

P2 Perception of boundary cues in speech and action: Parallels in chunking continuous information streams?

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CROSSING THE BORDERS
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Background

- **Continuous streams of information** must be processed when **perceiving language** and **observing actions** in order to identify and discriminate meaningful segments.
- In language, **prosodic boundary cues** (e.g., pre-boundary lengthening, pitch change, post-boundary pause) support syntactic analysis and help to chunk the stream into appropriate sub-chunks¹. It has been shown that adults and infants are highly sensitive to these prosodic cues in behavioural and electrophysiological studies^{2,3}.
- In action, it is assumed that **intention boundaries**⁴ (e.g., the attainment of an action goal) and **kinematic cues**⁵ (e.g., changes in acceleration or velocity, pauses) also help to segment the observed stream of information. While the existence of intention boundaries has been described in studies with adults, there are few comparable studies that looked at action segmentation in adults and infants. Except for the cue pause, the detailed investigation of further kinematic cues has not yet been studied.

Research questions

- Are the segmentation processes in speech perception and action observation based on domain-general or domain-specific mechanisms in adults and 12-month-old infants?
- Which cues (prosodic, kinematic) can be identified around the boundary in both domains using triplets of actions / verbs that include either an inner boundary or no boundary?

Initial studies: Stimuli construction and boundary cue analysis

Stimuli

Triples of spoken words and visually presented actions

- BOUNDARY [X & Y] # [& Z]
- NO-BOUNDARY [X & Y & Z]

Language:

- Real and novel verbs, transitive, two-syllabic with a similar phonological structure
- V1: ROLLEN, SCHÜTTELN, DREHEN, NEHMEN, ZIEHEN
- N1: LAHLEN, MELLEEN, LIMMEN, NOHLEN, MUHNEN

Action:

- Distinct actions that can be presented in any order, in the same place, on an object and cannot be performed at the same time
- V1: ROLLEN, SCHÜTTELN, HEBEN, SCHIEBEN

Action production

Adult participants asked to produce a series of three actions, with or without boundary. Movement of hands recorded by Vicon motion capture system.

[rollen & heben] [& schütteln]



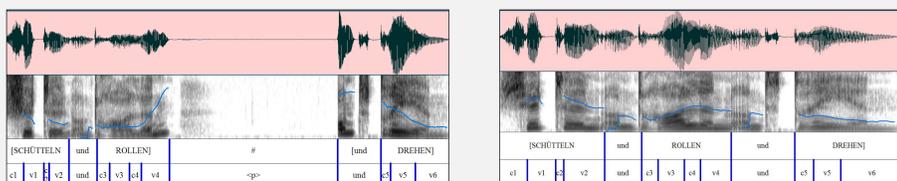
Action perception

Participants shown action sequence with or without boundary, examine for EEG correlates at boundary (in preparation).

Verb production

Adult participants asked to produce a series of three verbs, with or without boundary. Acoustic stream recorded in a sound-attenuating chamber.

[schütteln & rollen] # [& drehen] vs. [schütteln & rollen & drehen]



Verb perception

Participants perceive auditory sequences with or without boundary, examine for EEG correlates at boundary (in preparation).

References

- ¹ Frazier et al. (2006). *Trends in Cognitive Sciences*, 10, 244.
- ² Holzgrefe-Lang et al. (2016). *Language, Cognition and Neuroscience*, 31(7), 904.
- ³ Wellmann et al. (2012). *Frontiers in Psychology*, 3, 580.
- ⁴ Baldwin et al. (2001). *Child Development*, 72, 708.
- ⁵ Zacks et al. (2009). *Cognition*, 112, 201.

Preliminary results

Language

Acoustic cue	NO-BOUNDARY	BOUNDARY
Pitch rise in Hz	16 (-17–64)	259 (210–354)
Maximum pitch in Hz	260 (229–292)	411 (369–469)
Duration of final vowel in ms	128 (91–178)	195 (143–235)
Pause duration in ms	0	1065 (593–1466)

Action

X, Y, Z coordinates of hand movement during performance of action sequence, [heben & schieben & schütteln]

