Children’s Use of Prosodic Information in Syntactic Disambiguation

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Question
Are children and adults able to use prosodic cues to distinguish the intended meaning of a syntactically ambiguous structure?

Linguistic Background
- Prosody is the linguistic structure that governs the suprasegmental qualities of a language including intonation and pitch, stress, duration, and loudness.
- There is a partial match between syntactic and prosodic structures.
- Example: the phrase French wine and cheese can have two meanings:
  - meaning 1: both the wine and cheese are French.
  - meaning 2: the wine is French but the cheese is not.
- The difference in meaning here is distinguished prosodically with different intonation and duration of segments, but there is also a syntactic difference in the structures of these phrases:

  * meaning 1: French wine and cheese
  * meaning 2: French [wine and cheese]

- Prosody seems to reflect syntactic structure by virtue of boundary strength between words and rhythmic units.
- Prosodic changes such as changes in pitch or duration may reflect that words or word groups are not directly adjacent in the syntactic structure.

What we know about adults’ use of prosody
Although its exact role in language comprehension is unclear, it is readily evident that adults use prosodic information to disambiguate syntactic structures in speech.

One apparent limitation of adult’s active use prosody in sentence processing is the prominent bias towards non-gapped structures. Gapping is a syntactic process in which identical or repeated material is deleted from the second of two conjoined phrases to reduce repetition or redundancy. For example:
1. John went to the store and Bill went to the library.
2. John went to the store and Bill to the library.

Sentence 2 shows gapping in the deletion of went from the second phrase. In coordinated phrases, people prefer parallel structures and structures with non-gapped units. This bias towards non-gapped structures may override the effects of prosody and cause adults to interpret an ambiguous sentence accordingly.

What we know about children’s use of prosody
Children use prosody in certain contexts from an extremely early age; in English, as young as a few days old use prosodic cues to distinguish between languages. Later, children use prosody to separate speech stream into words and phrases.

Recent research has shown mixed results of children’s abilities to use prosodic information in sentence processing. Studies have found that children are able to utilize prosody to aid in tasks such as segmenting speech input into words (Morgan & Saffran, 1995) and can use prosody to disambiguate word segmentation boundaries (for example, the difference between night rate and nitrile) (Choi and Mazuka, 2003). Alternately, Choi and Mazuka (2003) found no clear effect of prosody on children’s interpretations of syntactically ambiguous structures.

It has also been found that children have some biases for certain syntactic structures, irrespective of the prosody of the phrase. Snedeker and Trueswell (2004) tested children’s understanding of the sentence touch the bunny with the feather when spoken with two different prosodic phrasings: one prosody designated the bunny as holding the feather (touch the bunny with the feather), the other instructed the child to use the feather to touch the bunny (touch the bunny with the feather). They found a strong bias towards the instrumental reading (in which the child uses the feather) over the modifier reading (in which the bunny has the feather).

Although children are adept at picking out prosodic information in speech, they are less capable of utilizing it in conjunction with their knowledge of syntax to disambiguate syntactic structures in cases like feel the bunny with a feather where there is a strong bias towards an instrumental reading.

Hypothesis
If children have a general problem using prosody with an ambiguous structure, they will default to the simpler, non-gapped structure, disregarding the prosody of the sentence.

Experiment 1
Procedure
- 13 children (ages 3-6) were instructed to select a set of flashcard items to which the phrase referred from an assortment of flashcards and place their set in one of two boxes.
- 30 adults were asked to circle pictures of items in a pencil-and-paper version of the task.
- Each subject was presented with 4 experimental items containing strings that were only disambiguated by the prosody (2 of each type) and 4 unambiguously control items (2 of each type). The materials were presented in a semi-randomized order.

Materials
1. Put the tall and pink / robots in the red box.
   (only the robots that are both tall and pink)
2. Put the tall / and pink robots in the red box.
   (all the robots that are tall and all those that are pink)
3. Put the tall and the pink robots in the red box.
   (all the robots that are tall and all those that are pink)
4. Put the robots that are tall and pink in the red box.
   (only the robots that are both tall and pink)

Experiment 2
To examine the effects of order on listener preference, a second experiment was conducted in which 24 adults were presented either with 4 sentences of (1) first or 4 sentences of (2) first. Once more, the adults were asked to circle the objects indicated by the sentence.

Results
Looking only at responses that included either the large or small sets, the following were the percent of responses that selected the correct set.

Table I: Percent correct responses for children, adults, and the adult blocking tests.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Conjoined</th>
<th>Relative Clause</th>
<th>Two Determiners</th>
<th>Gapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child</td>
<td>0.86</td>
<td>0.96</td>
<td>0.22</td>
<td>0.20</td>
</tr>
<tr>
<td>Adult</td>
<td>0.67</td>
<td>0.84</td>
<td>0.71</td>
<td>0.51</td>
</tr>
<tr>
<td>Adult (1)</td>
<td>0.79</td>
<td>0.76</td>
<td>0.33</td>
<td>0.47</td>
</tr>
<tr>
<td>Adult (2)</td>
<td>0.44</td>
<td>0.80</td>
<td>0.55</td>
<td>0.74</td>
</tr>
</tbody>
</table>

Discussion and Conclusion
In Figure 1, it can be seen that children displayed an absolute preference for the small set, regardless of syntax or prosody. While the gapped reading was most difficult for adults (only 50% correctly selected the large set), children did not seem to have any distinction between the gapped and the conjoined sentences.

- In the sentence with two determiners, children again did not have any distinction and selected the small set.
- For adults, there seems to be a very strong dependence on order. In Figure 2, the responses for the conjoined and gapped sentences were mirror opposites, depending on the order in which they were introduced.

Question for Further Research
Do children have a cognitive or a linguistic bias toward the small set?

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