



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

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46th Poznań Linguistic Meeting :: PLM2016 :: 15 September 2016





Outline

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



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
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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*
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Aims of the study

- (i) to compare speech styles in English and Polish (read vs. spoken)
- (ii) to investigate degree of reduction in spontaneous Polish and spontaneous English



previous scholarship

- a number of languages have been reported to vary across speech styles in the vowel space
- duration in spontaneous speech is shorter than in read speech (equated with formal style)
- formants are typically more centralized than in read speech (equated with formal style)

Previous scholarship

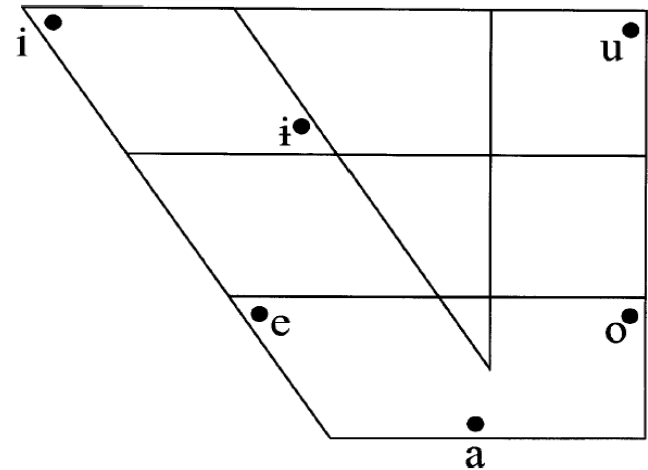
Vowel reduction (formants)	Koopmans-van Beinum (1980)	Dutch	isolated vowels, canonical word forms, read speech, retold story, conversational speech	vowel quality contrast decreases in more spontaneous productions
	Harmegnies and Poch-Olivé (1992)	Spanish	spontaneous conversational speech vs. laboratory 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 - 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 • 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 • 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 • more frequent elision of /j/ in spontaneous speech
		Dutch	spontaneous speech (story telling) vs. read speech	• longer segment durations in spontaneous speech • 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

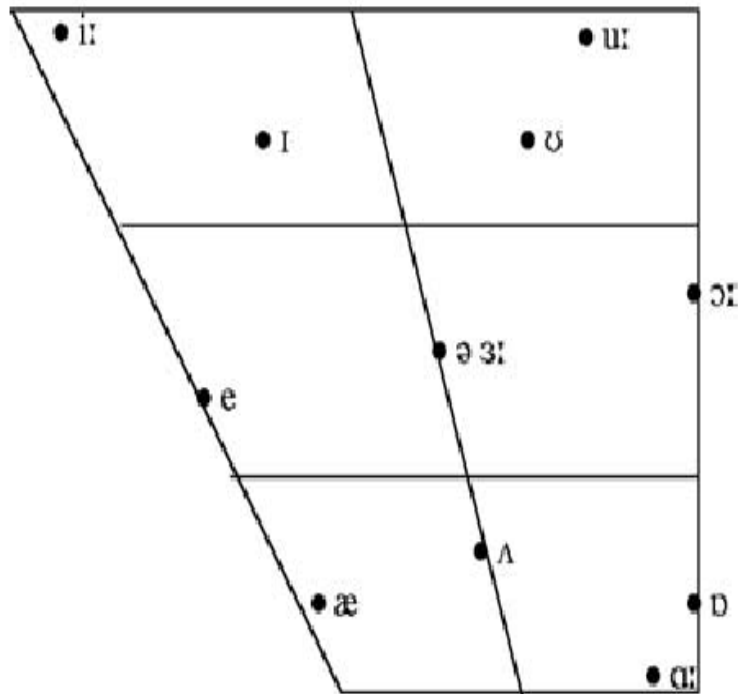
Previous scholarship

- Polish has no schwa in the vowel inventory (Jassem 2003)
- Polish has no quantity distinction nor short vowels

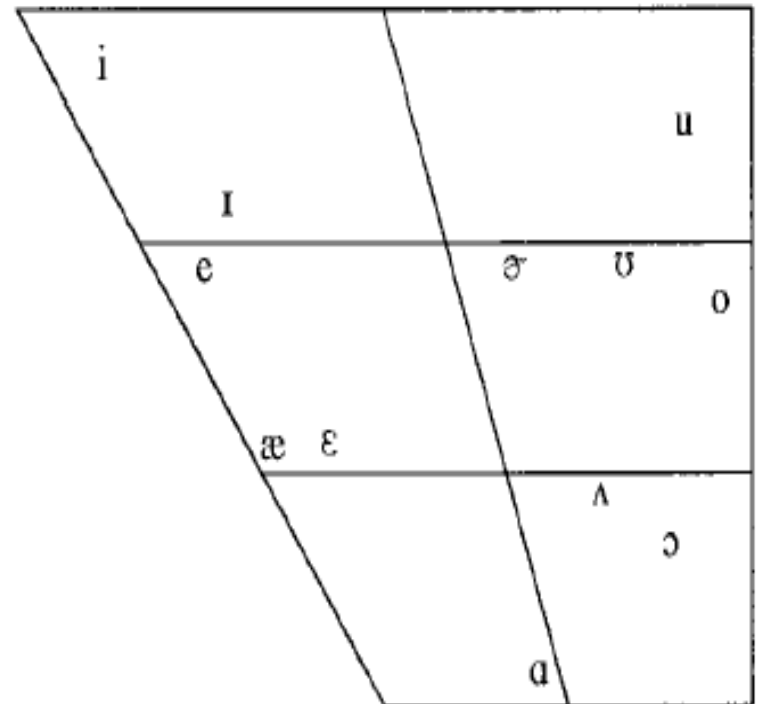


Vowels of English

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)
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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)

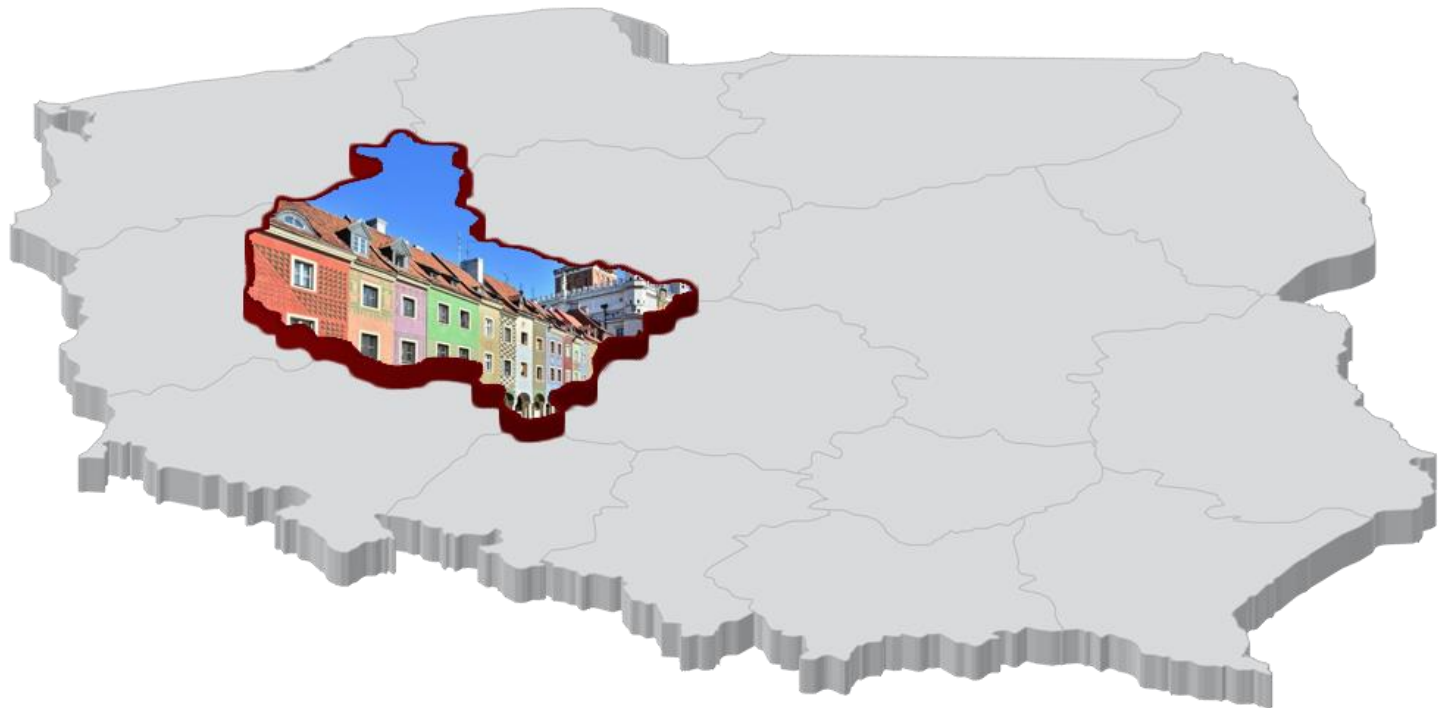
- the Corpus of Modern Spoken Polish in the area of Greater Poland
- Research project funded by the Ministry of Science and Higher Education
- 0113/NPRH2/H11/81/2013



Ministerstwo Nauki
i Szkolnictwa Wyższego



The Corpus (2)



The Corpus (3): speakers

- 100 speakers
- 80 speakers of standard Polish
- A range 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

- metadata questionnaire: background information about subjects
- 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 
- reading keywords embedded in a carrier phrase (soundproof lab) 



The Corpus (6): equipment

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



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

so far

- 74 standard speakers, 2 vernacular speakers
- orthographic transcripts and annotation in praat in preparation
- Planned forced alignment into phonemes (LABB-CAT)

final state

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



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 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: /i/, /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)

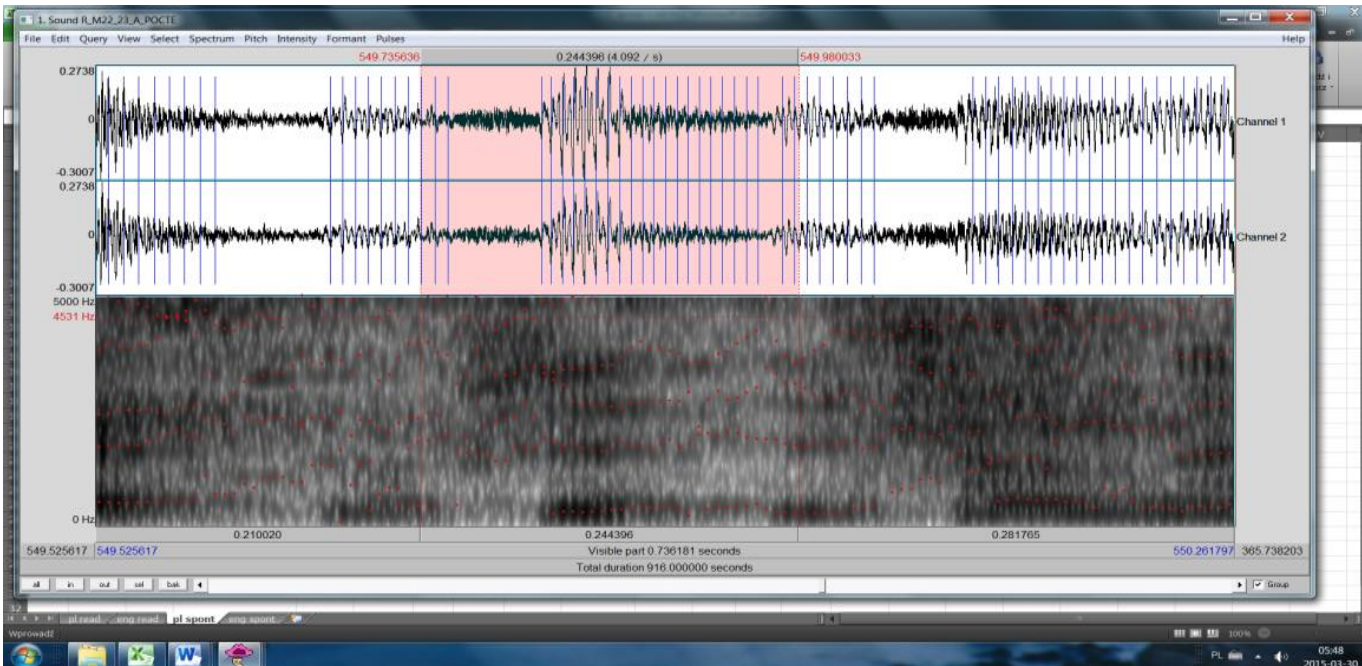
English

- 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

- acoustic analysis (manual annotation of vowel onset and end)
- Exemplary annotation *wszyscy*



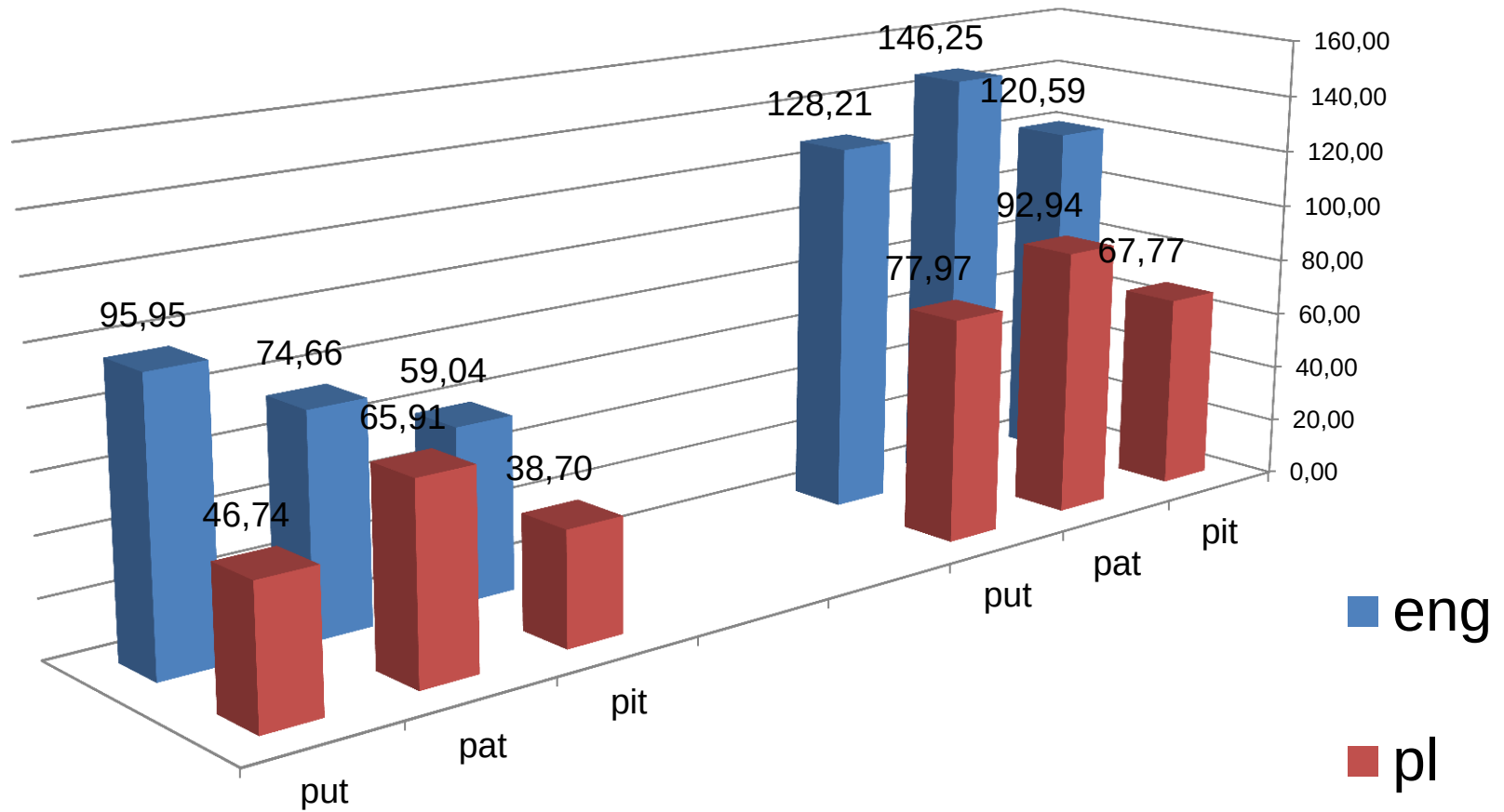


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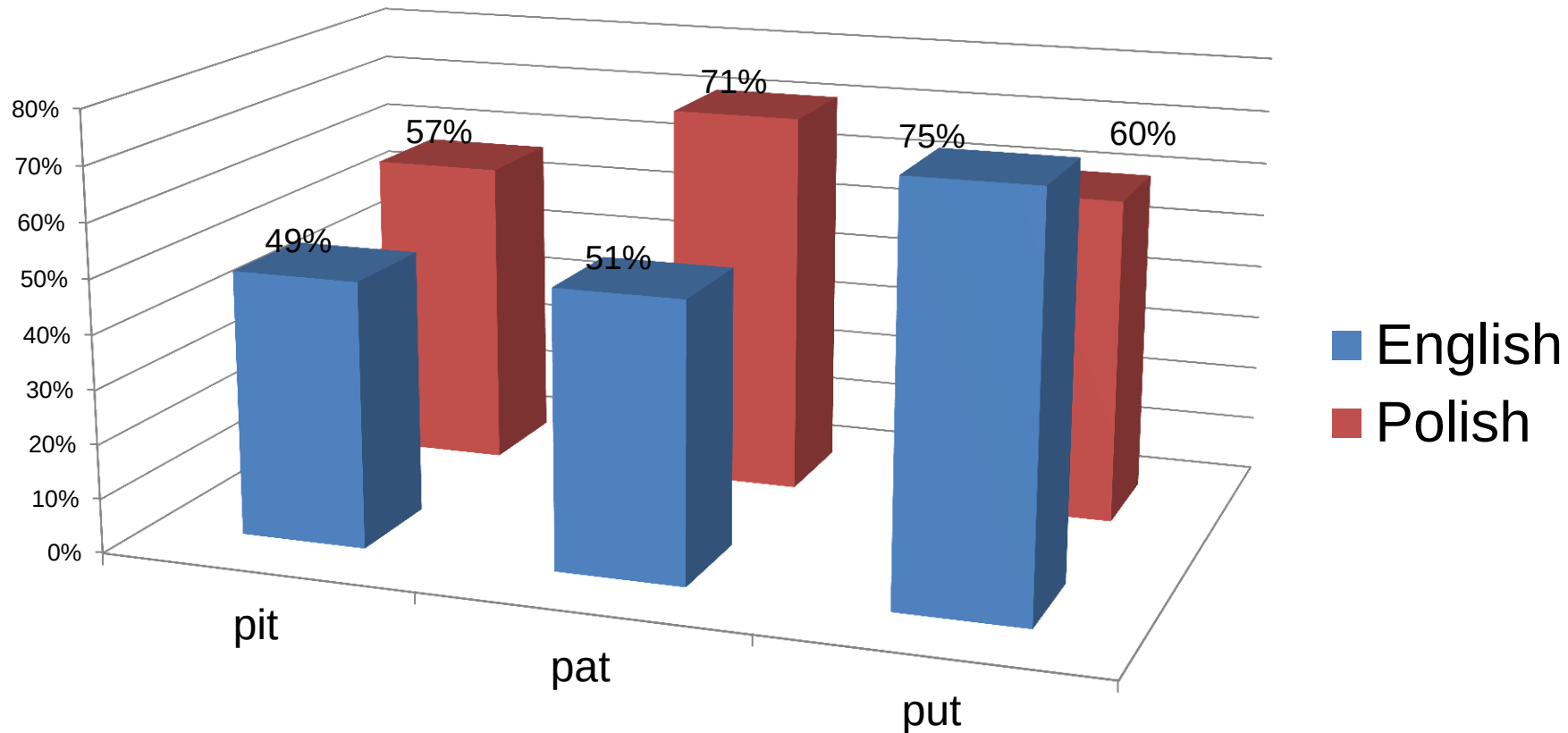


Results for duration: read vs. spontaneous





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



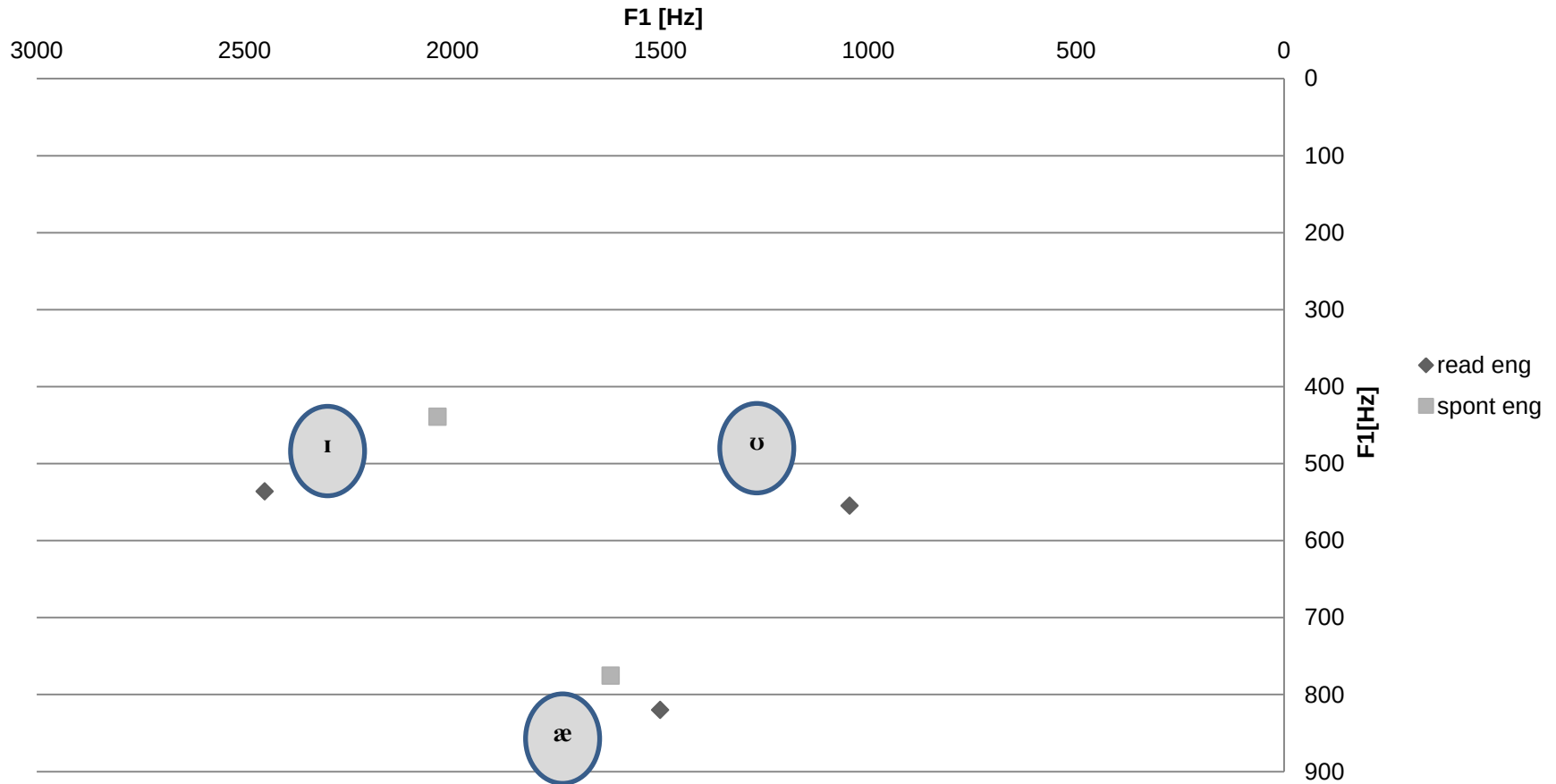


Results for duration

- vowels exhibit 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 /i/, /a/, /u/, respectively), duration was reduced by 58 % in English and by 63 % in Polish in relation to read speech

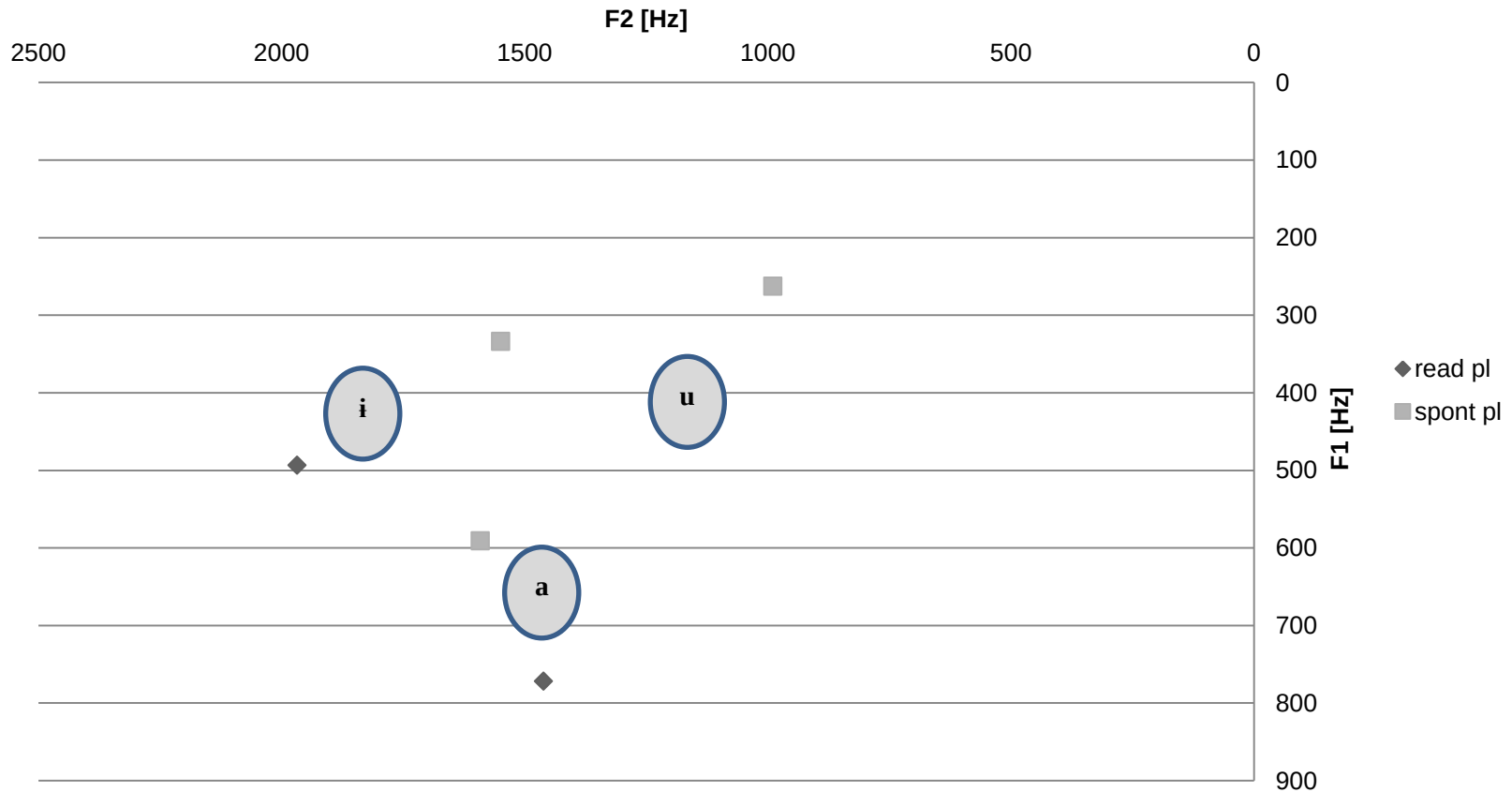


Read vs. spontaneous: formants (English)





Results for formants (raw values): Polish





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, should 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)

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

As for spectral analysis, we found evidence for vowel centralization in Polish, with the exception of certain tokens of the /u/ vowel



Example *czasami* /a/

- /a/ duration 71 msec
- *Kuchnię więc **czasami** się*
- /a/ duration 24 msec
- *Życ w zgodzie ale **czasami***





Example *wszystko* /y/

- *wyrobić **wszystko** się kumuluje na (unreduced)* 
- *można powiedzieć czy po rosyjsku i **wszystko** mi się miesza (reduced)* 



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 phonologically-grounded
 - 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)



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Limitations of the study

- Gender was not controlled (14 females, 5 males)
- A limited number of tokens
- Local rate not compared with speaking rate
- The conclusions should be taken as tentative suggestions, resulting from a pilot study
- They are however promising enough to continue this line of research



Future studies

- more corpus-based studies in the spirit of corpus phonology (Durand, Gut and Kristoffersen 2014)
 - the role of local rate in reduction
 - extreme reduction of high frequency words (which we excluded) such as *znaczy, w ogóle, dobra, właśnie, trzeba, pierwszy etc.*
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Future studies

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



Thank you

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