

Do Hungarian preschoolers always understand number words *exactly*?

Research question

The talk reports on two experiments in which we investigated children's understanding of number words in Hungarian. It has been claimed that the distinction between numerals' lower-bound ('at least n ') and upper-bound ('exactly n ') meaning is grammaticalized in Hungarian, i.e. numerals appearing in the so called 'focus position' obligatorily receive an 'exactly' interpretation, while numerals in other positions are assigned an 'at least' semantics in the unmarked case. In a previous experiment we found that irrespective of the information structure of the sentence, Hungarian preschoolers highly prefer the upper-bound interpretation and the lower-bound reading is apparently not available to them. Our research question is whether the lower-bound reading can be elicited by changing the pragmatic environment, i.e. by providing a context that facilitates the lower-bound ('at least') interpretation.

Background

It has been a source of much debate what numerals mean by default. On the standard neo-Gricean view (Horn 1972, Levinson 2000) numerals, just like other scalar terms, have a lower bounded ('at least') semantics and the upper bounded ('exactly') meaning is considered to be a scalar implicature that can be derived from Grice's Quantity Maxim. Others have adopted the view that the default meaning of numerals is 'exactly n ' and all the other readings can be derived from it (Geurts 2006, Breheny 2008).

One way of settling this debate is to investigate the acquisition path of number words, which is why it has become a recurrent topic in the psycholinguistic literature. Papafragou & Musolino (2003) and Musolino (2004) conducted several experiments with preschoolers and they found that by the age of 5 children can assign numerals the full range of interpretations available in the adult grammar. However, they have difficulty accessing the 'at least' interpretation, which challenges the neo-Gricean view on numerals.

Hungarian facts

Hungarian deserves special attention in this matter because in Hungarian the interpretation of numerals is claimed to be structure dependent (É. Kiss 1998, 2010). Numerals appearing in the focus position (the position immediately preceding the tensed verb) are assigned an 'exactly' semantics irrespective of pragmatic factors, which is the outcome of the [+exhaustive] feature associated with this pre-verbal position. Numerals appearing elsewhere in the sentence normally have an 'at least' semantics.

Experiments

In a recent study we investigated whether information structure has any effect on how children (mean age: 5; 6) interpret number words. Previous research has shown that children are generally not sensitive to the exhaustive feature of Hungarian identificational focus (Lukács-Kas in press, self reference 2011) which is claimed to be responsible for the upper-bound reading of numerals. Therefore we hypothesized that if the interpretation of numerals is indeed determined by the information structure, then the upper-bound ('exactly') reading would be less accessible to them. This was, however, not what we found. While in the case of adults the rate of upper-bound interpretations was significantly higher when the numeral appeared in focus position ($\chi^2 = 99.5$, $df = 3$, $p = .0001$), children consistently did not differentiate between the two readings. They always preferred the 'exactly' reading, regardless of the information structure of the sentence. We concluded, that the results we obtained favour the view that the default meaning of numerals is 'exactly n '. However, the question remained open, whether the 'at least' reading is not available at all, or it is, but it needs pragmatic support. To test this latter hypothesis, we carried out two follow-up experiments.

18 children participated in the first and 17 in the second experiment (mean age: 5;6 and 5; 8, respectively). In both experiments we provided a context that was biased toward the 'at least' interpretation. In the first experiment we tried to make the children personally affected by involving them in some sort of competition. We arranged a game that had two participants, the child and Hedgehog (a puppet acted by one of the experimenters). They had a pile of cards in front of them depicting different things (e.g. flowers and butterflies). The task was to sort out the cards that had the same thing on them (i.e. all the cards with flowers or all the cards with butterflies). The number of cards of the two types were carefully arranged in advance, so after finishing sorting out the cards the child ended up having two more cards than the puppet (e.g. child: 6 cards, Hedgehog: 4 cards) Then the experimenter put some balloons on the table and said the following:

- (1) *Elvehet egy lufit az, akinek van öt kártyája.*
 PRT.can get a balloon.ACC that who.DAT has five card.POSS
 'If anybody has five cards, he or she can take a balloon.'

Crucially, the numeral in (1) appeared out of focus so it was compatible with the 'at least' and 'exactly' readings alike. The game was repeated several times with different cards and number settings. We recorded how many times the child took a balloon, which indicated that she interpreted the numeral as 'at least n '.

The second experiment drew on Musolino (2004). Children were told short stories about Hedgehog, who was involved in some kind of activity and needed a certain amount of items, e.g. she was baking a pie and she needed four more apples to be able to finish it. Hedgehog's friends (three other puppets) were there, too, each of them having a certain amount of the items Hedgehog needed in front of them. In the critical trials one of them had more than Hedgehog needed (e.g. 2 apples, 3 apples and 5 apples, respectively). The experimenter then asked whether there was anyone who had the number of items that Hedgehog needed:

- (2) *Van valaki, akinek van négy almája?*
 is someone who.DAT has four apple.POSS
 'Is there anyone, who has four apples?'

Again, the numeral appeared out of focus. We recorded the number of 'yes' responses which indicated that the child interpreted the number word as 'at least n '.

Results

Children performed rather poorly on both tasks. In the first experiment 28% of the children took the balloon and out of them only 11% did consequently so. Similarly, in the second experiment only 24% answered 'yes' to the experimenter's question in all critical trials.

Conclusions

The results suggest that the lower-bound ('at least') reading of numerals is not accessible to children, even if the pragmatic context strongly favours this interpretation. It is possible that children at this age are unable to decompose a set of entities into smaller subsets which is a prerequisite of understanding the lower bound meaning of numerals. It means that they treat a set of n items as a single, atomic unit and they do not have access to the individual entities through the set.

Selected references: É. Kiss, Katalin (2010) Structural focus and exhaustivity. In Malte Zimmermann and Caroline Féry (eds.), *Information structure: Theoretical, typological and experimental perspectives*. Oxford: Oxford University Press. 64–88. Geurts, Bart (2006) Take 'five'. The meaning and use of a number word. In Liliane Tasmowski and Svetlana Vogeleer (eds.), *Indefiniteness and plurality*. Amsterdam: John Benjamins. 311–329. Levinson, Stephen (2000) *Presumptive meanings: The theory of generalized conversational implicature*. Cambridge, MA: MIT Press. Musolino, Julien (2004) The semantics and acquisition of number words: Integrating linguistic and developmental perspectives. *Cognition* 93, 1–41.

