24.901

Lecture-1: Course outline, background; vowels: articulation and transcription

[1]. course topics

- internal structure of speech sounds and their distributions as a function of adjacent sounds and their position in a word or phrase
- organization of sounds into prosodic units: syllable, foot (stress), phonological word

[2]. language as object of investigation

- 19th century: language a product of historical cultural evolution: to understand a language in its current state is to know how it developed from an earlier state
- reconstruction of Proto-Indo-European (PIE)

  systematic sound correspondences among Indo-European languages

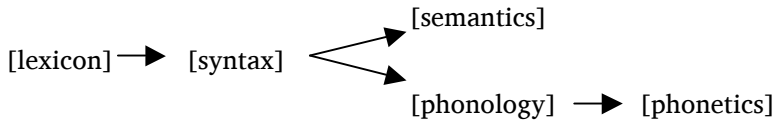
  Grimm's Law

PIE	*p	*t	k	*k^{w}	*bh
Sanskrit	pāda	treta		ka	bhrater
Latin	pēs	tres	canis	quod	frater
English	foot	θree	hound	what	brother

  Crowning achievement of 19th century linguistics; linguistics regarded as "queen of social sciences"
- early 20th century Ferdinand de Saussure: proper object of study is current synchronic state; sounds of a language form a system where the interpretation of a given element depends on the other elements it is in contrast with; very influential in 20th century European thought (e.g. semiotics)
- Structuralism: isolation and analysis of the distribution of units at various levels of analysis in a corpus of data: phonetic, phonological, morphological, syntactic; distinction of phoneme and allophone; [p^{h}]in, s[p]in vs. Mandarin [p^{h}]ai 'row' vs. [p]ai 'white' ; phonetically same sounds but in Mandarin they form a lexical contrast but not in English; emphasis on procedures of analysis of "objective" data
- Chomsky & Generative Grammar
- language is tacit knowledge (cognition) of the individual speaker-hearer that has developed from a language faculty present at birth as a biological endowment
- linguistic data are a reflection of this knowledge and of interest (only) to the extent they help to elucidate it
- basic questions become: what is the form of this knowledge (Internal-language), how is it acquired, and used to speak and understand?

- a grammar is the linguist's characterization of I-language and models the ability of speaker-hearer to assign a form and interpretation to a potentially infinite number of expressions
- a grammar is a computation over units of various types

[3]. grammar's architecture:



- lexicon: list of vocabulary items (morphemes)
  - grammatical features: noun vs. verb; singular vs. plural, etc.
  - semantic features: human, male vs. female, etc.
  - phonological features: vowel, consonant, bilabial, etc.
  - arbitrary association of sound and meaning:
    - 'dog': [dɔg], [ʃa], [kalb], [inu], ….
    - [t^hu]: 'two', 'too', 'to',
    - [bo]: 'bow', Fr 'beau', Jp 'stick', …
- syntax: items drawn from lexicon and organized into syntactic units which are combined and moved to form a sentence

student	bought	the book
the student	has bought	the expensive book
the MIT student	will have bought	the expensive book written by the instructor

Which book$_i$ did the student buy [e_i]?

- sentence is interpreted by two components
- a semantic component specifies the grammatical aspects of interpretation
- a phonological component that contains rules that enhance and change the sounds in the items (morphemes) inserted from the lexicon to yield a Surface Representation [SR]
- a phonetic component that converts the sounds of the SR into articulatory gestures with measurable physical dimensions: e.g. 100 milliseconds duration for a vowel, 150 Hz for F0 (tone), etc.
- in deaf individuals sentence may be realized alternatively in the manual/facial gestures of sign language

[4]. Phonology: basic research questions

- what is the nature of the phonological representations composing lexical items and the computations that realize them as articulatory gestures?
- phonological analysis of a language asks

  i. sound distinctions that encode the vocabulary of a language; language's sound system (phonemic inventory)

  nasal vowels: French beau [bo] vs. bon [bɔ̃] cf. Au Bon Pain (oh bone pan)

  stress location: A'merica vs. Ala'bama vs. Tenne'ssee cf. Ameri'ca, Alaba'ma
- not all concatenations possible: phonotactic restrictions

  act [kt] *atk (cf. Saudi Arabic fatk 'destruction'

  apt [pt] *atp magt [makt] 'despise'

  pray tray cray(fish)

  play *tl clay

- sounds altered on the basis of adjacent sounds and position in prosodic structure

  hat-**s** [t-s] fee**l** hai**r** 'tele͡graph [ɛ, ɪ, æ]

  kid-**s** [d-z] **l**eaf hai**r**-y te'legraph-y [ɪ, ɛ, ɪ]

  kiss-**es** [-ɪz]

[5]. phonetics

- mapping of phonological categories to articulatory gestures and their acoustic and perceptual correlates

Unit 1

[1]. goals

- first-order articulatory description of speech sounds
- transcription in the IPA

[2]. speech: moving body of air made audible by the vocal apparatus; sound source that is shaped/filtered by vocal tract

- air expelled from lungs into trachea (pulmonic egressive)
- larynx: a complex cartilage that contains vocal folds (cords) that sit across the glottis and can assume a variety of positions

  wide apart for normal breathing

  tightly closed for swallowing

  brought together (adducted) and set in vibration (phonation) by air passing through: s vs. z
- three supralaryngeal cavities (vocal tract) that modify/shape the airstream (PGG p. 142)

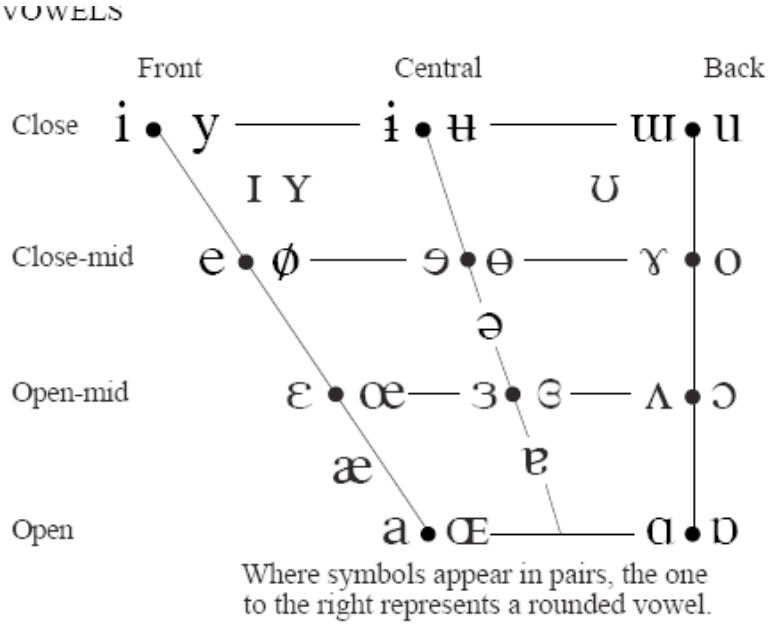
  pharynx/pharyngeal cavity; pharyngeal constriction: Arabic ħ, ʕ

nose/nasal passages; lowered velum: nasal consonant: ma vs. ba, nasal(ized) vowel: Fr. *beau* [bo] vs. *bon* [bɔ̃]

mouth/oral cavity: tongue and lips

[3]. vowels

- vowels produced with unobstructed, open vocal tract and lowered jaw
- major articulator is tongue body that can be arched and moved forward and back (horizontal dimension) and up and down (vertical); lips may be compressed and pursed (rounded), which lengthens the vocal tract
- vowel space is combination of articulatory and auditory factors
- widest at high vowels and tapered at lower: high-mid-low, front-central-back



[4]. International Phonetic Association (IPA) http://www.langsci.ucl.ac.uk/ipa/

- founded in 1886 by leading phoneticians in France, England, Germany, and Denmark
- goal: uniform system of transcription system to represent phonemic contrasts in any language
- 2008: 107 letters, 52 diacritics

[5]. vocalic distinctions

- all languages have a height distinction (greater acoustic energy at F1)
- minimal vowel system: [i,u,a] Cl Arabic, Yupik Eskimo, Quechua (maximal dispersion)

  Arabic l[i]bs 'clothes' x[u]ms 'one-fifth'

  h[a]ms 'whisper'

- proto-typical five-vowel system: [i,e,a,u,o] Spanish, Swahili, Hawaiian, Japanese (most common in Clements' survey)

Spanish	m[i]sa	'mass'			m[u]sa	'muse'
	m[e]sa	'table'			m[o]sca	'fly'
			m[a]sa	'dough'		

- proto-typical seven-vowel system: [i,e,ɛ,a,u,o,ɔ] Italian, Yoruba

Italian	p[i]no	'pine'	p[u]ro	'pure'
	n[e]ro	'black'	r[o]sso	'red'
	b[ɛ]ne	'well'	[ɔ]ro	'gold'
		l[a]ma	'blade'	

- Turkish [i,ɛ,y,oe,ɯ,ɑ,u,o,ɔ]: most economical use of three articulatory dimensions: [±high], [±back], [±round]

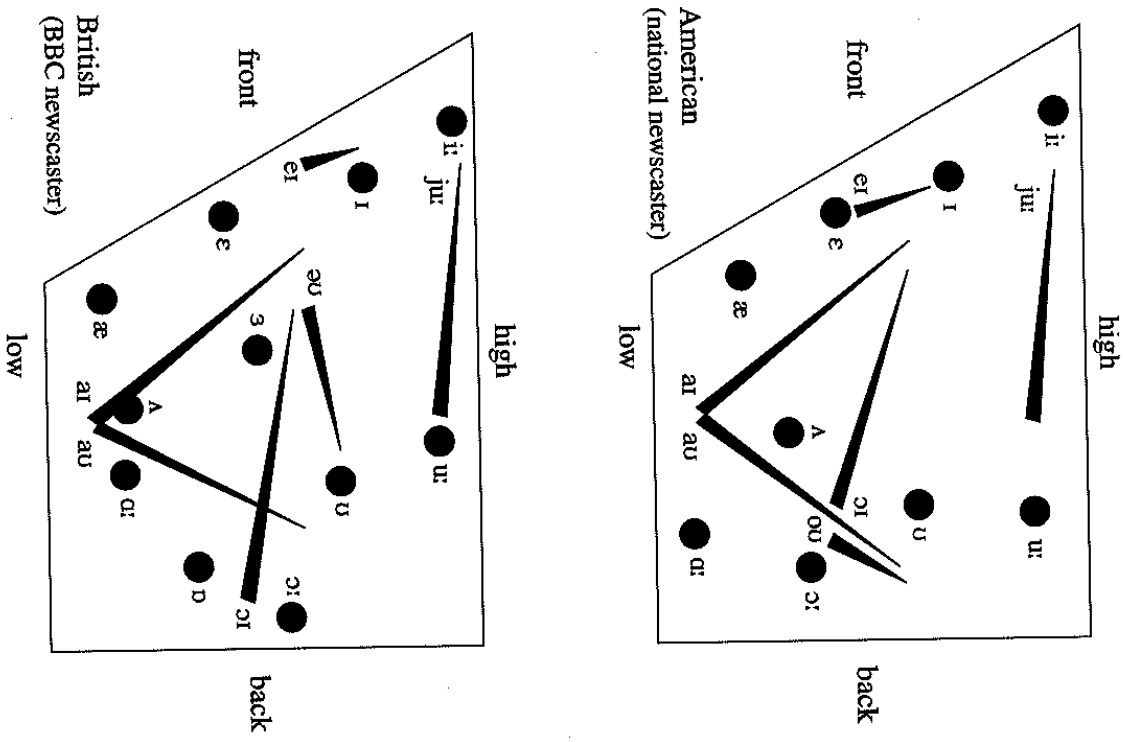
k[i]l	'clay'	k[y]l	'ashes'	k[ɯ]l	'hair'	k[u]l	'slave'
k[ɛ]l	'bald'	g[œ]l	'lake'	k[ɑ]l	'stay'	k[o]l	'arm'

http://www.langsci.ucl.ac.uk/ipa/

- French [i,e,ɛ,y,ø,oe,a,u,o,ɔ,ɑ]

l[i]t	'bed'	l[y]	'read' past.prt'	l[u]	'wolf'
l[e]s	'the' pl.	l[ø]	'the' masc.sg.	l[o]t	'prize'
l[ɛ]d	'ugly'	l[œ]r	'their'	l[ɔ]r	'during'
l[a]	'there'			l[ɑ]s	'tired'

[6]. vowels of General American (GA) and RP English



Am Eng vowels:

RP Eng vowels:

Key words	heed	[i]			food	[u]	feud	[ju]
	hid	[ɪ]	bird	[ɜ]	hood	[ʊ]	high	[aɪ]
	hayed	[e]	bud	[ʌ]	hoed	[o]	how	[aʊ]
	head	[ɛ]	a(bout)	[ə]	caught	[ɔ]	(a)hoy	[ɔɪ]
	had	[æ]			father	[ɑ]		

- low vowels have front-back distinction
- high vowels have tense-lax distinction

beat	[i]	[u]	boot
bit	[ɪ]	[ʊ]	book

tense vowels are longer (marked by colon) and more peripheral in vowel space

at surface level quality is basic property: shortened [i] is still distinct from [ɪ]; lengthened [ɪ] is still distinct from [i]

- [e]-[ɛ] and [o]-[ɔ] sometimes treated as tense vs. lax as well but based partially on phonological distribution: [ɪ,ʊ,ɛ] (but not [ɔ]) are barred from end of word
- according to L's chart, in AE [e] = [eɪ] and [o] = [oʊ] start at same point as [ɛ] and [ɔ] but are distinguished by movement of tongue to periphery of space as a diphthong
- three central vowels: [ɜ] is unusual sound; effect of rhotic; [ə] of *about, sofa* only in unstressed position; wedge vowel of *bud* very similar to schwa except found in stressed position
- in Am E [e] and [o] are realized with offglide
- off-glide-diphthongs: [aɪ], [aʊ], [ɔɪ]; on-glide diphthong [ju]

[7]. in sum:

- five front and back vowels: [i,ɪ,e,ɛ,æ] vs. [u,ʊ,o,ɔ,ɑ]
- three central and three diphthongs
- English vowels are a challenge for learners coming from a more restricted inventory like Spanish or Japanese

24.901 Language and Its Structure I: Phonology
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