Lecture 6
Phonology: phonemes and allophones

Phonology: the **structure and relationships** of speech sounds
i.e., the **grammar** of how speech sounds are organized.

Key concept of **segmental** phonology: the **phoneme**.
Phonemes are the set of **contrastive** segments a language uses.

Two sounds are **contrastive** if the difference between them is sufficient to **distinguish between different words**;
in that case we say the sounds are different **phonemes**.

For instance, the English words *fat* [fæt] and *vat* [væt] differ in **only one sound**:
*fat* has a [f] where *vat* has a [v].
This proves that [f] and [v] are **distinct phonemes** in English.
In fact, since [f] and [v] differ in only one **feature**—i.e., **voicing**—
this shows that voicing is a **distinctive feature** in English.

*Fat* and *vat* constitute a **minimal pair** for those two phonemes—
a pair of words that **differ in only one sound**.
We can expand the minimal pair to a **minimal set**: *fat, vat, that, sat, hat*
prove that [f], [v], [ð], [s], [h] are **all different phonemes** (in English).

Sounds are different phonemes if they can appear in the same **environment**:
i.e., the phonetic **context** they appear in.
So *fat* and *vat* show that [f] and [v] can both appear **word-initially before** [æt].
(We can write this **environment** as #__æt : the # symbol represents the edge
of the word, and the underscore shows where the sound in question goes.)
If we can’t find a minimal pair, demonstrate contrast with a **near-minimal** pair:
words that show two sounds in roughly the same **environment**,
even if it’s **not the only difference** between the two words.
E.g, *pressure*/*pleasure* is a **near-minimal pair** for [ʃ] and [ʒ].

Phonemes are represented between **slashes**:
*pressure*/*pleasure* shows the contrast of /ʃ/ and /ʒ/.

English has 24 consonant phonemes and about 16 vowel phonemes:
/p t k b d g ʧ ʤ f θ s ʃ h v ʤ z ʒ m n ŋ l w ɹ j/
/i i ɛ e æ a ʌ ɔ ʊ aʊ æ ə ə /
Languages vary greatly in the size and makeup of their **phonemic inventory**:
German has /x/ and /y/ as phonemes but not /θ/ and /ð/.
Hawaiian only has 13 phonemes total.
some Khoisan languages of Africa have over 80 phonemes.
But: phonemes are not just the set of segments a language uses:
e.g., American English flap [ɾ] as in city is not a phoneme of English.
Phonemes are sounds used contrastively.

What’s not contrastive?

**Aspiration** in English; there are both aspirated and unaspirated voiceless stops:
- aspirated in *pit* [pʰɪt]
- unaspirated in *spit* [spɪt]
— but aspiration cannot be used to distinguish between a minimal pair.
  *[pɪt] and [pʰɪt] aren’t even possible English words:
It’s not possible in English for the difference between [p] and [pʰ] to be the **only difference between two words**.
So [p] and [pʰ] are **not distinct phonemes** in English;
  instead, they are both **allophones** of a single phoneme /p/.

What’s an allophone?
Recall sounds are **different phonemes** if they appear in the **same environment**.
If two sounds are **allophones of one phoneme**, then they can’t appear in the **same environment**—they’re in **complementary** distribution.

So an allophone is **one of several ways to pronounce a given phoneme**, depending on **what environment** it’s in.
Thus the phoneme /p/ is pronounced as [p] in **some phonetic environments**, and as [pʰ] in others; environment is **sufficient to determine** which is used.
(In particular, [pʰ] appears at the **beginning of a word**, and [p] after a /s/:  
  [pʰ] in *pin, pot, pair*; vs. [p] in *spin, spot, spare.)*

This means that a phoneme is not really an individual sound; it is a **set of sounds** in complementary distribution with each other.

But phonemes, not allophones, are the basic **segmental building blocks** of words —to know how to pronounce a word, you need to **know its phonemes**, not the specific allophones it contains.
E.g., when you learn the word *pit*, you have to memorize that it’s /pɪt/, but not that it’s [pʰɪt]—the allophone is **determined by the environment**.
We think of this in terms of **phonological rules**:
  there is a **rule** in the **grammar** of English that /p/ is aspirated word-initially.

Different languages have **different allophonic relationships** between sounds:
- Spanish has phoneme /p/, but doesn’t have an allophone [pʰ] at all
- Spanish [n] allophone of /n/; [ð] allophone of /d/; /ɹ/ & /t/ 2 phonemes
  …which is the opposite of English in all three cases
- In Korean, /p/ and /pʰ/ are separate phonemes; [b] an allophone of /p/
- In Hindi, /p/, /pʰ/, and /b/ are all distinct phonemes

Phonology is about the **relationships between sounds** in a language’s grammar; English, Hindi, and Korean have different **relationships between** [p pʰ b].
Phonological patterns often apply to natural classes of sounds.

E.g., aspiration in English doesn’t only apply to /p/;
the phonemes /t/ and /k/ show the same pattern:
• [tʰ] in ton, talk, till; [t] in stun, stalk, still
• [kʰ] in come, cat, kill; [k] in scum, scat, skill.

A natural class is a set of segments that have some set of features in common—in this case, all voiceless stops.
All the phonemes in this natural class have a similar allophonic pattern.
Not a coincidence; phonology is often organized in terms of natural classes.
So instead of having three rules—
• /p/ is [pʰ] at the beginning of a word
• /t/ is [tʰ] at the beginning of a word
• /k/ is [kʰ] at the beginning of a word
—we can just state one rule:
• voiceless stops are aspirated at the beginning of a word.
This is the best description of the structure of this rule in the grammar.

The environments for phonological rules can also be natural classes.
For instance, the rule relating /p/ and [b] in Korean is:
“lax” unaspirated stops become voiced between voiced sounds.
(Yes, Korean has “tense” and “lax” consonants. What this means phonetically is complicated.)

English aspiration is a good example of how phonological knowledge behaves:
• It is systematic: applying to all words with voiceless stops, not just some
• It applies to a natural class, not some random collection of phonemes
• It is unconscious—speakers apply the rule without realizing it exists, and don’t even notice the two allophones are different sounds
• It’s hard to unlearn: English speakers will aspirate voiceless stops even when trying to speak a language that doesn’t use aspiration that way