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Faculty of English

# A corpus-based study of vowel reduction in two speech styles: a comparison between English and Polish

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# Outline

1. Introduction: vowel reduction
2. The Polish corpus
3. Methodology
4. Results
5. Implications for further research

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1. **Introduction: vowel reduction**
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# Vowel reduction

- centralization (Koopmans-van Beinum 1980)
- function of stress (Crosswhite 2003, Barnes 2006)
- undershoot (Lindblom 1963)
- information loss (Harris 2005)

- Phonetic vs. phonological reduction

# Vowel reduction cont.

- **phonetic reduction**: a centralised realisation of a vowel, any approximation of vowels towards schwa; universal, cross-linguistic (e.g. Farnetani and Busa 1999; Vayra et al. 1999; Nikolaidis 2003; Flemming 2005; Jaworski 2009), especially evident in *grammatical words*

- **phonological reduction**: neutralisation of phonetic contrast between two or more vowels (Crosswhite 2000, 2004; Barnes 2006); treats vowel reduction as a part of phonological inventory of a language; *schwas in the dictionary entries*

# Aims of the study

- (i)  to compare speech styles in English and Polish (read vs. spoken), both substandard dialects

- (ii) to investigate degree of reduction in spontaneous Polish and spontaneous English

# previous scholarship

- a number of languages has been reported to vary across speech styles in the vowel space

- formants and duration in spontaneous speech are typically more centralized than in read speech (equated with formal style)

# Previous scholarship

| | | | | |
|---|---|---|---|---|
| Vowel reduction (formants) | Koopmans-van Beinum (1980) | Dutch | isolated vowels, canonical word forms, read speech, retold story, conversational speech | • vowel quality contrast decreases in more spontaneous productions |
| | Harmegnies and Poch-Olivé (1992) | Spanish | spontaneous conversational speech vs. laboratory speech (i.e. word list reading) | • vowel centralisation and greater within-category scatter in spontaneous vs. laboratory speech |
| | Laan (1997) | Dutch | spontaneous speech on prepared topic, read speech (read version of the spontaneous speech transcript), isolated vowels | • smaller vowel space in both speaking styles as compared to vowels produced in isolation<br>• more centralised vowel formant values in spontaneous speech (only for one speaker) |
| | Bondarko et al. (2003) | Russian | spontaneous speech (dialogues) vs. read speech (read version of the spontaneous speech transcript) | • greater variability of formant values for peripheral vowels /a/, /i/ and /u/ in spontaneous speech |
| | Moon and Lindblom (1994) | English | citation forms (i.e. normal reading) vs. clear speech | • less formant displacement due to context in clear speech |

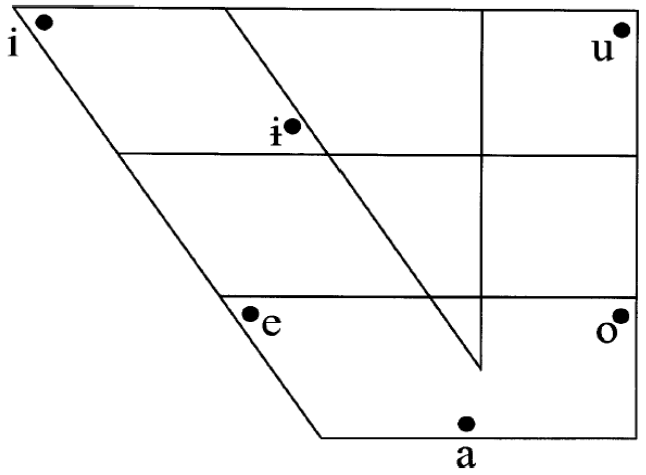
# Previous scholarship

| | Study | Language(s) | Types of speech material | Findings |
|---|---|---|---|---|
| Segment durations, elisions and other processes | van Son and Pols (1999) | Dutch | spontaneous speech (prepared stories) vs. read speech (read version of the spontaneous speech transcript) | • shorter consonant durations in spontaneous speech |
| | Bondarko et al. (2003) | Russian | spontaneous speech (dialogues) vs. read speech (read version of the spontaneous speech transcript) | • shorter segment durations in spontaneous speech |
| | Bolotova (2003) | Russian | spontaneous speech (dialogues) vs. read speech (read version of the spontaneous speech transcript) | • shorter segment durations in spontaneous speech<br>• greater segment duration variability (of vowels and sonorants) in spontaneous speech |
| | de Silva et al. (2003) | Finnish | spontaneous speech (dialogues) vs. read speech (read version of the spontaneous speech transcript) | • shorter segment durations in spontaneous speech<br>• more frequent elisions or assimilations of final /n/ in spontaneous speech |
| | | Russian | spontaneous speech (dialogues) vs. read speech (read version of the spontaneous speech transcript) | • **longer** segment durations in spontaneous speech<br>• more frequent elision of /j/ in spontaneous speech |
| | | Dutch | spontaneous speech (story telling) vs. read speech | • **longer** segment durations in spontaneous speech<br>• redundant final /n/ in plural suffixes more frequent in read speech |
| | Barry and Andreeva (2001) | Bulgarian, Czech, Greek, Italian, Polish and Russian | spontaneous speech (interactional task) vs. read speech (read version of the spontaneous speech transcript) | • consonant cluster simplifications, consonant weakening, vowel centralisations and syllable elisions more frequent in spontaneous speech |

# Previous scholarship

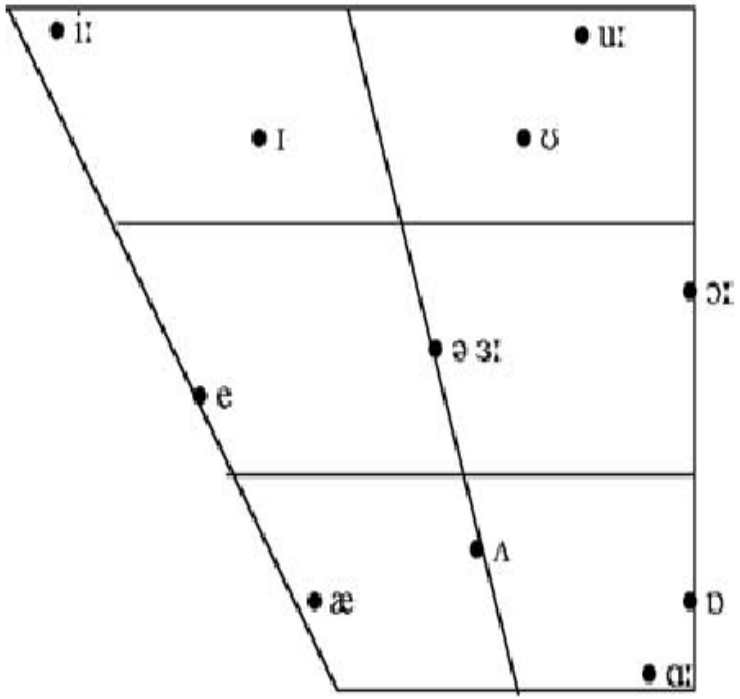
- Polish has no schwa in the vowel inventory (Jassem 2003)

- Polish has no quantity distinction nor short vowels

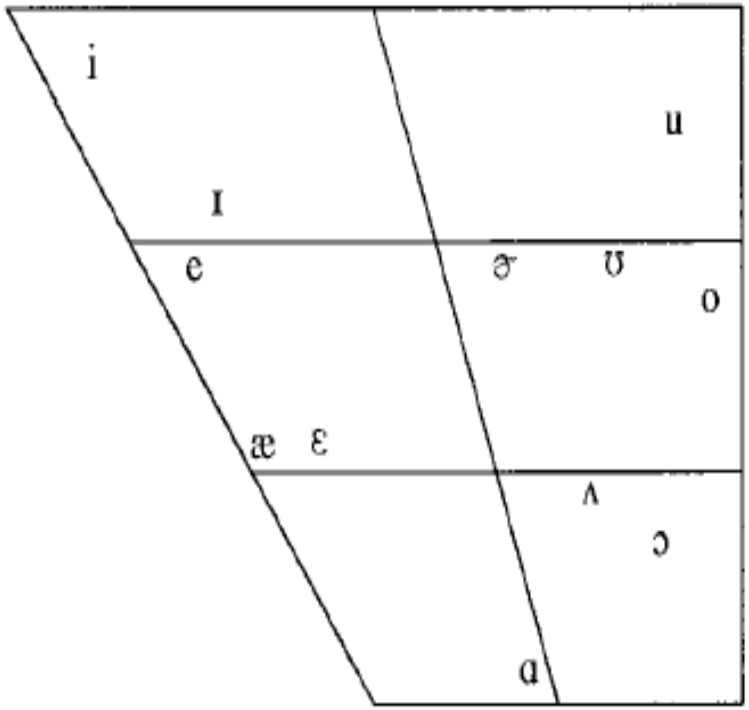


# Vowels of English

## Roach (2004)




## Hillenbrand (2003)



# Previous scholarship

- “Polish vowels are never reduced so thoroughly to a mid-central quality of schwa” (Sobkowiak 2008: 132).

- basing on our observations, we assumed that there is a lot of reduction (but less than in English)

# Introduction

- I already used the PAC corpus for Lancashire so we wanted to  a full corpus-based study in the spirit of corpus phonology (Durand, Gut and Kristoffersen 2014)

- problems with existing corpora: outdated corpora of Polish or corpus not phonological

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# The Corpus (1)

- the Corpus of Modern Spoken Polish in the area of Greater Poland
- Research project funded by the Ministry of Science and Higher Education
- 0113/NPRH2/H11/81/2013
- duration: 2013-2016

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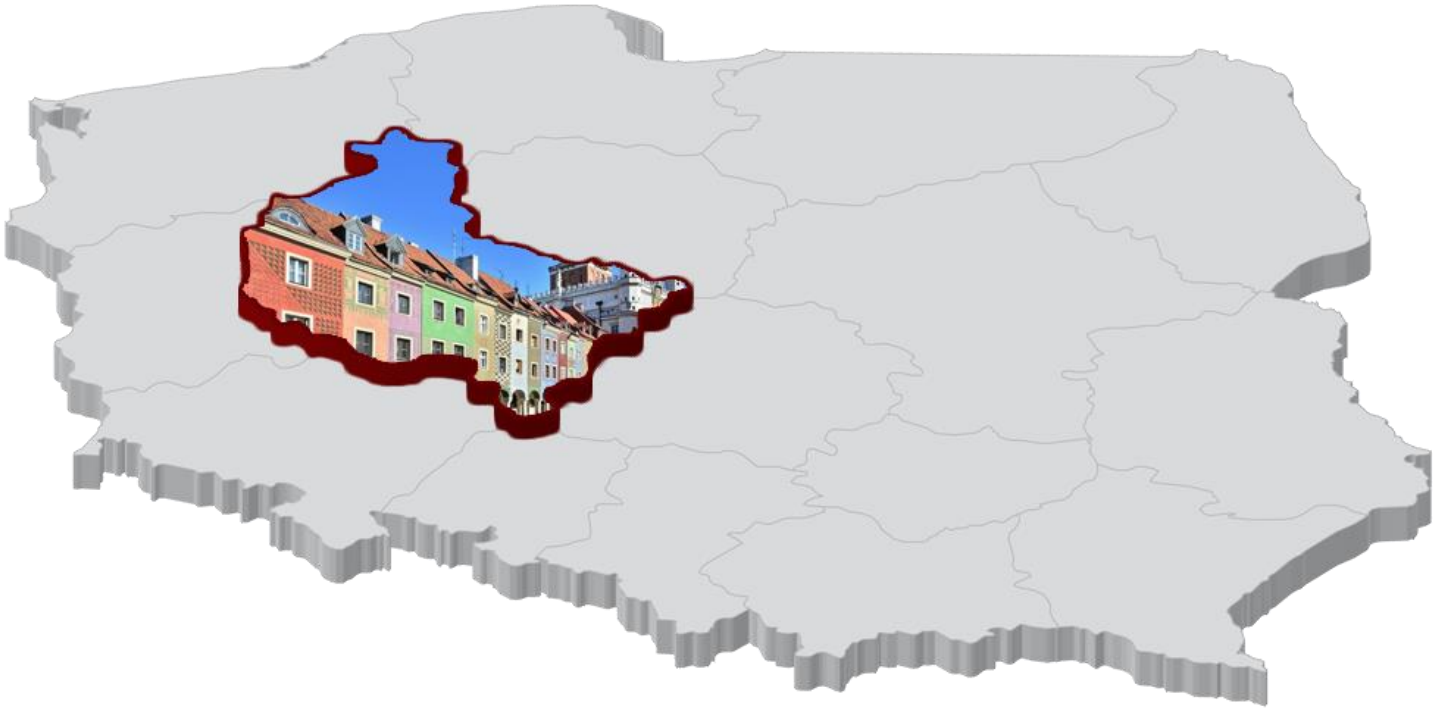
# The Corpus (2)



# The Corpus (3): speakers

- 75-100 speakers
- 50 speakers of standard Polish
- 25 speakers of the Greater Poland vernacular

# The Corpus (4): format

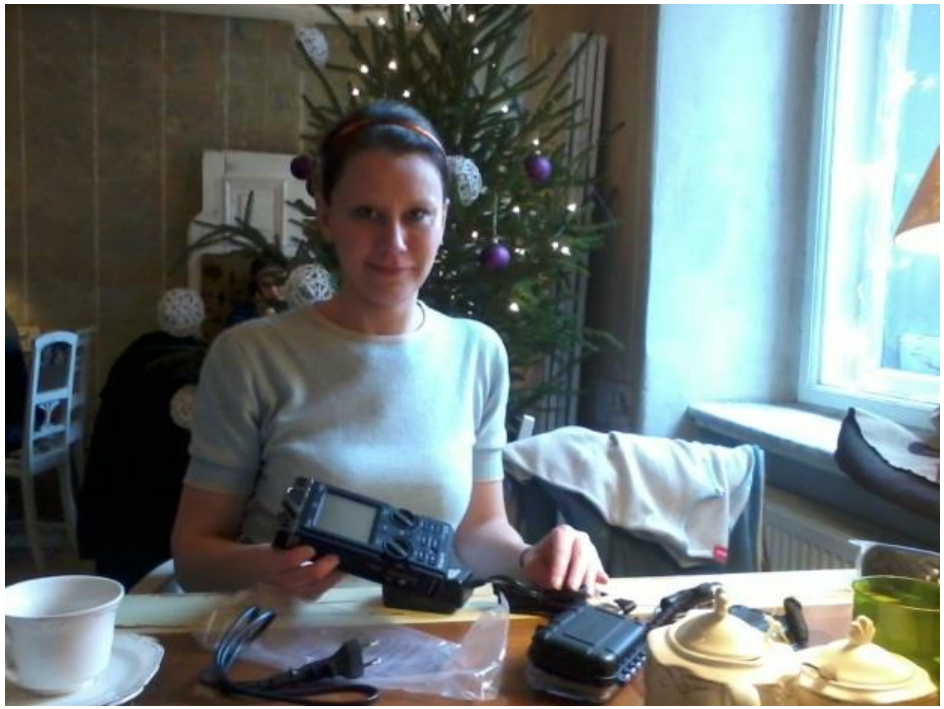
- 2+2 interview format
  - 2 interviewers
  - 2 interviewees
- speakers know each other

# The Corpus (5): format

- reading keywords embedded in a carrier phrase (soundproof lab) 
- an informal 40-minute conversation (friendly environment, quiet room at university or in a workplace)
- topics:
  - studies / work
  - living in Poznań
  - culture and entertainment in Poznań 
  - the Internet
- metadata questionnaire: background information about subjects

# The Corpus (6): equipment

- recorder: Roland R-26
- microphones: Rode, lavalier



# The Corpus (7): work so far & in the future

**so far**

- 35 speakers
- orthographic transcripts in preparation

**final state**

- a sample of phonemic transcription
- transcripts and audio files will be available in an electronic version
- website: http://wa.amu.edu.pl/korpuswlkp/

# The Corpus (9): purpose

- to build an **online** corpus of modern spoken Polish
- to capture the **truly spontaneous speech** (without resort to e.g. televised interviews, public or broadcast speeches)
- to compare / control **repeated items** (the same words in the informal speech as in the read part)
- to maintain fair **representation** of education, age and gender across speakers
- to differentiate between **standard** and **substandard** speech
- national heritage: preserving the language and the vernacular

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# Methodology: speakers

- 9 speakers of English (female)
- 9 speakers of Polish (4 female and 5 male)

# Methodology: materials (1)

## English

- 3 vowels: /ɪ/, /æ/, /ʊ/
- 1 word per vowel per speaker from the PAC vowel word list
- 5 words per vowel extracted mostly from the informal interview

## Polish

- 3 vowels: /ɨ/, /a/, /u/
- 3 words per vowel per speakers from the word list (carrier phrase)
- 3 words per vowel per speaker from the interview

# Methodology: materials (2)

**English**

- scripted speech: 27 tokens
- spontaneous speech: 135 tokens

**Polish**

- scripted speech: 81 tokens
- spontaneous speech: 81 tokens

- Total 324 vowel tokens

# Methodology: materials (3)

- (relatively) high frequency words
- English: (mostly) one-syllable words
- Polish: (mostly) two-syllable words (V in a stressed syllable was the focus)
- vowels in the neighbourhood of obstruents
- English: avoiding reducible grammar words

# Methodology: materials (4)

**English**

- scripted: pit, pat, put, (thick)
- spontaneous: this, big, bit, fix, have (= possess), haven't, had, back, bad, dad, good, took, put

**Polish**

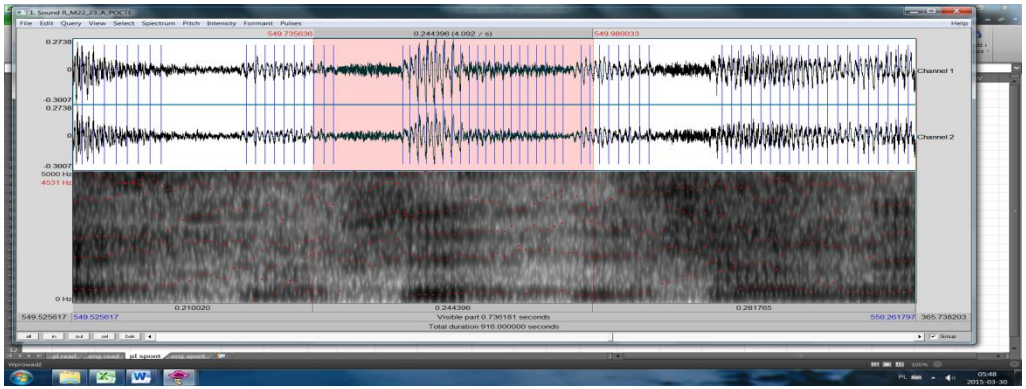
- scripted: bity, baty, buty
- spontaneous: wszystko, wszyscy, chyba, szybko, czasy, czasem, czasami, zasadzie, zawsze, tutaj, dużo, różne

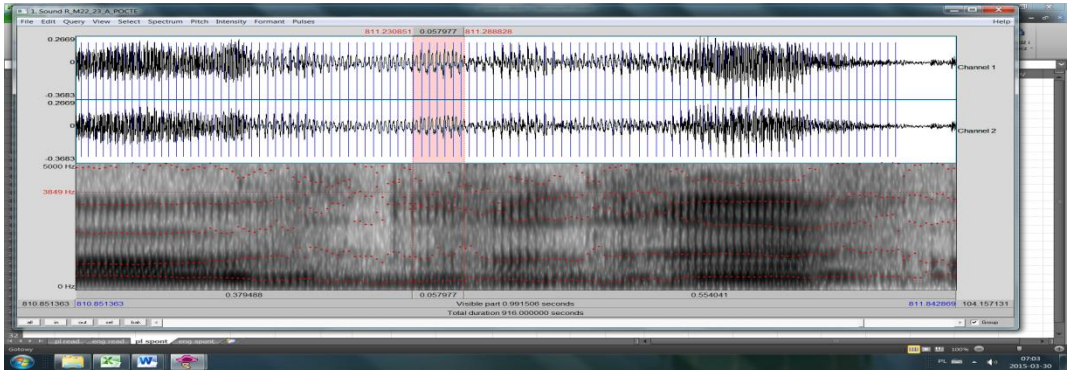
# Method

- acoustic analysis (manual annotation of vowel onset and end)
- we went for those contexts which allowed segmentation of speech (obstruents)

# Method

- exemplary annotations (*wszyscy, dużo)*





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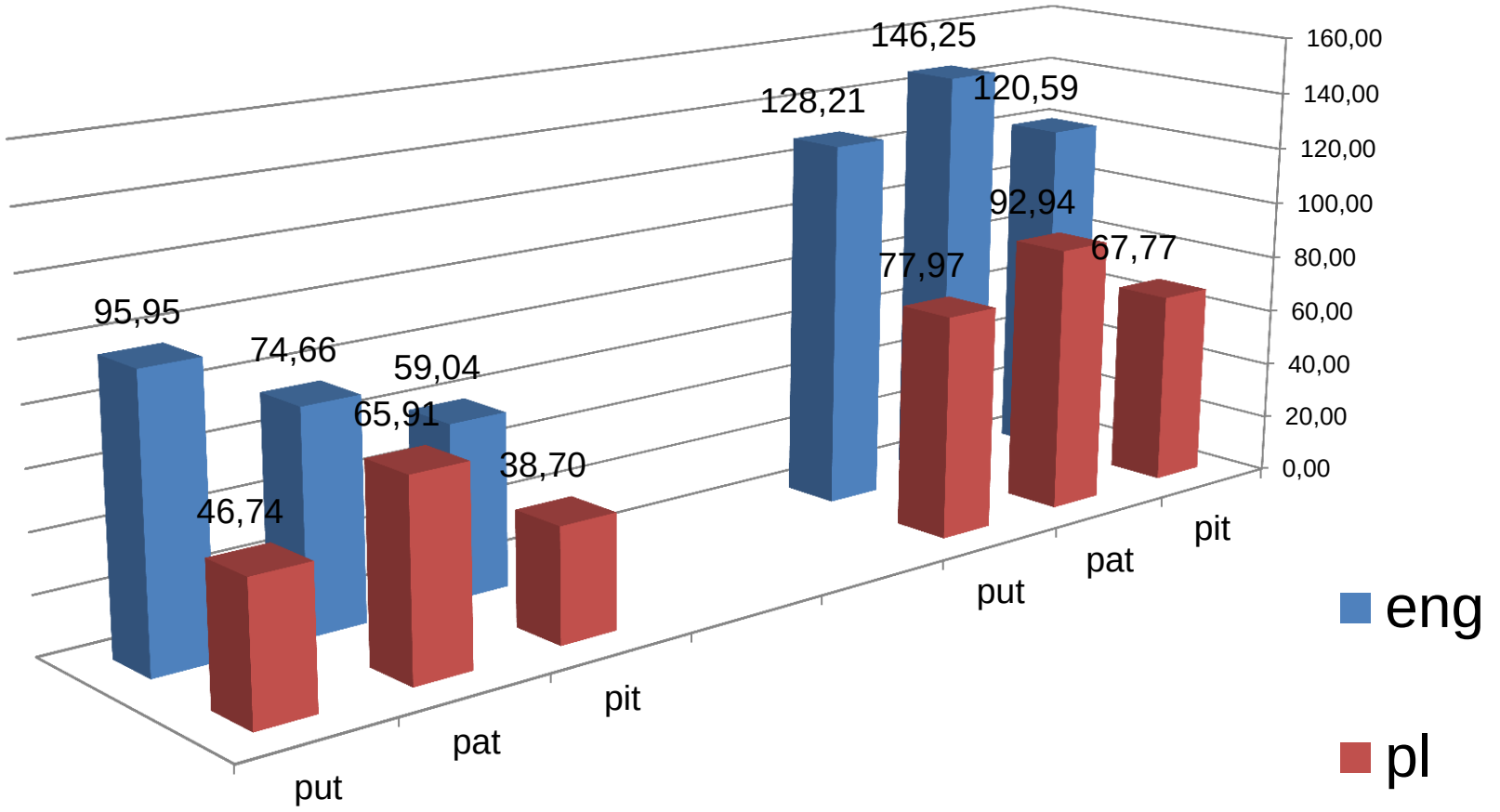
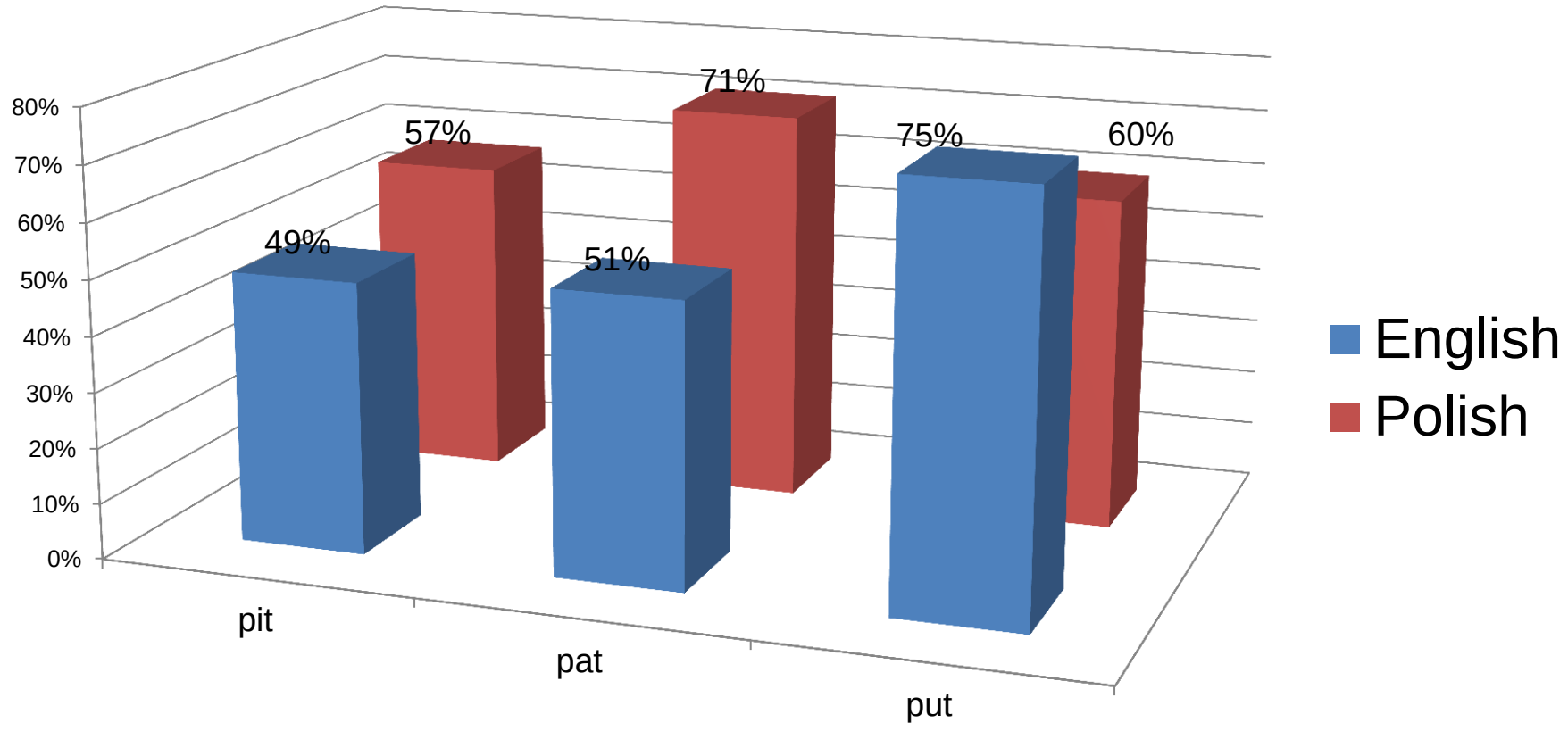
# Results for duration: read vs. spontaneous



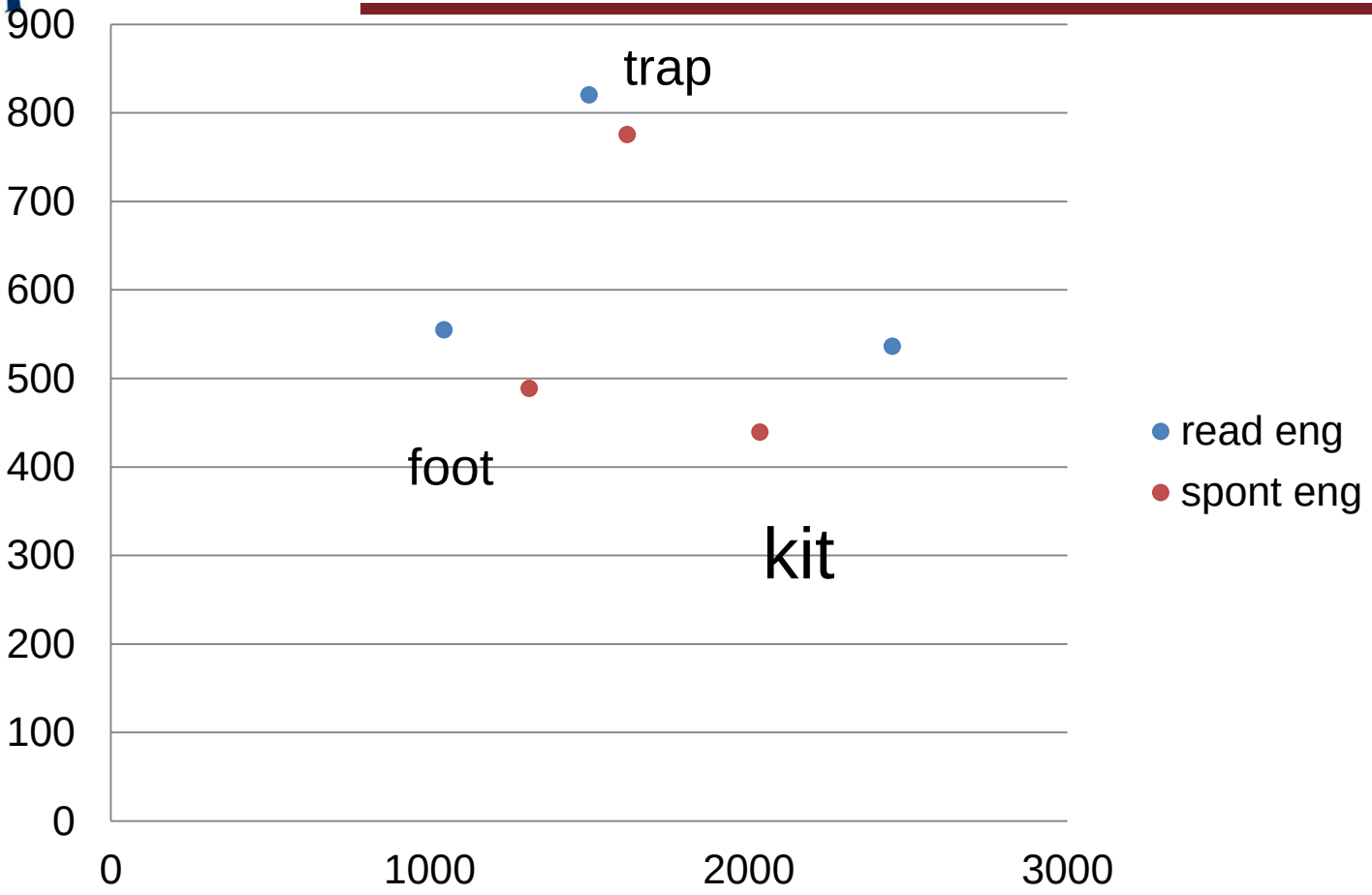
# Ratio of read to spontaneous speech ( e.g. 49 per cent means that spontaneous English took up 49 pr cent of read English)



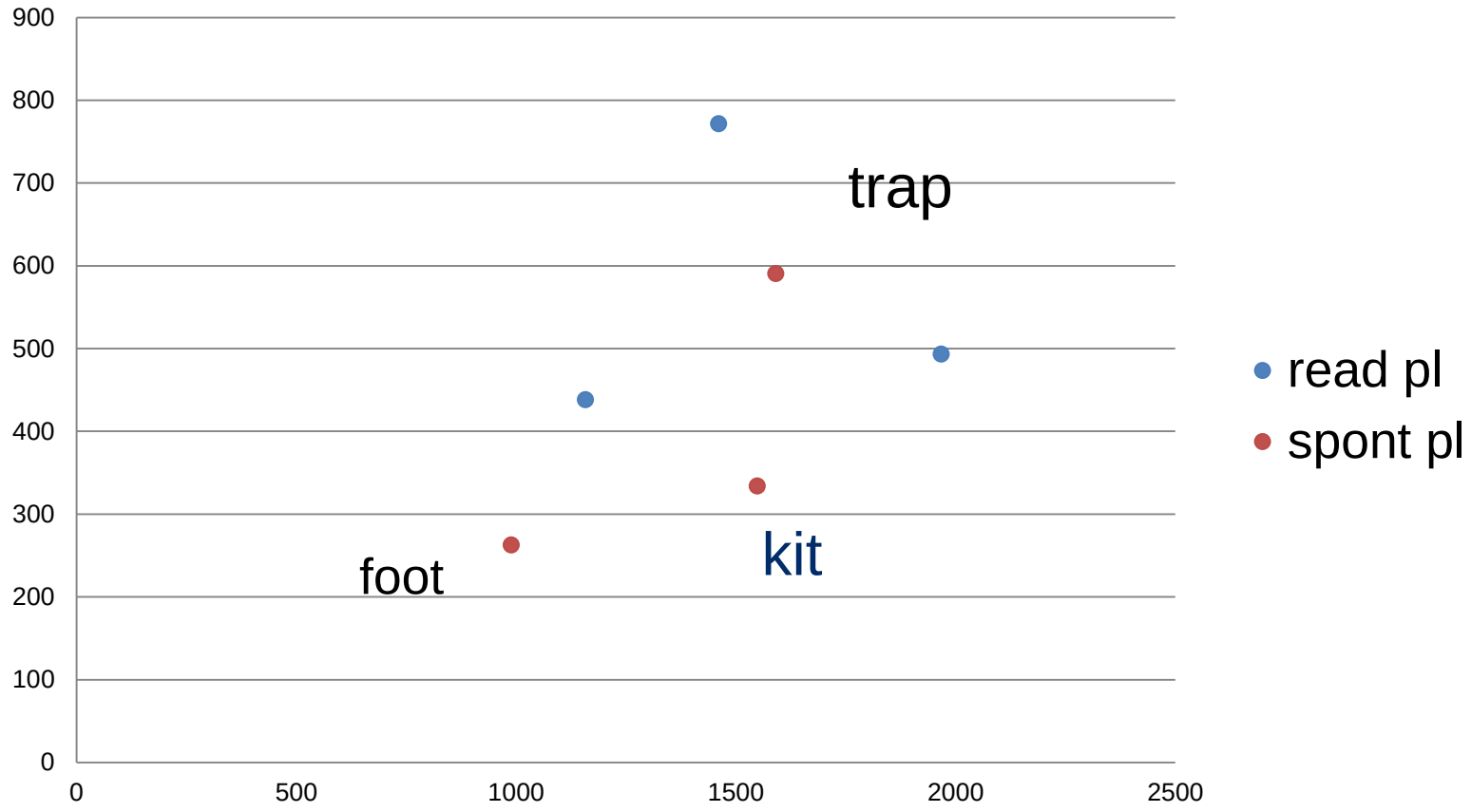
# Results for duration

- vowels exibit a degree of variability with reference to duration
  - FOOT the least reduced  in English
  - /a/ the least reduced in Polish
- on  average (mean of three vowels KIT TRAP FOOT, and /ɨ/, /a/, /u/, respectively), duration was reduced by 58 % in English and by 63 % in Polish in relation to read speech

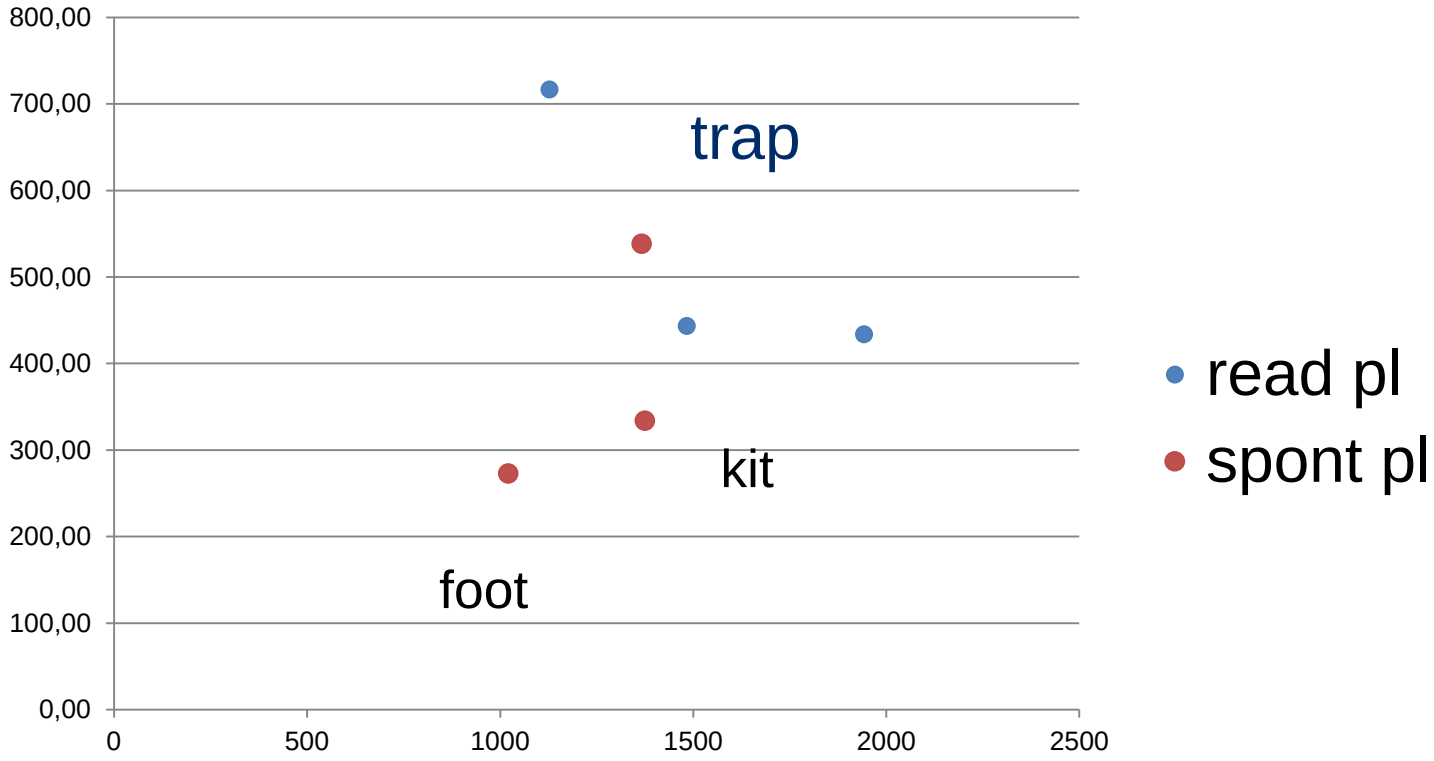
# Read vs. spontaneous: formants (English women)



# Results for formants (raw values): Polish women



# Results for formants (raw values): Polish men



# Normalization procedure

- the ratio of the least reduced token to the most reduced token
- allows to compare across speakers and languages

In other words, the distances between the least and most reduced token, rather than crude values, are be compared (this is similar to Amir and Amir's (2007)

# Results for rate

- we wanted to correlate speakers' individual rate (syllables per second) with their reduction in spontaneous speech

- we used simple Pearson's correlation

# Results for rate English

| | rate | drtn | F1 | F2 |
|---|---|---|---|---|
| LC | 3,59 | 75% | 21% | 36% |
| ST | 3,56 | 59% | 24% | 27% |
| MD | 3,21 | 42% | 21% | 26% |
| LB | 3,20 | 53% | 25% | 18% |
| PK | 3,20 | 55% | 23% | 25% |
| JM | 3,13 | 75% | 21% | 36% |
| MO | 2,86 | 51% | 51% | 14% |
| MC | 2,83 | 50% | 27% | 27% |
| SC | 2,80 | 61% | 26% | 25% |
| | | | | |
| | r | 0,36838 | -0,486106 | 0,457784 |
| | | rate drtn r | rate F1 | rate F2 |

# Results for rate Polish

| | rate | drtn | F1 | F2 | |
|---|---|---|---|---|---|
| M32 | 5,816667 | 50% | 21% | 13% | |
| M24 | 5,6 | 48% | 24% | 6% | |
| M23 | 5,02 | 48% | 21% | 9% | |
| M34 | 4,82 | 40% | 25% | 6% | |
| M21 | 4,383333 | 31% | 23% | 5% | |
| M22 | 4,34 | 42% | 21% | 8% | |
| M33 | 4,2 | 48% | 51% | 6% | |
| M25 | 3,85 | 27% | 27% | 4% | |
| M35 | 3,55 | 52% | 26% | 6% | |
| | | | | | |
| *r=* | | 0,329537 | 0,133019 | -0,33074 | |
| | | rate drtn r | rate F1 | rate F2 | |

# Results for rate

- Polish speakers were faster speakers (age)
- it seems that rate does not correlate with duration or formants, it actually correlates negatively
- correlation is feeble

# Discussion (1)

- Reduction to zero: 7 tokens (6 in Polish, 1 in English, total number of tokens 324)
- Reduction towards schwa: the rest (0.21 per cent)

# Example

- example of Polish reduction

- *można powiedzieć po rosyjsku i **wszystko** mi się miesza (reduced)*

- *yyy robić **wszystko** się kumuluje na tym rosyjskim (unreduced)*

# Discussion (2)

**Aim 1:** English (58 %) and Polish (63 %) exhibited nearly the same durational difference across styles.

As for spectral analysis, Polish does not centralise and is gender-specific.

# Discussion (3)

**Aim 2:** No correlation between the rate and individual reduction was observed for English. In Polish, however, the relationship was inverse. In fact, the slowest speaker deleted vowels to 0.

Instead of rate we propose

i) that vowel reduction is phonological

ii) that high frequency items became lexicalised

# Discussion (4)

A higher speech rate does not necessarily imply a higher reduction degree (e.g., Shockey, 2003:11–13; van Son&Pols,1990, Ernestus et al. 2015 p.72)

“casual speech need not to be fast; some speakers [...] use a quite informal speech even at fairly slow rates of speech, while others [...] give the impression of great precision even in hurried speech” (Zwicky 1972: 607)

# Discussion (5)

We propose:

i) that vowel reduction is not phonetic

ii) that high frequency items became lexicalised

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# Future studies

- more corpus-based studies in the spirit of corpus phonology (Durand, Gut and Kristoffersen 2014)
- the role of rate in reduction
- extreme reduction of high frequency words (which we excluded) such as *znaczy, w ogóle, dobra*
- perception experiments (vowel perception)

# Future studies

- relation between vowel reduction and consonant reduction (compensation strategy, preserving a phonetic skeleton of the word)?

# Thank you

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