

Week 2: Rule ordering, phonetic similarity, psychological reality of phonemes, contour segments, free variation

Readings: Hayes (APS reader) Chapter 3

Homework: Homework 2 will be handed out Wednesday, and will be due on Wednesday 4/19.

I. More on Natural Classes

1. *Language sounds fall into natural classes according to their articulatory and/or acoustic properties: +/-voice, +/- high [these properties are features – subject of Chapter 4].*

Natural class: A group of language sounds that share a phonetic feature or (usually small) set of features that no other sounds in the language share [at the phonetic level].

- Example we have seen

Papago Palatalization: $\left[\begin{array}{l} +\text{stop} \\ +\text{alveolar} \end{array} \right] \rightarrow \left[\begin{array}{l} +\text{stop} \\ +\text{delayed release} \\ +\text{alveopalatal} \end{array} \right] / _ \left[\begin{array}{l} +\text{vowel} \\ +\text{high} \end{array} \right]$

- | | |
|---------------------------------|--|
| 1. [bᶦd͡ʒim] <i>turn around</i> | 2. [t͡ʃikid] <i>vaccinate</i> |
| 3. [d͡ʒiwid] <i>soil, earth</i> | 4. [t͡ʃihaŋ] <i>hire</i> |
| 5. [d͡ʒú:ki] <i>rain</i> | 6. [ki:t͡ʃud] <i>build a house for</i> |
| 7. [d͡ʒik] <i>taste</i> | 8. [t͡ʃuku] <i>become black</i> |

Involves three natural classes = [t, d], [t͡ʃ, d͡ʒ], [i, i:, i, i:, u, u:]

- Where natural classes operate
 - Input segments: Papago alveolar stops [t, d]
 - Output segments: Papago alveopalatal affricates [t͡ʃ, d͡ʒ]
 - Trigger segments (environment): Papago high vowels [i, i:, i, i:, u, u:]
- Why do we not say that “Papago changes alveopalatal affricates to alveolar stops before non-high vowels?”
- In general, we expect phonological rules to have “natural motivations”.
 - Perceptual motivation: Papago – High vowels have a narrow air channel.
 - Obvious phonetic assimilations:
 - English Dentalization: /d/ → [d̪] / __ θ
 - Cross-linguistic frequency:
 - Elsewhere environments: other things being equal, we would say a segment or set of segments in a large/diverse set of environments would most closely resemble the input form.

II. Rule Interactions

2. *Sometimes independently needed rules interact in such that one rule has to apply to the output of another in order to correctly account for the ultimate phonetic output.[assembly line phonology].*

- The input to all the phonological rules we have seen so far has been the phonemic/underlying form
- A phonetic form can be the input to a phonological rule in the case of rule ordering.

- English allophonic variation of /l/
 - [l] = alveolar lateral approximant
 - [ɫ] - velarized, high back tongue body position, but still alveolar
 - [ɬ] – dental lateral approximant
- /l/ Dentalization: “An alveolar lateral approximant must be realized as dental when followed by /θ/
 /l/ → [ɬ] / ___ θ
- /l/ Velarization: “An alveolar lateral approximant must be realized as velar when word final”
 /l/ → [ɫ] / ___]word
- Imagine that phonology is an assembly line.
- Phonology takes the phonemic forms, applies phonological rules in a particular order, and outputs phonetic forms.

3. Rule ordering: English Tapping and /aɪ/ Raising

- English Tapping rule

/t/ → [ɾ] / ___ $\left[\begin{array}{l} +\text{vowel} \\ -\text{stress} \end{array} \right]$ /síti/ → [síɾi]

- Revised American English Tapping rule: affects both /t, d/

$\left[\begin{array}{l} +\text{anterior} \\ -\text{continuant} \end{array} \right]$ → $\left[\begin{array}{l} +\text{sonorant} \\ +\text{continuant} \\ +\text{tap} \end{array} \right]$ / [+syllabic] ___ $\left[\begin{array}{l} +\text{syllabic} \\ -\text{stress} \end{array} \right]$

	UR	SR
‘Ada’	/eídə/	[eíɾə]
‘sediment’	/sédimənt/	[séɾimənt]
‘adolescent’	/ædələ́sənt/	[æɾələ́sənt]

- /aɪ/ Raising – North American English – large number of dialects in northeastern U.S. (Michigan, New York State) and throughout Canada

/aɪ/ → [ʌɪ] / ___ $\left[\begin{array}{l} +\text{consonant} \\ -\text{voice} \end{array} \right]$

<i>tripe</i>	/tɹaɪp/	[tɹʌɪp]	<i>tribe</i>	/tɹaɪb/	[tɹaɪb]
<i>right</i>	/ɹaɪt/	[ɹʌɪt]	<i>ride</i>	/ɹaɪd/	[ɹaɪd]
<i>hiker</i>	/haɪkə/	[hʌɪkə]	<i>tiger</i>	/taɪgə/	[taɪgə]
<i>life</i>	/laɪf/	[lʌɪf]	<i>live</i>	/laɪv/	[laɪv]
<i>rifle</i>	/ɹaɪfəl/	[ɹʌɪfəl]	<i>rival</i>	/ɹaɪvəl/	[ɹaɪvəl]
<i>rice</i>	/ɹaɪs/	[ɹʌɪs]	<i>rise</i>	/ɹaɪz/	[ɹaɪz]

4. Ordering of Raising and Tapping is crucial for the following reasons:
- Raising depends of the voicing of the following consonant.

- Tapping changes a voiceless /t/ to a voiced [ɾ]
- Dialect A: Raising precedes Tapping [ʌɪ appears only before phonemic /t/, even though not present in the surface realization]. The input to the Raising rule is phonemic /t/

	‘writing’	‘riding’	
Underlying Representation	/ɹáɪtɪŋ/	/ɹáɪdɪŋ/	
	ɹáɪtɪŋ	-----	Raising [only applicable to ‘writing’]
	ɹáɪɾɪŋ	ɹáɪɾɪŋ	Tapping [applies to both]
Surface Realization	[ɹáɪɾɪŋ]	[ɹáɪɾɪŋ]	

- Dialect A: Raising applies even though the trigger is absent in the surface realization [voiceless C]
- Dialect B: Tapping precedes Raising. The input to the Raising rule is the phonetic form that has undergone Tapping. Tapping wipes out [“bleeds”] the Raising environment.

	‘writing’	‘riding’	
Underlying Representation	/ɹáɪtɪŋ/	/ɹáɪdɪŋ/	
	ɹáɪɾɪŋ	ɹáɪɾɪŋ	Tapping [applies to both]
	-----	-----	Raising [doesn’t apply to either, the input is the phonetic form – the rule doesn’t see phonemic /t/ of the UR]
Surface Realization	[ɹáɪɾɪŋ]	[ɹáɪɾɪŋ]	

- Why do dialects differ with respect to rule ordering?
 - Dialect A:** a ‘writing’ [ɹáɪɾɪŋ] and ‘riding’ [ɹáɪɾɪŋ] have distinct surface realizations. There is no ambiguity, they remain in contrast. Two UR have two different SR
 - Dialect B:** follows more phonetic principles, whatever phonetic tendency prefers [aɪ] before voiced consonants prevails in this dialect.

III. Phonemicization and Phonetic Similarity

5. *English aspiration: Are English [p] and [k^h] in complementary distribution?*

Complementary distribution: two sounds that never occur in the same environment

- Strictly speaking [p] and [k^h] are in complementary distribution:

English voiceless			
Aspirated		Unaspirated	
a. [p ^h ɪn]	<i>pin</i>	d. [spɪn]	<i>spin</i>
b. [t ^h oʊn]	<i>tone</i>	e. [stoʊn]	<i>stone</i>
c. [k ^h eɪt]	<i>Kate</i>	f. [skeɪt]	<i>skate</i>

6. 1st criterion: *Phonetic similarity*

- The most similar sound to [p] is [p^h]; when you write the aspiration rule, you just change the presence vs. absence of aspiration [+/- spread glottis], not the place of articulation
- A change for /k/ → [p^h] requires an addition change; place of articulation.

7. 2nd Criterion: *Intuition of native speakers; is it the same sound?*

- English speakers without phonetic training do not distinguish between [p] and [p^h], [t] and [t^h], or [k] and [k^h]
- The difference is audible; physically present in the sound waves, but not real to native speakers.

8. *Criteria of phonetic similarity*

- Are English [h] and [ŋ] allophones of the same phoneme?

English [h] and [ŋ]			
	[h]		[ŋ]
[hɪl]	<i>hill</i>	[sɪŋ]	<i>sign</i>
[haɪ]	<i>high</i>	[sɪŋk]	<i>sink</i>
[ahɛd]	<i>ahead</i>	[hæŋz]	<i>hangs</i>
[prɒhɪbɪt]	<i>prohibit</i>	[sɪŋə]	<i>singer</i>
[rɪhɜːs]	<i>rehearse</i>	[sɪŋəpɔɪ]	<i>Singapore</i>

9. *Unfortunately, phonemicization can't be done in a purely mathematical fashion.*

You have to take into account

- Native speaker intuition: As a native speaker of English, what is your intuition? [orthography gives you a hint]
- Phonetic Similarity: Are the sounds phonetically similar?
- “natural motivation” of sound change

10. *Where to draw the “phonetic similarity line” is not cut and dry.*

- Where do you draw the line? How close do sounds have to be?
 - i. Language change may result in sounds that were once relatively similar, drifting apart of the similarity continuum:
 - ii. In certain dialects of Spanish (Andalucia) [s] and [h] are allophones of /s/
 1. /s/ → [h] / ____]word
 ‘vez’ /bes/ → [beh] ‘one time’
 ‘dos veces’ /dos beses/ → [doh beseh] ‘two times’
- Other dialects may delete /s/ altogether: /s/ → ∅ / ____]word
 - i. ‘dos veces’ /dos beses/ → [do bese]
 - ii. What is the degree of phonetic similarity between /s/ and ∅ (silence)
- Development of Spanish: [s] → [h] → [∅]
- **Deletion is common, formalized as x → ∅ / x__y**

IV. Psychological Reality of Phonemes is Language Specific

11. Contrast (phonemes) and complementary distribution are language specific

- One language’s allophonic variants may be another language’s phonemes.
 - English tapping rule: [t] and [ɾ] are allophones in English: [stfɪ] ‘still’ vs. [sɪɾɪ] ‘city’
 - Tapping: /t/ → [ɾ] / ____ $\begin{bmatrix} +\text{vowel} \\ -\text{stress} \end{bmatrix}$
 - Spanish /t/ and /ɾ/: /páta/ ‘leg of an animal’ vs. /pára/ ‘for’
- Remember Korean: Aspiration is phonemic (meaning difference)

Korean aspirated vs. unaspirated voiceless stops			
Aspirated		Unaspirated	
a. /p ^h ul/	<i>grass</i>	d. /pul/	<i>fire</i>
b. /t ^h əlda/	<i>shake off</i>	e. /təlda/	<i>reduce</i>
c. /k ^h in/	<i>big</i>	f. /kin/	<i>a pound</i>

- English speakers have difficulty hearing and producing the aspiration distinction, **not because they don’t have aspirated vs. unaspirated consonants**, but because English does not have a phonemic distinction.

12. Dentals vs. Alveolars in Bengali and in English

- Phonetically dentals and alveolar stops are very close
- English speakers produce both dental and alveolar stops

Dentalization applies to a natural class: [+alveolar] → [+ dental] / ____ [+dental]
 /n/ → [n̪] / ____ θ - /ténθ/ → [tén̪θ] ‘tenth’
 /l/ → [l̪] / ____ θ - /fɪlθi/ → [fɪl̪θi] ‘filthy’
 /t/ → [t̪] / ____ θ - /eɪtθ/ → [eɪt̪θ] ‘eighth’
 /d/ _ [d̪] / ____ ð - /ɪn ðə/ → [ɪn̪ ðə] ‘in the’

- Native speaker intuition: For Bengali speakers they are completely different.

Bengali Dental vs. Alveolar stops phonemes			
Dental		Alveolar	
a. [t̪an]	<i>tune</i>	e. [tan]	<i>pull</i>
b. [sa̪t̪]	<i>seven</i>	f. [sat]	<i>sixty</i>
c. [d̪an]	<i>donation</i>	g. [dan]	<i>right</i>
d. [d̪in]	<i>day</i>	h. [dim]	<i>egg</i>

13. Native speakers are biased perceivers; they tend to hear the phonemic distinctions of their own language, and tune out the phonetic detail.

- Speakers focus attention on only the phonetic detail that is contrastive (phonemic): “distinctive features”

14. *Audibility of fine distinctions: Working with an Kisongo Maasai speaker*
(<http://www.bol.ucla.edu/%7Ekmccrary/maasaiarticulation.pdf>)

- It is hard, even for trained phoneticians and linguists, to perceive/describe/produce unfamiliar sounds.
- Kisongo Maasai has two stop consonants that are phonetically very similar

		Maasai stops	
“d”		“j”	
<i>ado</i>	‘I am red’	<i>ajo</i>	‘I say’
	[ado]		[a ? o]
			[ad ^h o]
			[adʒo]

- “d” and “j” in the orthography created by missionaries for Maasai (most Maasai do not read or write Maasai, even though they read and write other languages: Swahili, English)
- We used static palatography
- The distinction is /ɗ/ vs. /d̪/; same distinction for nasals /ŋ/ vs. /ŋ̪/, and possibly voiceless stops /t̪/ vs. /t̪̥/

15. *Notion of “same sound” is language specific*

- Are the vowels in /tɛd/ and /tɛn/ the same sounds?

16. *Notion of “different sounds”*

- French nasals: /me/ *mais* ‘but’ vs. /mɛ̃/ *main* ‘hand’; /tʁɛ/ *tres* ‘very’ vs. /tʁɛ̃/ *train* ‘train’
- Nasal and non-nasal vowels are “different sounds” for native French speakers.

17. *A phoneme is a psychological category:*

- A phoneme is not really “a sound”
- It is a psychological category that is instantiated by sounds (allophones)

18. *Native intuition is not necessarily “easily” accessible:*

- Phonological knowledge (same sound vs. different sound) is unconscious/implicit knowledge; not necessarily accessible to introspection