Speech sounds can be analysed from different points of view:
articulatory, acoustic, phonetic and perceptual.

Articulatory phonetics relates linguistic features of sounds to positions
and movements of the speech organs.

*This knowledge is limited by the lack of data on the motion of the vocal
tract. Visual and x-ray means do not provide 3d images. MRI is good
but limited to the study of sustained sounds.*

A phoneme is the smallest linguistic unit of speech. A phone is the corresponding
acoustic unit (the realisation of the phoneme).

Phone: It is the smallest meaningful, contrastive unit of speech. Duration of
phone may vary from 30 ms to 100 ms.

Every language has a defined phone inventory. We come across these phones
when we look up a dictionary for the pronunciation of a word (e.g. look up an
English dictionary).

Vowels of Amer. English

	b__d	IPA		b__d	IPA
1	bead	iː	9	bode	oʊ
2	bid	ɪ	10	booed	uː
3	bayed	eɪ	11	bud	ʌ
4	bed	ɛ	12	bird	ɝː
5	bad	æ	13	bide	aɪ
6	bod(y)	ɑː	14	bowed	aʊ
7	bawd	ɔː	15	Boyd	ɔɪ
8	budd(hist)	ʊ			

Examples of pronunciation…   hārăss   hʌræs

Phones are the basic speech sounds and are completely described based on a small set of attributes or features. Thus phones can be classified in multiple ways.

A syllable is a complex unit of phones made up of nuclear and marginal elements.

A major classification of phones is based on their role in a syllable as:
• Vowels
• Consonants

Classification based on Articulation:

Phones in each class have common articulatory configuration. The articulation of a phone has a source component and a tract component.

The Source component comprises the Voicing and Manner of Articulation (MoA).

(a) Whether glottis vibrates:
    (i) Voiced sound
    (ii) Unvoiced sound

(b) Manner of articulation
    (i) whether there is a constriction in the vocal tract, and type
   (ii) whether velum is open or closed

Tract component: described by the shape of the vocal tract in terms of where and what type of narrowing occurs. This depends on the positions of the articulators.

Vowels: always voiced and relatively steady.

Vowel quality is determined by the shape of the oral cavity, controlled by tongue and lip positions.

Distinguished by tongue height and backness.

Vowel quadrilateral: Articulatory and Acoustic interpretations

Tongue position

front   back

high

/ i /   F2 (2500 - 1000 Hz)   / u /

Λ

F1 (200 - 800 Hz)
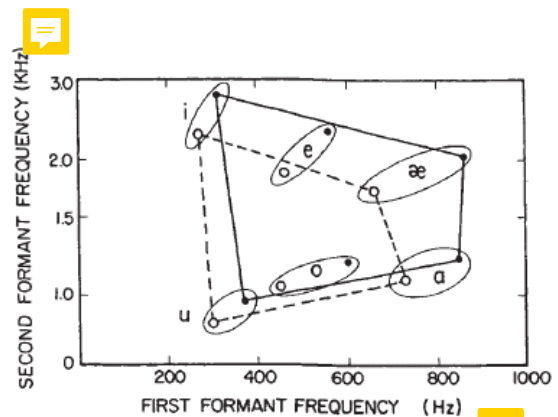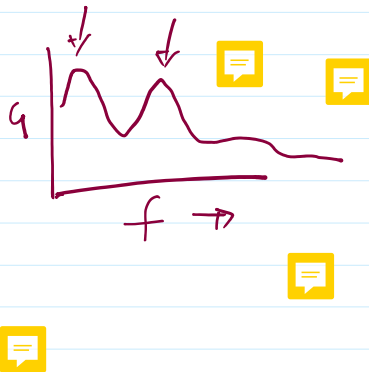
/ ae /   / aa /

low
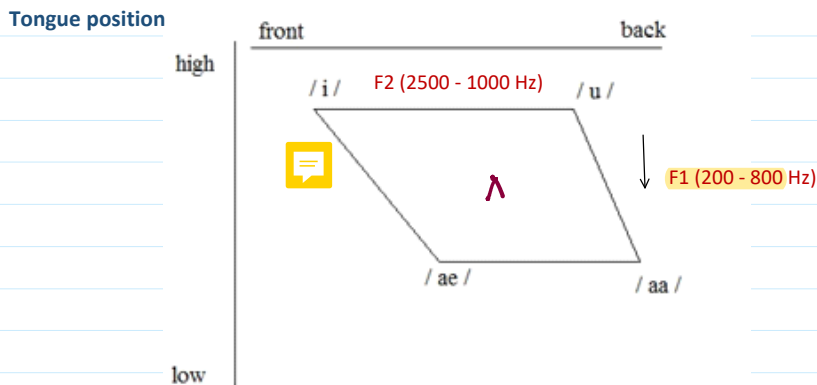
formants

Fig. 3   Plots of F_2 vs. F_1 for several vowels of American English. Open circles joined by dashed lines are data for adult male speakers and filled circles (solid lines) are for adult female speakers (From [7]).

Consonants: are classified based on

(i) voicing and MoA
(ii) place of articulation (PoA)

Voicing and MoA:

Bb: p.28

• Voicing -> Vocal fold vibration
• Aspiration source
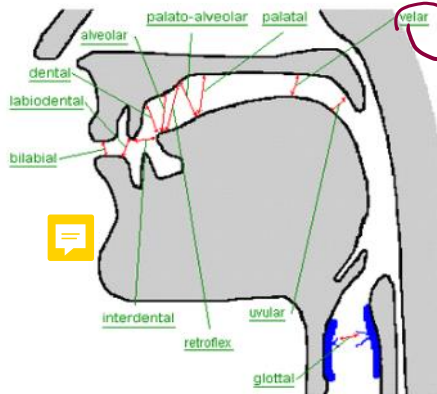• Frication source

glottis   lips
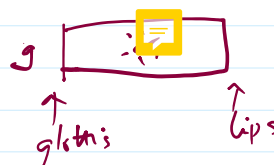
MOA: Vowels, Fricatives, Stops and Affricates, Nasal consonants, Glides and Semi-vowels

Bb: p30

Plosive

PoA: classification of consonants by PoA
  Active, passive articulators   Bb: p32

1. Labials : AA = lower lip , PA = upper lip
   Ex.: प फ ब भ म
        uv uv,asp V v.asp nasal

2. Labio dentals : AA: lower lip , PA= upper tooth
                                        teeth
   [f] [v]
   uv   V

3. Dentals : AA: tongue tip/blade , PA= upper
                                     tooth teeth l
   त थ द ध ध न
   uv uv,asp V v.asp nasal

4. Alveolar   AA = tongue tip , PA= rear of
5. Post-alveolar   teeth ridge
        /t/

6. Retroflex :
   AA = tongue tip , PA = hard palate
   ट ठ ड ढ ण
   uv uv,asp V v.asp nasal

7. Palatal : AA = front (blade) of tongue
             PA = hard palate   च छ ज झ ञ
                                     uv uv,asp V v,asp nasal

8. Velar : AA = back of tongue , PA: soft palate

   क ख ग घ "ng"
   uv uv,asp V v,asp nasal

9. Glottal : ह

Vowels

PoA / MoA	UvUa	Velar	Palatal/ Palato Alvelor	Retroflex	Dentals	Bilabials
Plosives Stop and Affricates	UvUa	क	च	ट	त	प
	UvAs	ख	छ	ठ	थ	फ
	VoUa	ग	ज	ड	द	ब
	VoAs	घ	झ	ढ	ध	भ
Nasal		ङ	ञ	ण	न	म

य र ल व   ← semi-vowels & glides

Fricatives: श ष स
              ह   palatal alveolar

Ex.   [m]   voiced, labial, nasal

                        velar
Ex.   घ   voiced, asp ∧ plosive

                    alveolar
Ex.   /s/   uv ∧ fricative.

A history of Phonetics ...*

Panini

- India ~ 7th - 4th centuries B.C.E.
- His work on Sanskrit was surprisingly modern and systematic
- Phonology/phonetics was explicitly dealt with
- Discovery of Panini's grammar helped develop today's linguistic science

King Sejong of Korea

1397-1450

- Wanted his people to be literate, but knew that the existing (Chinese-based) system was too difficult

- Created (*by himself*!) an entirely new, scientific alphabet based on phonetics (*see next slide* →)

- Named this alphabet *Hun Min Jong Um*, "Accurate Sounds to Educate the People"

- His alphabet was largely neglected, almost until the 20th century

- Now in general use in both South and North Korea

Han'gul

Han-gul is written in syllaabic units made up of two, three, or four letters.

a   k   silent

h — 한 국 어 — o
   u
n   k

[han-kuk-ǒ] (Korean language)

	consonants		vowels
ㄱ	k/g	ㅏ	a
ㄴ	n	ㅑ	ya
ㄷ	t/d	ㅓ	ǒ (3)
ㄹ	r/l	ㅕ	yǒ
ㅁ	m	ㅗ	o
ㅂ	p/b	ㅛ	yo
ㅅ	s/sh	ㅜ	u
ㅇ	ng (1)	ㅠ	yu
ㅈ	ch/j	ㅡ	ǔ (3)
ㅊ	ch'(2)	ㅣ	i
ㅋ	k' (2)		
ㅌ	t' (2)		
ㅍ	p' (2)		
ㅎ	h		

Image from Everyday Korea. "Bringing Back the Hangul." 2014. Accessed 5/20/16 http://www.everydaykorea.com/2013/10/bringing-back-the-hangul/

Velar	Alveolar	Dental	Bilabial	Glottal
ㄱ	ㄴ	ㅅ	ㅁ	ㅇ

Velars:	ㄱ ㅋ ㄲ
Alveolars:	ㄴ ㄷ ㅌ ㄹ ㄸ
Bilabials:	ㅁ ㅂ ㅍ ㅃ
Dentals:	ㅅ ㅈ ㅊ ㅆ ㅉ
Glottals:	ㅇ ㅎ

Sir William Jones

Image from Lidohibu. "William Jones." 2016. Accessed 5/20/16. http://lidohibu.com/pelisi/21/

1746-1794
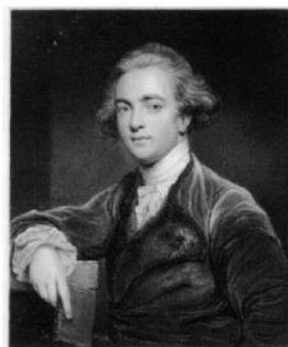
- British scholar, linguist, and lawyer
- Fluent in 7 languages by age 20
- Came to India as Supreme Court Judge
- In 1786, announced:
  …Sanskrit and the European languages "have sprung from some common source which, perhaps, no longer exists"
- Set a trend for studying Sanskrit as basis for the "Indo-European language family"
- Roots of historical linguistics