

# Lexical stress discrimination by simultaneous and late bilinguals

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## Introduction

### Categorical perception

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

- **Crosslinguistic differences (L1)**  
Language-specific acquisition starting at 6–8 months (e.g. Werker & Tees, 1984; Kuhl 1992).
- **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).
- **Simultaneous bilinguals (2L1)**  
Little is known about simultaneous bilinguals: 2 distinct phonological systems (Sundara & Polka, 2008), or predominant reliance on 1 dominant language (Sebastian-Gallés et al., 2005).

### Present study: CP of lexical stress

- Many languages (e.g., German) have contrastive lexical stress.
- 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 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).
- 2L1:** Sensitivity to lexical stress depends on language dominance (adults: Dupoux et al., 2010; infants: Bijeljac-Babic et al., 2012, but Abboub et al., 2015).
- Lexical stress is acoustically highly variable
  - Different acoustic cues (intensity, duration, pitch)
  - Depends on position in the word or sentence...
- Do we draw on abstract categories (trochee Xx) vs. (iamb xX) when perceiving stress?

## Hypotheses

Populations (adults)	CP?
L1 <b>with</b> contrastive lexical stress	Yes
L1 <b>without</b> contrastive lexical stress	No
Simultaneous bilinguals, 2L1, one <b>with</b> and one <b>without</b> contrastive lexical stress	Individual differences
L1 <b>without</b> , adult L2 <b>with</b> contrastive lexical stress	Individual differences

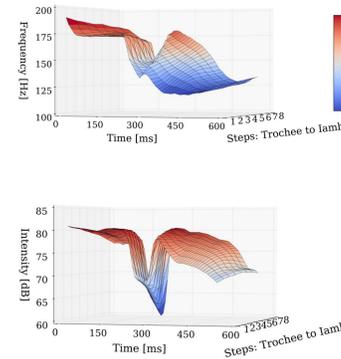
## Material

### 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

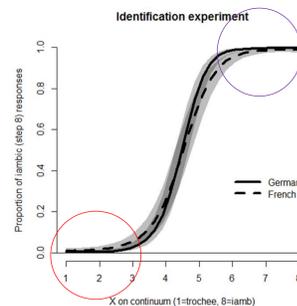


## Identification Task

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

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

**Results**  
Analysis: GAMMs with X as non-linear smooth factor  
○ Significant nonlinear effect of X  
○ Only marginal effect of Group ( $\chi^2(2) = 2.42, p = .089$ )



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

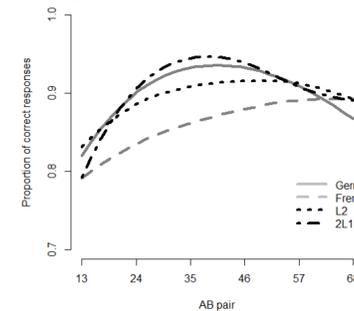
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## Discrimination task

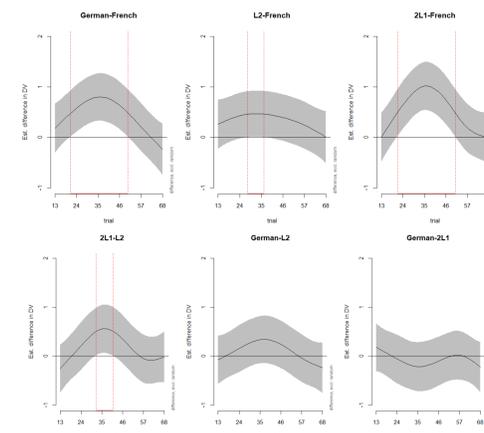
**Participants:**  
○ 40 monolinguals (20 French-, 20 German-speaking)  
○ 40 bilinguals  
○ 20 simultaneous French-German bilinguals (2L1)  
○ 20 French late L2 learners of German (L2)

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

**Results**  
Analysis: GAMMs with AB pair as non-linear smooth factor  
○ Significant Group \* AB pair



**Separate comparisons of groups**  
Difference plots, significant differences in red brackets

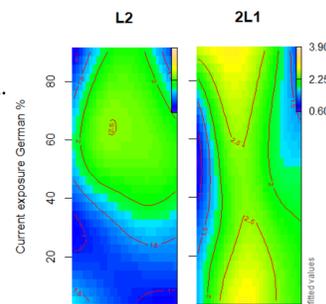


- Higher accuracy in middle of continuum by German monolinguals and the 2L1 group than by French monolinguals.
- L2 learners' performance is intermediate between the 2L1 group and French monolinguals.

## Individual differences in bilinguals?

Current exposure to German in % (self-estimated) is a predictor of Performance, as 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

2L1 show highest accuracy (green/yellow) when hearing AB pairs from the middle of the continuum irrespective of current exposure  
→ CP

## Discussion

This study of CP of lexical stress complements what we know about phonological CP in mono- and bilinguals:

- 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, with effect of current exposure. Similar to CP of L2 segments after high degrees of L2 exposure (e.g. MacKain, Best & Strange, 1981)
- 2L1:** Simultaneous bilinguals perform like German monolinguals at group level (unlike e.g. Dupoux et al., 2010; Sebastian-Gallés et al., 2005). Next steps: investigate whether there is variability that relates to exposure during participants' infancy.

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