Usefulness of prosodic cues in parsing: Evidence from a novel cross-modal maze task

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Background

In spoken language comprehension, prosodic cues such as boundaries (i.e., pause, pitch change, lengthening) can provide early cues signaling constituent boundaries, allow listeners to generate predictions about the upcoming structure, and facilitate efficient ambiguity resolution [1-3].

Example: tap $||_A$ the frog $||_B$ with the flower

Listeners predict a *modifier* interpretation of *with the flower* if a boundary occurs at location A and an *instrument* interpretation if the boundary occurs at location B.

Additionally, listeners adjust their use of predictive prosodic cues for syntactic processing contingent upon whether a given speaker adheres to the conventional prosody-syntax mapping [4].

However, little is understood regarding:

- How can the resolution of structural ambiguity beyond attachment and closure benefit from prosodic boundaries?
- How do listeners use prosodic and syntactic information to make predictions in sentence processing?

Research Questions

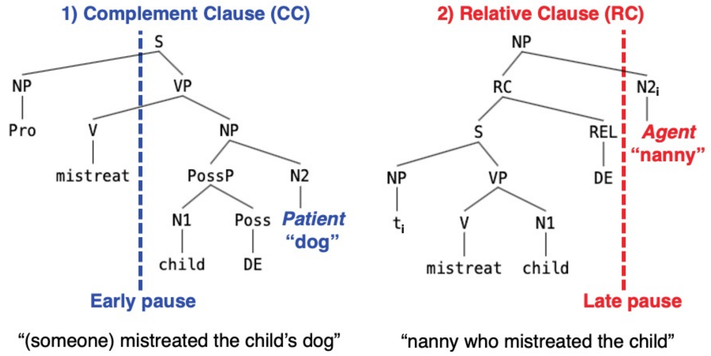
This study focuses on an ambiguous fragment *V+N1+DE+N2* in Chinese to investigate how listeners use prosodic cues to predict a head-final structure and alternative parses.

Q1 **:** Can listeners predict upcoming syntactic structures based on the location of prosodic boundaries (i.e., pause) within this fragment?

Q2 **:** If they do, do they learn the prosody-syntax mapping through exposure, which enables them to predict corresponding structures based on the prosodic cue?

Methods

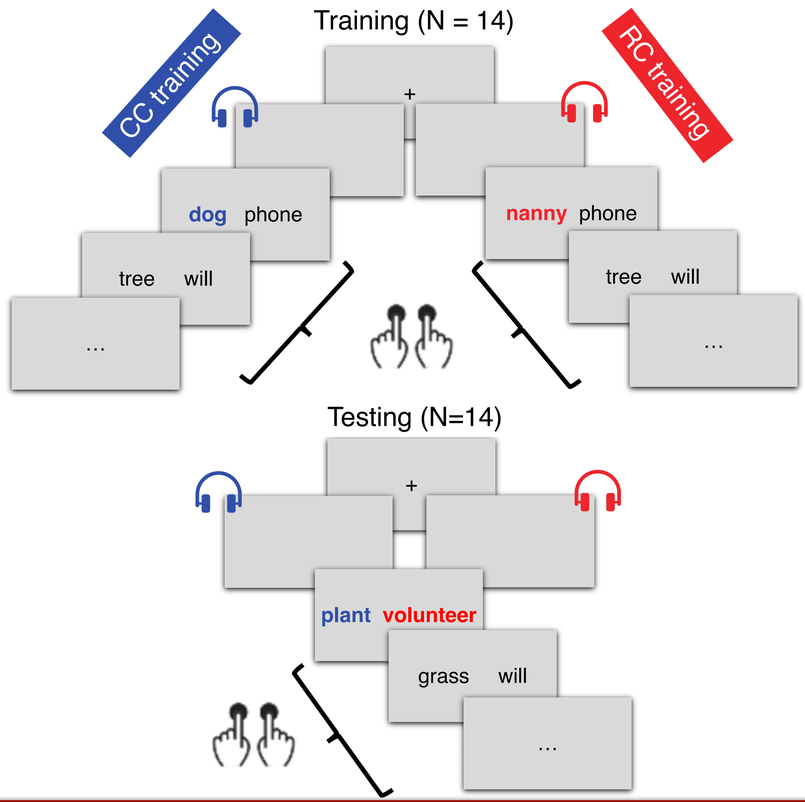
Fragment *V+N1+DE+N2* aligns with both CC and RC analyses. The RC parse is favored over the CC parse due to syntactic constraints [5-6]. Based on the location of pause, listeners may have different predictions for N2:



"(someone) mistreated the child's dog" "nanny who mistreated the child"

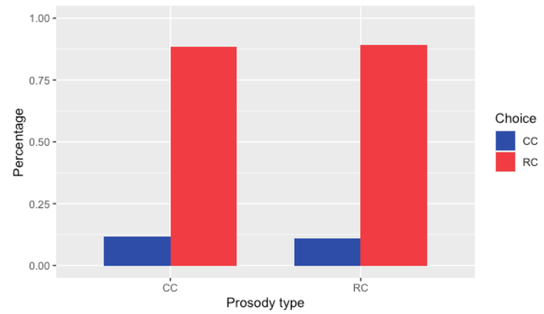
The **cross-modal maze task** (N=37)

有一个孩子，一些小狗，和一些保姆。
There is a child, some dogs and some nannies.
虐待 || Early pause 孩子 的 || Late pause 那些 …
mistreat child DE those …

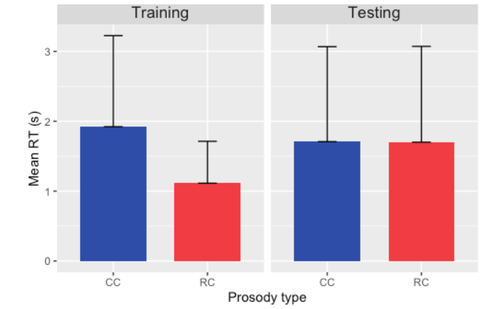


Results & Discussion

Choices



RTs



Training phase: early pause resulted in significantly longer RTs than late pause (*Est.* = 0.25, $t = 8.47$, $p < .001$).

- The presence of prosodic cues that align with the less frequent parse leads to parsing difficulty, confirming that the RC parse is more dominant and easier than the CC parse for this ambiguous fragment.

Testing phase: early pause (88%) and late pause (89%) invariably led to the RC parse. No significant difference in RTs on the target region (*Est.* = -0.01, $t = -0.16$, $p = .87$).

- The association between prosody and syntactic parses established in the training phase may be overshadowed by the strong preference for the RC parse.

Conclusions: Listeners experienced processing costs if prosodic information misaligns with syntactic parse in processing Chinese fragment *V+N1+DE+N2.* However, the strong bias for the RC analysis prevents them from adopting corresponding parse based on prosodic cues.

References: [1] Marslen-Wilson et al., 1992. *The Quarterly Journal of Experimental Psychology.* [2] Snedeker & Casserly, 2010. *Language and Cognitive Processes.* [3] Kraljic & Brennan, 2005. *Cognitive Psychology.* [4] Nakamura et al., 2022. *Language, Cognition, and Neuroscience.* [5] Hsieh & Boland, 2015. *Journal of Psycholinguistic Research.* [6] Ng & Wicha, 2014. *Journal of Memory and Language.*

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