Articulatory Phonetics

… a description of speech sounds in terms of the physical actions performed in their production
The Vocal Tract – A Reminder


The Resonant Cavities

Nasal Cavity

Pharyngial Cavity

Oral Cavity

Laryngial Cavity
The ‘Articulators’

- Alveolar Ridge
- Upper Teeth
- Upper Lip
- Lower Lip
- Tongue
- Hard Palate
- Soft Palate (Velum)
- Uvula
- Vocal Cords

The Tongue

- Tongue Tip
- Tongue Blade
- Tongue Front
- Tongue Back
- Tongue Root
Articulatory Phonetics

Speech sounds are classified in ‘articulatory phonetics’ as follows …

- all sounds (vowels & consonants)
  • where the air stream comes from
  • whether air is going in or out

- consonants
  • whether the vocal cords are vibrating: ‘voice’
  • where the constriction is: the ‘place’ of articulation
  • how the sound is made: the ‘manner’ of articulation

- vowels
  • the position of the tongue
  • the shape of the lips

Voice, Place, Manner
Voice

• Covered in Lecture 3

• ‘Degree of voicing’
  – voiced
  – voiceless

• ‘Voice quality’
  – modal (normal)
  – creaky
  – falsetto
  – breathy
‘Place’ of Articulation

• Articulation refers to the **constriction** of the vocal tract during speech production.

• Articulation involves the movement of an ‘**active articulator**’ (e.g. the tongue) towards a ‘**passive articulator**’ (e.g. the top of the mouth).

• The ‘**place**’ of articulation refers to the physical location of the constriction in the vocal tract.

‘Place’ of Articulation

- Bilabial
- Labiodental
- Dental
- Alveolar
- Postalveolar
- Retroflex
- Palatal
- Velar
- Uvular
- Pharyngeal
- Glottal
### Place of Articulation

<table>
<thead>
<tr>
<th>Place of Artication</th>
<th>Active Articulator</th>
<th>Passive Articulator</th>
<th>Example Sounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilabial</td>
<td>upper and lower lips</td>
<td>none</td>
<td>[p b m]</td>
</tr>
<tr>
<td>Labiodental</td>
<td>lower lip</td>
<td>upper front teeth</td>
<td>[f v]</td>
</tr>
<tr>
<td>Dental</td>
<td>tongue tip</td>
<td>upper front teeth</td>
<td>[θ ð]</td>
</tr>
<tr>
<td>Alveolar</td>
<td>tongue tip or blade</td>
<td>alveolar ridge</td>
<td>[t d n l s z]</td>
</tr>
<tr>
<td>Postalveolar</td>
<td>tongue tip or blade</td>
<td>rear of alveolar ridge</td>
<td>[ɹ ʃ]</td>
</tr>
<tr>
<td>Retroflex</td>
<td>tongue tip</td>
<td>hard palate</td>
<td>[t d n]</td>
</tr>
<tr>
<td>Palatal</td>
<td>tongue front</td>
<td>hard palate</td>
<td>[j n]</td>
</tr>
<tr>
<td>Velar</td>
<td>tongue back</td>
<td>soft palate</td>
<td>[k g ƞ]</td>
</tr>
<tr>
<td>Uvular</td>
<td>tongue back</td>
<td>uvula</td>
<td>[q ʢ]</td>
</tr>
<tr>
<td>Pharyngeal</td>
<td>tongue root</td>
<td>rear wall of pharynx</td>
<td>[h ʔ]</td>
</tr>
<tr>
<td>Glottal</td>
<td>vocal folds</td>
<td>none</td>
<td>[h ʔ]</td>
</tr>
</tbody>
</table>

Voice, Place, Manner
‘Manner’ of Articulation

• The ‘manner’ of articulation refers to the way in which the airstream is modified by the primary and secondary articulators

• Degrees of ‘stricture’ …
  – closure: articulators in firm contact (‘stops’)
  – narrowing: articulators close together but not touching (‘tricatives’)
  – approximation: wide gap between articulators (‘approximants’)

‘Manner’ of Articulation

**Stops:**

– complete blockage of the airstream
– can be produced at many different places of articulation
– stops made with a velic closure are called ‘oral stops’
– stops made without a velic closure (and with airflow through the nasal cavity) are called ‘nasal stops’
‘Manner’ of Articulation

Oral Stops:
- air pressure rises rapidly in the vocal tract during closure
- the compressed air bursts out of the vocal tract with a small explosive noise when the closure is released
- such sounds are called ‘plosives’, e.g. [p t k b d g]
- slower release sounds are called ‘affricates’, e.g. [ʧ dʒ]

Fricatives:
- sound is produced with a very narrow opening between the active and passive articulators
- the resulting airflow is turbulent and hence noisy
- air for a ‘median fricative’ flows through a narrow channel in the centre of the cavity, e.g. [s]
- airflow for a ‘lateral fricative’ escapes through a narrow space at the sides of the tongue, e.g. [ʃ]
‘Manner’ of Articulation

**Approximants:**
- sonorants do not have a stricture narrow enough to cause turbulence
- ‘lateral approximants’ have complete closure on the midline, e.g. [l]
- ‘median approximants’ have no complete closure and are also called ‘semi-vowels’ or ‘glides’, e.g. [w v j]

‘Manner’ of Articulation

**Taps and trills:**
- closure in a ‘tap’ or ‘flap’ is much shorter than for a plosive hence there is no build up of air pressure, e.g. [ɾ]
- a ‘trill’ or ‘roll’ consists of a series of rapid tap-like closures, e.g. [ɾ]
Voice, Place, Manner

- Voice, Place, Manner (VPM) labels are the standard method of specifying consonants.
- For example …

  - \([p]\) → voiceless bilabial plosive
  - \([g]\) → voiced velar plosive
  - \([s]\) → voiceless alveolar fricative
  - \([tʃ]\) → voiceless postavolar affricate
  - \([n]\) → voiced alveolar nasal
  - \([t]\) → voiceless alveolar plosive
  - \([l]\) → voiced alveolar lateral-approximant
Exercise 1

What are the VPM labels for the following consonants?

[k] → voiceless velar plosive
[θ] → voiceless dental fricative
[m] → voiced bilabial nasal
[b] → voiced bilabial plosive
[h] → voiceless glottal fricative
[j] → voiceless postalveolar fricative
[ʔ] → glottal stop
Exercise 2

What consonants have the following VPM labels?

- voiced alveolar nasal → [n]
- voiced alveolar fricative → [z]
- voiceless labiodental fricative → [f]
- voiced bilabial plosive → [b]
- voiced postalveolar fricative → [ʒ]
- voiceless alveolar plosive → [t]
- voiced velar nasal → [ŋ]
Vowels

- Vowels are articulated by …
  - raising the front or the back of the tongue towards the roof of the oral cavity
  - shaping the lips
  … thereby changing the ‘vowel quality’

- Vowel quality is governed by …
  - ‘vowel height’: high / low
  - ‘vowel location’: front / back
  - ‘lip position’: rounded / unrounded

Vowel Height

- The ‘height’ of a vowel refers to the relationship between the highest point of the tongue and the roof of the oral cavity

- A ‘close’ or ‘high’ vowel (such as [i] or [u]) is produced when the tongue is raised close to the roof

- An ‘open’ or ‘low’ vowel (such as [æ] or [a]) is produced when there is a wide gap between the highest point of the tongue and the roof of the oral cavity

- Vowels can also be ‘mid’ ([ə]), ‘half-close’ ([ɛ]) or ‘half-open’ ([ʌ])
Vowel Location

• The ‘location’ of a vowel refers to the part of the tongue which is highest

• A ‘front vowel’ (such as [i]) is produced by raising the front part of the tongue towards the hard palate

• A ‘back vowel’ (such as [u]) is produced by raising the back part of the tongue towards the soft palate

• A ‘central vowel’ is produced by raising the central part of the tongue towards the junction of the hard and soft palates

• The mid-central vowel [ə] is called “schwa”
Vowels

- Many languages make a distinction between …
  - rounded and unrounded vowels
  - long and short vowels
  - oral and nasalised vowels
  - monophthongs and diphthongs (vowel glides)

- Vowel quality can be indicated by …
  - placing a dot on the ‘vowel quadrilateral’
  - or …
  - relating it to a set of language-independent ‘cardinal vowels’

The Vowel Quadrilateral

The Cardinal Vowels
Vowel Instability

- Vowels appear to carry less information than consonants, e.g. …
  [əәəәəәəә]

- Vowels seem to act as a carrier signal that is modulated by the consonants

- For these reasons, vowel quality is very variable and can drift over time (hence giving rise to different historical and contemporary accents) …
  - Chaucer: “house” → [hʌ:s]
  - Shakespeare: “house” → [hoʊs]
  - Modern day: “house” → [haʊs]

- This is why a non-phonetic writing system can have an advantage; people can communicate despite having very different accents

Demonstration

https://dood.nl/pinktrombone/
This lecture has covered …

- The articulators
- Consonants
  - voice, place, manner (VPM)
- Vowels
  - vowel quality
  - vowel height (open-close)
  - vowel location (front-back)
  - rounded/unrounded
  - the neutral vowel ‘schwa’
  - the vowel quadrilateral
  - cardinal vowels

Any Questions?
Next time …

Acoustic Phonetics