M.Sc. Language Science and Technology

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Phonology

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Levels of linguistic description

- Phonetics
- Phonology
- Morphology
- Lexicon
- Syntax
- Semantics
- Pragmatics

- Psycholinguistics
- …linguistics (socio, neuro, patho, …)

Phonology

- Scientific study of the *sound system* of a language
- Inventory and organization of speech sounds in a specific language

Minimal pair analysis

- Determination of the *phoneme inventory*, by minimal pair analysis
  - minimally different phonetic form
  - distinct meaning
  - use lists instead of pairs as shortcut

    hit

    hot

    hut

    hat fat sat cat

Minimal pair analysis

- Determination of the *phoneme inventory*, by minimal pair analysis
- hemmen – Hennen – hängen
  /hɛmən/ – /hɛnən/ – /hɛŋən/

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  → /m n ŋ iː ɪ aː a øː œ/
  - can distinguish meaning of words
  - are *phonemes* of German

Distribution analysis

- Determination of the *phoneme inventory*, by distribution analysis
  - complementary distribution
    - [ç] - [x]
      "nicht" [nɪçt] - "Nacht" [naxt]
      *[nɪxt] *[naçt]
    - [h] - [ŋ]
      [h] only word-initial, [ŋ] never word-initial

Distribution analysis

- Criterion of phonetic similarity
  - [ç] ≈ [x] → /x/ (one phoneme, two allophones)
  - [h] ≠ [ŋ] → /h/ /ŋ/ (two phonemes)

Phonology: technical terms

- *Phoneme*: smallest unit that distinguishes meanings
  - unit of speech in the sound system of a language that can distinguish the meanings of (pairs of) words
  - distinctive / contrastive function
  - phonetic differences that do not contribute to distinguishing meaning are phonologically irrelevant
- *Phoneme*: speech sound as structural unit, e.g. /t/
- *Phone*: phonetic realization of a phoneme, e.g. [t]
- *Allophone*: systematic realization variant, e.g. [t^h]

Allophones

- *Allophones* are free or context-dependent variants of phonemes
  - free: e.g. realizations of /r/ as [rʀʁɾɣ] (in Ger., Eng.)
  - context-dependent: e.g. realization of "ch" as [x] after back vowels, as [ç] elsewhere
- Problem: phonemic value of complex sounds, such as diphthongs [aɪ] [aʊ] or affricates [pf] [ts]

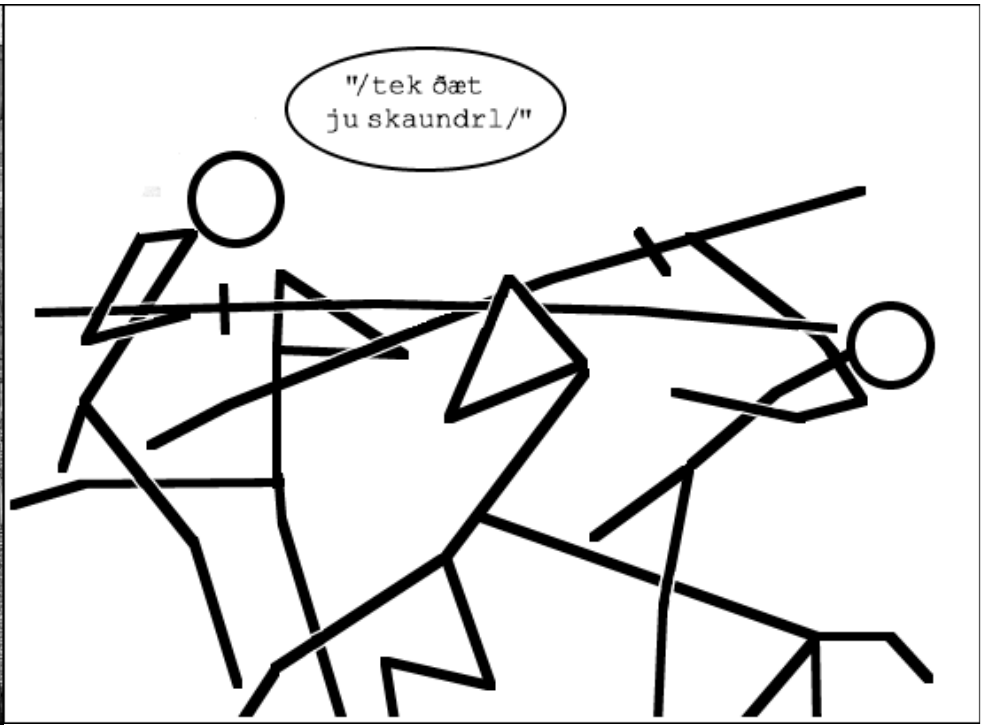
Cf. Phonetics: technical terms

- *Phone*: single identified speech sound
- *Features* of speech sounds
  - articulatory, acoustic, auditory
- *Features* of phonetic utterances
  - segmental (pertaining to speech sounds)
  - suprasegmental (exceeding individual speech sounds)
  - again: articulatory, acoustic, auditory
- Dynamic processes
  - coarticulation, assimilation

Phoneme

- *Observation*: Despite systematic and statistical (chance?) variation in the realization of speech sounds, e.g. of /a/ in "Mann", we identify all these realizations as /a/.
- Evidently, some of the differences in pronunciation are *contrastive* and *distinctive*, while others are not.
- Sound differences that can distinguish the meaning of words in a language tend to become phonologized, they become elements of the phonological inventory.
- *Definition*: The smallest unit of speech that can distinguish the meaning of words in a language is the *phoneme*.

Phonetics vs. Phonology



Phonetics and Phonology

- Different levels of linguistic description or artificial separation of disciplines? Consider:
  - describing the vowel system of a language
  - "Auslautverhärtung" (neutralized voicing contrast)
  - universal vs. language-specific properties of speech
  - methods: experiments, measurements, statistics
  - mental representations
  - relation between linguistic organization and physical events
  - organization of university institutes

Neutralization

- Some pairs of sounds established as phonemes in a context A cannot enter a contrast in context B
- E.g. neutralization of the voicing contrast in German (and a number of other languages)
  - stops and fricatives in word-final position, e.g.:
    - "bunt" and "Bund" [bʊnt]
    - "lies" and "ließ" [li:s]

Interdisciplarity

- Phonetics and Phonology have many connections with other scientific disciplines
- communication theory, philosophy of language, logic
- sociology, psychology
- acoustics and signal processing
- clinical research and applications; language and speech disorders, speech therapy, logopedics, early diagnosis
- cognition, reading and writing, orthography
- communications technology, dialog systems: automatic speech recognition, speech synthesis, speech-to-speech translation

Phonology

- Scientific study of the *sound system* of a language
- Inventory and organization of speech sounds in a specific language
- Classification of speech sounds by *distinctive features*

Distinctive features

- Aims of using distinctive features
  - describing of all speech sounds in all languages by means of a universal set of features
  - describing phonemes/allophones of a language in terms of a vector of (mostly binary) features
    - each phoneme is distinct from all others by its specific constellation of feature values
    - the function of phonemes to distinguish meaning is actually achieved by distinctive features
  - capturing regularities in sound systems
  - forming natural classes of sounds with common properties

Distinctive features

- Historical development of sets of distinctive features
  - Trubetzkoy (1939), Jakobson (1939)
  - Jakobson, Fant and Halle (1952) [articulatory, acoustic]
  - Chomsky and Halle (1968) [SPE, Generative Phonology]
  - Fant (1973) [purely acoustic]
  - Ladefoged (1982) ["traditional"]
  - Clements (1985) [feature geometry]
  - …
- No definitive universal feature set yet
- Usually a mix of articulatory, acoustic, auditory features

German consonants (Wiese, 2000)

voice	–	p	t	k	f	s	ʃ	ç	x	χ						h	ʔ
voice	+	b	d	g	v	z	ʒ	j	ɣ	ʁ	m	n	ŋ	l	R		
consonantal		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
obstruent		+	+	+	+	+	+	+	+	+	–	–	–	–	–	+	+
continuant		–	–	–	+	+	+	+	+	+	–	–	–	–	+	+	–
nasal		–	–	–	–	–	–	–	–	–	+	+	+	–	–	–	–
spread glottis		–	–	–	–	–	–	–	–	–	–	–	–	–	–	+	–
constricted gl.		–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	+
labial		+			+						+						
dental					+												
coronal			+			+	+					+		+			
dorsal				+				+	+	+			+		+		
d. front				–				+	–	–			–		–		
tongue pos.		+	+	+	+	+	+	+	+	+	+	+	+	+	+		
high t.p.		–	–	+	–	–	+	+	+	–	–	–	+	–	–		
low t.p.		–	–	–	–	–	–	–	–	+	–	–	–	–	+		

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German vowels (Wiese, 2000)

	iː	ɪ	eː	ɛː	ɛ	aː	a	oː	ɔ	uː	ʊ	yː	ʏ	øː	œ	ə	ɐ
cons.	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−	−
high	+	+	−	−	−	−	−	−	−	+	+	+	+	−	−	−	−
low	−	−	−	−	−	+	+	−	−	−	−	−	−	−	−	−	+
front	+	+	+	+	+	−	−	−	−	−	−	+	+	+	+	−	−
back	−	−	−	−	−	−	−	+	+	+	+	−	−	−	−	−	−
round	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+	−	−
ATR	+	−	+	−	−	−	−	+	−	+	−	+	−	+	−	−	−
long	+	−	+	+	−	+	−	+	−	+	−	+	−	+	−	−	−

cf. tables for American English in Fromkin et al. p. 244f.

Phonology

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- Inventory and organization of speech sounds in a specific language
- Classification of speech sounds by *distinctive features*
- Combinatorics od speech sound: *phonotactics*

Syllable structure, Phonotactics

- Complex syllable structure of German (and English and …)
  "(du) strumpfst" [ʃtʁʊmpfst] /CCCVCCCCC/
- Anything goes?
  - [ʃtʁo:], aber *[ʁʃto:]
  - [aʁm], aber *[amʁ]
- Language-specific:
  - Georgian: [.tsvkl] [.mkr]
- German and English each have at least 12,500 distinct syllables – cf. Japanese: ~110

Syllable structure, Phonotactics

- Phonotactics: systematic description of combinatorics of speech sounds, thereby forming larger constituents
- Constraints imposed by syllable boundaries
- No universally valid definition of "syllable (boundary)"
- Syllable boundaries are difficult to determine, but counting syllables is easy (really?)
  - how many syllables in "Fenster", "Papst", "schrumpfst"?
  - syllable boundary in "Fenster": [fɛn.stɐ] or [fɛns.tɐ]?

Syllable structure in German

- General structure: C*VC* (obligatory vowel, optionally surrounded by consonants)
- Max: CCCVCCCCC ("strumpfst" [ʃtʁʊmpfst])
- Sonority hierarchy: syllable nucleus maximally sonorous, decreasing sonority with increasing distance from nucleus
  $\rightarrow$ concept much disputed
- Syllable constituents
  - ONC - onset, nucleus, coda (flat)
  - OR – onset, rhyme (hierarchical)
- Logatomes: phonotactically possible but non-existant syllables or words

Phonology

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- Inventory and organization of speech sounds in a specific language
- Classification of speech sounds by *distinctive features*
- Combinatorics od speech sound: *phonotactics*
- Suprasegmental units and features

Phonetics/Phonology: Prosody

- Prosody comprises properties of spoken language beyond single sounds
  - intonation: accenting, phrasing, sentence mode
  - ambiguities
    - "Ja zur Not geht's auch am Samstag"
    - "Flying planes can be dangerous."
  - discourse and information structure
    - Carter called Nixon a Republican, and then he offended him.

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Suggested exercises, readings, online resources

- Apply the minimal pair and distribution tests to establish the phoneme inventory of (British or American or …) English
- Exercises 10a-c, 13, 14, 24, 25 (incl. text p. 227ff.) in Fromkin et al. p. 273ff.

- Richard Wiese (2000): The Phonology of German. Oxford Univ. Press.
- Vowels and consonants in the world's languages [http://www.phonetics.ucla.edu/]

Thanks!