The interaction of grammatical and visual information in preschoolers’ understanding of doubly quantified sentences

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How do preschoolers interpret doubly quantified sentences?

The problem

Sentences containing two quantified expressions are ambiguous, e.g. (1a) and (1b).

(1a) Three girls are watering two flowers.
(1b) Two boys are building three towers.

There are two analysis possibilities: (a) or (b). In both cases, the quantifiers are encoded syntactically; scope order corresponds to surface order (only direct scope).

The hypotithis: Children choose the scope interpretation whose visual representation is easier to chunk into identical subevents.

Background

It has been observed that children exhibit non-adult-like behavior in the interpretation of the universal quantifier every. They tend to judge the sentence “Every boy is riding an elephant” as false in (1a) and true in (1b) where there are three events each riding an elephant and an extra elephant without a boy. It has been claimed that in child grammar the universal quantifier does not quantify over events. Children construct sub-events from the participants of the original event (boys and elephants), and they reject this sentence because it is not the case that every sub-event involves a boy riding an elephant (Philip, 1995; Kang, 2001; Richmond et al., 2004).

Along this line of reasoning, we assumed that the decomposition of the original event into sub-events in the case of doubly quantified sentences, is as well. For them, each member of the wide scope set constitutes a sub-event in which it is associated with an instance of the narrow scope set. E.g., in (1a) (under reading (1a)), shown in Picture 1a, a sub-event consists of 1 girl + 2 flowers, whereas under reading (1b), shown in Picture 1b, a sub-event consists of 1 boy + 3 towers.

Other test cases 

In another experiment, children had to decide about the sentences in (4a) and (4b) whether they are true or false.

(4a) Három mackó is két szánkót húz
(3 girls, 6 flowers; three hole-ACC each two excavator digs)

Two excavators each three hole-ACC digs

Two excavators are digging three holes.

(4b) Három gödröt is két markoló ás
(3 girls, 6 flowers; three hole-ACC wide scope = inverse scope)

Two flowers each wide scope = inverse scope

The effects of linguistic and visual cues combine

Biais towards a chunked direct scope visual representation is 62%. Biais towards a chunked direct scope representation with subject wide scope is 66%.

In example (2) and (5), where the majority of the children preferred the non-chunked visual interpretation, the quantifier to which they assigned wide scope is linguistically more prominent than the other quantifier in every respect: It is subject (versus object), it is agent (versus patient), and it is initial. Furthermore, the preferred mingled picture (Picture 1g) is also fairly easy to chunk into identical subevents. Observe the pictures associated with ex. (5).

Results

The visual grouping of objects affected children’s choice of scope interpretation: they matched with the doubly quantified sentence the picture that was more clearly separated into distinct sub-events in 58% of all answers.

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Discussion

Our results confirmed that Hungarian preschoolers’ interpretation of relative scope is not isomorphic with the linear order of quantifiers (contrary to adult linguistic input, and to the isomorphism hypothesis of Lidz and Musolino (2002)).

– It cannot be derived directly from the subject vs. object role, or the agent vs. patient role of the quantifiers, either.
– Children prefer interpretations which are visually easier to chunk into distinct identical subevents.
– However, the visual cue can be counterbalanced by converging grammatical prominence relations.

More generally, whereas Hungarian adults only use grammatical cues in the processing of doubly quantified sentences, children rely on both grammatical and visual resources.

Further questions

The finding that children’s interpretation of doubly quantified sentences and of every involves quantification over sub-events converges in an interesting way with the generalization that Amazonian and Australian languages with deficient number systems only use adverbial quantifiers quantifying over events, they lack determiner quantifiers quantifying over individuals. Further study of the issue might bear on the question whether or not the ontology of language reflects primate (Bickerton, 1981) or stilbn (2004).

References


The majority of children choose picture (3b) in both cases. 85% of them chose picture (3b) when hearing (4a), and 78% of them chose it when hearing (4b), which indicates that their scope interpretation was independent of the linear order of quantifiers. Other test cases showed that children did not depend on syntactic features vs. objective role of the quantifiers, either. At the same time, children’s choice of scope order was not random, but followed a strategy. The data support that it was determined by visual cues provided by the stimulus picture. Here we present a follow-up study intended to clarify the interaction of linguistic and visual information in children’s scope interpretation.

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