

Introduction to Phonetics

The Study of Speech Sounds

Phonetic Grounding

"...conditions used in natural language directly reflect physical correlates..."

Archangeli & Pulleyblank 1994:167

Areas of phonetics

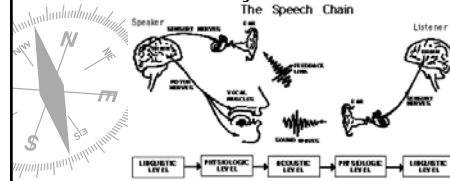
- Articulatory phonetics
 - study of the physiological mechanisms of speech production
- Acoustic phonetics
 - study of the physical properties of sound waves produced when we speak
- Auditory phonetics
 - study of the perception of sound, as mediated by the ear, auditory nerve, and brain

Goals of Phonetic Theory & Practice

- ▶ The Phonetician can ...
 - Describe speech chain
 - Understand the mechanisms of speech production and perception
 - Knows how languages use these mechanisms
- ▶ Goals of phonetic science ...
 - Identification
 - Description
 - Classification
 - Generalization

A. Describing the Speech Chain

- ▶ Purpose of speech: transmission of ...
- ▶ Abercrombie: language & medium (artifact)
- ▶ Liberman: brokered agreement
- ▶ Denes & Pinson: cyclic communication chain



(From Denes & Pinson 1992)

Recording Speech #1: Writing

- ▶ Why don't orthographies work? Inconsistencies
 - 1 letter : 1+ sounds
 - 1 sound : 1+ letters
 - 1 sound : letter combo
 - 1 letter : sound combo
 - Silent letters

Additional Problems

- ▶ Level of transcription
 - Broad
 - Narrow
- ▶ Transcriber's linguistic experience
 - Continuum divided differently
 - Unable to "hear" differences outside L1
 - ▶ Categorical
 - [p t k/ in English
 - ▶ Non-categorical
 - [p^h p^w p̄ p̄] in English

Solution: The International Phonetic Alphabet (IPA)

- ↳ Designed by the the International Phonetic Association
 - Develop a set of symbols which would be *convenient* to use
 - But *comprehensive* enough to cope with the wide variety of sounds found in the languages of the world
- ↳ Has the potential to represent with the sounds of every human language
 - [IPA web site](#)

Guiding ideas

- some human sounds are important, others are not
- Holophonic: speech can be represented as *segments*
- Major categories: *consonants & vowels*
- phonetic description by articulation
- suprasegmental aspects independently represented
 - [IPA chart](#)

B. Mechanism of Speech Chain

- ▶ Anatomy
 - Sublaryngeal
 - Laryngeal
 - Supralaryngeal
 - ▶ [Sammy](#)
- ▶ Metaphors
 - Pneumatic device
 - [Source-filter](#)

Basic Speech Events

- ▶ Initiation:
 - an activity that initiates the flow of air
- ▶ Phonation
 - an activity that modulates the quality of sounds
- ▶ Articulation
 - an activity that modulates or articulates the air stream

Initiation

- ▶ Setting the airstream in motion
 - Change in pressure
- ▶ Consequent direction of the airflow
- ▶ Mechanisms
 - Pulmonic
 - Glottalic
 - Velaric

Direction

- ▶ Egressive/pressure
 - *Exhalation*: deflation of lungs and consequent compression of the air
- ▶ Ingressive/suction
 - *Inhalation*: dilate the lungs, sucking air into the lungs

Pulmonic/Plosives

- ▶ Respiratory mechanism whereby a stream of air initiated by the lungs
- ▶ Just before speaking, pressure greater in lungs
- ▶ Speaking transfers the pressure to the vocal tract (compresses air in v.t.)



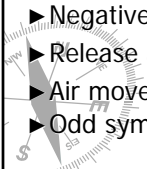
Glottalic: Ejectives and Implosives

- ▶ Oral closure
- ▶ Raise/lower larynx
 - Open glottis > voiced
 - Closed glottis > voiceless
- ▶ Compress/rarify air trapped between the oral closure
- ▶ Release oral closure
- ▶ Air moves out of the mouth: apostrophe [p' t' k']
- ▶ Air moves into the mouth: hook [bɗ fɗ ɡɗ]



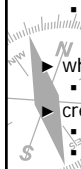
Velaric/Clicks

- ▶ Tongue-velum contact
- ▶ Anterior closure
- ▶ Drop tongue
- ▶ Negative pressure (rarified air)
- ▶ Release anterior closure, then posterior
- ▶ Air moves into the mouth
- ▶ Odd symbols [ǀ ! ǃ ǁ]



Phonation

- ▶ voiced
 - vibration of vocal cords
 - ▶ normal voicing
 - ▶ creak
 - ▶ falsetto
- ▶ voiceless
 - no vibration of vocal cords
 - ▶ nil phonation
 - ▶ breath phonation
 - whisper
 - ▶ considerably narrowed glottis
 - creak
 - ▶ closed vocal folds along most of their length
 - ▶ air to escapes in a low frequency series of bursts
 - ▶ through a vibrating segment near the front of glottis



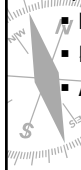
Phonation types

- ▶ Voiced (Lenis?)
- ▶ Voiceless (Fortis?) Burmese
- ▶ Creaky/Laryngeal Mazatec
- ▶ Breathy/Aspirated Hindi
- ▶ Whisper/Murmur ?? Hawaiian



Articulation

- ▶ Contribution by organs to shape airflow
- ▶ Articulatory and temporal coordination between neighboring segments
- ▶ Options
 - Place of articulation
 - Degree of stricture (part of manner)
 - Aspect of articulation (part of manner)



Abercrombie's Questions

- ▶ What is the airstream mechanism?
- ▶ Is the airstream ingressive or egressive?
- ▶ What is the state of the glottis?
- ▶ What is the position of the velum?
- ▶ What is the active articulator?
- ▶ What is the passive articulator?
- ▶ What is the degree and nature of stricture?

Recording Speech #2: Digitizing

- ▶ Anatomy > compression/rarefaction
- ▶ Waveform
 - Amplitude
 - Time
- ▶ Spectrum
 - Amplitude
 - Frequency
- ▶ Spectrogram
 - All three