Perception of voicing distinction in syllable-initial stops by multilingual speakers

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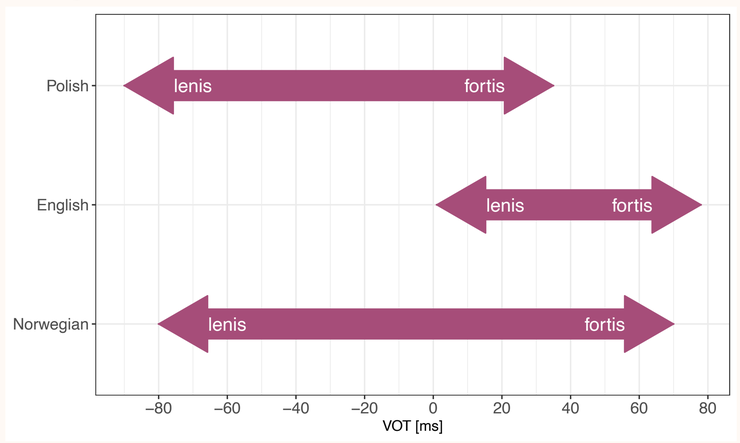
1 Background

Limited data on VOT in multilingual acquisition:

- Liu & Cebrian 2019: regressive and progressive cross-linguistic influence of a newly acquired L3 on L1 and L2
- Liu & Lin 2021: low accuracy in the perception of L3 voiceless stops; learners were more accurate in perceiving voiced stops in L3 than in perceiving voiceless stops

VOT in Polish, English and Norwegian:

- **Polish:** true voicing language (prevoicing in /bdg/ and short-lag VOT in /ptk/) (e.g., Keating et al. 1981)
- **English:** aspirating language (partially voiced /bdg/ and aspiration in /ptk/) (e.g., Lisker & Abramson 1964)
- **Norwegian:** prevoicing in /bdg/ (in most cases) and aspiration in /ptk/ (e.g., Ringen & van Dommelen 2013)



2 RQs and predictions

RQ1: What are the patterns of VOT categorisation in multilinguals? Are they language- and PoA-specific?
Prediction 1: Multilingual advantage might trigger more language- and PoA- specific patterns of VOT categorisation (e.g., Kopečková 2015, Onishi 2016).

RQ2: What are the perceptual boundary locations for the perception of voiced and voiceless stops in all three languages? Do they point to potential sources of CLI?
Prediction 2: Based on learning process and phonological similarity (e.g. Bardel & Falk 2007, Hermas 2010):

	Scenario 1	Scenario 2	
L1-based CLI boundaries earlier in the continuum ←	L1=L3 at initial stages of language learning	L2=L3 in terms of foreign language learning process	→ **L2-based CLI** boundaries later in the continuum
	L1=L3 in voiced stops	L2=L3 in voiceless stops	

3 Study design

Participants: 19 L1 Polish L2 English L3 Norwegian speakers, aged 20, 14 females & 5 males; 8 weeks of intense initial exposure to the L3 in a formal academic settings

Instruments: LexTALE for English proficiency, Norwegian placement test, Language History Questionnaire (Li et al. 2006), perception experiment in PsychoPy (Peirce et al. 2019) in all three languages

Stimuli: 9 VOT continua – 3 per language and place of articulation, based on minimal pair words with word-initial stop sounds; ranges based on the values obtained from native speakers' recordings in all three languages; each step differed from the other by 10 ms

	Polish	English	Norwegian
b-p	-90 - 30 ms (13 steps)	0 - 70 ms (8 steps)	-140 - 80 ms (23 steps)
d-t	-130 - 20 ms (16 steps)	0 - 90 ms (10 steps)	-130 - 90 ms (23 steps)
g-k	-80 - 60 ms (15 steps)	0 - 70 ms (8 steps)	-140 - 90 ms (24 steps)

Perception task: a two-alternative forced-choice (2AFC) task; participants were presented with one word from the continuum and asked whether they heard a voiced or voiceless consonant at the beginning

Administration: experiment conducted in PsychoPy in three separate sessions – one per language

Analysis: 1. Pearson's correlation for Accuracy~Response Time (RT);
2. Accuracy data transformed with logistic regression;
3. Boundary location calculated with *-LN(b0)/LN(b1)*, *b0* = constant and *b1* = slope;
4. Linear Mixed Model:
- Dependent variable: perceptual boundary locations
- Fixed factors: language (Polish, English, Norwegian), place of articulation (PoA; labial, coronal, velar)
- Random effect: participant

4 Results

- Moderate and strong negative correlations between accuracy and RTs across continua and languages → the longer RT, the lower accuracy
- Some discrepancies in accuracy across L1/L2/L3 languages, especially visible in /b-p/ and /d-t/; but /g-k/ more consistent across languages (Figures 1-3)

- Significant main effects of Language ($F=43.878$, $p<.001$), PoA ($F=108.036$, $p<.001$) and their interaction ($F=18.822$, $p<.001$)
- /b-p/: stat. signif. differences between all three languages;
- /d-t/: stat. signif. differences between L1-L2 and L2-L3;
- /g-k/: stat. signif. differences between L1-L3 and L2-L3 (Figure 4)

Fig. 1

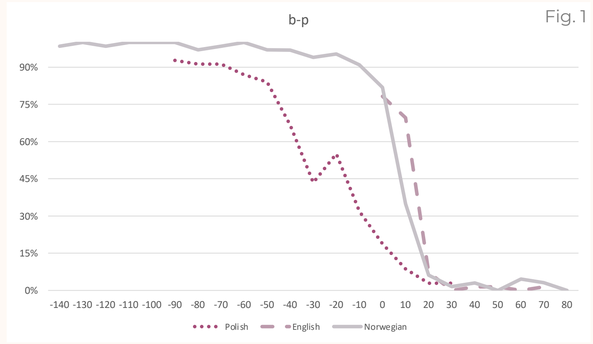


Fig. 2

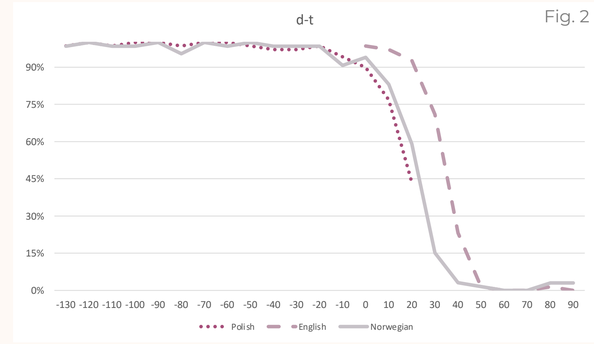


Fig. 3

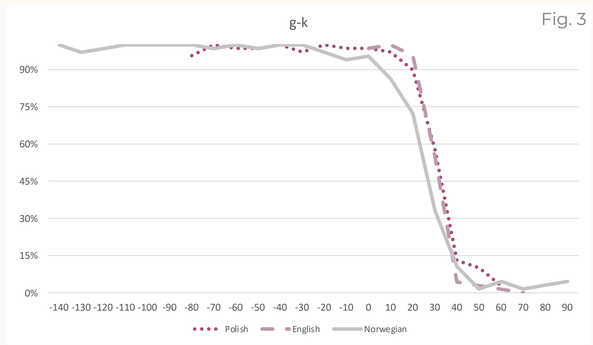
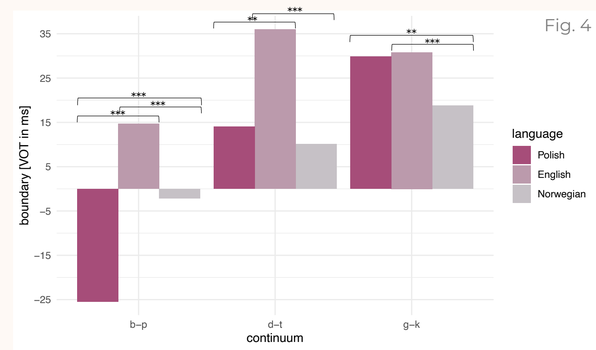


Fig. 4



5 Discussion & conclusions

- **RQ1:** Language- and PoA-specific patterns of VOT categorisation in most cases – an indication of a multilingual advantage, according to which, multilinguals tend to discriminate in perception between the three languages and perceive subtle linguistic contrasts

✓ **Prediction 1** mostly confirmed

- **RQ2:** confirmation of Scenario 1 only in /d-t/ continuum, as there was no stat. signif. difference between L1-L3– possible interdependence between the two languages
- No stat. signif. difference between L1-L2 in /g-k/ – possible, unexpected, interactions between L1 and L2
- No other traces of CLI attested in the data – possible role of multilingual advantage

✗ **Prediction 2** mostly disconfirmed

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