Intro to Linguistics – Phonetics

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Overview of topics

1. What is Phonetics
2. Subfields of Phonetics
3. Phonetic alphabet
4. Czech and English Speech Sounds
5. Narrow vs. Broad Transcription
6. Some Other Speech Sounds

1 What is Phonetics

Phonetics is the study of speech sounds:

- how they are produced,
- how they are perceived,
- what their physical properties are.

The technical word for a speech sound is **phone** (hence, *phone*tics). Cf. *telephone*, *headphone*, *phonograph*, *homophone*.

Place of phonetics in the language system:

Pragmatics	– Meaning in context
↑↓	
Semantics	– Literal meaning
↑↓	
Syntax	– Sentence structure
↑↓	
Morphology	– Word structure
↑↓	
Phonology	– Sound patterns, language dependent abstraction over sounds
↑↓	
Phonetics	– Sounds; (nearly) language independent

↑ – understanding language expressions; ↓ – producing language expressions

2 Subfields of Phonetics

Articulatory Phonetics – the study of the production of speech sounds.
The oldest form of phonetics.

> A typical observation: "The sound at the beginning of the word 'foot' is produced by bringing the lower lip into contact with the upper teeth and forcing air out of the mouth."

Auditory Phonetics – the study of the perception of speech sounds.
Related to neurology and cognitive science.

> A typical observation: "The sounds [s, ʃ, z, ʒ] are called sibilants because they share the property of sounding like a 'hiss'."

Acoustic Phonetics – the study of the physical properties of speech sounds.
A relatively new subfield (circa 50 years); uses sophisticated equipment (spectrograph, etc). Related to acoustics (the subfield of physics dealing with sound waves).

> A typical observation: "The strongest concentration of acoustic energy in the sound [s] is above 4000 Hz."

3 Phonetic Alphabet

Why do we need a new alphabet?
Because: We want to be able to write down how things are pronounced and the traditional Roman alphabet is not good enough for it:

- Words are pronounced differently depending on region, speaker, mood, ... but they are (usually) spelled the same way
  root [rut] or [rʊt], *truck* [trʌk] or [tʃrʌk], *strong* [strɔŋg] or [ʃtrɔŋg]
- Words or word forms sounding differently can be spelled the same way
  read [rid] vs. [rɛd]
- One sound is spelled many different ways:
  [k]: *king, card, clique, nick, chasm, exit*
  reed vs. *read*; *mě* 'I$_{gen/acc}$' vs. *mně* 'I$_{dat/loc}$', *tip* 'tip' vs. *typ* 'type'
- There are many more sounds than there are letters in Latin alphabet
  There are only 6 vowel letters, but English has at least 10 vowel sounds
  thigh, *thy*
  There are many other sounds in other languages

What we want is a simple system where every symbol would correspond to exactly one sound.
IPA (International Phonetic Alphabet) - a special alphabet for representing sounds was developed. See: `http://www.langsci.ucl.ac.uk/ipa/index.html`

4 Describing Czech and English sounds

Consonants vs Vowels

- consonants – involve some constriction (closure/narrowing) at some point in the vocal tract
- vowels – do not have constriction; can always be held indefinitely.

4.1 Describing Consonants

Three-part description of consonants:

- **Voicing** – do vocal folds vibrate?
  - **voiced** – vocal folds vibrate
    [b], [d], [ɡ] [m], [n], [ŋ], [z], [ʒ], etc.
  - **voiceless** – vocal folds are open and do no vibrate
    [p], [t], [k], [s], [ʃ], etc.
- **Manner of Articulation** – degree of the obstruction (narrowing, closure) & closure release type (sudden, slow), etc.
  - **Stops:** made by completely obstructing ("stopping") the flow of air
    [p/b, t/d, c/ɟ, k/ɡ, ʔ]

    [c]: *tisknout* 'print', *ťapka* [capka] 'paw', Greek: [ceri] 'candle'
    [ɟ]: *ďábel* [ɟaːbɛl] 'devil', *děda* [ɟɛda] 'grand-father'
    [ʔ] (glottal stop): *uh oh!* [ɔʔoʊ], *doopravit* [dɔʔɔp..] 'finish repairing'

    English voiceless stops are either aspirated (*pit* [pʰɪt]) or nonaspirated (*spit* [spɪt])
  - **Fricatives:** made by forming a very narrow constriction and forcing air through, producing a hissing turbulent sound because of the friction between the air and the sides of the constriction.
    [f/v, θ/ð, s/z, ʃ/ʒ, x/ɣ, h/ɦ]

    [θ]: *th*ick, *th*igh
    [ð]: *th*en, *th*y
    [ʃ]: *sh*ip, *š*est 'six'
    [ʒ]: vi*s*ual, *ž*ába 'frog'
    [j]: *yes*
    [x]: *chleba* [xlɛba] 'bread'; German *Bach*
    [ɣ]: *abych byl* [abɪɣbɪl]; Spanish *digno* 'worthy'
    [h] (voiceless) / [ɦ] (voiced)
    Czech glottal fricative is usually voiced, English usually voiceless.

- **Affricates:** stop immediately followed by a fricative.
  [t͡s / d͡z, t͡ʃ / d͡ʒ]

  [t͡s]: *c̲ihla* [t͡sɪfila] 'brick', German *Z̲ug* 'train' (≈ as *ts* in *cats*)
  [d͡z]: *le c̲kdo* [lɛd͡zgdɔ] 'various people'; sometimes in *Honza* [..nd͡za] x [..nza]
  [t͡ʃ]: *c̲hange*, *č̲eský* 'Czech';
  [d͡ʒ]: *j̲ournal*, *dž̲bán* 'pitcher'; sometimes in *manžel* [..nd͡ʒɛl] x [..nʒɛl] 'husband'

  Often written as [ʧ, ʤ, . . .] or simply as [tʃ, dʒ. . . .].
- **Trills**

  [r] (voiced alveolar trill): *krtek* 'mole'
  [r̝] (voiced raised alveolar trill): *dři* [dr̝ɪ] 'labour/sweat$_{imp}$'
  [r̝̥] (voiceless raised alveolar trill): *tři* [tr̝̥ɪ] 'three'
- **Nasals (nasal stops):** the velum is lowered, air passes also through the nose.
  [m, ɱ, n, ŋ, ɲ]

  [ɱ]: sometimes in *comfort* [kʌɱfərt] x [..mf..], *tramvaj* [..ɱv..] x [..mv..]'tram'
  [ŋ]: *walkin̲g* [..kɪŋ] (some dialects [..kɪm])
  [ɲ]: *nic* [ɲɪts] 'nothing'; Spanish *caña* [kaɲa] 'cane' (≈ *n* in *annual*)
- **Liquids:** narrow passage, but not narrow enough to cause friction (a la fricatives).
  [l, ɹ, ɾ]
  [ɾ] (flap): *vi̲tamin* in U.S. English (≈ short [d]), some *r*'s in Czech
- **Glides:** almost a vowel, but slightly more constricted. The least constricted type of consonant.
  [j, w]

  Since liquids and nasals are produced with a relatively open passage of air flow, they can be *syllabic*: *bird* [bɹ̩d] (U.S.), *simple* [sɪmpl̩], *reason* [rizn̩]; *vlk* [vl̩k] 'wolf', *krk* [kr̩k] 'neck'

- **Place of Articulation** – where the main obstruction is made (lips, teeth, velum, etc.)
  - **Bilabial** (bi – two, labium – lip): the lips are close together or touching.
    [p/b, m, w]
  - **Labiodental** (dental – teeth): the lower lip up is against the upper front teeth.
    [f/v]
  - **Interdental** (inter – between): the tip of the tongue is between the front teeth
    [θ/ð]
  - **Alveolar:** the tip of the tongue is at the alveolar ridge (the ridge just behind the teeth)
    [t/d, s/z, n, l, r, ɹ, ɾ]
  - **Palatal:** the tongue is near the hard palate (hard part of the roof of the mouth).
    [ʃ/ʒ; j; tʃ/dʒ]
  - **Velar:** the tongue approaches the velum (soft part of the roof of the mouth)
    [k/g, ŋ]
  - **Glottal:** the glottis is the point of constriction.
    [h/ɦ; ʔ]

4.2 Describing Vowels

Vowels are produced with a mostly open oral tract, so place/manner of articulation (a la consonants) is not useful in describing them.

4.2.1 English Vowels

In English, all vowels are usually *voiced*.

- **Tongue height:** high = near the roof of mouth

  Opening of mouth coincides more or less with tongue height.

  - **High:** [i, ɪ, u, ʊ] *leak, lick, luke, look*
  - **Mid:** [e, ɛ, ə, ʌ, ɔ, o] *bait, bet, sofa, but, bought, boat*
  - **Low:** [æ, a] *cat, cot*

- **Tongue advancement:** tongue further forward or back in mouth

  - **Front:** [i, ɪ, e, ɛ, æ] *seek, sick, sake, sec, sack*
  - **Back:** [u, ʊ, o, ɔ, a] *ooze, look, road, paw, dot*
  - **Central:** [ə, ʌ] *sofa, but*

- **Lip rounding:**

  - **rounded:** [u, ʊ, o, ɔ] *food, put, road, caught*
  - **unrounded:** the rest

- **Tenseness:** tongue position of the lax vowels are less extreme.

  - **Tense** – [i] (*deed*), [u] (*loose*)
  - **Lax** – [ɪ] (*did*), [ʊ] (*put*)

  Tense vowels are longer than their lax counterparts – *deed* vs. *did*.

diphthong – a complex sound consisting of two vowel sounds.
[aɪ] (*r*i*ght*), [oɪ] (*b*oy*), [eɪ] (*th*ey*), [aʊ] (*l*au*d*), [oʊ] – (*g*o*)

Note: English [e] occurs only in [eɪ] and [o] only in [oʊ]. Therefore the glide is often omitted in simplified transcriptions, because you know it is always there.

4.2.2 Czech Vowels

short: [ɪ, ɛ, a, ʊ, ɔ]
long: [iː, ɛː, aː, uː] and borrowed [ɔː]
diphtongs: [aʊ] and borrowed [oʊ], [ɛʊ]

5 Some Other Speech Sounds

5.1 Vowels

Rounded Vowels

The only rounded vowels in Czech/English are the back vowels [u, ʊ, o, ɔ].

German and French both have front rounded vowels. They are written as [y] and [œ] in IPA. The high front rounded vowel [y] is pronounced like [i], but with rounded lips.

	Front rounded		Back rounded		Front unrounded	
French:	[sy]	sue (*I sweat*)	[su]	sous (*under*)	[si]	si (*if/yes*)
	[nø]	noed (*knot*)	[no]	nos (*our*)	[ne]	né (born)

Nasalized Vowels

- Oral vowels – more common; the nasal passage is closed (the velum is raised).
- Nasal vowel – like oral, but the nasal passage is open; marked by a tilde ([ẽ, ã, . . .]).

	Oral		Nasal	
	[mɛ]	*mais* (but)	[mɛ̃]	*main* (hand)
French:	[lɛ]	*lait* (milk)	[lɛ̃]	*line* (linen)
	[ʃas]	*chasse* (hunt)	[sãs]	*chance* (luck)
	[mo]	*mot* (word)	[mõ]	*mon* (my)

In fact, there are nasal vowels in Czech and English – before nasal consonants, e.g. in *bin* [bĩn]. However, because they do not distinguish meaning (as they do in French), in a simplified transcription, their nasality is usually ignored ([bɪn]).

5.2 Consonants

- voiceless uvular stop [q]: Farsi (Persian, Iran)
- voiced bilabial fricative [β]: Spanish *Cuba*
- voiceless labial affricate [pf]: German *Pfennig* (penny)
- non-pulmonic consonants – sounds whose airflow is not dependent on the lungs:
  - clicks – in Khoisan languages and some Bantu languages in Africa
  - implosives
  - ejectives – in many native American languages and Caucasian languages

6 Narrow vs. Broad Transcription

Depending on the purpose of the transcription, we are either more detailed (the so called narrow transcription) or less (broad transcription). Usually we omit details that can be obtained by using simple and regular rules (e.g. all English word initial voiceless stops are aspirated).

In a really narrow transcription of English we have to capture all of the following (and much more). We ignore it in broad transcriptions:

- **Aspiration:** *pat* [pʰæt] vs. *spat* [spæt]

  All English word initial voiceless stops are aspirated ([pʰ, tʰ, kʰ])

- **Flaps:** *put* [pʊt] vs. *putting* [pʊɾɪŋ], *ladder* [lærər] = *latter* [lærər]

  In American English, /t/ and /d/ are pronounced as [ɾ] between two vowels, where the first one is stressed.

- **Lengthened vowels:** *hat* [hæt] vs. *had* [hæːd], *beat* [bit] vs. *bead* [biːd]

  Vowels are slightly longer before voiced consonants.

- **Assimilations** – sounds tend to become similar to their neighbors:

  - *input* often as *imput* [ɪmpʊt], *lean bacon* often as *leam bacon* [lim beɪkn̩]
  - **Nasalized vowels**: *bit* [bɪt] vs. *bin* [bĩn]
    vowels are nasalized before nasals ([n, m, ŋ]).
  - **Labiodental nasal**: [ɱ] in *comfort* [kʌɱfərt]
    /m/ is pronounced as [ɱ] before labiodentals ([f, v]).

- **Deletions**: some sounds are omitted, esp. in fast speech and word-final consonants.

  past as *pas*, *lost shoe* [last ʃu] as *losh shoe* [laʃ ʃu] ([t] omitted, [s] assimilated to [ʃ])

- etc.

7 Links

- IPA (charts, sounds)

  `http://www.langsci.ucl.ac.uk/ipa/index.html`

- Customizable vocal tract showing the corresponding IPA symbol

  `http://www.chass.utoronto.ca/~danhall/phonetics/sammy.html`

- Interactive IPA charts linking each symbol to its pronuntiation (note that consonants are surrounded by vowels)

  `http://www.yorku.ca/earmstro/ipa/index.html`

- List of various online phonetic resources:

  `http://www.unc.edu/~jlsmith/pht-url.html`