English Consonants & Vowels
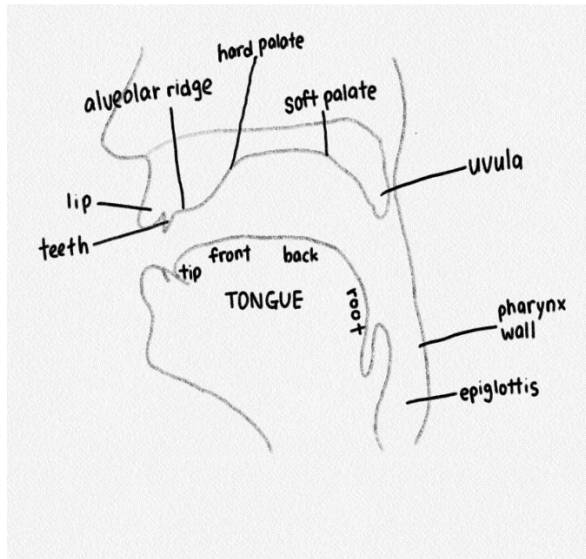
- Phonetics: a study on speech

articulatory phonetics (from mouth) → how to produce speech

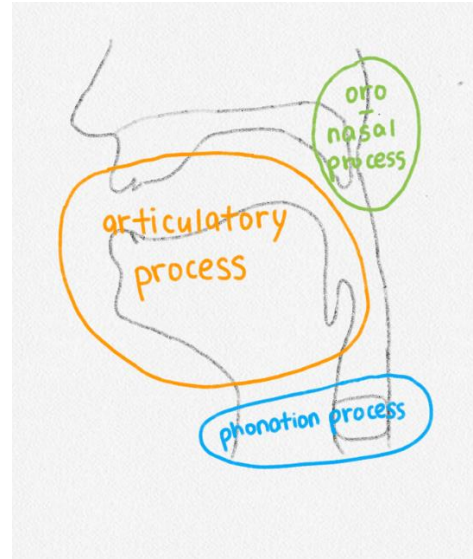acoustic phonetics (through air) → how to transmit speech

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 (/r, l, w, j/) > 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

  * 모든 모음은 constrictor 로서 tongue body 만 사용

- 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(모음 구별 수치) > 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 tone

  * sine wave: frequency + magnitude(amplitude) (x 축 시간 / y 축 value, voltage)

- 모든 신호는 단순한 sine wave 들의 합으로 표현된다. (synthesis)

  complex tone 이 반복하는 주기는 Fundamental Frequency 와 동일

  spectrum: x 축 frequency / y 축 magnitude(amplitude)

  spectrogram: spectrum 을 시간으로 visualize 한 것 (x 축 시간 / y 축 frequency)

  sine wave(time-value graph)→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 (measured by EGG)

        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 (10 개의 pure tone)
  Combine > Combine to Stereo (10 개의 channel 을 가진 하나의 stereo)
  Convert > Convert to Mono (10 개의 pure tone 이 합쳐진 complex tone)
  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)

Coding
- 코딩: 자동화 > 똑같은 과정을 쉽게 반복할 수 있기 위해서
- 모든 language 는 공통적으로 단어와 문법으로 이루어짐
  단어: 정보를 담는 그릇
- Computer Language 의 단어: 변수(variable)
  Computer Language 의 문법: 1. variable assigning
  2. 'if' conditioning
  3. 'for' loop
  함수: 어떤 입력을 넣어야 자신이 원하는 출력이 나오는지
  ex. Praat 입력: 마우스로 구간 설정 / Praat 출력: 소리
- Anaconda Prompt > 'Jupyter Notebook' 입력
  원하는 디렉토리 > New > Python 3
- cell 생성: cell 선택 후 b(아래쪽에 생성) / a(위에 생성) / x(삭제)
- Run: Shift + Enter
- =: 오른쪽에 있는 정보를 왼쪽에 있는 variable 로 assign 한다
  ex. a=1 > 정보: 1 / variable: a
  Print: 어떤 변수를 넣으면 그 값을 출력함
- Comment 쓰기: cell 에 #을 쓴 후 내용 적기
  Code 를 Markdown 으로 바꾼 후 내용 적기