Children’s exhaustive readings of embedded questions
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Summary: Embedded questions have been argued to give rise to multiple readings, which are related in terms of strength. In this study, we investigated children’s comprehension of such questions, and found that 5-year-olds access these multiple readings. They are more tolerant, however, of weaker readings than adults. The findings have implications for theories of questions, particularly those that derive stronger readings from weaker ones through the same pragmatic enrichment that underlies the derivation of scalar implicatures (SIs). Our results are compatible with existing literature on children’s performance on SIs: in both cases children appear to be aware of the ambiguity between weaker and stronger forms, but are more tolerant of weak meanings than adults.

Background: Cremers & Chemla (2014) provide experimental evidence that questions embedded under know (1) are ambiguous between weakly exhaustive (WE) (1a), intermediate exhaustive (IE) (1b), and strongly exhaustive (SE) readings (1c). As indicated in (1), these readings are related in terms of strength. Certain proposals in the semantics literature derive stronger readings from weaker ones through the same process of pragmatic enrichment that underlies SIs (Klinedinst & Rothschild 2011). Given previous findings that children are less sensitive than adults to pragmatic enrichment (Noveck 2001; Chierchia et al. 2001; Papafragou & Musolino 2003, among others), such proposals lead us to expect that children may initially prefer weak readings.

Experiment: Our experiment was conducted in French, but the materials will be described here in English. We tested 35 French-speaking children (4;03-6;04, M=5;08) and 23 adults on the comprehension of questions such as Does Zap know which animals are on the couch? in situations that variously made the readings in (1) true. Children were shown pictures such as Figure 1, containing two sets of objects in different locations. A puppet named Zap would see the same image as the child, and then put on a blindfold; he would then be asked to recall the location of each set of objects (see Table 1 for an example of statements and expected responses). In the WE condition, Zap knew the location of the first set but was wrong about the location of the second. In the WE+IE condition, Zap knew the location of the first but stated that he did not know the location of the second. On each trial, children were asked to repeat Zap’s statements about the two sets of objects; they then answered the critical test question, e.g., Does Zap know which of the animals are on the couch? Children indicated their responses by stamping in colored boxes in an answer booklet. In addition to the 6 critical test trials, each child also received 3 ‘baseline false’ ∅-controls, where Zap was wrong about both sets of animals, 3 ‘baseline true’ WE+IE+SE controls, where Zap knew where both sets were, as well as 6 ‘NP’ control trials where the final question targeted one of the sets of objects, e.g., Does Zap know where the rabbits are? These were selected based on children’s responses to critical test trials, and ensured that children were not basing their responses on only one of the sets of objects. Adult controls were tested with the same materials but through a web-based version of the task.

Results: The results are presented in Figures 2 and 3. Children and adults performed as expected on WE+IE+SE, ∅ and NP control trials; no participant was excluded from analysis. The proportions of yes-responses across the test conditions indicate access to the WE, IE, and even SE interpretations. Of the 35 children: (i) 2 were categorized as ‘SE responders’, rejecting both WE and WE+IE items; (ii) 16 ‘IE responders’ rejected when only the WE reading was true, but accepted once the IE reading was also made true; (iii) 14 ‘WE responders’ accepted in both WE and WE+IE conditions, suggesting they considered Zap to “know” which animals were on the couch as soon as he knew that the rabbits were on the couch. Crucially, no child demonstrated an inconsistent pattern: yes-responses to WE items but no-responses to WE+IE items (recall the IE reading entails the WE reading). With the exception of 2 SE and 2 WE responders, all adults were ‘IE responders’. A logit mixed-model shows that children give more true responses than adults in the
WE condition ($\chi^2=6$, $p=.01$), but do not differ from adults in the WE+IE condition ($\chi^2=0.5$, $p=.1$). 11 children also spontaneously gave some ‘both yes and no’ responses, providing further evidence that they were sensitive to the ambiguities. 10 of them did so on WE targets, and 4 of them on WE+IE targets. $\chi^2$-tests reveal that this distribution is significantly different from chance ($p<.001$) and nearly significant when WE targets are excluded ($p=.05$).

**Conclusion:** Our findings provide novel evidence that 5-year-old children are sensitive to the ambiguity of questions embedded under *know*. However, they answer according to the stronger readings less often than adults. This could be due to difficulties with the strengthening mechanism or to pragmatic tolerance (Katsos & Bishop, 2011). Both interpretations allow for a parallel with the computation of SIs, a link which is made explicit in certain theoretical accounts of embedded questions (Klinedinst & Rothschild, 2011).

**Examples & Figures**

(1) Zap knows which animals are on the couch.

a. **Weakly exhaustive (WE) reading:**
   For each animal on the couch, Zap knows that it is on the couch.

b. **Intermediate exhaustive (IE) reading** (entails WE reading):
   For each animal on the couch, Zap knows that it is on the couch, and Zap does not have false beliefs about animals that are not on the couch.

c. **Strongly exhaustive (SE) reading** (entails IE and WE readings):
   For each animal on the couch, Zap knows that it is on the couch, and he knows that no other animals are on the couch.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Puppet’s statements</th>
<th>WE</th>
<th>IE</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WE</td>
<td>The rabbits are on the couch. The monkeys are also on the couch.</td>
<td>yes</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>WE+IE</td>
<td>The rabbits are on the couch. The monkeys, I don’t know.</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
</tr>
</tbody>
</table>

Table 1: Puppet’s statements corresponding to Figure 1, along with expected responses on each reading.

**Selected References**


