

Quantity implicature and access to scalar alternatives in language acquisition

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In this study, we argue that children are capable of deriving quantity implicatures but fail in certain cases (e.g., *some/all*) because they are unable to access the relevant scalar alternatives.

The Controversy: Recent experimental studies of pragmatic development have reported that children as old as 7 have difficulty deriving quantity implicatures.¹⁻⁶ For example, upon hearing *Mary ate some cake*, a competent adult: (1) computes the basic meaning of the sentence (e.g., *Mary ate at least some of the cake*), (2) generates alternative utterances (e.g., replacing *some* with *all*, yielding *Mary ate all of the cake*), and (3) negates these alternatives by a process of “exhaustification” or strengthening (e.g., *Mary ate some but not all of the cake*). Children often fail to compute these strengthened meanings. The source of children’s difficulty has been hotly debated. Noveck¹ has argued that children do not calculate implicatures and are more literal than adults. Similarly, Papafragou & Musolino⁶ have proposed that children are generally incapable of deriving implicatures without a strong push from context. By both accounts, children’s difficulty can be described as a failure to pragmatically exhaustify utterances (Step 3, above), due to a generally immature pragmatic competence. In contrast, Chierchia et al.⁷ and Barner & Bachrach⁸ have argued that young children are able to exhaustify sentences, but fail to derive implicatures in some cases because they cannot access relevant scalar alternatives (Step 2). For example, Barner & Bachrach claim that 2-year-olds can derive implicatures for numerals, because they begin numeral acquisition by memorizing an explicit count list; thus, the scalar alternatives for numerals are readily available early in acquisition, whereas the alternatives for quantifiers like *some* are never memorized in a list, and therefore are less accessible. Deciding between these accounts is relevant to determining whether quantity implicatures are a product of gradual learning that emerge late in acquisition, or whether the machinery for such implicatures is part of a child’s early competence. Also, the question has important consequences for the theory of *Horn Scales*, and how they are detected in acquisition.

Experiment: Existing developmental accounts can be contrasted by testing children in contexts that manipulate the availability of alternatives, and by grammatically forcing the activation and denial of these alternatives. If children’s difficulty is due to pragmatic exhaustification, then forcing exhaustification grammatically should allow them to strengthen utterances involving quantifiers like *some*. However, if their difficulty is specific to accessing scalar alternatives, then children should fail to strengthen even grammatically exhaustified sentences, since it is still necessary to generate and negate alternatives in such cases. Fortunately, in English this hypothesis is easily tested because the algorithm for calculating quantity implicatures is grammatically mirrored by the semantics of *only*. Thus, it is possible to grammaticality force exhaustification with *only*. For example, consider the sentences in (1).

- (1) a. Mary ate only some of the cake.
- b. Mary ate all of the cake.

Here, the truth of (1a) entails that (1b) is false; this is part of the meaning of (1a), where the relevant *Horn Scale* contains *some* and *all*.

In our experiment, we provided children with sentences that either included *only* or did not. Also, we manipulated the availability of alternatives. As noted by Hirschberg⁹, scales that determine alternative sentences can be broadly categorized into two classes: those whose accessibility is almost completely dependent on context and world knowledge and those whose accessibility is mostly independent of such factors, like *Horn Scales* (e.g., <*some*, *all*>). In the first case, alternatives are readily available in the context, whereas in the second case they must be retrieved from memory. We predicted that if children’s primary difficulty in computing

implicatures is due to access to alternatives, then they should have significantly less difficulty with context-dependent alternatives than with alternatives specified by memorized scales. To test this, we presented 53 4-year-old children (mean age 4;5) with pictures in which 3 animals were performing activities. On critical trials, all three animals were performing the same activity (e.g., reading). Children were asked either:

- (2) a. Are some of the animals reading?
- b. Are *only* some of the animals reading?
- c. Are the cat and the dog reading?
- d. Are *only* the cat and the dog reading?

If children's main difficulty is exhaustification, then providing *only* should allow them to strengthen the interpretation of *some* to mean "*some but not all*". Also, they should accept (2c) but deny (2d). However, if their difficulty is accessing alternatives, then they should be able to use *only* to exhaustify only when provided with alternatives contextually (in 2d), but not when they must be generated from memory (in 2b).

Data strongly supported the hypothesis that children's primary difficulty is accessing alternatives (see Fig.1a & 1b). Although children had no difficulty using *only* to exhaustify when alternatives were context dependent (as in 3d), they often failed to strengthen utterances that included *only some*. This suggests that children can use *only* to exhaustify when the relevant alternatives are available but not otherwise.

Consequences: The experimental data presented here indicate that children's difficulty in computing quantity implicatures is due to their failure to access relevant scalar alternatives, thus supporting the hypotheses of Barner and Bachrach.⁸ The current study also raises questions about the nature and origin of Horn scales. Despite knowing the syntax and semantics of scalar items like *some* and *all*, children do not activate *all* as an alternative when interpreting *some*. This suggests that *all* and *some* are not automatically treated as scale mates by virtue of their monotonicity or substitution based on the preservation of syntactic simplicity (contrary to Katzir¹⁰).

Refs: ¹Noveck, 2001, ²Barner et al., 2009, ³Huang & Snedeker, 2009, ⁴Hurewitz et al., 2006, ⁵Musolino, 2004, ⁶Papafragou & Musolino, 2003, ⁷Chierchia et al., 2001, ⁸Barner & Bachrach, 2010, ⁹Hirschberg, 1985, ¹⁰Katzir 2009.

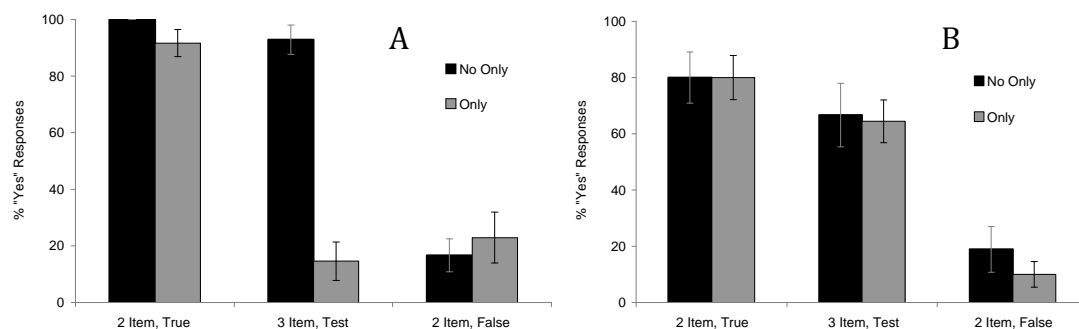


Fig. 1. A: Percentage of children who said "yes" to sentences with contextually determined alternatives (*dog*, *cat*, *cow*). Contexts included either 2/3 or 3/3 animals performing an activity. B: Data for conditions with context independent alternatives (*some*, *all*).