English Consonants & Vowels

- Phonetics: a study on speech

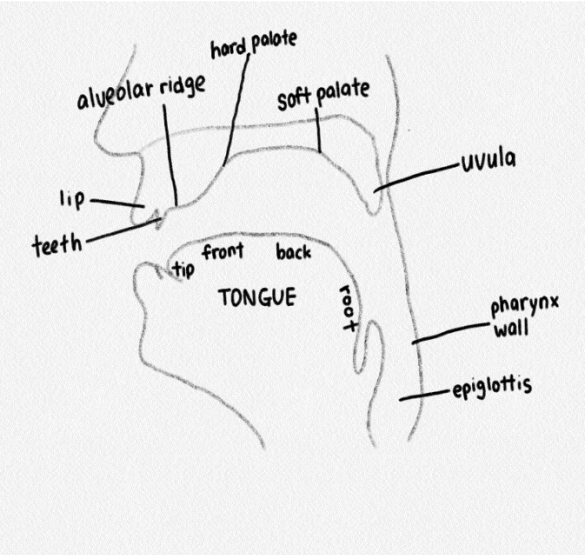
  articulatory phonetics (from mouth) → how to produce speech

  acoustic phonetics (through air) → how to transmit speech

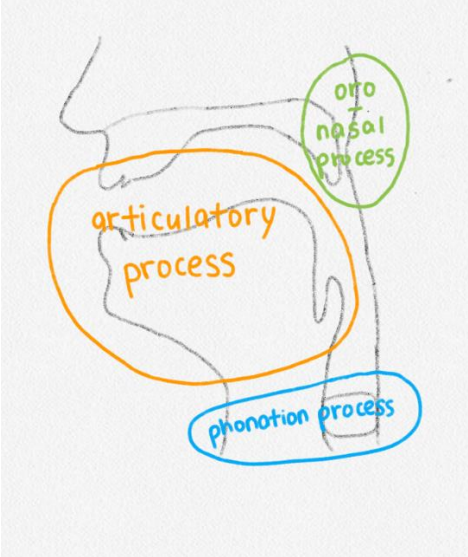
  auditory phonetics (to ear) → how to hear speech

Articulation

- Vocal tract:



- 5 speech organs = constrictors = articulators



Phonation Process in Larynx

- larynx = voicebox: voiced → can feel vibration

  ex. v, z, l, m, a, i

  voiceless → can't feel vibration

  ex. f, s, k, p, h

Oro-nasal Process in Velum

- nasal: when velum lowered

  ex. m, n, ng

Articulatory Process

- lips / tongue tip / tongue body

Control of Constrictors(Articulators)

- Each constrictor needs to be more specific in geometry

  constriction location(CL) / constriction degree(CD)

- Constriction location: Lips → bilabial / labiodental

  Tongue body → palatal / velar

  Tongue tip → dental / alveolar / retroflex / palate-alveolar

- Constriction degree: stops > fricatives > approximants > vowels

How to Produce English Consonants and Vowels

- constrictors(lips, tongue tip, tongue body) / CD / CL / velum / larynx
  ex) /p/: lips / bilabial / stop / velum raised / larynx open
  /b/: lips / bilabial / stop / velum raised / larynx closed
  /d/: tongue tip / alveolar / stop / velum raised / larynx closed
  /z/: tongue tip / alveolar / fricative / velum raised / larynx closed
  /n/: tongue tip / alveolar / stop / velum lowered / larynx closed
- Phonemes: individual sounds that form words
  a combination of speech organs' actions

Acoustics

- Praat: duration > select(click and drag on waveform or spectrogram) →
  read a value (sec.) on the top → zoom in (if not visible)
  intensity > show intensity → click on green → read a value (dB) on the right
  pitch > show pitch → pitch setting – pitch range (65-200Hz male / 145-276Hz female)
  → click on blue → read a value (Hz) on the right
  formant > show formants → place the cursor on one of the trajectories
  → read a value (Hz) on the left
- the number of occurrences of a repeating event per second (frequency, Hz)
  repeating event = vibration of vocal folds / repeating > sine wave = pure wave
  * sine wave: frequency + magnitude(amplitude) (x 축 시간 / y 축 value, voltage)
- 복잡한 신호는 단순한 sine wave 들의 합으로 표현된다. (synthesis)
  simplex tone: 단순한 sine wave / complex tone: 복잡한 신호
  spectrum: x 축 frequency / y 축 magnitude(amplitude)
  spectrogram: spectrum 을 시간으로 visualize 한 것 (x 축 시간 / y 축 frequency)
  sine wave→spectrum: spectral analysis
- pure tone→spectral analysis: frequency 가 같은 sine wave 한 개
  complex tone→spectral analysis: 일정한 간격의 sine wave 여러 개 (간격=pitch)
  (Praat: Spectrum > View Spectrum Slice)
- source: 성대에서 나는 소리
  human voice source consists of harmonics
  a complex tone = sum of pure tones at integer multiples of the lowest pure tone
  the lowest pure tone = fundamental frequency(F0) = rate of vibration of the larynx
  = the number of opening-closing cycles of the larynx per second
  amplitude of pure tones gradually decreases
- filter: vocal tract 에 의해서 달라지는 소리
  filter 의 spectrum → jigjagging with peaks and valleys (amplitude 의 패턴이 사라짐)
  peaks/mountains: frequencies VT likes (formants)
  valleys: frequencies VT does not like

- Synthesize Source: New > Sound > Create Sound as Pure Tone
  > Tone frequency 100~1000Hz / Amplitude 1.0~0.55Pa
  Combine > Combine to Stereo
  Convert > Convert to Mono
  반복 주기: frequency 100Hz / Amplitude 1.0Pa 와 일치
  음: frequency 100Hz / Amplitude 1.0Pa 와 일치
  Spectrum > View Spectral Slice: gradually decrease / 10 개 / 100Hz
- F1: 모음의 height / F2: 모음의 frontness(backness)
  F1 and F2 are enough to disambiguate vowels.
  (Praat: New > Sound > Create Sound as VowelEditor)