Week 13 Lecture: Phonology

Ling 201 - Fall 2025

Phonology: Phonemes and Allophones

- Before the break, we introduced the field of **Phonology**: study of language sounds as a system

- We discussed the **phonemes** and **allophones**:

  - A **phoneme** is a family of sounds that are all treated as the same by speakers.

  - Each individual sound within a phoneme is an **allophone**.

  - Example: English phoneme /t/ is pronounced with the allophone [tʰ] in *top* and [t] in *stop*.

  - Slightly different sounds, but speakers treat them as different versions of the same sound: /t/.

/t/

[tʰ]   [t]

Phonology: Phonemes and Allophones

- Phonemes occur in **contrastive distribution**:

  - Two different phonemes can occur in the same environment, and switching one for the other will cause a change in meaning.

  - For example, **minimal pairs**.

- Allophones occur in **complementary distribution**:

  - Each allophone occurs in its own context, (just like superheroes).

/t/

[tʰ]   [t]

Phonemic analysis

- We also learned about **phonemic analysis** – how to determine whether two sounds are separate phonemes or allophones of the same phoneme in a language.

- Our first step in doing this is to determine the **phonetic environment** in which each sound occurs.

- Phonetic environment involves:
  - What sounds come before/after target sound.
  - Is target sound at beginning/middle/end of word?
  - Is target sound at beginning/middle/end of syllable?
  - Is target sound in stressed/unstressed syllable?

[d]	[ð]
[dar] 'give'	[toðo] 'all'
[desir] 'say'	[biða] 'life'
[dama] 'lady'	[koðo] 'elbow'
[duða] 'doubt'	[duða] 'doubt'
[deretʃo] 'right'	[asaðo] 'roast'
[deðo] 'finger'	[deðo] 'finger'

Phonemic analysis

- Writing out phonetic environments is fairly simple.

- We'll use the Spanish dataset we saw last lecture to illustrate this.

- For each token of target sound in dataset, write [x_y], where:

  - x = sound preceding target sound

  - _ = target sound

  - y = sound following target sound

  - use # to indicate word boundary

[d]	[ð]
[dar] 'give'	[toðo] 'all'
[desir] 'say'	[biða] 'life'
[dama] 'lady'	[koðo] 'elbow'
[duða] 'doubt'	[duða] 'doubt'
[deretʃo] 'right'	[asaðo] 'roast'
[deðo] 'finger'	[deðo] 'finger'

Phonemic analysis

- Take the first row for example. [ð] occurs in [toðo].

  - Preceding sound is [o], following sound is [o].

  - We write phonetic environment as: [o_o].

- [d] occurs in [dar]:

  - No preceding sound, beginning of word.

  - Following sound is [a].

  - We write phonetic environment as [#_a].

[d]	[ð]
[dar] 'give'	[toðo] 'all'
[desir] 'say'	[biða] 'life'
[dama] 'lady'	[koðo] 'elbow'
[duða] 'doubt'	[duða] 'doubt'
[deretʃo] 'right'	[asaðo] 'roast'
[deðo] 'finger'	[deðo] 'finger'

Phonemic analysis

- Writing out the rest of the environments, we get:

[d]	[ð]
[#_a]	[o_o]
[#_e]	[i_a]
[#_a]	[o_o]
[#_u]	[u_a]
[#_e]	[a_o]
[#_e]	[e_o]

[d]	[ð]
[dar] 'give'	[toðo] 'all'
[desir] 'say'	[biða] 'life'
[dama] 'lady'	[koðo] 'elbow'
[duða] 'doubt'	[duða] 'doubt'
[deretʃo] 'right'	[asaðo] 'roast'
[deðo] 'finger'	[deðo] 'finger'

Phonemic analysis

- Our next step: determine whether [d] and [ð] are in contrastive or complementary distribution.

- Do they occur in the same or different environments?

  - Same → contrastive → separate phonemes

  - Different → complementary → allophones

- These sounds occur in different environments:
  [d] at the start of words, [ð] between two vowels.

  - So they're in complementary distribution

  - In Spanish, [d] and [ð] are two allophones of the same phoneme, /d/.

[d]	[ð]
[#_a]	[o_o]
[#_e]	[i_a]
[#_a]	[o_o]
[#_u]	[u_a]
[#_e]	[a_o]
[#_e]	[e_o]

Simplifying phonetic environments

- We can also rewrite these phonetic environments in a simpler format to help us find patterns.

- What do the environments of [d] have in common?

  - They're all word-initial

  - We can generalize this as: [#_]

- What do the environments of [ð] have in common?

  - They're all intervocalic (between two vowels)

  - We can generalize this as [V_V]

  - (In phonology, V = vowel, C = consonant)

[d]	[ð]
[#_a]	[o_o]
[#_e]	[i_a]
[#_a]	[o_o]
[#_u]	[u_a]
[#_e]	[a_o]
[#_e]	[e_o]

Phonological rules

- With these simplified environments, we can rewrite our allophonic pattern as a **phonological rule**.

  - Format: *original sound > changed sound / environment*

- /d/ becomes [d] (no change) at beginning of word:

  - d > d / #_

- /d/ becomes [ð] between two vowels:

  - d > ð / V_V

[d]	[ð]
[#_a]	[o_o]
[#_e]	[i_a]
[#_a]	[o_o]
[#_u]	[u_a]
[#_e]	[a_o]
[#_e]	[e_o]

Phonological rules and processes

- As we write out phonological rules, it's important to note that they aren't completely random.

- For example, the allophones of a particular phoneme tend to be similar in various ways:

  - For Spanish /d/, its allophones [d] and [ð] are both *voiced dental* sounds

  - For English /t/, its allophones [tʰ, t, t̚, ɾ, ʔ] all share some of the features *voiceless*, *alveolar*, and *plosive*

- So when one sound changes to another in a phonological rule, these changes tend to fit into a few different categories of change – which we call **phonological processes**.

Phonological processes

- **Phonological processes**: typical changes that speech sounds undergo

  - Phonological processes explain why we find particular **allophones** in particular contexts.

  - They explain **morphological alternations** like *magic > magician*.

  - They also explain many of the historical **sound changes** by which pronunciation has changed over time in the world's languages, like *knight* [knixt] > [najt]

- We're going to be focusing on six important phonological processes in this class, though there are others we won't have time for:

  - **Assimilation** and **Dissimilation**

  - **Insertion** and **Deletion** (aka Epenthesis and Elision)

  - **Strengthening** and **Weakening** (aka Fortition and Lenition)

Assimilation

- Recall our discussion of how plural *-s* has multiple pronunciations: [s] in *caps* vs. [z] in *cabs*

- Fill in the features for each sound segment in the tables below.

    - When [s] changes to [z], what feature changes?

    - Does that change make the [z] match more or fewer of the features of the preceding [b]?

caps [kʰæps]		
Feature	[p]	[s]
Voicing		
Place		
Manner		

cabs [kʰæbz]		
Feature	[b]	[z]
Voicing		
Place		
Manner		

Assimilation

- Recall our discussion of how plural *-s* has multiple pronunciations: [s] in *caps* vs. [z] in *cabs*

- Fill in the features for each sound segment in the tables below.

  - When [s] changes to [z], what feature changes?

  - Does that change make the [z] match more or fewer of the features of the preceding [b]?

caps [kʰæps]		
Feature	[p]	[s]
Voicing	voiceless	voiceless
Place	bilabial	alveolar
Manner	plosive	fricative

cabs [kʰæbz]		
Feature	[b]	[z]
Voicing	voiced	voiced
Place	bilabial	alveolar
Manner	plosive	fricative

Assimilation

- Plural *-s* **changes** its **voicing** feature to match that of the preceding consonant.

  - In *caps*, it is voiceless to match [p], and in *cabs* it is voiced to match [z].

- This type of change is called **assimilation** – when a sound segment changes to become more similar to another nearby sound segment, which we can measure in terms of their features.

  - Here, the plural *-s* morpheme undergoes **voicing assimilation**: in other words, it assimilates to the voicing of the preceding consonant [p] or [b].

caps [kʰæps]		
Feature	[p]	[s]
Voicing	**voiceless**	**voiceless**
Place	bilabial	alveolar
Manner	plosive	fricative

cabs [kʰæbz]		
Feature	[b]	[z]
Voicing	**voiced**	**voiced**
Place	bilabial	alveolar
Manner	plosive	fricative

Dissimilation

- The opposite of assimilation is **dissimilation**: when a sound changes to become **less similar** to another consonant. Some well-known examples involve the dissimilation of liquids (*l* and *r* sounds):

    - Latin *pe**r**eg**r**inu* > Eng. *pi**l**g**r**im*   (compare *pe**r**eg**r**ine falcon, San Pe**ll**eg**r**ino*)

        - The first *r* **dissimilates** to an *l* to become less like the second *r*.

    - Old Italian *co**l**one**ll**o* > Middle French *co**r**onne**l*** > Modern English *co**l**one**l*** [kɜ**r**nə**l**]

        - In Modern English, we pronounce it *with* dissimilation and spell it *without* dissimilation.

        - Compare Modern French *co**l**one**l***, Spanish *co**r**one**l***, both pronounced as spelled.

- In Modern English, we often delete *r* in words with *r* repetition for purposes of dissimilation:

    - *su(r)prise, pa(r)ticular, gove(r)nor, be(r)serk, Feb(r)uary, inf(r)astructure*

Insertion

- How would you pronounce these words in English? As written, or do you add a vowel somewhere?

    - *Gdansk*   (a city in Poland)

    - *Tbilisi*   (capital of the republic of Georgia)

    - *Ksenia*   (a Slavic first name)

Insertion

- **Insertion** or **epenthesis** is when a sound segment is **added** to a word.

  - This often happens in loanwords that have sound combinations that violate the phonology of the target language:

    - *Gdansk, Tbilisi, Ksenia* all start with consonant clusters not allowed in English, so English speakers adapt them by **inserting** a schwa vowel [ə] to break them up:

      - *G[ə]dansk, T[ə]bilisi, K[ə]senia*

    - English allows word-initial consonant clusters like *str-* that are not allowed in some languages. These languages can **insert** vowels to break up such clusters in loanwords:

      - English *stress* > Spanish *e̲s.trés*

      - English *stress* > Japanese *s̲u̲.t̲o̲.re.su*

Insertion

- Listen to how Michael (on the left) says *I'm sure*.

- Does he insert some additional sound between the /m/ and the /s/?

- Why do you think he might do that?


Clip from *The Office*

🔊 *I'm sure*

Insertion

- In examples like *estrés* 'stress', insertion happened to fit the language's **syllable structure**. Another reason insertion can happen is due to **coarticulation** – overlap between sound segments.

- If you say [mʃ], but keep your lips closed a little too long, the [m]-[ʃ] overlap sounds like [p], which combines features of both:
    - [p] is **voiceless** like [ʃ]
    - [p] is **bilabial** like [m]
    - [p] is a **plosive** – oral closure from the nasal + raised velum from the fricative

I'm sure		
Feature	[m]	[ʃ]
Voicing	voiced	voiceless
Place	bilabial	postalveolar
Manner	nasal	fricative
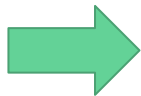
I'm[p]*sure*			
Feature	[m]	[p]	[ʃ]
Voicing	voiced	**voiceless**	**voiceless**
Place	**bilabial**	**bilabial**	postalveolar
Manner	**nasal**	**plosive**	**fricative**

Insertion

- Similar coarticulatory effects can occur in words like *sen*[t]*se*, *prin*[t]*ce*

- If the overlapping sound is interpreted as a new segment, we have **insertion**.

- English words *tender* and *ensemble* show this type of insertion in their histories:

  - Latin *teneru* > *tenru* > French *tendre* > English *tender*

  - Latin *in semel* 'together' > *insemle* > French *ensemble* > English *ensemble*

- So insertion is the addition of a sound segment to a word, which can occur for various reasons.

Deletion

- How do you pronounce *and* in these phrases? Do you pronounce all the letters?

  - *rock and roll*

  - *Barnes and Noble*

  - *Fast and Furious*

- The opposite of insertion is **deletion** or **elision**: when a sound is removed from a word.

  - rock [n] roll

  - English "silent letters" are often historical instances where a sound was deleted but they never updated the spelling: *house, knee, write, right, knight*

  - Sometimes we adapt loanwords with complex sound sequences through **deletion**: *(p)sychology, (m)nemonic, (p)neumatic, xylophone* (Greek [ks] > English [z])

Strengthening and Weakening

- Strengthening and weakening are processes by which sound segments get "stronger" or "weaker".

- "Stronger" and "weaker" can be vague terms, so one way to think about this is in terms of **sonority**.

- What is the difference between vowels and consonants?

    - Vowels = no obstruction of airflow   Consonants = obstruction of airflow

    - Vowels = voiced   Consonants = voiced or voiceless

- Based on this, what is the most "un-vowel-like" of the following sounds: [n], [l], [w], [s], [t]

    - Most "un-vowel-like" = greatest obstruction + voiceless

        - [t] = air completely blocked (stop) + voiceless, most "un-vowel-like"

Strengthening and Weakening

- Using this logic, we can arrange speech sounds on a scale from **most vowel-like** (most sonority) to **least vowel-like** (least sonority). We call this the **sonority scale** or **sonority hierarchy**:

< Higher sonority < More vowel-like < Lesser obstruction of airflow					**Lower sonority >** More consonant-like > Greater obstruction of airflow >	
vowels	glides	liquids	nasals	fricatives	affricates	stops

- Voiced sounds are also considered to have higher sonority than voiceless sounds:

< Higher sonority < More vowel-like	**Lower sonority >** More consonant-like >
voiced	voiceless

Strengthening and Weakening

< Higher sonority < More vowel-like						Lower sonority > More consonant-like >
vowels	glides	liquids	nasals	fricatives	affricates	stops
voiced				voiceless		

- If a consonant changes to **decrease in sonority**, it is called **strengthening** or **fortition**, because the consonant is becoming more consonant-like:

  - *th*-stopping in some American English varieties: *with* [wɪt], *them* [dɛm] (fricative → stop)

- If a consonant changes to **increase in sonority**, it is called **weakening** or **lenition**, because the consonant is becoming less consonant-like:

  - /t/ → [ɾ] in *butter, better, water* (/t/ becomes voiced and is no longer a stop)

- For vowels, opposite is true: more sonority = vowel strengthening, less sonority = vowel weakening

Practice: Strengthening and Weakening

< **Higher sonority**						**Lower sonority >**
< More vowel-like						More consonant-like >
vowels	glides	liquids	nasals	fricatives	affricates	stops
voiced			voiceless			

Spanish /d/ is pronounced with allophone [ð] after a vowel:

1. *dos* [**d**os] 'two'

2. *mitad* [mita**ð**] 'half'

3. *asado* [asa**ð**o] 'roast'

Is /d/ → [ð] an example of strengthening or weakening?

German /d/ is pronounced with allophone [t] at the end of a word:

1. *der* [**d**ɛɐ̯] 'the'
2. *Bad* [ba:**t**] 'bath'
3. *Wald* [val**t**] 'forest'

Is /d/ → [t] an example of strengthening or weakening?

Practice: Strengthening and Weakening

< Higher sonority						Lower sonority >
< More vowel-like						More consonant-like >
vowels	glides	liquids	nasals	fricatives	affricates	stops
voiced			voiceless			

Spanish /d/ is pronounced with allophone [ð] after a vowel:

1. *dos* [**d**os] 'two'

2. *mitad* [mita**ð**] 'half'

3. *asado* [asa**ð**o] 'roast'

Is /d/ → [ð] an example of strengthening or weakening?

Weakening: [d] = stop, [ð] = fricative
stop → fricative = increase in sonority = weaker

German /d/ is pronounced with allophone [t] at the end of a word:

1. *der* [**d**ɛɐ̯] 'the'
2. *Bad* [baː**t**] 'bath'
3. *Wald* [val**t**] 'forest'

Is /d/ → [t] an example of strengthening or weakening?

Strengthening: [d] = voiced, [t] = voiceless
voiced → voiceless = decrease in sonority = stronger

Phonological processes and allophones

- We've seen six phonological processes: **assimilation/dissimilation**, **insertion/deletion**, **weakening/strengthening**

- These processes can explain why we use particular **allophones** for a given **phoneme**:

    - When we aspirate /t/ → [tʰ] as in *top*, it's **strengthening**.

    - When flap /t/ → [ɾ] as in *water*, it's **weakening**.

    - When we delete /t/ → Ø as in *center*, it's **deletion**.

    - All of these allophones are the result of the application of some phonological process.

Phonological processes and sound change

- Phonological processes also explain **sound change**.

  - Languages are **constantly changing** on all linguistic levels: morphology, syntax, semantics, pragmatics, and also phonetics/phonology.

  - **Sound change** involves processes like the ones we've seen, and over time, words can exhibit *multiple* different changes over time:

    - Latin 'man, person'   *hominem*
    - Deletion of [h]   [ominem]
    - Deletion of [m]   [omine]
    - Deletion of [i]   [omne]
    - Dissimilation of [mn] > [mr]   [omre]
    - Insertion of [b]   [ombre]
    - Spanish 'man' (*h* is silent)   *hombre*

Summary

- **Phonological processes** are sound changes that follow some systematic pattern. These include (but are not limited to):

  - Assimilation and dissimilation

  - Insertion and deletion (epenthesis and elision)

  - Strengthening and weakening (fortition and lenition)

- Phonological processes often explain why we see particular allophones in particular contexts

- They also explain many sound changes that have taken place over the history of languages