Segmentation of Vowel-Initial Words from Continuous Speech in Infancy

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1 Background & research question

- Infants' first segmentation abilities seem to be restricted to consonant (C)-initial words.
- Vowel (V)-initial word segmentation:
  - In English at the age of 13.5 months (Mattys & Jusczyk, 2001; Nazzi et al., 2006; at 11 months if at edges of phrases: Seidl & Johnson, 2008).
  - In French at 25 months (Babineau & Shi, 2014).

…CVCVCVCVCV…

CVCVC

VCVC ?

Accounts

1. **Phonetic account**: Cs are acoustically more salient (Mattys & Jusczyk, 2001; Seidl & Johnson, 2008)
2. **Phonological account**: "Universal" onset bias (Babineau & Shi, 2014)
3. **Input-based account**: C-initial words are more frequent in the L1 input than V-initial words (Mattys & Jusczyk, 2001)

Research question

- If infants acquire a language that has more V-initial words than English: Will they be able to segment V-initial words at a younger age?

Test case: German

C-initial words	English	German	Difference
Adult input: CELEX	82%	75%	7%
Child input: CDI-Clex	91%	88%	3%

- Frequency counts (CELEX lemma types, CDI-Clex types) suggest:
  - German has more C-initial than V-initial words
  - **German has fewer C-initial / more V-initial words than English.**

3 Method

Participants

Onset	N	Girls/boys	Mean age	Age Range
C-initial	19	11/8	10.9 months	10.5–11.3
V-initial	24	11/13	8.0 months	7.5–8.4
V-initial	21	11/10	11.1 months	10.6–11.9

- Dropouts: 19 additional 11mo infants (32%) and 11 additional 8mo infants (31%) due to excessive movements, distractions, parental interference, and fatigue

Materials

- Onset of the familiarization word
  - (C)VCVC nonsense words, long first vowel, stress on first syllable
    C-initial: notel (luger), **V-initial**: otel (uger)
  - Each child was familiarized with one word

> Pa**notel** ust aun peißer Storn.
> Uf Nendal paht pa**notel** sulmen euf.
> Dos Gamtrum umperes Zastums hillket pa**notel**.
> Pa**notel** ergämlicht dall Lufen auk Ergen.
> Ik lor Muffe pa**notel** mispet Ranfpusion stupp.
> Om Plunerasium erlöhrt lum biel iba pa**notel**.

> Ti**luger** erpleut sech iller drüßerer Barieftheit.
> Kandiner baufen ti**luger** belofders gom.
> Jedumm kummen nor jümere Leupe ti**luger**.
> Ti**luger** schmockt getühmt möhr erbraschend.
> Teufen konn moll ti**luger** off Spörmauf.
> Zam rach gleigen trimpen miele Munscher ti**luger**.

Procedure

- Headturn Preference Procedure
- Familiarization phase: 30 seconds
- Test phase: 12 trials (6 familiar, 6 novel)
- Blocks of 2
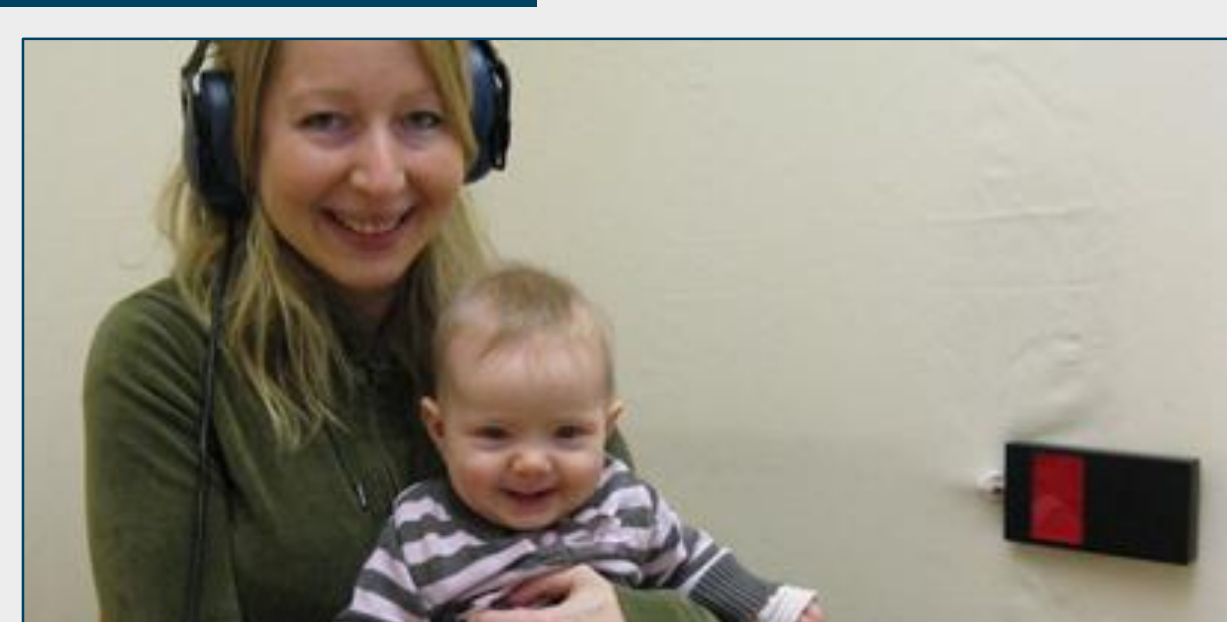
2 Predictions

1./ 2. C-initial > V-initial
- If infants more readily segment C-initial than V-initial words, this will replicate findings for English and might be attributed to acoustic properties or a universal bias.

3. C-initial = V-initial
- If both word types are segmented equally well, this will suggest an influence of L1 input properties on segmentation preferences.

4 Results

- Analysis of trial looking times (LTs) with a mixed model (lme4 in R):
  LT ~ 1 + target * onset * position * age + (1 + target * position | baby) + (1 | audio)

Effects

- Interaction TARGET WORD X AGE ($p < .05$), effect of trial POSITION ($p < .001$) and the three-way interaction ($p < .05$), no other effects
- Follow-up models within each age group
  - 8mo: Only an effect of POSITION ($p < .001$), all other p's > .5
  - 11mo:
    - TARGET WORD ($p < .01$), no interaction with ONSET ($p = .75$)
    - POSITION ($p < .001$), POSITION X TARGET WORD ($p < .05$)

5 Discussion & Conclusions

- 11-month-old German-learning infants segment V-initial words in a similar fashion as C-initial words.
- At 8 months, the ability to segment V-initial words does not seem to be in place yet, for C-initial words testing is in progress.
- German-learning infants can segment V-initial words at a younger age than English-learning infants.
- As German has more V-initial words than English and given the developmental change this supports the **input-based account.**
- Future studies need to disentangle the potentially separate influences of acoustics, universal bias and input frequency on the preference for C-initial over V-initial segmentations.

6 References & Thanks

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