

Dialogue systems

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Introduction to Phonetics

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Introduction
to Phonetics

- Focuses to different aspects of sound of a language.
- Speech processing and dialogue systems basic concepts:
 - phonemes
 - vowels – formants
 - consonants – voiced/unvoiced consonants
 - co-articulation
 - form of sonority

Phonemes and Phonetic Transcription

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- Phoneme – elementary sound segment, corresponding to character units of the language system (morphemes).
- Phonetic transcription – written text transcription into the corresponding phonetic form:

na shledanou → na zhledanou | na schledanou

- Phonetic alphabet – used to unambiguous phonetic transcription
 - International Phonetic Alphabet (IPA) – part of the UNICODE standard
 - (Speech Assessment Methods Phonetic Alphabet – SAMPA) – 7 bit IPA transcription used by automatic speech processing (MBrola TTS for example).

Czech Phonetic Transcriptions Examples

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- Phonetic transcription of sentence: „Ukázka fonetických transkripcí“
- IPA: 'uka:ska f'onet,itski:x tr'anskriptsi:
- SAMPA: ukAska fonetickIH transkripčsl

- Vowel – forms a syllable.
- Czech vowels classification:
 - short: a, e, i, o, u
 - long: á, é, í, ó, ú
 - diphthongs: eu, au, ou
- Contains:
 - F_0 – a vocal cords vibration frequency (approx, 100 — 400 Hz)
 - formants – frequencies formed by resonance of sound in the cavities of the a voice tract.

Formants

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- Frequencies created and amplified by resonance in cavities of the vocal tract.
 - F_1 – resonance in oral cavity.
 - F_2 – resonance in laryngeal cavity.
- There are even higher formants (F_3, \dots) – existence is individual.
- Formants presence and intensity depends on:
 - sex – male/female
 - age – childhood/adolescence/adult/senior age
 - health – cold, hoarseness, larynx and vocal cords diseases,
...
 - ...

Czech Vowels F_1 and F_2 Formats

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Vowel	F_1	F_2
a	700 — 1100 Hz	1100 — 1500 Hz
e	500 — 700 Hz	1500 — 2000 Hz
i	300 — 500 Hz	2000 — 3000 Hz
o	500 — 700 Hz	900 — 1200 Hz
u	300 — 500 Hz	600 — 1000 Hz

Tabulka: Vowels F_1 and F_2 formants

Czech Vowels Frequency

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Vowel(s)	Relative frequency
[e]	10 %
[a], [o], [i]	6 — 7 %
[í]	4 %
[á], [u], [é], [ou], [ú]	< 4 %
[ó], [au], [eu]	uncommonly

Consonants

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- Consonants, opposite to vowels, are dynamic actions.
- Strongly dependent on a context of their occurrence.
- Only parts of some consonants have a tonal character.
- Divided according to:
 - voiced – created in larynx, contains basic vocal tone.
 - unvoiced – created in voice tract cavities (nasopharyngeal, oral, ...), can be a noises (sibilants, for example):
 - Problematic start of the speech detection in noisy sound source/environment.
 - Voiced and unvoiced consonants can be in pairs (pair consonants) for example:
 - r/l
 - b/p
 - d/t
 - ...