Do Hungarian preschoolers always understand number words exactly?

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Research questions

• Can children differentiate between the ‘at least’ and ‘exactly’ readings of numerals?
• How does the manipulation of the pragmatic environment affect children’s interpretation of numerals?
• How do the results obtained contribute to the semantic debate on the default meaning of numerals and on the analysis of Hungarian pre-verbal focus?
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Different interpretations of the numerals:

(1) - *How many mistakes did you make?*
    - *I made five mistakes.*

(2) *You need to make five mistakes to be allowed to take the test again.*

(3) *You can make five mistakes and still pass this test.*

What is the **default** meaning?
The neo-Gricean view

Horn 1972, Levinson 2000

Default meaning: „at least $n$"

Scalar implicature: „exactly $n$"
Maxim of Quantity

(4) John: *Are the cakes ready?*

   Mary: *Some of them are.*
   → implicature: *some but not all*

(5) John: *Are the cakes ready?*

   Mary: *Three of them are.*
   → implicature: *no more than three*
The Alternative Approach

Geurts 2006, Breheny 2008

Default meaning: "exactly n"

Implicature: "at least n"

Existential Closure
• ‘at least’ reading
  → an instance of Existential Closure
• EXISTS [a set of cardinality n]
• compatible with both the lower-bound and upper-bound readings

• Breheny (2008): „pragmatically derived existential closure“
Hungarian data

• In Hungarian the distinction between the lower and upper bound meaning of numerals is claimed to be structure dependent.

• Numerals appearing in focus position obligatorily receive an ‘exactly’ reading.

• Numerals in other positions are interpreted as ‘at least n’.

(É. Kiss 1998, 2010)
(8a) János 15 PALACSINTÁT evett meg.
  John 15 pancake.ACC eat.Sg3.PRT
  ’John ate exactly fifteen pancakes.’

(8b) János meg.evett 15 palacsintát.
  John PRT.eat.Sg3 15 pancake.ACC
  ’John ate at least fifteen pancakes.’
The standard analysis

(i) the default meaning of numerals is ‘at least n’ (Horn 1972)

(9) Aki fel-nevelt két gyereket, az 15% nyugdíj-emelésre jogosult.

‘Who brought up (at least) two children is entitled to a 15% pension raise.’
(ii) Hungarian preverbal focus expresses exhaustive identification which is responsible for imposing the upper-bound (É. Kiss 2006)

• alternatives to $n$: all the numbers higher than $n$

• as a result of identification numbers not being equal to $[n]_{Foc}$ are excluded

• in the case of numerals exhaustivity manifests itself as the upper bound reading
Experimental background
Scalar implicatures

Children, unlike adults, often fail to derive scalar implicatures.

*might vs. must* – Noveck, 2001.

*some vs. all* – Huang and Snedeker, 2009; Musolino, 2004; Noveck, 2001; Papafragou and Musolino, 2003.
(11) Some of the horses jumped over the fence.
adults: false (92%)
children: false (12%)

(12) Two of the horses jumped over the fence.
adults: false (100%)
children: false (65%)
Musolino presumes that children do not rely on implicatures to derive the upper bound meanings of numerals, but they rely on their default meaning which must be 'exactly n'.

(See also Huang, Snedeker and Spelke, 2004.)
Experimental background
Focus sensitivity

(13) A MACI ült fel a székre.
The bear sat.Sg3.PRT the chair
’It is the bear who is sitting on the chair.’

5-year-old children: true (100%)

(Pintér, 2011)

See also Lukács and Kas, 2013.
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Experiment I.

Predictions:

- If the default meaning of numerals is indeed ‘at least n’,
- and children are not sensitive to exhaustivity which is claimed to be responsible for producing the upper-bound reading,
- then it follows that the ’at least’ reading of numerals will be more accessible for them.
Experiment I. – Participants

- a group of 20 preschoolers (mean age 5;6)
- a group of 17 adult native speakers of Hungarian.
Kapjanak cukorkát azok a macik, ...
Get.IMP candy.ACC those the bear.PL
'Those bears shall get a candy ...'

(1.) ... akik szedtek három málnát.
who.PL picked three raspberry.PL.ACC
(non-focussed numeral with action verb)

(2.) ... akik HÁROM MÁLNÁT szedtek.
who.PL three raspberry.PL.ACC picked
(focussed numeral with action verb)

'Those bears shall get a candy who picked three raspberries.'
„exactly n“

„at least n“
Experiment I. – Results

- **Adults**: the position of the numeral had a significant effect on how the numeral got interpreted ($X^2 = 99.5$, df=3, $p= .0001$)
- **Children** interpreted the numeral as ‘exactly n’ in every single case.

- Did children believe that they were tested on counting?
- Does pragmatic highlighting have any effect on interpretation?
Experiment II.

Is the ‘at least n’ meaning available at all?

(14) Elvehet egy lufit az, akinek van öt kártyája.

PRT.get a ballon.ACC that who has five card.POSS

’If anybody has five cards, he or she can take a balloon.’
Experiment II. – Results

Explanations:
„I don’t have five.”
„I have only six.”
„If this one was not here, I could have one.”

Pie chart:
- 72%: Did not take a balloon
- 17%: Took a balloon once
- 11%: Took a balloon consequently
Musolino (2004)

Experiment III. – Background

Does Goofy have two cookies?  
Children: 80% – ‘yes’
Experiment III.
(15) Van valaki, akinek van négy almája?
    is someone who-DAT has four apple-POSS
    ‘Is there anyone, who has four apples?’
Is there anyone, who has a blue balloon?

Is there anyone, who has a bicycle?
Experiment III. – Results

Explanations:
„I can see only three and five, not four.”
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Findings:

• Children's interpretation of numerals is unaffected by the information structure of the sentence.

• Strong preference for the upper-bound ('exactly') reading.

• The influence of the context is limited.
Discussion

Conclusions:

• The results disconfirm the claims of the standard analysis.

• The ‘exactly’ interpretation is not a consequence of exhaustivity.

• The results are in line with the Alternative Approach:
  - the default meaning of numerals is in fact 'exactly n'
  - the 'at least' reading is an implicature arising through pragmatic inferences

• Children seem to have no or limited access to the lower-bound reading.
Discussion

Why is the 'at least' reading blocked if the numeral is focussed?

- Focus: answers to the Question Under Discussion (QUD, Roberts 1998)
- congruency criterion
- at issue $\rightarrow$ cardinality of the set
- presupposed $\rightarrow$ existance of the set
- in order to be congruent with the QUD focus must specify the cardinality of the set
Thank you for your attention!
References

References