Categorical perception of lexical stress in French L2 learners of German: Effects of musical acuity

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Introduction

Categorical perception

Abundant evidence for categorical perception (CP) of phonemes from studies with speech continua.

o **Crosslinguistic differences (L1)**
Language-specific acquisition starting at 6 –8 months (e.g. Werker & Tees, 1984; Kuhl 1992).

o **Second language learners (L2)**
Phonological categories can be acquired in an L2, depending on experience, the exact phonetic contrast… (e.g. MacKain, Best & Strange, 1981).

Present study: CP of lexical stress

o Many languages (e.g., German) have contrastive lexical stress.
o Some (e.g., French) have no lexical stress.

L1: The presence/absence of contrastive lexical stress affects prosodic perception (adults: Dupoux et al., 1997, infants: Skoruppa et al., 2009; Höhle et al., 2009; Bijeljac-Babic et al., 2012).

L2: Lexical stress is difficult to acquire (Dupoux et al. 2008), and results in important individual variability, linked to degree of exposure to spoken language (Boll-Avetisyan et al., 2016).

Individual differences: Musicality is associated with prosody perception in L1 (Boll-Avetisyan et al. 2017; Kolinsky et al., 2009) and L2 (Boll-Avetisyan et al. 2016).

Research questions

o Do we draw on abstract categories (trochee Xx) vs. (iamb xX) when perceiving stress?
o Is there individual variability in L2 lexical stress perception?
o Specifically: Does musicality explain individual differences?

Hypotheses

| Populations (adults)	CP?
L1 with contrastive lexical stress	Yes (maybe with individual differences?)
L1 without contrastive lexical stress	No
L1 without, adult L2 with contrastive lexical stress	Individual differences

Material

8 step lexical stress continuum of /gaba/

Acoustic manipulation:

Trochee	32	211	91	243
step 2	32	193	93	258
step 3	32	175	96	273
step 4	32	157	98	288
step 5	32	139	100	304
step 6	32	121	103	319
step 7	32	103	105	334
Iamb	32	86	108	350

Table 1: *Segment duration in ms*
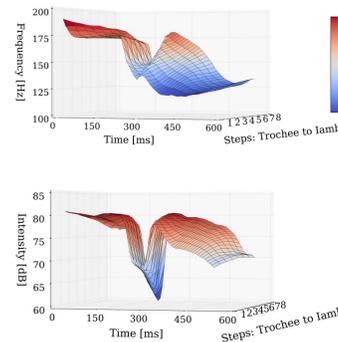
Identification Task

Participants: 40 monolinguals (20 French-, 20 German-speaking)
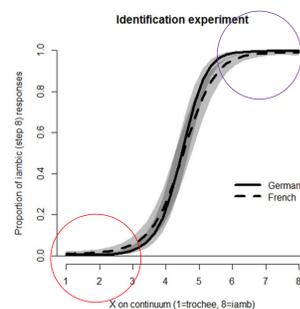**Task:** Is X more similar to A or to B?

Trial structure: 160 AXB triplets
o X: Any of the 8-steps (1-1-8, 1-6-8, 8-4-1 etc.)
o AB frame: 1 X 8 or 8 X 1

Results
Analysis: GAMMs with X as non-linear smooth factor
o Significant nonlinear effect of X
o Only marginal effect of Group (χ2(2) = 2.42, p = .089)

Discussion
Probable effect of psycho-physic sensitivity (similar finding by Hallé et al., 2004).
Not ideal task to measure phonological CP.

Discrimination task

Participants: 40 monolinguals (20 French-, 20 German-speaking), 20 French late L2 learners of German (L2)

Task: X = A or B?
**Trial structure:** 240 AXB triplets
o X: Any of the 8 steps (e.g. 1-1-3, 2-4-4, 5-5-3 etc.)
o Either A or B are = X, the other A or B is at 2 steps distance

Musical Ear Test (MET): Standardized test (Wallentin et al. 2010) measuring musical rhythm and musical melody perception (tested with L2 learners and German (but not French) monolinguals).
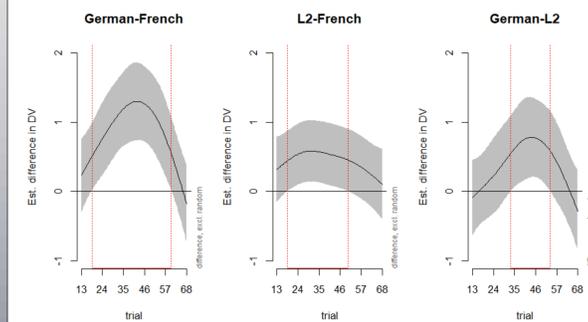
Results
Analysis: GAMMs with AB pair as non-linear smooth factor:
Significant Group * AB pair
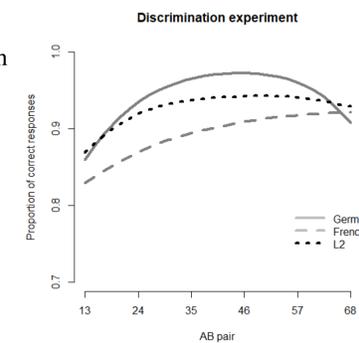
Separate group comparisons
Difference plots, significant differences in red brackets

In the middle of the continuum, L2 learners are less accurate than the German monolinguals but more accurate than the French.
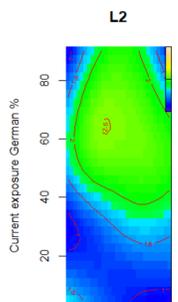
Discussion
L1: CP of lexical stress (similar to CP of phonemes/lexical tones) for adults with a contrastive stress language. No CP when language without contrastive stress ➔ reliance on abstract categories

L2: Intermediate performance. Due to individual differences?

Current exposure to L2 as predictor
Current exposure to German in % (self-estimated) predicts performance (model fit improves by adding "current exposure" as smooth factor).

L2 with > 65% exposure to German show higher accuracy (green) when hearing AB pairs from the middle the of continuum.
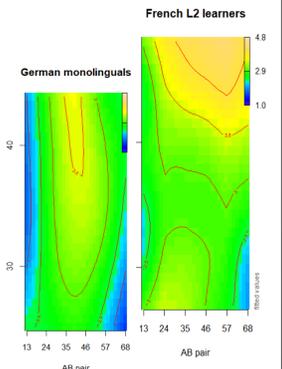➔ CP

L2 with < 65 % show linear (low = blue) accuracy along the continuum
➔ No CP

Rhythm acuity as predictor
MET scores obtained in the rhythm test improve model fit: Rhythm predicts performance by German monolinguals and by L2 learners.

L1 German: higher accuracy (yellow) with higher rhythm acuity, but CP is not affected by musical rhythm acuity.

L2: higher accuracy (yellow, brown) with higher rhythm acuity. CP reflected mostly in individuals with low (< 32 scores) rhythm acuity.

Conclusion

o We draw on abstract categories (trochee Xx) vs. (iamb xX) when perceiving stress, if the L1 has lexical stress.
o There is individual variability in L2 lexical stress perception.
o Musical rhythm acuity explains some individual differences, but is not a clear predictor of CP of L2 lexical stress.
o Current L2 exposure is a clear predictor of L2 lexical stress: CP of L2 lexical stress after high degrees of L2 exposure (Similar to CP of L2 segments. e.g. MacKain, Best & Strange, 1981)

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