Methodological issues in measuring (online) word segmentation

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Publication date
2019

Citation for published version (APA):

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The word segmentation task has been used frequently to measure statistical learning in different populations since seminal study of Saffran et al. (1996).

There is great need for online measures of statistical learning. (Siegelman et al., 2017) and (conceptual) replication studies. (Marsden et al., 2018)

**RESEARCH QUESTIONS**

- Are adults and children able to detect word boundaries based on only transitional probabilities (TPs)?
- Can we measure word segmentation online? (Gómez et al., 2021; Franco et al., 2015)

**THE LANGUAGE**

- 8-minute stream, repetition of four disyllabic words in a random order per participant.
- No pauses or other intonational cues. A word never appeared twice in a row.
- Two versions: same syllables were combined into words differently.
- TPs were 1.0 within words and 0.33 between words.
- The syllables were recorded by a female native speaker of Dutch in every co-articulation context.

**EXPERIMENT 1**

METHOD

Participants

30 Dutch neurotypical adults.

Online measure: click detection task

Click sounds were added to the stream of syllables, either within words or between words. Sensitivity to word boundaries should result in faster reaction times (RTs) for clicks between words than for clicks within words. (Gómez et al., 2011)

Offline measure: 2AFC test phase

16 test items: part-words were used as foils. All four words (TP=1) were combined with all four part-words (TP=0.33) to test whether participants preferred words.

**RESULTS**

Generalized mixed effect models were used for analysis. Participant and item were included as random factors.

Online measure: click detection task

RTs for clicks between words were not significantly shorter than RTs for clicks within words (t = 0.781, p = 0.4386). There was no significant interaction between click context (within/between words) and block (t = -1.127, p = 0.2663).

Offline measure: 2AFC test phase

The estimate of the average performance was 0.61 (CI: 0.33 – 0.50). As the CI contains 0.50, performance is not significantly above chance level.

**EXPERIMENT 2**

METHOD

Participants

30 Dutch neurotypical adults and 27 typically developing children (8 to 10 years old).

Offline measure: 2AFC test phase

The estimate of the average performance was 0.49 (CI: 0.39 ... 0.60) for adults and 0.49 (CI: 0.38 ... 0.61) for children. As the CIs contain 0.50, performance is not significantly above chance level for either group.

**EXPERIMENT 3**

METHOD

Participants

48 Dutch neurotypical adults.

Offline measure: 2AFC test phase

The estimate of the average performance was 0.55 (CI: 0.46 ... 0.63). As the CI contains 0.50, performance is not significantly above chance level.

**DISCUSSION**

- We did not find evidence for ONLINE or OFFLINE learning of word boundaries in adults and children in any of the experiments.
- No indication that interference of click detection task hampered learning, as there was no evidence of learning overall (Franco et al., 2015)
- Possible influencing factors: disyllabic words instead of trisyllabic words (e.g. Saffran et al., 1996), natural speech instead of synthetic speech (Black et al., 2017), influence of prior knowledge (Siegelman et al., 2016), repeating test items problematic (Siegelman et al., 2017), task interference.

**REFERENCES**

8. Marsden, E.; Siegelman, S. E.; Kohnert, K. & Frost, R. (2017). Repetition task interference: P0.50. 2AFC test phase. The estimate of the average performance was 0.55 (CI: 0.46 ... 0.63). As the CI contains 0.50, performance is not significantly above chance level.