

Syntactic Differences in the Reliability of Prosodic Disambiguation

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The problem. Whether speakers reliably produce prosodic cues to resolve ambiguity in surface structure constituency remains controversial. This paper re-examines PP-attachment ambiguities as a testing ground for competing theories. Snedeker and Trueswell (2003, ST) found that the structural ambiguity between NP-modifier and instrument readings of the PP in (1) is prosodically disambiguated only when the referential context in which the utterance is produced is compatible with both interpretations and speakers are aware of the ambiguity. Kraljic and Brennan (2005, KB), however, report that speakers disambiguate (2), irrespective of these factors.

KB consider two possible explanations for these divergent findings: (i) their task, allowing for listener feedback, was more interactive than ST's; (ii) the test sentence in (2) is longer than that in (1), making it more likely to be broken up by a prosodic boundary. We propose an alternative hypothesis that there is a *syntactic difference* between (1) and (2) responsible for the difference in the reliability of prosodic phrasing as a disambiguating cue.

Experiments 1-3. To test our hypothesis against KB's, we studied three-way ambiguous sentences, as in (3): the ambiguity between (3a) and (3b) (left vs. list) parallels the one in ST; the ambiguity between (3a) and (3c) (left vs. right) parallels the one in KB.

We ran three production experiments, with 16 participants each and nine test sentences similar to (3). Stimuli were presented to participants with written contexts biasing toward a particular bracketing. Two factors were manipulated across experiments: (i) whether participants were made explicitly aware of the ambiguity prior to the experiment (Exp1), or naïve (Exp2+3); (ii) whether subjects received contexts supporting each of left-, list-, and right-bracketing structures across trials (Exp1+2), or all contexts a given subject received supported the same bracketing (Exp3). Data were annotated by forced-alignment and acoustic measures extracted. We looked for differences between conditions using duration, intensity and pitch-measures in a mixed model controlling for subject and item as random effects.

The results show all three structures to be prosodically disambiguated whenever participants saw all three bracketings, independent of whether they were instructed to disambiguate (Exp1+2). When participants were exposed to only one of the possible bracketings (Exp3), however, (3a) and (3b) were not disambiguated (both conveyed with a *left-like* prosody, according to durational measures), but (3a) and (3c) were. Exp3 thus replicates the contrast between ST and KB *in the same experiment*, a finding incompatible with KB's task-based explanations.

Proposal. We adopt a model of direct syntax-prosody mapping, under which prosodic options reflect choices between different syntactic structures. We propose that (3b) is compatible with both a flat structure and an articulated left-branching structure. When the ambiguity is salient (Exp1+2), speakers opt to convey (3b) with a flat structure, so as to differentiate it from (3a). When the ambiguity is not salient (Exp3), (3b) is instead conveyed with a left-branching structure (preferred for processing reasons) and is prosodically indistinguishable from (3a). A right-bracketing reading is *not* compatible with a left-branching structure, so (3a) and (3c) are consistently disambiguated.

- (1) Tap the frog [**with the flower**].
 - a. Tap the frog that has a flower.
Left-bracketing: Tap ((the frog) (with the flower))
 - b. Tap the frog by using the flower.
List-bracketing: Tap (the frog) (with the flower)

- (2) Put the dog [**in the basket**] on the star.
 - a. Put the dog that is in the basket onto the star.
Left-bracketing: Put ((the dog) (in the basket)) (on the star)
 - b. Put the dog into the basket that is on the star.
Right-bracketing: Put (the dog) ((in the basket) (on the star))

- (3) Tap the frog [**with the flower**] on the hat.
 - a. Tap the frog that has a flower and tap it on its hat.
Left-bracketing: Tap ((the frog) (with the flower)) (on the hat)
 - b. Tap the frog by using a flower and tap it on its hat.
List-bracketing: Tap (the frog) (with the flower) (on the hat)
 - c. Tap the frog by using a flower that is on a hat.
Right-bracketing: Tap (the frog) ((with the flower) (on the hat))

References.

- Snedeker, J. and J. Trueswell. (2003). Using prosody to avoid ambiguity: Effects of speaker awareness and referential context. *Journal of Memory and Language* 48:103-130.
- Kraljic, T. and S. Brennan. (2005). Prosodic disambiguation of syntactic structure: For the speaker or for the addressee? *Cognitive Psychology* 50:194-231.