# ELL101: Intro to Linguistics
## Week 2-3 Phonology

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# Fields of linguistics

- Week 1-2: Phonetics (physical sound properties)
- Week 2-3: Phonology (speech sound rules)
- Week 4: Morphology (word parts)
- Week 5-7: Syntax (structure)
- Week 8-9: Semantics (meaning)
- Week 8-9: Pragmatics (conversation & convention)
- Week 10: First & Second language acquisition
- Week 11-12: Historical linguistics (history of language)
- Week 11-12: Socio-linguistics (language in society)
- Week 11-12: Neuro-linguistics (the brain and language)
- Week 11-12: Computational linguistics

- See the video clip and tell what sound (either [b], [d] or [g]) the guy produced.
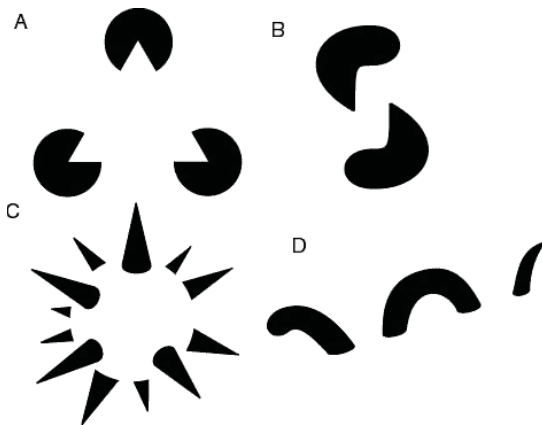
# Example:: McGurk effect II

- Our ears receive the acoustic information for [p], but the brain hears the sound [d] because of the interference of the visual information (i.e., lip reading that indicates the sound [g]).

- Our perceptual ability is not foolproof. The brain interprets the acoustic information sometimes inaccurately.

- The acoustic sounds (in the realm of phonetics) and the mental representation of the sound (in the realm of phonology) are different.
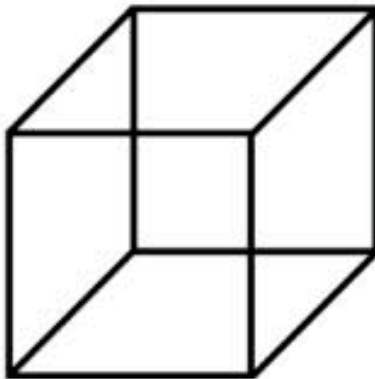
# Example:: Speech illusions I

- Pronounce the following pairs of sentences (From Pinker (1995)):
    - The good can decay many ways.
    - The good candy came anyways.

    - The stuffy nose can lead to problems.
    - The stuff he knows can lead to problems.

    - Some others I've seen.
    - Some mothers I've seen

- In the speech sound wave, one word runs into the next seamlessly.
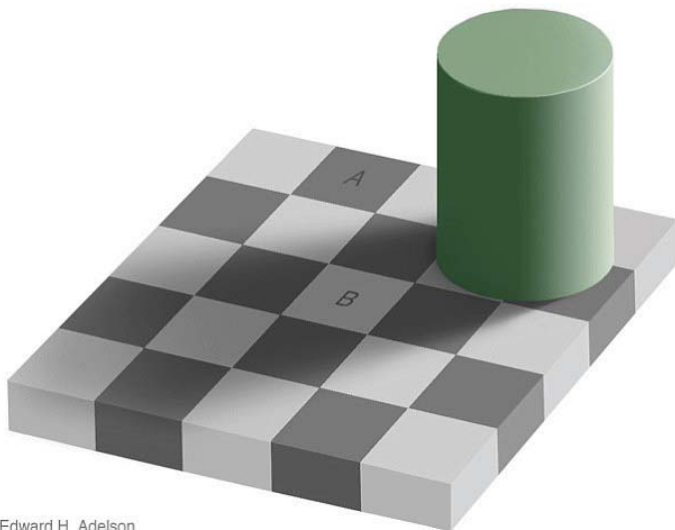
- We always try to make sense of our perceptual information. Gestalt shift is a visual illusion almost comparable with the speech illusions.

Edward H. Adelson

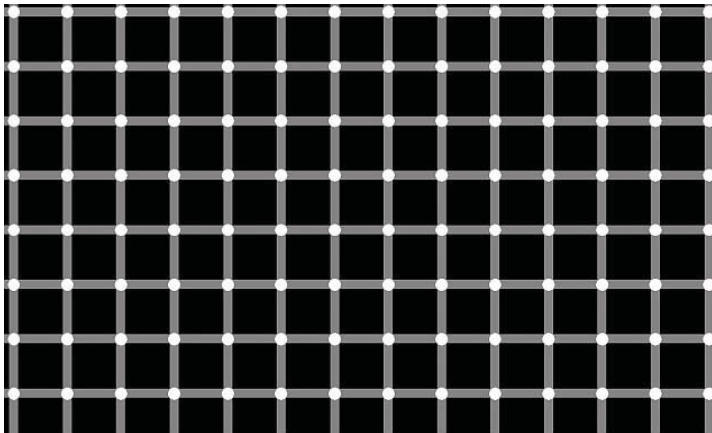© Roger Shepherd, Mind Sights

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# Example:: Optical illusions VI
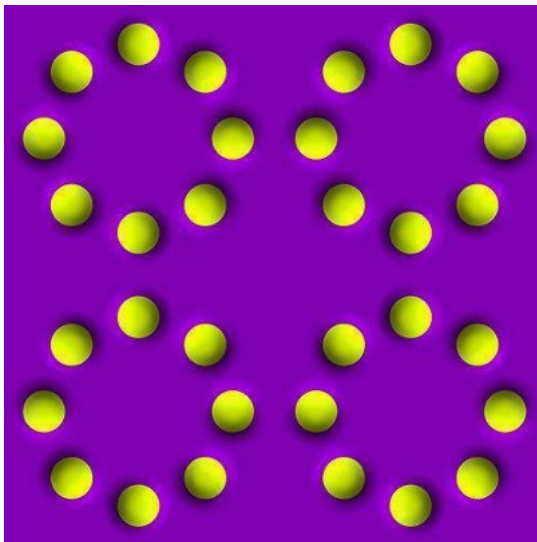
# Example:: Optical illusions VII
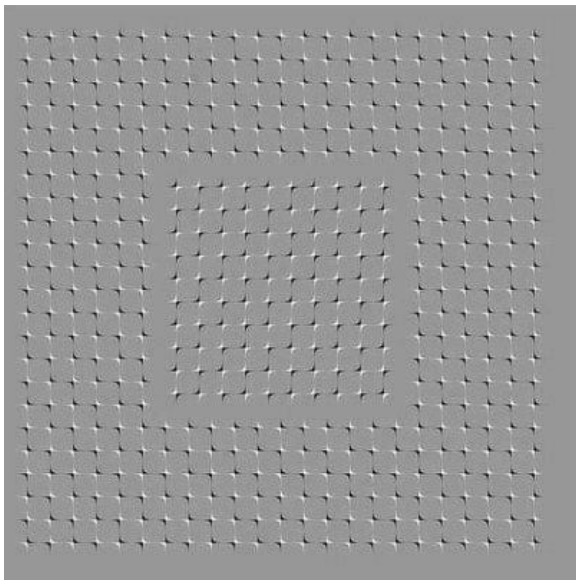
- Again, the physical facts in the world and the mental (psychological) facts may not be the same.
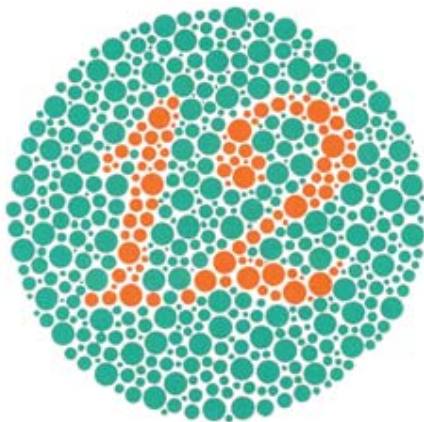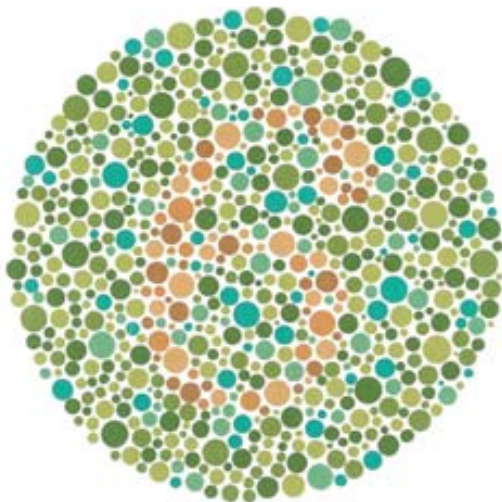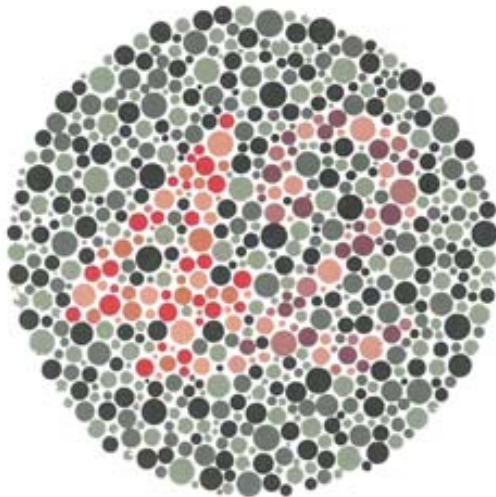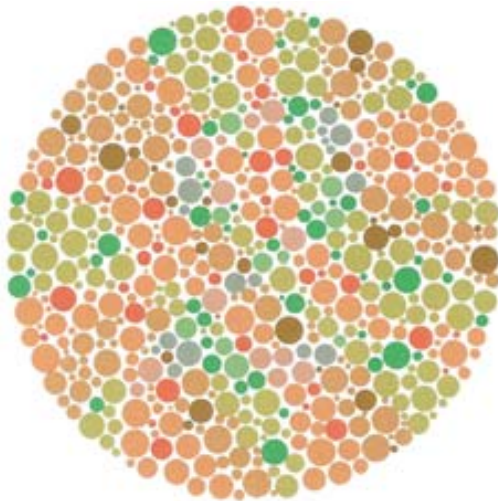
# What's the point? I

## Psychological reality

The actual & physical information (in the world) and the mental & psychological representation (in the brain) may not be identical

- The physical sounds and the mental (psychological) sounds are different entities.

# A note on phonetics I

- Phonetics is a study of speech sound. Therefore, phoneticians are less interested in language specific properties of the speech sound.

- We covered only English sounds, but phonetics handles all of the speech sound of human language.

- See the handout for the complete IPA chart.

- The IPA Chart (revised 2005) - only the consonants/vowel sections.



THE INTERNATIONAL PHONETIC ALPHABET (revised to 2005)

© 2005 IPA

# A note on phonetics III

- Each language picks a selected set of phonemes.
- Spanish phoneme inventory (consonant)
- See the handout for the phonemic inventories of other languages

CONSONANTS
(PULMONIC)

| | Bilabial | Labiodental | Dental | Alveolar | Postalveolar | Retroflex | Palatal | Velar | Uvular | Pharyngeal | Glottal |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Plosive | p | | | t | | | | k　g | | | |
| Nasal | m | | | n | | | ɲ | | | | |
| Trill | | | | r | | | | | | | |
| Tap or Flap | | | | ɾ | | | | | | | |
| Fricative | β | f | θ ð s | | | | | x　ɣ | | | |
| Affricate | | | | | tʃ | | | | | | |
| Lateral fricative | | | | | | | | | | | |
| Approximant | | | | | | | j | | | | |
| Lateral approximant | | | | l | | | ʎ | | | | |

Where symbols appear in pairs, the one to the right represents a voiced consonant. Shaded areas denote articulations judged impossible.

# A note on phonetics IV

- Each language picks a selected set of phonemes.
- Spanish phoneme inventory (vowel)
- See the handout for the phonemic inventories of other languages



VOWELS

Where symbols appear in pairs, the one
to the right represents a rounded vowel.
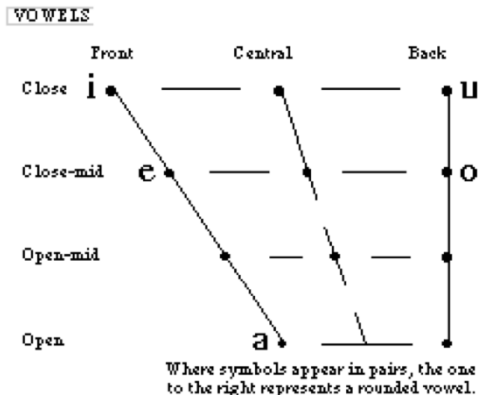
- Some languages use rather unusual speech sounds (to our ears), but those sounds are part of natural speech sounds of the language.
- Listen to "Miriam Makeba's Click Song" (from youtube)

# A note on phonetics VI

- Human language uses a highly restricted set of sounds that human can (almost infinitely) make.

- The latest IPA includes 28 vowels, 86 consonants, and 75 markers for tone, stress, aspiration and other phonetic details.

- The most recent discovery of a new consonant (called *labiodental flap*, which is produced by the lower lip moving back and forward, flapping on the inside of the upper teech) was in 2005 (following a set of new consonants discovered in 1993)

## Phonetics vs. Phonology

- Phonetics is concerned about speech sounds at the physiological level.
- Phonology is concerned about speech representations at the linguistics (mental/brain) level.
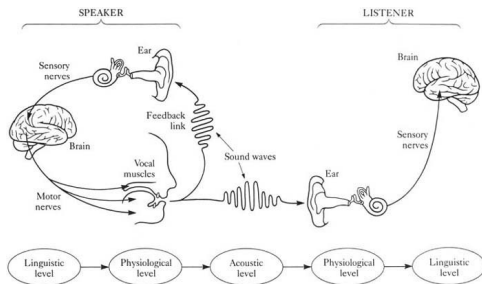
# Phonetics vs. Phonology II

## Phonology

- The description of the systems and patterns of speech sounds in a language
- "about the underlying design, the blue print of each sound type which serves as the constant basis of all the variations in different physical articulations of the sound type in different context" (Yule (2010); p.44)

# Phoneme, phone, and allophone I

## Phoneme

- usually written with slashes; e.g., /e/
- "meaning-distinguishing sounds in a language" (p.44)
- abstract mental representation of sounds

## Phones

- usually written with the square brackets; e.g., [e]
- "different variations of the sound type (phoneme) in actual speech" (p.45)
- physical realization of sounds

# Phoneme, phone, and allophone II

## Allophones

- A group of phones that belong to the same phoneme
- Allophone is language-specific. Thus, two languages may not have the same allophones.

# Phoneme, phone, and allophone III

- Think about the orthography of English to grasp the relationship between phonemes and phones

- Read the following sentences
  - THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG.
  - *the quick brown fox jumps over the lazy dog.*
  - `the quick brown fox jumps over the lazy dog.`
  - **the quick brown fox jumps over the lazy dog.**
  - *the quick brown fox jumps over the lazy dog.*
  - the quick brown fox jumps over the lazy dog.

# Phoneme, phone, and allophone IV

- Do they look the same? No! They are different, but we still read all the sentences in the same way.

- It is because we have the mental representation for each alphabet type (say, /a/ can be [a], [A], [ᴀ], [**A**], [ɑ], [**a**], [a] or [**a**])

- The same phenomenon applies to our perception of speech sounds. We pose a mental representation of each sound (**phoneme**) that has a number of different sound realizations (**phones**)

- Phones that are perceived as the same phoneme in a language are called **allophones**. (Important: Phonemes are language-specific)

- **Allophones** are a set of phonemes that are perceived as one phoneme.

- English examples

| Word | Phonemic | Phonetic |
|------|----------|----------|
| st̲ar | /stɑr/ | [stɑr] |
| t̲ar | /tɑr/ | [tʰɑr] (aspiration) |
| wri̲ter | /rɑɪtər/ | [rɑɪɾər] (flap) |
| eig̲th | /etθ/ | [et̪θ] (dentalized *t*) |

- **Allophones are language specific** → each language has its own allophonic sounds (e.g., aspiration is not an allophone in Hindi)

# Important things to remember

## Important things to remember

- Substituting one phoneme for another will result in a word with a different meaning
- Substituting one allophone for another will only results in a different pronunciation of the same word (just a weird pronunciation of the same word).
    - English "bin" /bɪn/ & "pin" /pɪn/
- /p/ in /pɪn/ has two phone variants (allophones), one with aspirated (with puff of the air) and without aspiration. They are allophones in English, but not in other languages (such as Hindi)
    - pin /pɪn/ → [pʰɪn] or [pɪn]

# Minimal pairs I

## Minimal pairs

When two words are identical except for only one phoneme (see examples below), we call the two words a "minimal pair"

- gun - dun (different place of articulation)
- ban - man (different manner of articulation)
- fan - van (different voicing)
- site - side (different voicing)
- bet -bat (different vowel position)

- If two sounds constitute a minimal pair, they cannot be the allophones of the same phoneme. → they should be two separate phonemes in that language

# Minimal pairs II

- Find the minimal pairs from the following set of words.

| | | | | |
|---|---|---|---|---|
| bee | time | tomb | fat | room |
| fan | knee | than | dine | ton |
| goat | shine | note | loom | none |

- See the handout for more examples of minimal pairs

# Syllable structure I

- Each syllable consists of "onset" and "rhyme"

- The rhyme, in turn, consists of at least one nucleus (vowel or vowel-like consonant) and a coda
  - When there is no consonant at the coda = **open syllable**
  - When there is a consonant at the coda = **closed syllable**

```
                        syllable
                       /        \
                  onset          rhyme
                    |           /     \
            consonant(s)    nucleus    coda
                               |         |
                             vowel   consonant(s)
```
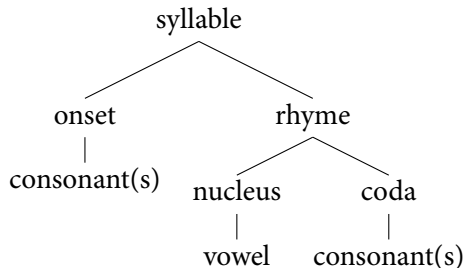
# Syllable structure II

- What are the onset, nucleus, and coda in the following words?
  - *green* /grin/
  - *eggs* /ɛgz/
  - *and* /ænd/
  - *ham* /hæm/
  - *I* /aɪ/
  - *am* /əm/

- In English, onset can consist more than two consonants (up to three consonants)
  - *stop* /stap/, *black* /blæk/, *bread* /brɛd/, *trick* /trɪk/, *twin* /twɪn/, *flat* /flæt/, *throw* /θro/, *stress* /strəs/, *splat* /splæt/, *splash* /splæʃ/, *spring* /sprɪŋ/, *strong* /strɔŋ/, *scream* /skrɪm/, *square* /skwɛr/
  - Is there any rule that applies to the heavy (multiple) consonant at the onset?

# Syllable structure III

- Three consonants (consonant cluster) at the onset are allowed when
    - the first consonant is [s]
    - the second consonant is a voiceless stop sound (/p/, /t/, /k/)
    - the third consonant is liquid or glide (/l/, /r/, /w/)

- "stress" [strəs] and "splat" [splat]

# Syllable structure IV
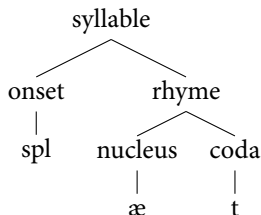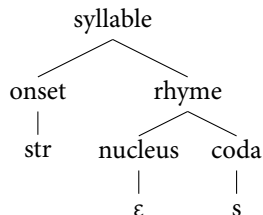
## Phonotactics

Possible combinations of sound sequences in a language.

- Which of the following made-up words can be English words? (see the previous frame)

  | [ptak] | [θal] | [hlad] | [plaft] | [sram] |
  |--------|-------|--------|---------|--------|
  | [mgla] | [vlas] | [flʊtʃ] | [dnom] | [trut] |
  | [tosp] | [njip] | | | |

- See the case of Japanese phonotactics
  - In Japanese only CV and V are allowed

  ◯ [taberu] (*to eat*)  ◯ [kireina] (*beautiful*)  ◯ [otera] (*temple*)
  ✕ [kɪk]  ✕ [maɪk]  ✕ [sɪŋ]

# Natural class I

- In Phonology, the phonemes are often represented as a set of phonological features (as opposed to articulatory features such as Voicing-Place-Manner)

- For example, mid-low vowel /ɑ/ is represented as

$$
\begin{bmatrix}
- & \text{consonantal} \\
+ & \text{syllabic} \\
+ & \text{sonorant} \\
+ & \text{voice} \\
+ & \textsc{dorsal} \\
- & \text{high} \\
+ & \text{low} \\
+ & \text{back} \\
+ & \text{tense}
\end{bmatrix}
$$

# Natural class II

## /p/, /t/, /k/

- Articulatory feature: "voiceless stop"
- Phonological feature: [+ consonantal] [- continuous]

## /l/, /r/, /w/

- Articulatory feature: "liquid" or "glide"
- Phonological feature: [+ sonorant] [+ continuous]

## /p/, /v/, /f/, /v/, /m/, /w/

- Articulatory feature: "bilabial" or "labiodental"
- Phonological feature: [+ LABIAL]

# Natural class III

## /t/, /d/, /θ/, /ð/, /s/, /z/, /ʃ/, /ʒ/

- Articulatory feature:
- Phonological feature: [+ CORONAL]

# Natural class IV

**Table 3.25**  Feature matrix for English consonants

| | | Stops | | | | | | Fricatives | | | | | | | | Affricates | | Nasals | | | Liquids | | Glides | | | Glottals | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | p | b | t | d | k | g | f | v | θ | ð | s | z | ʃ | ʒ | tʃ | dʒ | m | n | ŋ | l | ɹ | j | w | ʍ | h | ʔ |
| **Major class features** | [consonantal] | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + | − | − | − | − | − |
| | [sonorant] | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | + | + | + | + | + | + | + | + | − | − |
| | [syllabic] | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − |
| **Manner features** | [nasal] | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | + | + | + | − | − | − | − | − | − | − |
| | [continuant] | − | − | − | − | − | − | + | + | + | + | + | + | + | + | − | − | − | − | − | + | + | + | + | + | + | − |
| | [lateral] | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | + | − | − | − | − | − | − |
| | [delayed release] | − | − | − | − | − | − | | | | | | | | | + | + | | | | | | | | | | |
| **Laryngeal features** | [voice] | − | + | − | + | − | + | − | + | − | + | − | + | − | + | − | + | + | + | + | + | + | + | + | − | − | − |
| | [CG] | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | + |
| | [SG] | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | − | + | − |
| **Place of articulation features** | LABIAL | o | o | | | | | o | o | | | | | | | | | o | | | | | | o | o | | |
| | [round] | − | − | | | | | − | − | | | | | | | | | − | | | | | | + | + | | |
| | CORONAL | | | o | o | | | | | o | o | o | o | o | o | o | o | | o | | o | o | | | | | |
| | [anterior] | | | + | + | | | | | + | + | + | + | − | − | − | − | | + | | + | + | | | | | |
| | [strident] | | | − | − | | | | | − | − | + | + | + | + | + | + | | − | | − | − | | | | | |
| | DORSAL | | | | | o | o | | | | | | | | | | | | | o | | | o | o | o | | |
| | [high] | | | | | + | + | | | | | | | | | | | | | + | | | + | + | + | | |
| | [back] | | | | | + | + | | | | | | | | | | | | | + | | | − | + | + | | |

*Note:* [low], [tense], and [reduced] are not used for English consonants.
Aspirated stops [pʰ, tʰ, kʰ] will have the feature [+SG].
Syllabic liquids and nasals will have the feature [+syllabic].

**Table 3.26**  Feature matrix for English vowels

| | | i | ɪ | e | ɛ | æ | ə | ʌ | u | ʊ | o | ɔ | ɑ/a |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Major class features | [consonantal] | – | – | – | – | – | – | – | – | – | – | – | – |
| | [sonorant] | + | + | + | + | + | + | + | + | + | + | + | + |
| | [syllabic] | + | + | + | + | + | + | + | + | + | + | + | + |
| Manner feature | [continuant] | + | + | + | + | + | + | + | + | + | + | + | + |
| Laryngeal feature | [voice] | + | + | + | + | + | + | + | + | + | + | + | + |
| Place of articulation features | LABIAL | | | | | | | | o | o | o | o | |
| | [round] | | | | | | | | + | + | + | + | |
| | DORSAL | o | o | o | o | o | o | o | o | o | o | o | o |
| | [high] | + | + | – | – | – | – | – | + | + | – | – | – |
| | [low] | – | – | – | – | + | – | – | – | – | – | – | + |
| | [back] | – | – | – | – | – | + | + | + | + | + | + | + |
| | [tense] | + | – | + | – | – | – | – | + | – | + | – | + |
| | [reduced] | – | – | – | – | – | + | – | – | – | – | – | – |

# Natural class VI

- Why do we need an alternative system to describe phonological rules? → the same groups of phonemes repeatedly appear in different phonological rules.

- In this class, we do not worry about the phonological features (we keep using the articulatory features + only three phonological features: **obstruents**, **sonorant**, and **sibilants**)

| [+ sonorant] | = singable sounds | (= nasal, liquid, and glide) |
|---|---|---|
| [+ obstruent] | = not singable sounds | (= stop, fricative, affricate) |
| | = [- sonorant] | |
| [+ sibilants] | = noisy sounds | (= [s, z, ʃ, ʒ, tʃ, dʒ]) |
| | = a.k.a. [+ strident] | |

# English phonological rules I

- Natural classes are motivated by the fact that the same set of phonemes repeatedly appear in the phonological rules (i.e. sound change rules)

- In the following frames, we will see several phonological rules in English. We will keep using the articulatory features (e.g., bilabial, nasal, voiced etc.), but ideally those rules should be described with the phonological features

# English phonological rules II

## Co-articulation

Merging one of segment features of two phones. Either an anticipatory or preservatory pattern.

## Assimilation

A type of coarticulation. "When two sound segments occur in sequence and some aspect of one segment is taken or 'copied' by the other" (i.e., a segmental feature of one phone overwrites the corresponding feature of the other phone)

# English phonological rules III

- **Nasalization**
  - In English, a vowel that appears before a nasal sound is nasalized
  - "pin" /pɪn/ → [pɪ̃n]
  - "pan" /pæn/ → [pæ̃n]
  - "in + possible" /ɪ n + pasəbəl/ → [ɪmpasəbəl]
  - "in + tolerable" /ɪn + talrəbəl/ → [ɪntalrəbəl]

- **Alveolar stop assimilation (dentalization)**
  - alveolar stops assimilate to the place of articulation of a following consonant
  - "width" /wɪdθ/ → [wɪd̪θ]
  - "in this" /ɪnðɪs/ → [ɪn̪ðɪs]

- **Palatalization**
    - a special type of assimilation that occurs when an alveolar, dental, and velar stop or fricative appears before a front vowel. [t] → [ʧ], [d] → [ʤ], [k] → [ʧ], and [g] → [ʤ]
    - "did you eat?" /dɪd ju it/ → [dɪʤa it]

# English phonological rules V

## Lenition

A type of coarticulation. Some aspect of one sound segment becomes weaker in a certain condition.

- **Flapping**
    - a dental or alveolar stop articulation changes to a flap [ɾ]. In English, intervocalic (i.e., between vowels) [t] becomes [ɾ]
    - "butter" [bəɾər]
    - "writer" [raɪɾər]
    - "waiter" [weɪɾər]

## Strengthening

The strengthening rule makes sounds stronger

- **Aspiration**
    - voiceless stops become aspirated when they occur at the beginning of a stressed syllable. **Aspiration** is characterized with the "puff of the air"
    - "tap" /tæp/ → [tʰæp]
    - "cat" /kæt/ → [kʰæt]

# English phonological rules VII

## Epenthesis

Inserting syllabic or non-syllabic segment

- **Consonant Insertion**
  - In English, the consonant insertion is observed in the following words.
  - "something" [sʌmθɪŋ] → [sʌmpθɪŋ]
  - "warmth" [wɔrmθ] → [wɔrmpθ]
  - "length" [lɛŋθ] → [lɛŋkθ]
  - "prince" [prɪns] → [prɪnts]
  - "tenth" [tɛnθ] → [tɛntθ]

- **ə-insertion**
  - between two consonants (especially sibilants), a schwa is inserted
  - "train" [tren] → [təren] / [tiren]
  - "sport" [sport] → [səport] / [suport]
  - "forks" /fɔksz/ → [fɔksəz]

## Metathesis

Swapping sound segments. (i.e., "reordering of segments")

- **Metathesis**
  - In English, metathesis is frequently observed in the following words.
  - "spaghetti" → "pesghetti" [pəskɛɾi]
  - "prescribe" → "perscribe"
  - "prescription" → "perscription"

## Deletion/Elision

Dropping sound segments

- **/d/-deletion**
  - In English, /d/ in "and" is often deleted
  - "you and me" /ju ænd mi/ → [ju ən mi]

- **/h/-deletion**
  - In English, /h/ in words like "his" and "her" is often deleted.
  - He handed her his hat
    /hi hændəd hr hɪz hæt / → [hi hændəd r ɪz hæt]

- ə-**deletion**: In English, [ə] are dropped in a rapid speech
  - "parade" /pəred/ → [pred]
  - "corrode" /kərowd/ → [krowd]
  - "suppose" /səpowz/ → [spowz]

# English phonological rules X

## Dissimilation

The feature of segments is changed to make a contrast with its surrounding words

- **Dissimilation**
    - In English, dissimilation is observed in the suffix *-al*
    - *anecdot-al*, *annu-al*, *ment-al*, and *pen-al*
    - *angul-ar* (not *angul-al*), *perpendicul-ar* (not *perpendicul-al*), and *simil-ar* (not *simil-al*)

# Distributions of the phoneme I

## Complementary distribution

- *X* is found in one condition. *Y* is found everywhere else.
- e.g., pan [pʰæn] vs. span [spæn]

## Free variation

- Both *X* and *Y* appear in the same condition, but they do not make any significant meaning difference.
- e.g., often [ɑfn] or [ɑftn]

# Distributions of the phoneme II

## Contrastive distribution

- Both *X* and *Y* appear in the same condition and they make any significant meaning difference.
- e.g., keep [kip] and sheep [ʃip]

# Phonological generalization I

- /n/ - [n], [m], or [ŋ]

- Say the following sentences.
  - I can ask.
  - I can see.
  - I can bake.
  - I can play.
  - I can go.
  - I can come.

# Phonological generalization II

- We pronounce "can" in different ways.
  - I can ask. [aɪ kæ<u>n</u> æsk]
  - I can see. [aɪ kæ<u>n</u> si]
  - I can bake. [aɪ kæ<u>m</u> beɪk]
  - I can play. [aɪ kæ<u>m</u> pleɪ]
  - I can go. [aɪ kæ<u>ŋ</u> goʊ]
  - I can come. [aɪ kæ<u>ŋ</u> kʌm]

- Can we make any generalization (rule) for those different pronunciations?

# Phonological generalization III

- We pronounce "can" in different ways.
  - I can ask. [aɪ kæn æsk]
  - I can see. [aɪ kæn si]
  - I can bake. [aɪ kæm beɪk]
  - I can play. [aɪ kæm pleɪ]
  - I can go. [aɪ kæŋ goʊ]
  - I can come. [aɪ kæŋ kʌm]

- Assimilation rule for /n/
  - / n / is pronounce as [m] before a bilabial consonant.
  - / n / is pronounced as [ŋ] before a velar consonant.
  - / n / is pronounced as [n] everywhere else.

# Phonological generalization I

- /l/ - [l] or [l̥]

- We pronounce [l] in different ways (voiced lateral liquid [l] and voiceless lateral liquid [l̥]).
    - blue [blu], gleam [glim], slip [slɪ], flog [flɔg], leaf [lif]
    - plow [pl̥aw], clap [kl̥æp], clear [kl̥ir], play [pl̥ej]

- The voiceless [l̥] always appears after a voiceless stop consonant (e.g., [p] and [k])
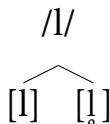
# Phonological generalization II

- [l] and [l̥] are in a **complementary distribution** (i.e., the existence of one feature indicates the absence of the other features)

|  | [l] | [l̥] |
|---|---|---|
| after voiceless stop | No | Yes |
| elsewhere | Yes | No |

# Phonological generalization III

- We pronounce [l] in different ways (voiced lateral liquid [l] and voiceless lateral liquid [l̥]).
    - blue [blu], gleam [glim], slip [slɪ], flog [flɔg], leaf [lif]
    - plow [pl̥aw], clap [kl̥æp], clear [kl̥ir], play [pl̥ej]

- Since [l] and [l̥] are in the complementary distribution, those two sounds are allophones of the same phoneme /l/.

```
        /n/                    /l/
       / | \                  /  \
    [n] [m] [ŋ]            [l]   [l̥]
```
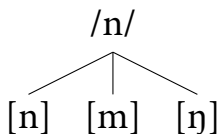
- /r/ - [r] and [r̥]

- We pronounce [r] in different ways (voiced retroflex liquid [r] and voiceless retroflex liquid [r̥]).
  - brew [bru], green [grin], drip [drlɪp], frog [frɔg], shrimp [ʃrɪmp]
  - prow [pr̥aw], trip [tr̥ɪp], creep [kr̥ip], pray [pr̥ej]

- [r] and [r̥] are in the complementary distribution, those two sounds are allophones of the same phoneme /r/.

# English plural -*s* I
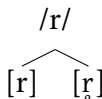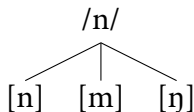
## Goals of phonology (and linguistics in general)

- Explain complex and superficially random linguistic phenomena with a simple (generalizable) rule
- *Occam's razor* in linguistics – the simplest explanation or strategy is the best theory
- When one single rule is not sufficient for a given phenomenon,
  - you should NOT attempt to create a more complex rule
  - you should consider the interaction of two simple (already existing) rules

- We will see two complex phonological phenomena in English: plural -*s* and past-tense -*ed*.
- Remember that we want to use the existing phonological rules (those rules we have talked about above) rather than to create a new one

- What are the plural form for the following words?

| **A** | **B** | **C** | **D** |
|-------|-------|-------|-------|
| cab | cap | bus | child |
| cad | cat | bush | ox |
| bag | back | buzz | mouse |
| love | cuff | garage | criterion |
| lathe | faith | match | sheep |
| cam | | badge | |
| can | | | |
| bang | | | |
| call | | | |
| bar | | | |
| spa | | | |
| boy | | | |

# English plural -s III

- They are grouped by the sound of the plural marker (i.e., [z], [s], [əz], or irregular).

| A | B | C | D |
|---|---|---|---|
| cabs | caps | busses | children |
| cads | cats | bushes | oxen |
| bags | backs | buzzes | mice |
| loves | cuffs | garages | criteria |
| lathes | faiths | matches | sheep |
| cams | | badges | |
| cans | | | |
| bangs | | | |
| calls | | | |
| bars | | | |
| spas | | | |
| boys | | | |
| [z] | [s] | [əz] | irr |

- English orthography is misguiding. Let's use IPA.

| A | B | C | D |
|---|---|---|---|
| [kʰæb] | [kʰæp] | [bʌs] | – |
| [kʰæd] | [kʰæt] | [bʊʃ] | – |
| [bʰæg] | [bæk] | [bʌz] | – |
| [lʌv] | [kʰʌf] | [gəraʒ] | – |
| [leð] | [feθ] | [mætʃ] | – |
| [kæm] | | [bædʒ] | |
| [kʰæn] | | | |
| [bæŋ] | | | |
| [kʰɔl] | | | |
| [bar] | | | |
| [spa] | | | |
| [bɔj] | | | |
| | | | |
| [z] | [s] | [əz] | irr |

# English plural -*s* V

| <u>A</u> | <u>B</u> | <u>C</u> | <u>D</u> |
|---|---|---|---|
| [kʰæb] | [kʰæp] | [bʌs] | – |
| [kʰæd] | [kʰæt] | [bʊʃ] | – |
| [bʰæg] | [bæk] | [bʌz] | – |
| [lʌv] | [kʰʌf] | [gəraʒ] | – |
| [leð ] | [feθ] | [mætʃ] | – |
| [kæm] | | [bædʒ] | |
| [kʰæn] | | | |
| [bæŋ] | | | |
| [kʰɔl] | | | |
| [bar] | | | |
| [spa] | | | |
| [bɔj] | | | |

[z] = after [b], [d], [g], [v], [ð], [m], [n], [ŋ], [l], [r], [a], [ɔj]
[s] = after [p], [t], [k], [f], [θ]
[əz] = after [s], [ʃ], [z], [ʒ], [tʃ], [dʒ]

- Phonological rule for English plural morpheme?
  - [z] = after voiced non-sibilant (no hissing sound; that is, /s/, /z/, /ʃ/, /ʒ/, /tʃ/, and /dʒ/) consonants and vowel segments
  - [s] = after voiceless non-sibilant segments
  - [əz] = after sibilant (hissing sound) segments

- But those rules are unnecessary complex (and ugly). Can we simplify them?

# English plural -*s* VII

- Phonological rule for English plural morpheme?
  - [z] = after voiced non-sibilant (no hissing sound; that is, /s/, /z/, /ʃ/, /ʒ/, /tʃ/, and /dʒ/) consonants and vowel segments
  - [s] = after voiceless non-sibilant segments
  - [əz] = after sibilant (hissing sound) segments

- The observation above can be explained by the combination of two simple phonological rules.
  - ə-**insertion**: between two sibilant sounds (that is, /s/, /z/, /ʃ/, /ʒ/, /tʃ/, and /dʒ/), a schwa is inserted
  - **de-voicing of alveolar sound**: alveolar fricative (and stop) assimilate the voicing condition to that of the preceding sound.

# English plural -*s* VIII

- The observation above can be explained by the combination of two simple phonological rules.
  - ə-**insertion**: between two sibilant sounds (that is, /s/, /z/, /ʃ/, /ʒ/, /tʃ/, and /dʒ/), a schwa is inserted
  - **de-voicing of alveolar sound**: alveolar fricative (and stop) assimilate the voicing condition to that of the preceding sound.

| MENTAL REP. | | ə-INSERTION | | DEVOICING | | OUTPUT |
|---|---|---|---|---|---|---|
| /kæb/ + /z/ | → | /kæb-z/ | → | /kæb-z/ | → | [kæbz] |
| /kæp/ + /z/ | → | /kæp-z/ | → | /kæp-z/ | → | [kæps] |
| /bʌs/ + /z/ | → | /bʌs-z/ | → | /bʌsəz/ | → | [bʌsəz] |

- What does it buy us?
  - We can claim that the plural forms in English (realized in three different morphemes [-z], [-s], and [-əz]) are represented by a single morpheme (i.e., /z/) in our brain
  - It simplifies the learning problem of plural morphemes (namely, this is why children learn the plural formation in English without any problem)
  - The same set of rules can explain other phenomena (such as English past-tense morpheme /-əd/)

# English plural -*s* X

- What are the pasat-tense forms of the following words?

| A | B | C | D |
|---|---|---|---|
| grab | reap | state | is |
| hug | peak | raid | run |
| seethe | unearth | | sing |
| love | huff | | have |
| buzz | kiss | | go |
| rouge | wish | | hit |
| judge | pitch | | |
| fan | | | |
| ram | | | |
| long | | | |
| | | | |
| [d] | [t] | [əd] | irr |

# Phonology Exercises I

- How to solve the Phonology problems
  - Identify the relevant sounds in the data. Circle or highlight them.

  - Try finding a minimal pair with those highlighted sounds. If there is a minimal pair, those sounds are **phonemes**.

  - If there is no minimal pair, list the target sounds with its immediately preceding and following sounds.

  - Compare the environments for the two sounds and identify the distinctive condition of one sound.

  - If any specific environment for one of the sounds is found (i.e., the sounds are in the complementary distribution), those sounds are **allophones of the same phoneme**.

  - Write up the rule.

# Phonology Exercises II

Examine the phones [d] and [ð] in Spanish. Determine whether they are allophones of one phoneme or of separate phonemes. Note that finding minimal pairs is the first step to identify phonemes in a language. If they are allophones of one phoneme, identify the rule that describes the distribution of those allophonic variations.

| | | | |
|---|---|---|---|
| [drama] | 'drama' | [komiða] | 'food' |
| [dolor] | 'pain' | [anda] | 'scram' |
| [dime] | 'tell me' | [sueldo] | 'compensation' |
| [kaða] | 'each' | [durar] | 'to last' |
| [laðo] | 'side' | [toldo] | 'curtain' |
| [oðio] | 'hatred' | [falda] | 'skirt' |

# Phonology Exercises III

[**d**rama]   'drama'      [komi**ð**a]   'food'
[**d**olor]   'pain'       [an**d**a]   'scram'
[**d**ime]   'tell me'     [suel**d**o]   'compensation'
[ka**ð**a]   'each'        [**d**urar]   'to last'
[la**ð**o]   'side'        [tol**d**o]   'curtain'
[o**ð**io]   'hatred'      [fal**d**a]   'skirt'

**d**r      **d**o      n**d**a      **d**i      l**d**o
**d**u      l**d**o      l**d**a

i**ð**a      a**ð**a      a**ð**o      o**ð**i

d r    d o    n d a    d i    l d o
d u    l d o    l d a

i ð a    a ð a    a ð o    o ð i

- Observation
  - ð always appear between vowels (inter-vocalic position)
  - d always appear at the syllable onset position or after an alveolar sound.
- Alveolar place assimilation rule (in Spanish)
  - ð becomes d when it appears at the syllable onset or after an alveolar consonant.

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