Readings: Hayes (APS reader) Chapter 5-6
Homework: Homework 4 due Wed. May 10th
Midterm: May 3rd (one week from today): Bring blue books, open book/note, you have to solve problems (like homeworks)
Term Paper: Turn in one-paragraph description (with one reference source). Due before May 17th.

Week 4, Class 2:
Phonological Alternation

I. Alternation

1. *Alternation: A change in the phonological shape of a morpheme conditioned by context*
   - A morpheme alternates when it appears in different forms in different contexts

2. *Alternation of English /t/-final stems: preglottalization, tapping and aspiration*
   - Preglottalization**:** voiceless stops and affricates /p, t, t͡ʃ, k/ are preglottalized, [ˀp, ˀt, ˀt͡ʃ, ˀk], when they occur in word final position

Preglottalization: $\begin{bmatrix}\text{-continuant}\\\text{-voice}\end{bmatrix} \rightarrow$ [+constricted glottis] / ____]$_{word}$

1.	/kæp/	[kæˀp]	*cap*
2.	/kæt/	[kæˀt]	*kat*
3.	/hæk/	[hæˀk]	*hack*
4.	/hæt͡ʃ/	[hæˀt͡ʃ]	*hatch*

   - Tapping: /t/ is realized as [ɾ] when preceded by a syllabic sound (vowel or syllabic consonant) and followed by a stressless vowel
     i. e.g. 'city' /síti/ → [síɾi]

Tapping: /t/ → [ɾ] / [+syllabic] _____ $\begin{bmatrix}\text{+syllabic}\\\text{-stress}\end{bmatrix}$

   - Aspiration: voiceless stops become aspirated when before a stressed vowel (if the preceding consonant is not /s/)

Aspiration: $\begin{bmatrix}\text{-continuant}\\\text{-delayed release}\\\text{-voice}\end{bmatrix} \rightarrow$ [+spread glottis] / X _____ $\begin{bmatrix}\text{+syllabic}\\\text{+stress}\end{bmatrix}$ condition: where X is not /s/

1.	Tom	/tɑm/	[tʰɑ́m]	2.	Atlas	/ætləs/	[ǽtləs]
3.	tell	/tɛl/	[tʰɛ́l]	4.	get	/gɛt/	[gɛ́t]
5.	obtain	/əbteɪn/	[əbtʰéɪn]	6.	actor	/æktɚ/	[ǽktɚ]
7.	attest	/ətɛst/	[ətʰɛ́st]	8.	stun	/stʌn/	[stʌ́n]
9.	retain	/riteɪn/	[ritʰéɪn]				

3. *Morphology/phonology interaction (morphophonemics)*
   - Morphology rearranges the phonological environments of the phonemes

- The segments of prefixes and suffixes are also a part of the phonological environment.
- Affixation triggers aspiration and tapping, blocks glottalization

Allophones of /t/ in root morphemes

note	notable	notation	
/noʊt/	/noʊtəbl̩/	/noʊteɪʃən/	Underlying representation
nóʊˀt	-------	-------	Preglottalization
------	nóʊrabl̩	------	Tapping
------	------	noʊtʰéɪʃən	aspiration
[nóʊˀt]	[nóʊrabl̩]	[noʊtʰéɪʃən]	Surface Realization

- Alternation: The morpheme /noʊt/ has three phonologically conditioned allomorphs: [nóʊˀt], [nóʊr], [noʊtʰ]
  i. The morphology creates the context for phonology
  ii. The phonology determines the realization of morphemes
  iii. Lots of "hanky-panky" between morphology and phonology

4. Rhythmic Lengthening in Choctaw (Native American language spoken in Oklahoma)

- The root for 'see' in Choctaw is /pisa/. Realized as [pisa] when by itself (in isolation)
- When you add a single syllable suffix, the final root vowel is lengthened
  i. /pisa/ + /-li/ = [pisaːli] 'I see' [/-li/ 1st person singular]
  ii. /pisa/ + /-tʃi/ = [pisaːtʃi] 'cause to see' [/-tʃi/ causative]
  iii. The morpheme /pisa/ has at least two allomorphs: [pisa] and [pisaː]
- Hypotheses
  i. Choctaw always lengthens stem final vowels before suffixes
  ii. Choctaw lengthens stem final vowels before monosyllabic suffixes
  iii. Choctaw shortens word final vowels (the underlying for is /pisaː/ - when it occurs alone it is [pisa] because vowel is word final)
  iv. Choctaw lengthens the second to the last vowel in all words, as long as it is not also the first vowel of the word.
- To test your hypotheses you need further data: What happens if you add a prefix?
  i. /tʃi-/ + /pisa/ = [tʃipiːsa] "(someone) sees you' [/-tʃi/ 'you' object]
  ii. Which hypothesis was confirmed?
- Two remaining hypotheses:
  i. Choctaw shortens word final vowels (the underlying for is /pisaː/ - when it occurs alone it is [pisa] because vowel is word final)
  ii. Choctaw lengthens the second to the last vowel in all words, as long as it is not also the first vowel of the word.
- more data
  i. [tʃi - piːsa - li] 'you (object)-see-I (subject) = 'I see you'
  ii. [tʃi - piːsa - tʃi] 'you (object) –see- causative' = '(someone) causes to see you'
  iii. [pisaː - tʃi - li] 'see-causative-I (subject = 'I cause to see')
  iv. [tʃi - piːsa - tʃiː - li] 'you (object)-see-causative-I (subject)' = 'I cause you to see'

- Summary of affixes:
  i. /-li/ = 1st person, 'I'
  ii. /-tʃi/ = causative, 'cause to do something'
  iii. /tʃi-/ = 2nd person object, 'for you, you'

- Can we rule out the hypothesis that the underlying for is /pisaː/ which shortens when word final?
- To see the pattern you can align words to the left and vowel for vowel.

[p i s a]	‘see’
[p i s aː l i]	‘I see’
[p i s aː tʃ i]	‘cause to see’
[tʃ i p iː s a]	‘(someone) sees you’
[tʃ i p iː s a l i]	‘I see you’
[tʃ i p iː s a tʃ i]	‘(someone) causes to see you’
[p i s aː tʃ i l i]	‘I cause to see’
[tʃ i p iː s a tʃ iː l i	‘I cause you to see’

- Choctaw duration rhythm: every second syllable from the left is long, provided that it is not also word final
- Test hypothesis on another verb with 3 syllables: [haːbina] ‘receive a present,

[h a b iː n a]	‘receive a present’
[h a b iː n a l i]	‘I receive a present’
[h a b iː n a tʃ i]	‘cause to receive a present’
[tʃ i h aː b i n a]	‘(someone) receives a present for you’
[tʃ i h aː b i n aː l i]	‘I receive a present for you’
[tʃ i h aː b i n aː tʃ i]	‘(someone) causes you to receive a present’
[h a b iː n a tʃ iː l i]	‘I cause to receive a present’
[tʃ i h aː b i n aː tʃ i l i]	‘I cause you to receive a present’

- What is the underlying form of [pisa] and [habiːna]?
- Morphological rules of Choctaw attach various suffixes, changing the position of the vowels relative to the left edge of the word.
- All words must comply with rhythmic lengthening rule

  Rhythmic Lengthening: Lengthen the vowels of non-final, even-number syllables, counting from the beginning of the word (the left)

- /pisa/ has allomorphs [pisa], [pisaː], [piːsa]
- /habina/ has allomorphs [habiːna], [haːbina], [haːbinaː]
- /pisa/ actually occurs as a surface form, /habina/, with no long vowels, never occurs as a surface realization.
- Derivation of /habina/, first morphology then phonology

Underlying R		/habina/			
morphology:	adds prefix, suffix or both	∅	/habina-tʃi/	/tʃi-habina/	/tʃi-habina-tʃi/
Phonology:	Rhythmic lengthening	habiːna	habiːnatʃi	tʃihaːbina	tʃihaːbinaːtʃi
Surface R		[habiːna]	[habiːnatʃi]	[tʃihaːbina]	[tʃihaːbinaːtʃi]

- **T**his derivation is very simple; there are more complicated interactions between morphology and phonology (hanky-panky)

5. Neutralization: the identical phonetic realization of distinct phonemic forms.

- In Korean, /p, t, k/ and /m, n, ŋ/ are contrastive in word final position

1.	[nuɾinpap]	'scorched rice'	/p/ vs. /m/
2.	[nuɾinpam]	'scorched chestnut'	
3.	[otʃiŋətʃət]	'squid pickle'	/t/ vs. /n/
4.	[otʃiŋətʃən]	'squid pancake'	
5.	[tʃakɨnpak]	'small gourd'	/k/ vs. /ŋ/
6.	[tʃakɨnpaŋ]	'small room'	

- Korean Stop Nasalization:

- Constraint: Stop consonants are banned before nasals

$$* \begin{bmatrix} \text{-sonorant} \\ \text{-continuant} \\ \text{-delayed release} \\ \text{-nasal} \end{bmatrix} / \_\_ \begin{bmatrix} \text{-syl} \\ \text{+nasal} \end{bmatrix}$$

Rule: a stop that immediately precedes a nasal sound must be replaced by the corresponding nasal

- /p/ → [m], /t/ → [n], /k/ → [ŋ]

$$\begin{bmatrix} \text{-sonorant} \\ \text{-continuant} \\ \text{-delayed release} \\ \text{-nasal} \\ \alpha\text{place} \end{bmatrix} \rightarrow \begin{bmatrix} \text{+nasal} \\ \text{+sonorant} \\ \text{+voice} \\ \alpha\text{place} \end{bmatrix} / \_\_ \begin{bmatrix} \text{-syl} \\ \text{+nasal} \end{bmatrix}$$

- Phonetically grounded constraint/rule: eliminates the need to rapidly close the velum for a sharp transition between the stop and the nasal.

- Domain of rule is the accentual phrase or phonological phrase (larger than the word)

1.	[nuɾinpap]	[nə X mɛkɛpwassni] 'you tried X ?'	[nə nuɾinpam mɛkɛpwassni]	'Have you tried scorched rice?'
2.	[nuɾinpam]		[nə nuɾinpam mɛkɛpwassni]	'Have you tried scorched chesnut?'
3.	[otʃiŋətʃət]	[nɛmsɛka] 'smell'	[otʃiŋətʃən nɛmsɛka]	'the smell of the squid pickle'
4.	[otʃiŋətsən]		[otʃiŋətsən nɛmsɛka]	'the smell of the squid pancake'
5.	[tʃakɨnpak]	[nɛmsɛka] 'smell'	[tʃakɨnpaŋ nɛmsɛka]	'the smell of a small gourd'
7.	[tʃakɨnpaŋ]		[tʃakɨnpaŋ nɛmsɛka]	'the smell of a small room'

- Derivation

'the smell of the squid pickle'	'the smell of the squid pancake'	
/otʃiŋətʃət nɛmsɛka/	/otʃiŋətʃən nɛmsɛka/	Underlying representation
n	----------	Obstruent nasalization
[otʃiŋətʃən nɛmsɛka]	[otʃiŋətsən nɛmsɛka]	Surface realization

- Phonological contrast is neutralized: words that have different meanings are pronounced exactly the same way.
- The phonemic distinction between /p, t, k/ and /m, n, ŋ/ is neutralized before a nasal consonant.
- The distinction is there in the underlying representation, but not in the surface realization.
- The result is that when a Korean speaker hears [nə nuɾinpam mɛkɛpwassni] it could either mean "Have you tried scorched rice?" or "Have you tried scorched chestnut?" (you need context or you need to ask for clarification)

6. Neutralization of phonemes

- /nt/ contrasts with /n/ in English

1.	[plænt]	*plant*	2.	[plæn]	*plan*
3.	[stʌnt]	*stunt*	4.	[stʌn]	*stun*
5.	[bɛnt]	*bent*	6.	[bɛn]	*ben*
7.	[bɛntli]	*Bentley*	8.	[hɛnli]	*Henley*

- Post nasal /t/ deletion in English (dialects of American English or casual speech): /t/ is deleted when it is preceded by /n/ and is followed by an unstressed vowel or syllabic consonant

$$/t/ \rightarrow \varnothing \; / \; n\_\_\_\_\_ \begin{bmatrix} +\text{syllabic} \\ -\text{stress} \end{bmatrix}$$

1.	[plǽnt]	*plant*	2.	[plǽnɾ̩]	*planter*
3.	[plǽn]	*plan*	4.	[plǽnɾ̩]	*planner*
5.	[stʌ́nt]	*stunt*	6.	[stʌ́nɪŋ]	*stunting*
7.	[stʌ́n]	*stun*	8.	[stʌ́nɪŋ]	*stunning*
9.	[pʌ́nt]	*punt*	10.	[pʌ́nɪŋ]	*punting*
11.	[pʌ́n]	*pun*	12.	[pʌ́nɪŋ]	*punning*

- Morphophonological derivation

plan	*planning*		*plant*		*planting*	*plantation*		
/plǽn/			/plǽnt/				Underlying Representation	
	/plǽn-ɪŋ/	/plǽn-ɾ̩/		/plǽnt-ɾ̩/	/plǽnt-ɪŋ/	/plǽn-éɪʃən/	Morphology:	affixation
-------	---------	--------	---------	plǽnɾ̩	plǽnɪŋ	--------	Phonology:	post-nasal deletion
[plǽn]	**[**plǽnɪŋ**]**	[plǽnɾ̩]	[plǽnt]	[plǽnɾ̩]	**[**plǽnɪŋ**]**	[plæntéɪʃən]	Surface realization	

- The phonemic /nt/ vs. /n/ contrast is wiped out in order to satisfy the phonological rule

Word	Underlying Form	Surface Neutralized Form
planning	/plǽnɪŋ/	[plǽnɪŋ]
planting	/plǽntɪŋ/	[plǽnɪŋ]
planner	/plǽnɹ̩/	[plǽnɹ̩]
planter	/plǽntɹ̩/	[plǽnɹ̩]

- 'I am planting/planning the garden' can be ambiguous.

7. Neutralization and contextually limited contrast

- **Contextually limited contrast**: A phonemic contrast that is confined to a particular phonological context
  - i. A property that is distinctive in some context, is non-distinctive (predictable) in another context
  - ii. **Static limitation of constrast**: Toba Batak, English Alveolar Place Enforcement
  - iii. **Dynamic limitation of contrast:** English Obstruent Voicing

- Toba Batak (Austronesian) – Has voiced vs. voiceless consonants contrast

Toba Batak – word initial stops			
Voiceless		Voiced	
a. [pinoppar]	'descendent'	d. [biaŋ]	'dog'
b. [tuak]	'palm of wine'	e. [dukkar]	'let out'
c. [korea]	'korea'	f. [garut]	'name of town in Indonesia'

- Only voiceless consonants occur word finally

Toba Batak – word final stops	
Voiceless	
a. [sukkup]	'adequate'
b. [surat]	'letter'
c. [rappok]	'steal'

- Two approaches: Rule or constraint
- Constraint: $*\begin{bmatrix}+\text{stop}\\+\text{voice}\end{bmatrix}$ / ___]$_{\text{word}}$
  - **i.** "Voiced stops are banned in word final position"
  - **ii.** The constraint doesn't tell you how to fix the problem, when it occurs; you need more constraints.
- Rule: [+stop] → [-voice] / ___]$_{\text{word}}$

- Problem with rule: What are the forms to which the rule applies?
  - i. When a word ends in a stop, the stop is always voiceless
  - ii. The point is, it is **static** because all word final stops are voiceless, but they don't have to become voiceless. It is a property of all Toba Batak words.

- English Alveolar Place enforcements - **Static**
    i. When an English word ends in two stops, the second stop must be alveolar: ‘apt, ‘corrupt’, ‘act’, *atp, *apk
    ii. There is no evidence that the second consonant has to become a stop. It is a property of all English words

- English Obstruent Voicing: **Dynamic**
    i. When an English word ends in two obstruents, the second obstruent must agree in voicing with the first: there is no contrast for voicing in obstruents in final position
    ii. [dɔgz] vs. [kæts]
    iii. Dynamic because there is evidence that /s/ → [z] after a voiceless consonant

8. Other cases of contextually limited contrast

- Spanish /r/ vs. /rː/ only contrast intervocalically: e.g. /péro/ ‘but’ vs. /pérːo/ ‘dog’
    i. word initial and after /n/: only [rː] occurs: [rːáro], [onrːár]
    ii. after consonant, before consonant, word finally, only [r] occurs: [ombre], [nórte], [már]
        1. is there evidence that it is dynamic or static?

Spanish Data Set

1.	[rːásko]	‘I scratch’	19.	[onrːáðo]	‘honored’
2.	[estráɲo]	‘strange’	20.	[rːíko]	‘rich’
3.	[rːáro]	‘rare’, ‘strange’	21.	[rːázɣo]	‘trait’, ‘feature’
4.	[dár]	‘to give’	22.	[már]	‘sea’
5.	[pérːo]	‘dog’	23.	[rːáto]	‘time’, ‘while’
6.	[ómbre]	‘man’	24.	[kárːo]	‘cart’
7.	[kórːo]	‘I run’	25.	[enrːikeθér]	‘to enrich’
8.	[káro]	‘expensive’	26.	[kóro]	‘choir’
9.	[rːezβála]	‘s/he slips’	27.	[márθo]	‘March’
10.	[amarĭʎo]	‘yellow’	28.	[trés]	‘three’
11.	[párte]	‘part’	29.	[rːáya]	‘stripe’
12.	[kúrso]	‘course’, ‘class’	30.	[rːóθa]	‘it chafes’
13.	[rːóka]	‘rock’	31.	[bróma]	‘joke’
14.	[parːíʎa]	‘grill’	32.	[rːósa]	‘rose’
15.	[péro]	‘but	33.		

- Italian /s/ vs. /z/: only contrast intervocalically: e.g. /kása/ ‘cash register’ vs. /káza/ ‘house
    i. word initially before a vowel, only [s] occurs: [sapóne] ‘soap’
    ii. before a voiceless consonant, only [s] occurs: [skárpa] ‘shoe’
    iii. before a voiced consonant, only [z] occurs: [zdentáto] ‘toothless’
        1. **dynamic**: because /s-/ is a morpheme
        2. *sfortunato* [sfortunáto] ‘unlucky’ vs. *sdentato* [zdentato] ‘toothless’
            a. evidence that /s/ → [z] / ___ [-syl, +voice]

[1] In class, and in the book, we said that Spanish “r” is a tap in intervocalic position: e.g *para* [paɾa] ‘for’. Hualde & Escobar (2001) describe this sound as the trill [r]. For the purpose of this homework we will assume that it is a trill.

Standard Italian Data Set

1.	[sapóne]	‘soap’	11.	[televizióne]	‘television’
2.	[pásta]	‘pasta’	12.	[pasáre]	‘to pass’
3.	[spagét:i]	‘spaghetti’	13.	[kásа]	‘cash register’
4.	[rósa]	‘red’ [fem. s.]	14.	[róza]	‘rose’
5.	[zvélto]	‘fast’	15.	[zbáʎo]	‘mistake’
6.	[róspo]	‘toad’	16.	[sálsa]	‘sauce’
7.	[pǐza]	‘Pisa’	17.	[pérso]	‘lost’
8.	[sfortunáto]	‘unlucky’	18.	[ǐzola]	‘island’
9.	[póso]	‘I can’	19.	[pózo]	‘I place’
10.	[zgárbato]	‘rude’	20.	[sfrut:áre]	‘to exploit’
11.	[sperdúto]	‘isolated’, ‘far from civilization’	21.	[zgan͡ʧáre]	‘to release’
12.	[káza]	‘house’	22.	[vázo]	‘vase’
13.	[stampáre]	‘to print’	23.	[zdentáto]	‘toothless’
14.	[skárpa]	‘shoe’	24.	[spáɲa]	‘spain’
15.	[nǐzba]	‘nothing’	25.	[kɔ́za]	‘thing’
16.	[táska]	‘pocket’	26.	[kórso]	‘course’

- **Neutralization**: the identical phonetic realization of two distinct phonemic forms

9. Catalan Vowel Reduction: The phonology conditions the realization of the vowels in root morphemes in Catalan

i. Vowel reduction in stressless syllables results in the alternation of morphemes
ii. The [-high] front vowels /a, e, ɛ/ become the central vowel [ə] when [-stress]
iii. The [-high] back vowels /o, ɔ/ become the high back vowel [u] when [-stress]
iv. root morpheme /pɛl/ ‘hair’ has two allomorphs, [pɛ́l] when [+stress] and [pəl] when [-stress]
v. What are the root morphemes and what are their allomorphs
vi. Is this contrast dynamic or static

1.	[sɛ́k]	‘dry’	2.	[səkáʎ]	‘dry branch of tree’ ‘very skinny person’
3.	[sák]	‘sack’	4.	[səkɛ́t]	‘small sack’
5.	[pɛ́l]	‘hair’	6.	[pəlút]	‘hairy’
7.	[sérp]	‘snake’	8.	[sərpɔ́tə]	‘big snake’
9.	[pɔ́rt]	‘harbor’	10.	[purtuári]	‘of a harbor’
11.	[gɔ́s]	‘dog’	12.	[gusás]	‘big dog’
13.	[prǐm]	‘thin’	14.	[əprimá]	‘to make thin’
15.	[ʎúm]	‘light’ (noun)	16.	[ʎuminós]	‘light’ (adj.)

10. Polish: contextually limited contrast and alternation

- What are the root morphemes and what are their allomorphs
- What is the evidence for this constraint?
- How do we know the underlying forms?

- Can we write a rule that says “voiced consonants become voiced in intervocalic position"?
- Just look at singulars: what is the contextually determined constraint on contrast in Polish?
- Is it dynamic or static?

Polish

	singular	plural	Gloss
1.	[klup]	[klubi]	‘club’
2.	[trup]	[trupi]	‘corpse’
3.	[snop]	[snopi]	‘sheaf
4.	[ʒwup]	[ʒwobi][2]	‘crib’
5.	[trut]	[trudi]	‘labor’
6.	[kot]	[koti]	‘cat’
7.	[lut]	[lodi]	‘ice’
8.	[grus]	[gruzi]	‘rubble’
9.	[nos]	[nozi]	‘nose’
10.	[vus]	[vuzi]	‘cart’
11.	[koʃ]	[koʒe]	‘basket’
12.	[nuʃ]	[noʒe]	‘knife
13.	[wuk]	[wugi]	‘lye’
14.	[wuk]	[wuki]	‘bow’
15.	[sok]	[soki]	‘juice’
16.	[ruk]	[rogi]	‘horn’

11. Tangale, a Chadic language of Nigeria

	‘meat’	‘window’	‘berry’	‘load’	‘harp’
'N’	loː	bugat	tugat	aduk	kúluk
‘the N’	loːǐ	bugatǐ	tugadǐ	adukǐ	kúlugǐ
‘my N’	loːnó	bugadnó	tugadnó	adugnó	kúlugnó
‘your N’	loːgó	bugatkó	tugadgó	adukkó	kúluggó
‘her N’	loːdó	bugattó	tugaddó	adukto	kúlugdó

- What is the root for ‘meat’?
- What are the affixes on the form ‘meat’
- What are the allomorphs of the affixes?
- What are the allomorphs of ‘window’ and the root ‘berry’?
- What are the underlying forms
- What are the allomorphs of ‘load’ and ‘harp’
- What are the underlying forms of the root ‘load’ and the root ‘harp’?
- What rule accounts for the forms [bugat] vs. [tugat]
- What rule accounts for the forms [bugadnó] vs. [tugadnó]?
- What rule accounts for the forms [bugatkó] vs. [tugadgó]?
- What rule accounts for the forms [bugattó] vs. [bugattó]?
- Is the contextually limited contrast dynamic or static?

[2] You can ignore the additional changes in the vowels