	*feel*						

24. Rules and derivations for English [l], [ɬ], [ɬ̪], [l̥͡l]

- /l/ Velarization: "An alveolar lateral approximant must be realized as velar when word final"
  /l/ → [ɬ] / ___]$_{word}$
- /l/ Dentalization: "An alveolar lateral approximant must be realized as dental when followed by /θ/
  /l/ → [ɬ̪] / ___ θ
- /l/ Devoicing: " An alveolar lateral approximant must start voiceless and end voiced when preceded by a voiceless consonant"
  /l/ → [l̥͡l] / $\begin{bmatrix}\text{+consonant}\\\text{-voice}\end{bmatrix}$ —

25. Derivations: used to illustrate the application of rules (given as evidence of validity of the rule)

- Give each rule a name
- Select examples so that all rules are illustrated, but don't give redundant examples.

Derivations

fool /fúl/	*plow* /pláu/	*filthy* /fĩlθi/	*lose* /lúz/	Underlying form
				application of phonological rules
---	pl̥͡láʊ	---	---	/l/ Devoicing
---	---	fíɬ̪θi	---	/l/ Dentalization
fúɬ	---	n/a	---	/l/ Velarization
[fúɬ]	[pl̥͡láʊ]	[fíɬ̪θi]	[lúz]	surface (phonetic) representation

26. Phonetic motivation?

- Assimilation (co-articulation): devoicing, dentalization
- Velarization: not clear (better cues for /l/ on preceding vowel)
- Maybe no clear phonetic motivation (could be result of series of historical changes).

VII. Phonemes in other languages

27. Phonemes and phonological rules are language specific

- English Tapping rule
  /t/ → [ɾ] / ____ $\begin{bmatrix}\text{+vowel}\\\text{-stress}\end{bmatrix}$

- Spanish /t/ and /ɾ/ are contrastive (two phonemes); no Tapping or Aspiration rules in Spanish.
    i. Phonemic distinction: /t/ and /ɾ/ are minimal pairs; there is a meaning difference

- English speakers of Spanish need to learn to not applying Tapping or Aspiration in order to reduce accent.

English /t/: [t^h], [t], [ɾ]

	tone	*stone*	*city*	
	/tóʊn/	/stóʊn/	/síti/	UR
	t^hóʊn	------	--------	Aspiration
	------	------	síɾi	Tapping
	[t^hóʊn]	[stóʊn]	[síɾi]	SR

Spanish: /t/ and /ɾ/ are in contrast (distinctive)

tono	'tone'	*está*	'it is'	*pata*	'foot'{animal}	*para*	'for'	
/tóno/		/está/		/páta/		/páɾa/		UR
[tóno]		[está]		[páta]		/páɾa/		SR

- *Spanish Spirantization rule*

/d/ → [ð] / [+vowel]___

Spanish /d/: [d], [ð]

dedo	'finger'	*dado*	'given'	*usted*	'you' (formal)	*donde*	'where'	
/dédo/		/dádo/		/ustéd/		/dónde/		UR
déðo		dáðo		ustéð		------		Spirantization
[déðo]		[dáðo]		[ustéð]		/dónde/		SR

English /d/ and /ð/ are distinctive

den	*then*	
/dɛ́n/	/ðɛ́n/	UR
[dɛ́n]	[ðɛ́n]	SR

- Spanish and English have some of the same sounds, [d, ð, t, ɾ] however the phonetic space is grouped differently
    i. Spanish: [d] and [ð] are allophones of same phoneme, /d/
    ii. English: /d/ and /ð/ are separate phonemes (can convey meaning distinction)
    iii. Spanish: /t/ and /ɾ/ are separate phonemes
    iv. English: [t] and [ɾ] are allophones of /t/

28. Natural class: complete set of sounds in a given language that share the same value for a feature or set of features.

- [p, t, k] – [+stop, -voiced] – natural class in English because these are all of the consonants that have these properties
- [m, n] – [+nasal], not a natural class in English because does not include all nasals – [m, n, ŋ] contains all nasals

- Most phonological rules target natural classes; you try to identify the natural class when writing rules so that you can write the most general rule possible.

- English Aspiration Rule
  /p/ → [p^h] / [$_{word}$ _____
  /t/ → [t^h] / [$_{word}$ _____
  /k/ → [k^h] / [$_{word}$ _____

$\begin{bmatrix} +\text{stop} \\ -\text{voice} \end{bmatrix} \rightarrow$ [+aspirated]/ [$_{\text{word}}$ ____

29. Natural class exercise

- Phonemes of Hawaiian: /a, e, i, o, u, p, k,ʔ, m, n, l, h, w/; /w/ has allophones [v, β, w]
- It helps to make a phonetic chart of all of the sounds

	front [-round]	central [-round]	back [+round]
high	i		u
mid	e		o
low		a	

		bilabial	labio-dental	dental/alveolar	velar	glottal
stops	voiceless	p			k	ʔ
fricatives	voiceless					h
	voiced	β	v			
nasals		m		n		
approximants	lateral			l		
	central	w				

- Which of the following are natural classes in Hawaiian
  i. [h, ʔ]
  ii. [k, ʔ]
  iii. [p, m, w]
  iv. [l, w]
  v. [i, e, a]
  vi. [u, o, a, i]

- Is [p, k, ʔ] a natural class in English?