

Foundations of Language and  
Speech Technology  
**Speech [Session 1]**

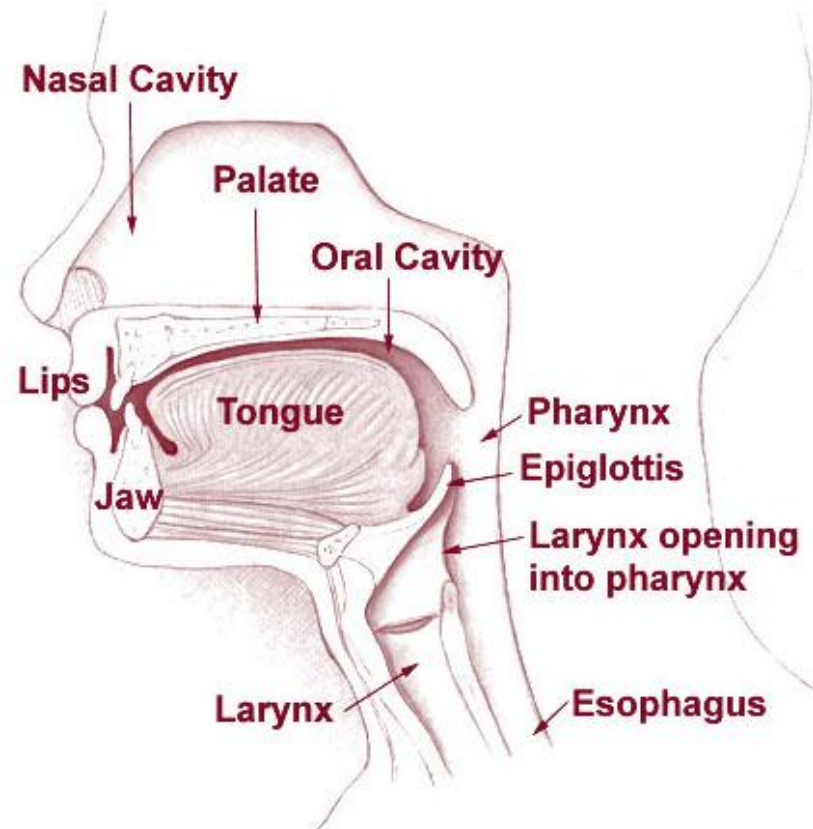
Jürgen Trouvain

# Segmental Phonetics

- What is the difference between vowels and consonants?  
(from the production point-of view)

# Vocal tract

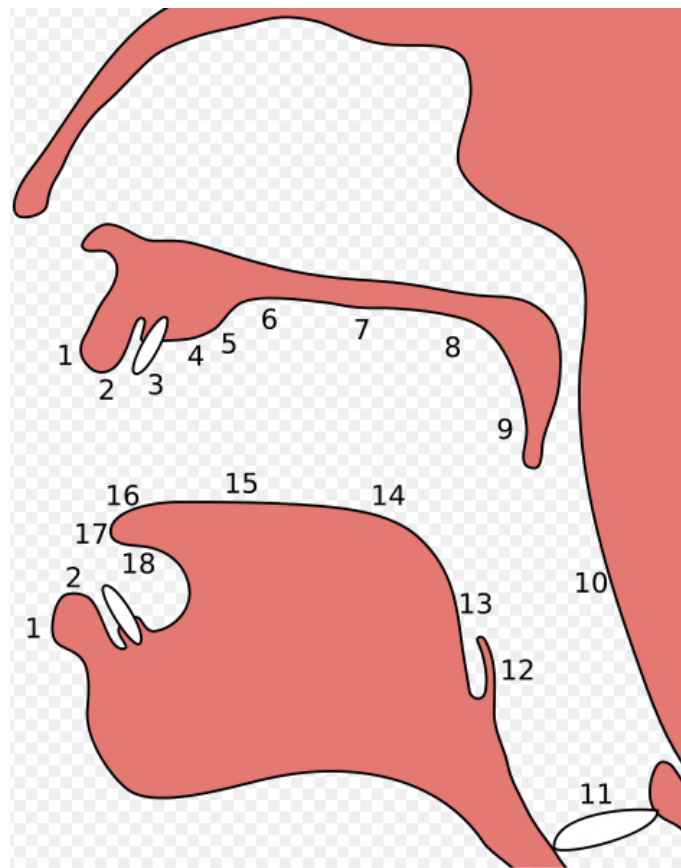
- vocal tract in a median (mid-sagittal) view



# Places of Articulation

Places of articulation (passive & active):

1. Exo-labial, 2. Endo-labial,
3. Dental,
4. Alveolar,
5. Post-alveolar,
6. Pre-palatal, 7. Palatal,
8. Velar,
9. Uvular,
10. Pharyngeal, 11. Glottal,
12. Epiglottal, 13. Radical,
14. Postero-dorsal, 15. Antero-dorsal,
16. Laminal,
17. Apical, 18. Sub-apical



# Manners of Articulation

- Constricting the airway
  - closures and releasing the closures
  - narrowing (=> friction noise)
- Manners
  - Stops = plosives
  - Fricatives
  - Nasal consonants
  - Laterals
  - Glides
  - Trills

# Consonants in the IPA

THE INTERNATIONAL PHONETIC ALPHABET (revised to 2005)

CONSONANTS (PULMONIC)

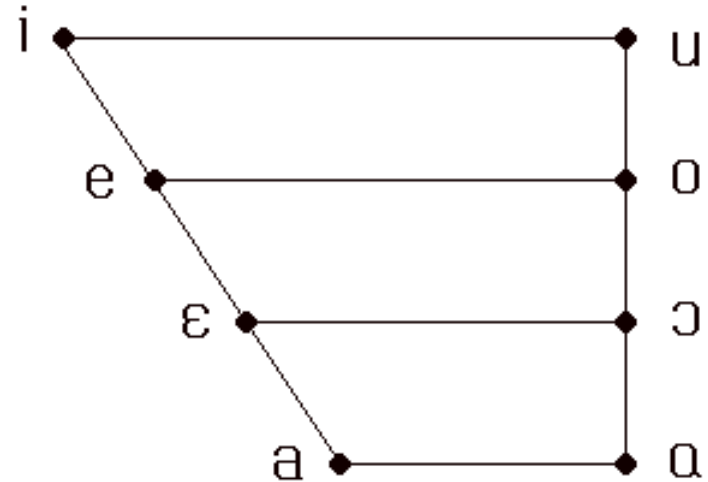
© 2005 IPA

	Bilabial	Labiodental	Dental	Alveolar	Postalveolar	Retroflex	Palatal	Velar	Uvular	Pharyngeal	Glottal
Plosive	p b			t d		ʈ ɖ	c ɟ	k ɡ	q ɢ		ʔ
Nasal	m	ɱ		n		ɳ	ɲ	ŋ	ɴ		
Trill	ʙ			r					ʀ		
Tap or Flap		ⱱ		ɾ		ɽ					
Fricative	ɸ β	f v	θ ð	s z	ʃ ʒ	ʂ ʐ	ç ʝ	x ɣ	χ ʁ	ħ ʕ	h ɦ
Lateral fricative				ɬ ɮ							
Approximant		ʋ		ɹ		ɻ	j	ɰ			
Lateral approximant				l		ɭ	ʎ	ʟ			

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

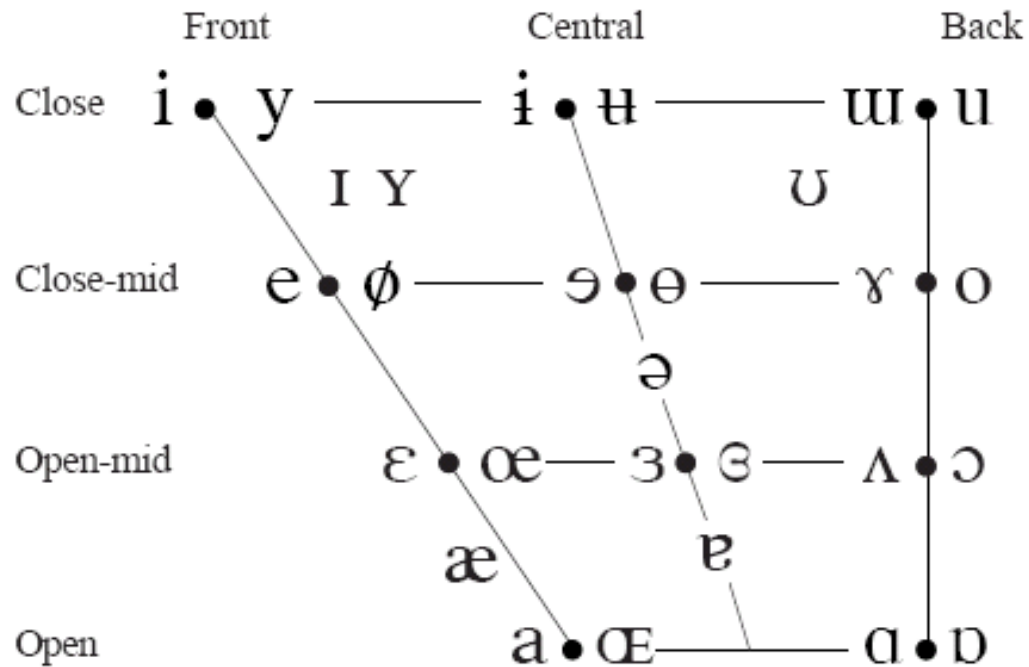
# Cardinal vowels

- front - back
- high/closed - low/open
- rounded - unrounded



# Vowels in the IPA

## VOWELS



# Symbols

- Symbols in phonetic alphabets
  - IPA (International Phonetic Alphabet)
  - SAMPA
  - ARPABET
- Sounds corresponding to the symbols
  - eLAUT [www.coli.uni-saarland.de/elaut](http://www.coli.uni-saarland.de/elaut)

# Speech Production

- Respiration - sub-glottal
- Phonation - glottal
- Articulation - supra-glottal

# Phonation

- Segmental distinctions
  - voiced vs. voiceless sounds
  - glottal stop
- Change of the phonation rate (pitch)
  - pitch accents
  - pitch contours
  - pitch range and mean F0
  - *pitch* (perception) =  
*fundamental frequency* or *F0* (acoustics)

# Voice Qualities

- voice qualities

- breathy

- creaky

- falsetto

- harsh

- Video by John Esling

- [www.coli.uni-saarland.de/conf/laughter-07](http://www.coli.uni-saarland.de/conf/laughter-07)

# Moving the Articulators

- **SpeechTrainer by Bernd Kröger**

`www.speechtrainer.eu`

`license code`

`Phonetik, Universität Saarbrücken`

`No.: 1682727127902`

- **Coarticulation**

# What is more important: Consonants or vowels? [1]

- Manipulating text vs. speech
- text file manipulation  
"vowel-only" version

remove all consonant letters, replace them with a space, so  
that only the vowels are left

e ea e o ea o oo o: a e ou y i  
e o i i a e u y e i ea e oo.

# What is more important: Consonants or vowels?[2]

- text file manipulation  
"consonants-only" version  
remove all vowel letters, replace them with a space,  
so that only the consonants are left

Th w th r f r c st f r t m rr w: r th r  
cl d n th m n ng w th f w s nn  
sp lls n th ft n n.

# What is more important: Consonants or vowels?[3]

- The weather forecast for tomorrow: rather cloudy in the morning with a few sunny spells in the afternoon.
- speech file manipulation
  - original recording, not manipulated
  - "consonants-only" version:  
vowel segments replaced with silence
  - "vowels-only" version:  
consonant segments replaced with silence



Audiorecorder



Audiorecorder



Audiorecorder

# What is more important: Consonants or vowels?

vowels-only version  
without silent pauses



Audiorecorder

vowels-only version  
with monotonous F0 (pitch)



Audiorecorder

- coarticulation
- timing information
- melodic information

# Prosody = Intonation + Timing

- sentence mode
  - Scotland has beaten England. vs.  
Scotland has beaten England? vs.  
Scotland has beaten England but a long time ago.
- information structure
  - What is her real name? vs.  
Everybody calls her Bo, what is her real name?
- attitude and affect
  - Could you come to my office? in two versions



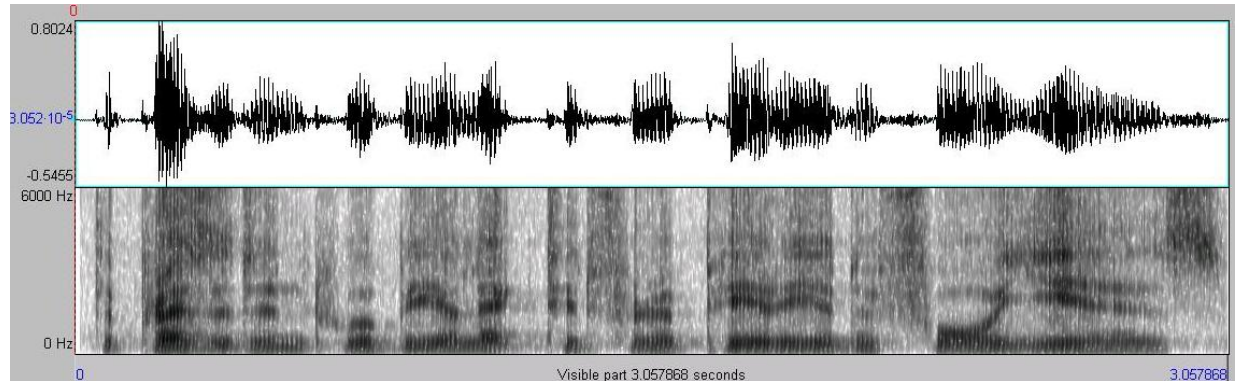
# Weak Forms

*The President will be elected for a period of four years.*

**as connected  
speech**



Sound (OLE2)

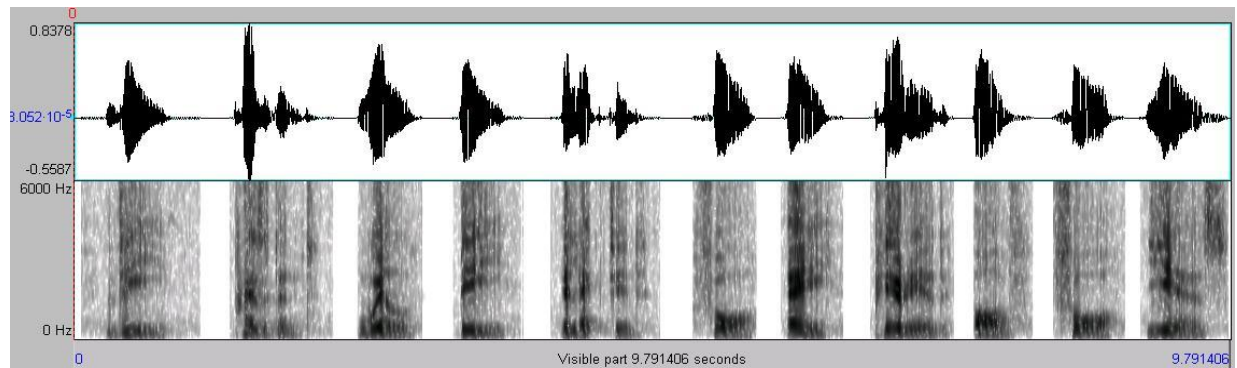


3,1 sec

**as isolated  
words**



Sound (OLE2)



9,8 sec

**isolated vs. in context:**

*will be for a of*  
FLST - Speech



Sound (OLE2)