ADAM MICKIEWICZ UNIVERSITY IN POZNAŃ
Faculty of English

Speech perception in young multilinguals

Marta Marecka[1,3], Magdalena Wrembel[1],
Romana Kopečková[2] & Ulrike Gut[2]

[1]Adam Mickiewicz University,
[2]University of Münster,
[3]Jagiellonian University

L3 workshop 2017

Outline

- Speech perception in multilinguals
  - Models of L2 speech perception
  - Overview of research
- Study
  - Aims
  - Methods
  - Results
  - Conclusion

Models of L2 speech perception

- Perceptual Assimilation Model (PAM, PAM-L2)

  Best 1995, Best & Tyler 2007

- L2 sounds may be assimilated into L1 phonological space => as good/acceptable/deviant exemplars of L1 category

- Different assimilation patterns:
  - TC – 2 L2 phones to two different L1 categories
  - CG - 2 L2 phones to one L1 category (but one is better exemplar)
  - SC - 2 L2 phones to one L1 category (equally good/bad exemplars)
  - UC – uncategorised assimilation

Speech perception by multilinguals?

- PAM does not make any predictions
- Are L3/Ln categories assimilated to L1 or L2 categories in multilinguals?
- Will phonological categories from multiple languages help distinguish between two similar L3/Ln categories?

Overview of previous L3 perception studies (1)

- Studies on L3 perception rather scarce

- Kopečková 2013, 2015
  - cross-linguistic vowel identification task
  - child participants
  - Polish: L1, English: L2 or L3
  - basic mechanism of equivalence classification for both L2 and L3 learners
  - gradual change in perceptual sensitivity

Overview of previous L3 perception studies (2)

- Cabrelli Amaro 2013, 2016
  - word-final vowel reduction in L3 BP and L2 Spanish
  - naturalness preference task
  - Phonological Permeability Hypothesis not supported
- Onishi 2016
  - perception of Japanese contrasts by L3 and L2 learners
  - L1 Korean/L2 English/L3 Japanese vs. L1 English/L2 Japanese
  - AXB discrimination task
  - increase in perceptual sensitivity with L2 phonological acquisition (claimed multilingual advantage)

Multilingual advantage for perception

- Multilinguals deal better with cross-linguistic interference
  (Bartolotti & Marian 2012)
- Advantage for perception of novel contrasts
  (e.g. Antoniou et al., 2015; Enomoto, 1994; Tremblay & Sabourin, 2012)
- No difference between monolinguals and bilinguals acquiring novel contrasts
  (e.g. Díaz, 2011; Gabriel et al., 2014; Patihis et al., 2015)
- Conflicting outcomes possibly due to differences in:
  - cross-linguistic similarity,
  - bilingual dominance and proficiency,
  - specific vs. global advantage

Previous related research

- Kopečková, Marecka, Wrembel, Gut, 2016, IJM

  ”*Interactions between three phonological subsystems of young multilinguals: the influence of language status”*

  - **Vowel production** in L3 Polish by child participants
  - **L1:** German, **L2:** English
  - Heritage speakers vs. foreign language learners
  - Complex patterns, individual variation

Aims of the study

- To investigate perceptual categorisation of L3 sounds
- To trace possible facilitation effect of multilingualism
- To explore differences in the vowel and sibilant inventories of the three languages tested

German	***English***	***Polish***
14 vowels */i-ɪ/, /u-ʊ/*	*12 vowels* */i-ɪ/, /u-ʊ/*	*6 vowels* *no vowel length distinction*
/s z ʃ t͡ʃ t͡s/	/s z ʃ ʒ t͡ʃ d͡ʒ/	/s z ɕ ʑ ʂ ʐ t͡s d͡z t͡ɕ d͡ʑ t͡ʂ d͡ʐ/

Research questions

- **RQ1:** Do L3 speakers distinguish L3 vowels and sibilants?
- **RQ2:** Are L3/Ln vowels and sibilants assimilated to L1 or L2 categories?

Hypotheses:

- **H1:** Problems distinguishing L3 Polish sibilants (not occurring in L1 German or L2 English)
- **H2:** No problem distinguishing L3 Polish vowels (L1 and L2 being vocalic)

Participants

- 10 participants growing up in Berlin (9 for the vowel perception)
- 5 male, 5 female (4 male in the vowel perception task)
- aged 14
- enrolled in Polish classes for 10 months
- L2: English, L3/Ln: French or Latin

- 3 German speakers (grew up as monolinguals)
- 7 heritage speakers (at least one Polish parent, grew up with two or more home languages)

Research design (1)

Perceptual task 1: vowels

- **Cross-linguistic categorical discrimination**
  (cf. Fox, Flege and Munro 1995, Cebrian 2015)
  - indicate (dis)similarity on 7-point Likert scale
  - minimal pairs within L3 and across other languages:
    - L3 – L3, L3 – L1, L3 – L2
  - vowels: 6 Polish, 9 English, 9 German
  - 55 trials in 2 blocks, randomised
  - bVt context, e.g.

L3 Polish	L2 English	L1 German
byt	bit	Bitt
	beat	Bütt

Research design (2)

- **Perceptual task 2: sibilants**
- **AX discrimination** task
  - tokens presented auditorily in monosyllable /Xan/
  - 4 sibilant pairs selected

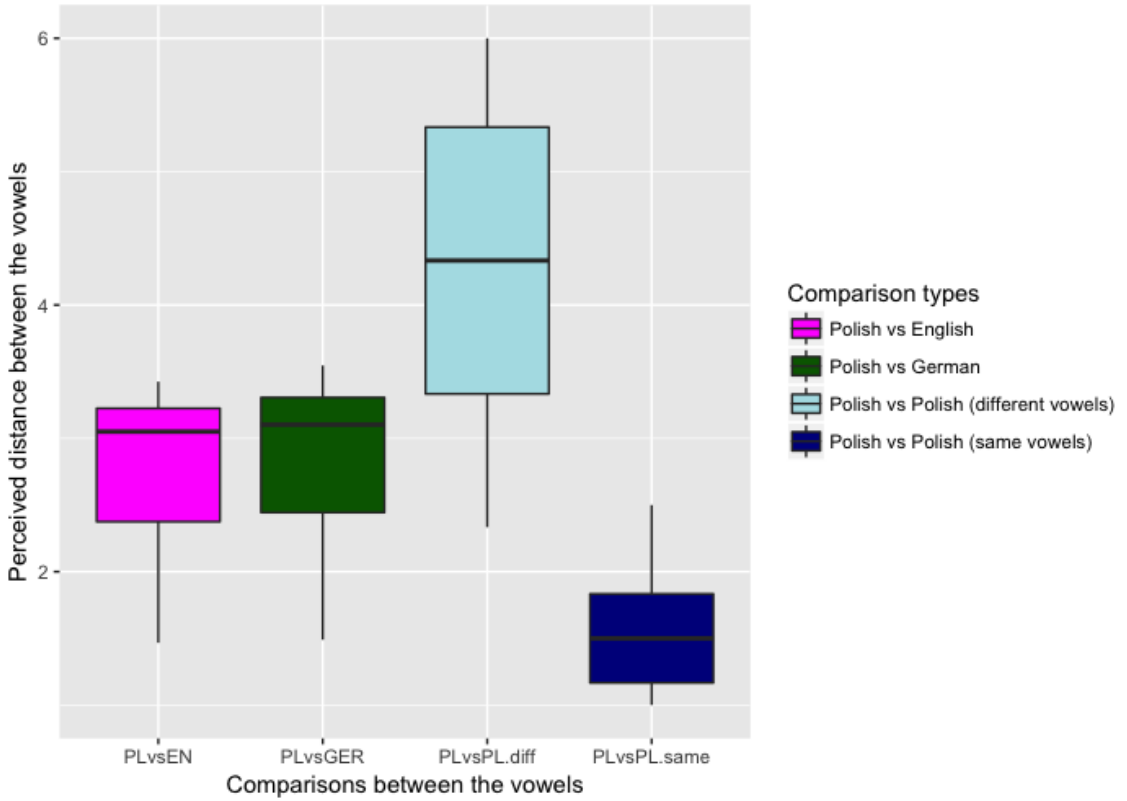
    /ʂan/ - /ɕan/ **/**t͡ʂan/ **-** **/**t͡ɕan/ /ʐan/ - /ʑan/ /d͡ʐan/ - /d͡ʑan/
  - ISI: 300 ms
  - (4 same pairs + 4 different) x 2 repetitions = 16 trials
  - in random order
  - reaction time (RT) task in E-prime

Results: vowel perception (1)

- 2 x 4 ANOVA (group x type of vowel comparison)
- **Group:** German vs. heritage speakers
- **Type:**
  Polish & Polish vowels (same)
  Polish & Polish vowels (different)
  Polish & English vowels
  Polish & German vowels
- **Significant effect of vowel comparison type**
  $F(3,21) = 26.14$, $p < .001$, *eta squared* = 0.59
- **No effect of group, no interaction** between group and vowel comparison

Results: vowel perception (2)

- **Polish vs Polish vowels (same):** *M* = 1.59, *SD* = 0.50
- **Polish vs English vowels:** *M* = 2.73, *SD* = 0.65
- **Polish vs German vowels:** *M* = 2.80, *SD* = 0.68
- **Polish vs Polish vowels (different):** *M* = 4.22, *SD* = 1.26



Results: vowel perception (3)

- **Polish vs Polish vowels (same)**

< Polish vs Polish vowels (different)

($t(8)$= -7.66, p<.001, d = -2.55)

Big differences

M = 4.22 on PL vs PL (different)

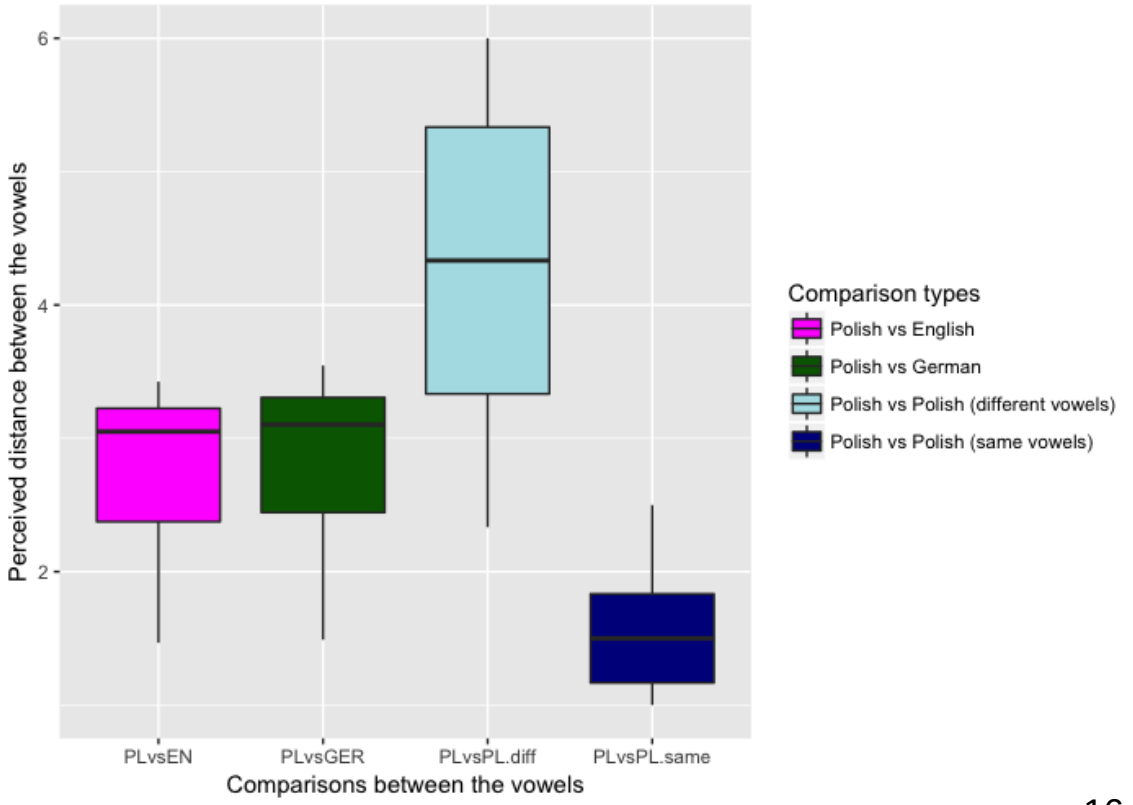
vs *M* = 1.59 on PL vs PL (same)

BUT

greater variability on

PL vs PL (different)

(*SD* = 1.26)



Results: vowel perception (4)

- **Polish same < Polish vs English**

  (*t*(8)= -4.64, *p*<.05, *d* = -1.55)

  but

  Polish different > Polish vs English

  (*t*(8)= 4.38, *p*<.05, *d* = 1.46).

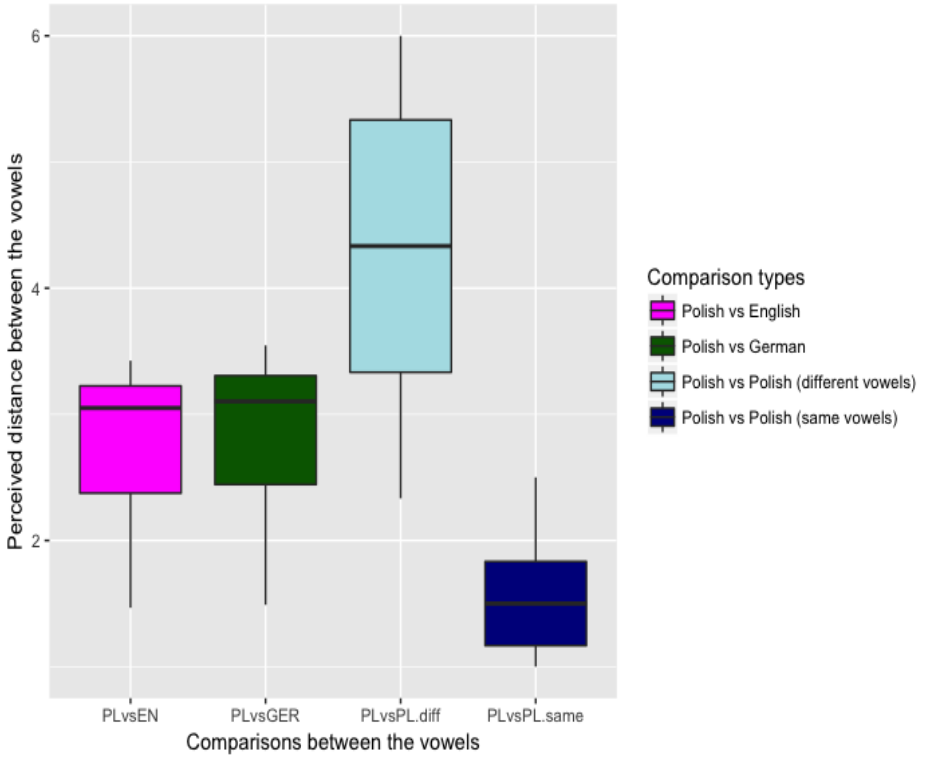
- **Polish same < Polish vs German**

  (*t*(8)= -4.86, *p*<.01, *d* = -1.61).

  but

  Polish different > Polish vs German

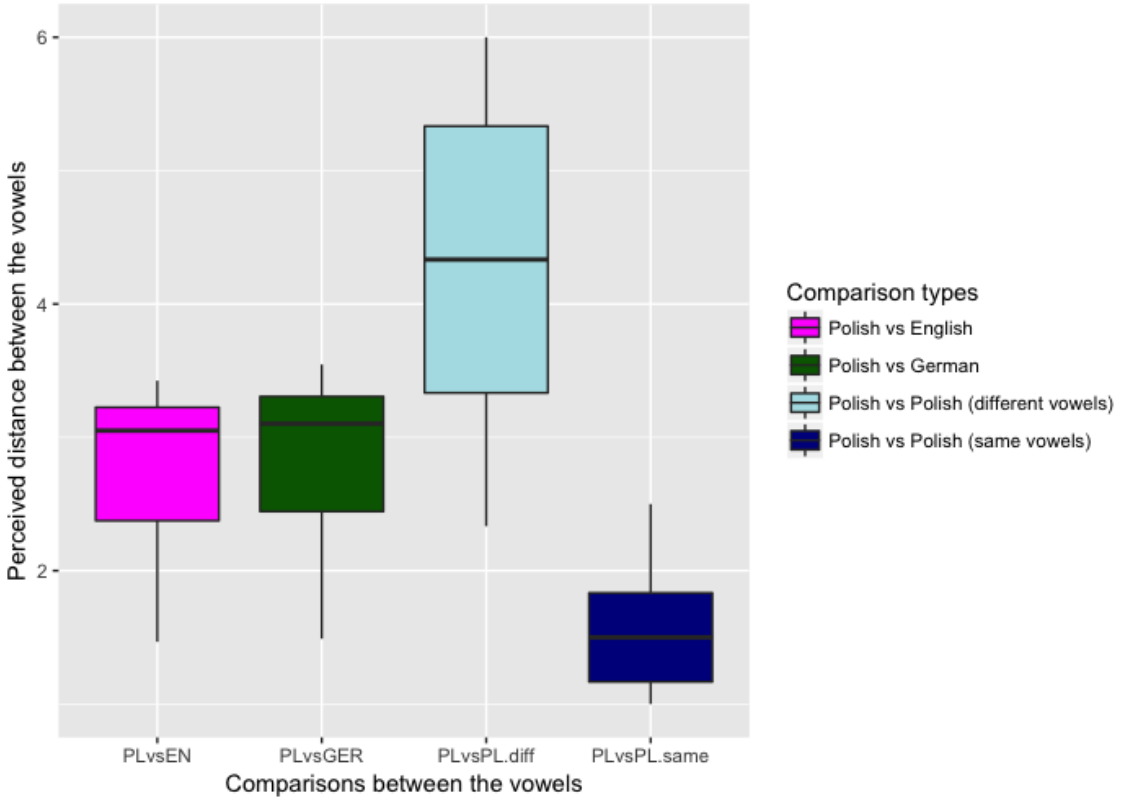
  (*t*(8)= 4.18, *p*<.05, *d* = 1.39)



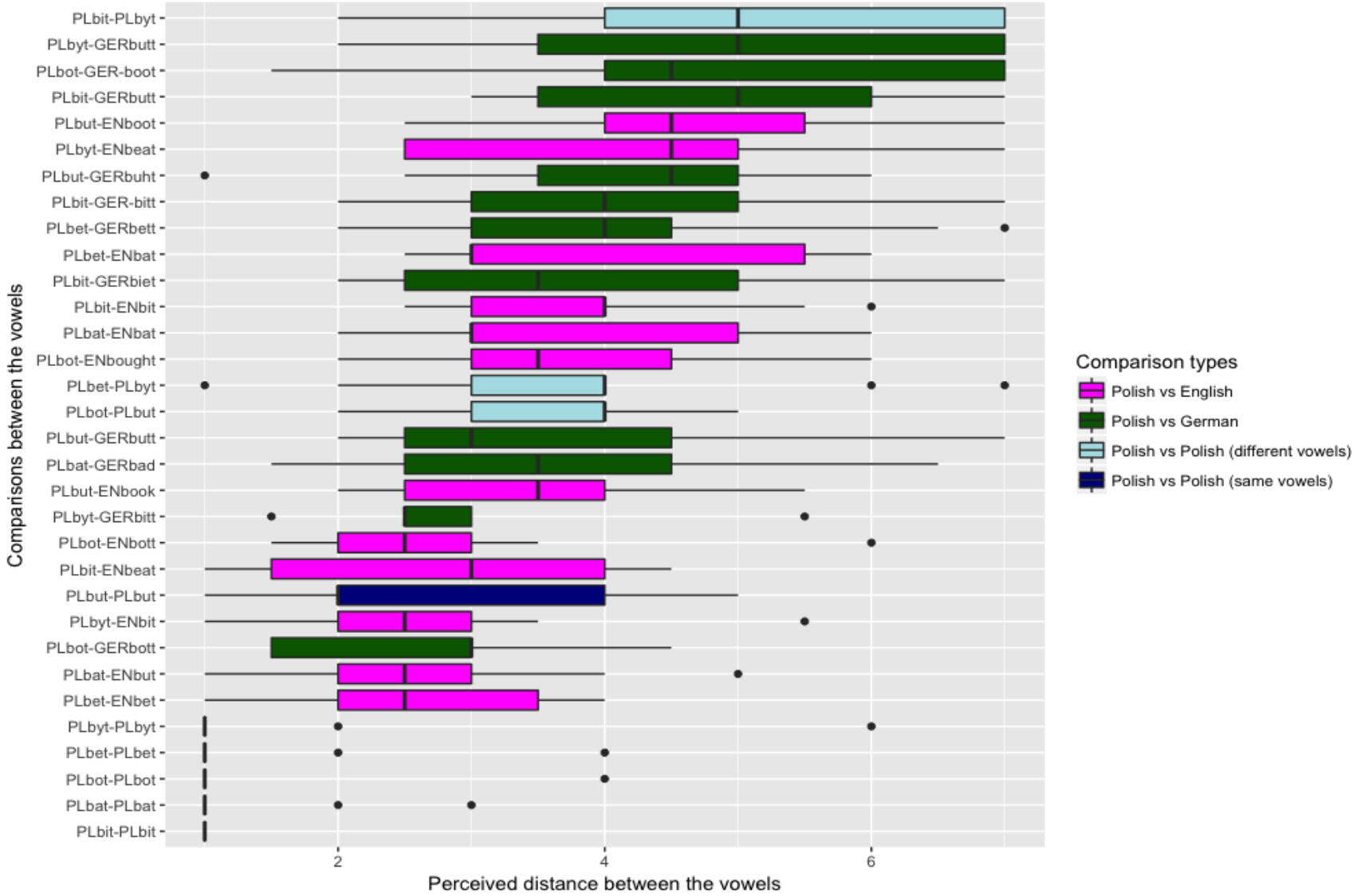
Results: vowel perception (5)

- **Polish vs English < Polish vs German**
  ($t(8)= 5.53$, $p<.01$, $d = 1.84$)

- English vowels were consistently rated as more similar to Polish than German vowels
  BUT
  the actual difference between German and English is very small:
  Polish vs English vowels:
  $M = 2.73$, $SD = 0.65$
  Polish vs German vowels:
  $M = 2.80$, $SD = 0.68$



Results: individual vowels



Results: sibilants

- **perception of different sibilant pairs highly accurate**
- **discrimination accuracy:**
  ż-ź (92.50%) > **dż-dź** (85.00%) > **sz-ś** (81.25%) > **cz-ć** (73.75%)
- difference between cz-ć & ż-ź statistically significant (Mann-Whitney U test with Bonferroni corrections, $p < 0.01$)
- **RT: no statistically significant differences**
  sz-ś (M = 157.23 ms, SD = 347.23) > **cz-ć** (M = 242.75 ms, SD = 454.11) > **dż-dź** (M = 285.00 ms, SD = 399.39) > **ż-ź** (M = 413.77 ms, SD = 1298.73).
- **no effect of group, no interaction** between group and sibilant type

Results: individual differences

d' score (across sibilant types)

HeritPol07	1.277
GerMono10	1.552
GerMono05	1.622
HeritPol06	1.887
GerMono09	2.229
HeritPol01	2.229
HeritPol03	2.229
HeritPol04	2.367
HeritPol02	2.73
HeritPol08	4.645

- NB. excellent discrimination >3.0, lack of discrimination <1.0.

mean distances (vowel types)

	Polish vs Polish (same)	Polish vs Polish (different)	Polish vs German	Polish vs English
German monolingual1	1.67	3.00	2.14	2.08
German monolingual2	1.50	4.33	3.31	3.29
German monolingual3	1.33	5.67	3.10	3.05
Heritage speaker 1	2.50	6.00	2.60	2.53
Heritage speaker 2	1.83	3.67	3.34	3.23
Heritage speaker 3	1.17	4.33	3.55	3.43
Heritage speaker 4	1.00	2.33	1.49	1.47
Heritage speaker 5	2.17	5.33	3.23	3.13
Heritage speaker 6	1.17	3.33	2.44	2.38

Discussion: vowel perception (1)

- Different **Polish vowel types** perceived as highly **distinct** (although greater SD than for other comparisons)
- Different **tokens of the same Polish vowel** perceived as the **same**
- English and German ’equivalents’ perceived as similar but not the same as Polish vowels

  => developed categorical perception for Polish vowels
- German vowels perceived as less similar to Polish than English, but the difference is small

  => possibly L2 effect

Discussion: vowel perception (2)

- No group effect – heritage speakers not different from the German learners of Polish (but v. small group)
- Categorical perception different for different vowel types:
  - Polish and English **bet** or **bot** perceived as very similar
  - Polish **bit** and English **beat** also perceived as similar
  - Polish **but** and German **buht** perceived as very dissimilar

Discussion: sibilant perception

- Different Polish sibilant pairs perceived with **high discrimination accuracy** => task effects?

  (short ISI, tapping auditory sensory ability rather than categorization processing?)

- The highest the accuracy of sibilant discrimination the lowest the reaction time

- No group effect – heritage speakers not different from the German speakers (but v. small groups)

Discussion: vowel and sibilant perception

- Results **partly contradict PAM's prediction** that two similar sounds in the target language and non-existent in the L1 should be assimilated to this L1 category
- In general the L3 child learners **clearly distinguished** between the tested Polish vowels and sibilants, respectively, and **did not seem to assimilate them to L1 categories**
- More assimilation to L2 than L1 vowel categories (although the difference is very small)

Conclusions

- **RQ 1:** Do L3 speakers distinguish L3 Polish vowels and sibilants?
  - **YES**
- **RQ 2:** Are L3/Ln vowels and sibilants assimilated to L1 or L2 categories?
  - **Rather to L2**
- **Hypothesis 1:** Problems distinguishing L3 Polish sibilants
  - **NO**
- **Hypothesis 2:** No problem distinguishing L3 Polish vowels
  - **YES**

Conclusions

- **Future work**
  - Longitudinal study to trace development in L3 perception
  - Both cross-linguistic dissimilation and identification tasks
  - Mirror groups
    - L3 Pol/L2 Eng/L1 Ger vs.
    - L3 Ger/L2 Eng/L1 Pol

THANK YOU

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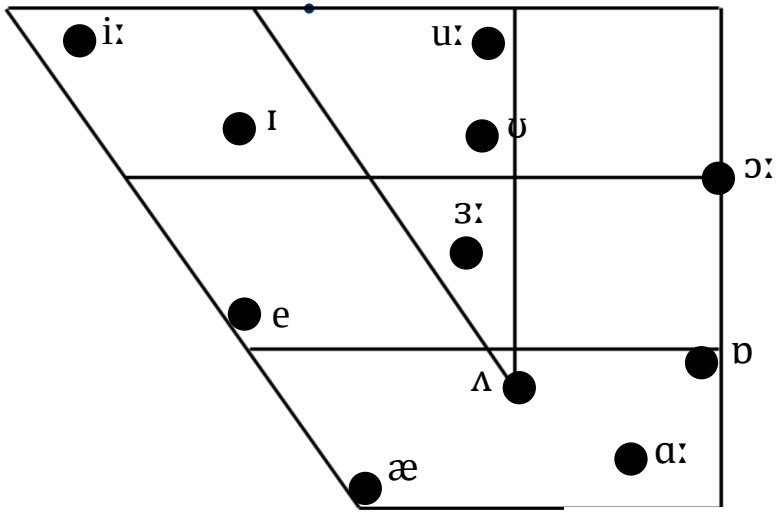
EXTRAS

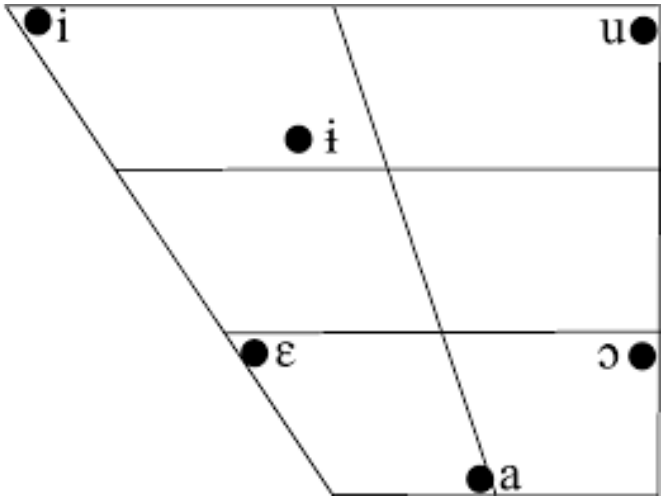
Perception task 1 - stimuli

POLISH L3	ENGLISH L2	GERMAN L1
bet	bet bat	Bett
bat	bat but	Bad
bit	beat bit	Biet Bitt Bütt
byt	bit beat	Bitt Bütt
but	boot book/t	Buht Butt
bot	bott bought	Bott Boot

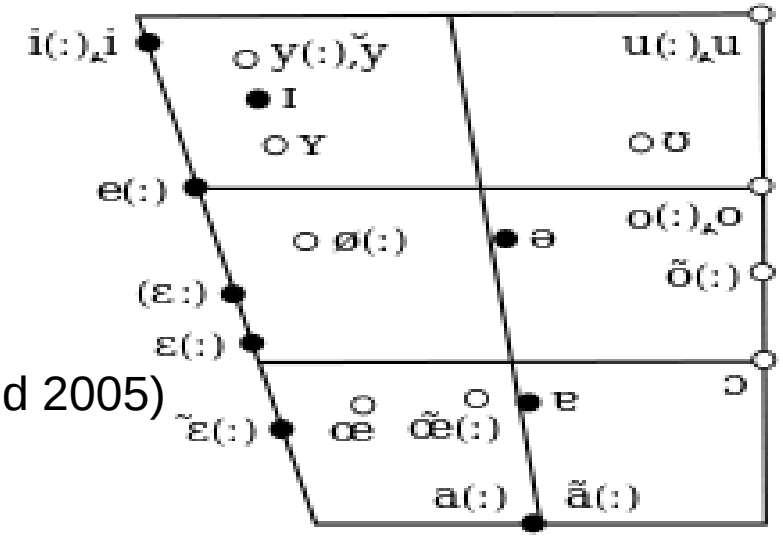
Vowel systems



English (Roach 2006)



Polish (Jassem 2003)



German (Mangold 2005)