

How do Hungarian preschoolers interpret number words?



Mátyás Geröcs – Lilla Pintér
Pázmány Péter Catholic University
Hungary

- Research questions
- Background
- Experiments
 - Predictions
 - Participants
 - Material
 - Results
- Conclusion

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Research questions

- Are Hungarian preschoolers sensitive to the differences between focused and non-focused numerals with respect to the upper versus lower bound interpretation?
- Is it indeed the information structure of the sentence that determines how numerals are interpreted in Hungarian or there are other, structure-independent factors responsible for the differences?
- How do the results obtained in the experiment contribute to the semantic discussion concerning the default meaning of numerals?

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Background

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.*

The neo-Gricean view

Horn 1972, Levinson 2000

Default meaning:

„*at least n*”



*inferential
processes*

Scalar implicature:

„*exactly n*”

- Scales

(4) *<a, some, many, most, all>*

- Scalar implicatures:

The use of a weaker term implicates that the use of a stronger alternative from the same scale would result in a false statement.

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

Mary: *Some of them are.*

not all → Maxim of Quantity

- Numerals behave similarly to other scalar expressions.

<one, two, three, etc.>

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

Mary: *Three of them are.*

(No more than three.)

- (7) $P(|x|) >$ implicature: $- (P(|x+n|))$

The Alternative Approach

Geurts 2006, Breheny 2008

Default meaning:

„*exactly n*”



*inferential
processes*

Implicature:

„*at least n*”

- The behavior of numerals is not completely parallel to that of scalar expressions.
- Downward entailing contexts:

(8a) *Fred didn't read many of the books Wilma gave him.*

(8b) *Fred didn't read all the books Wilma gave him.*

(8a) \implies (8b)

(9a) *Fred didn't read two of the books Wilma gave him.*

(9b) *Fred didn't read three of the books Wilma gave him.*

(9a) $\not\implies$ (9b)

Hungarian data

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

Numerals appearing in the position immediately preceding the tensed verb obligatorily receive an 'exactly' reading.

(É. Kiss 1998, 2010)

(10a) János 15 PALACSINTÁT eszik meg.
John 15 pancake.ACC eat.Sg3.PRT
'John eats *exactly* fifteen pancakes.'

(10b) János megeszik 15 palacsintát.
John PRT.eat.Sg3 15 pancake.ACC
'John eats *at least* fifteen pancakes.'

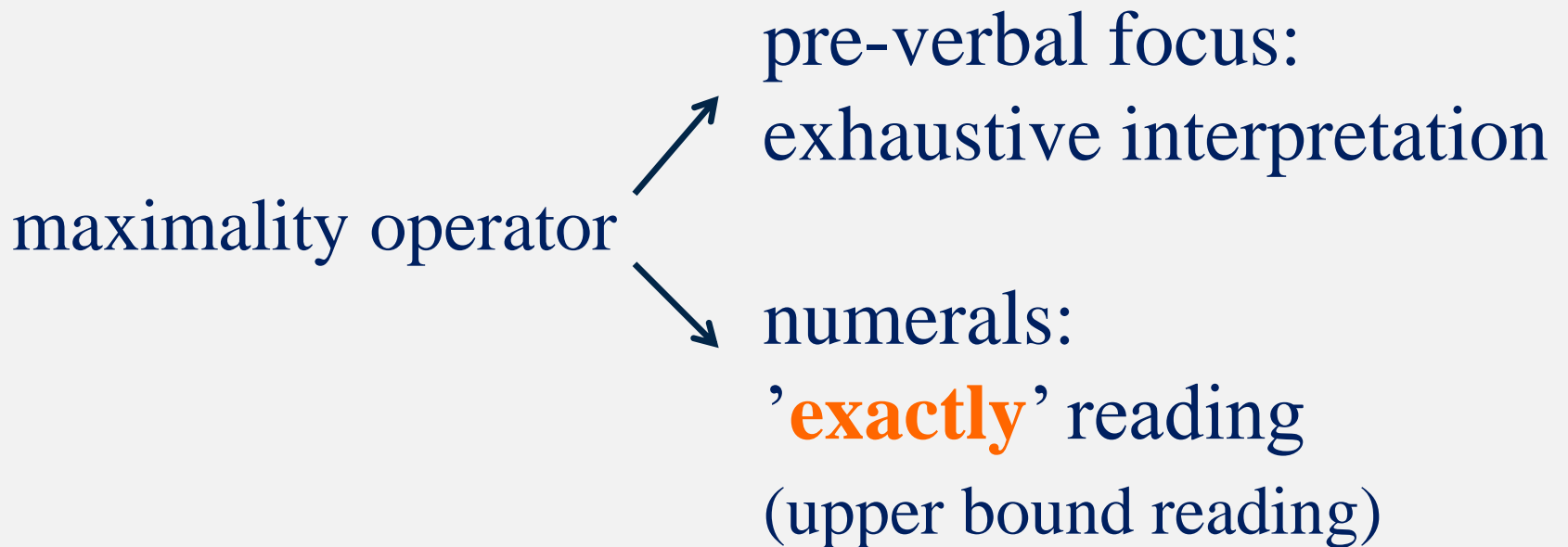
Identificational focus is obligatorily associated with an **exhaustive reading**.

(11) Kit hívott fel János?
'Who did John call?'

János A KIRÁLYNŐT hívta fel.
John the Queen.ACC called up.
'It is the Queen that John called.'

('The set of individuals John called consists of the Queen and nobody else')

This preverbal position is the syntactic realization of an abstract semantic operator, also called **maximality operator**.



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.

Papafragou and Musolino, 2003.

(12) *Some of the horses jumped over the fence.*

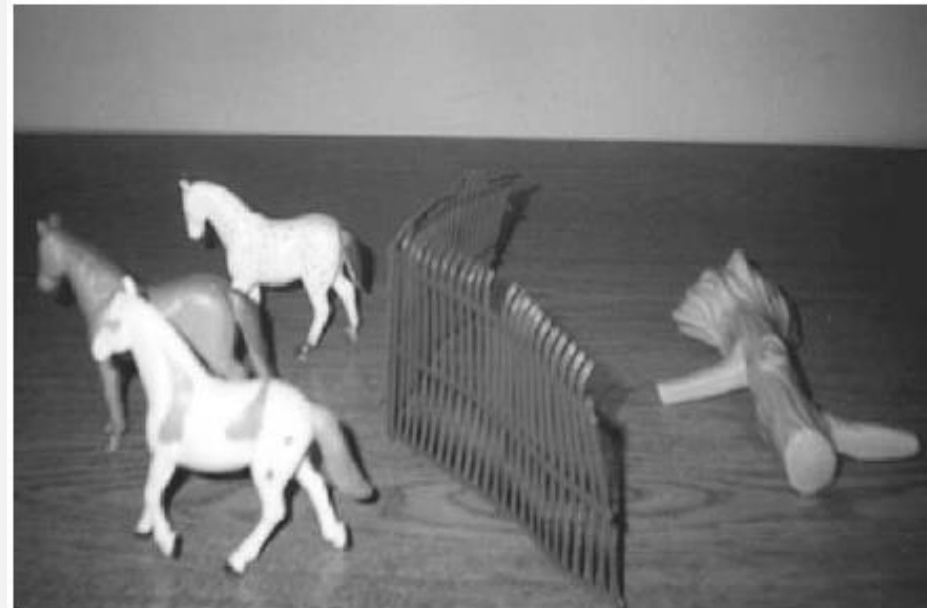
adults: false (92%)

children: **false (12%)**

(13) *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

(14) 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,
in press.)

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Experiments – Predictions

- If it is true that in Hungarian the interpretation of numerals is determined by the information structure of the sentence,
- and children are not sensitive to the exhaustivity feature of identificational focus,
- then it is reasonable to assume that the '**at least**' reading of numerals will be more accessible for children.

Experiments – Participants

- a group of **20 preschoolers**
(9 girls and 11 boys; mean age 5;6)
- a group of **17 adult native speakers of Hungarian.**

None of the children received any mathematical training before and none of the adults were educated in linguistics.



Experiments – Material

- 16 test sentences
 - The position of the numeral and the type of the verb were varied:
 - The numeral appeared either in or out of focus,
 - and the verb expressed either a simple action (e.g. *pick*) or possession (*have*).
- **four conditions**

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.'

Kapjanak cukorkát azok a macik, ...

Get.IMP candy.ACC those the bear.PL

'Those bears shall get a candy ...'

(3.) ... akiknek van három málnájuk.

who.PL have three raspberry.POSS

(non-focussed numeral with possession verb)

(4.) ... akiknek HÁROM MÁLNÁJUK van.

who.PL three raspberry.POSS have

(focussed numeral with possession verb)

'Those bears shall get a candy who have three raspberries.'

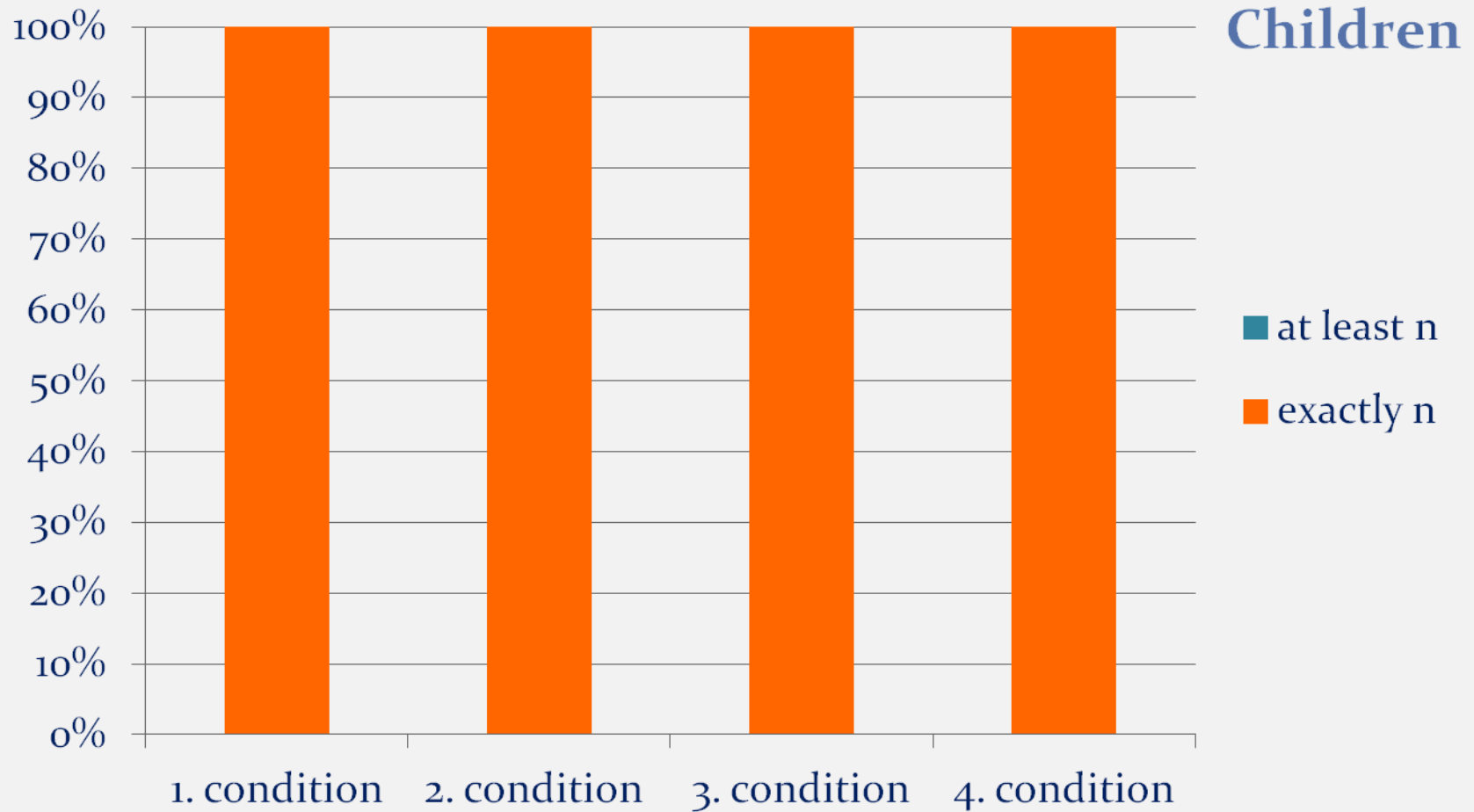
„*exactly n*”



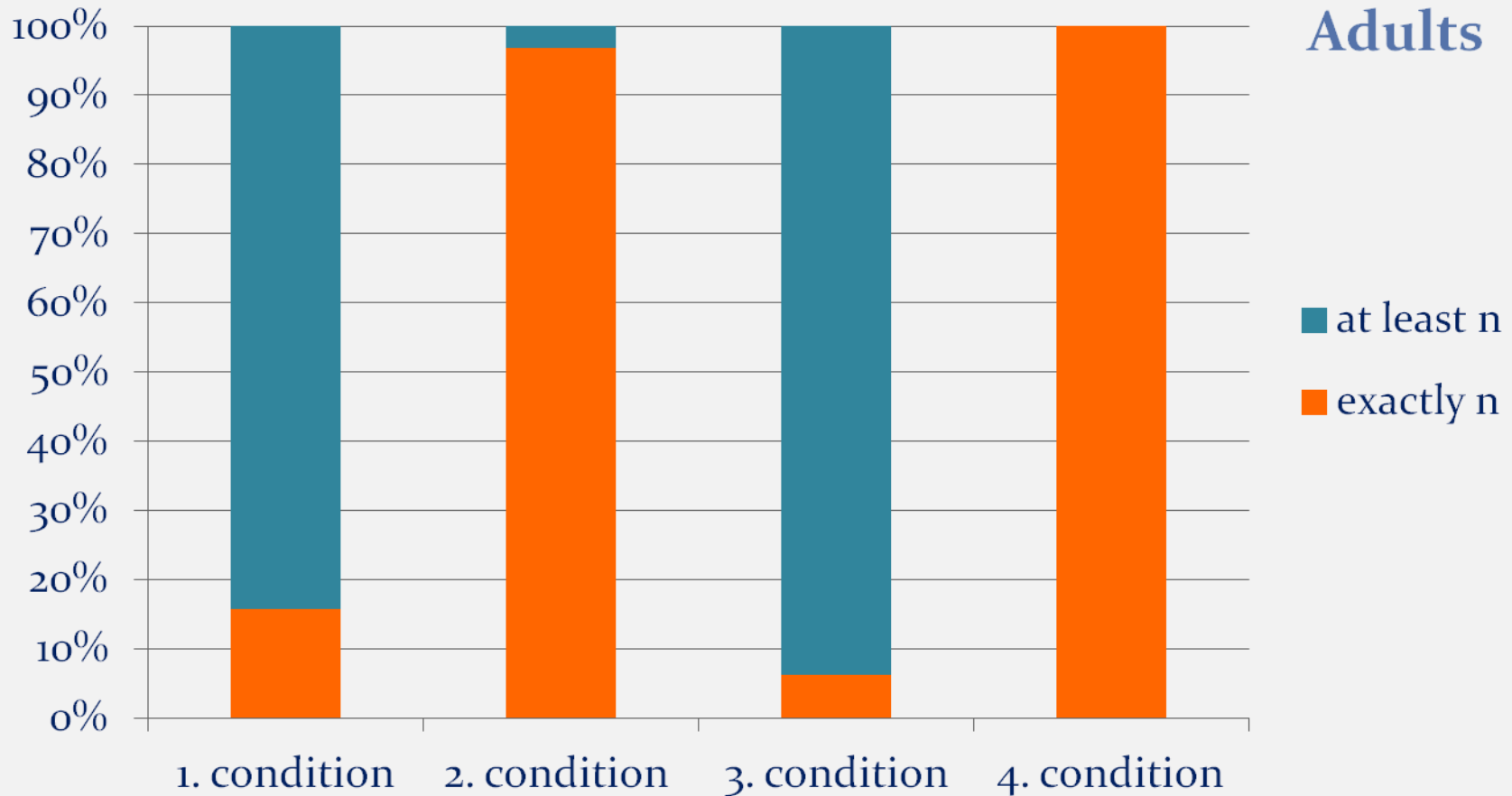
„*at least n*”



Experiments – Results



Experiments – Results



$\chi^2 = 99.5, df=3, p= .0001$

Experiment 2

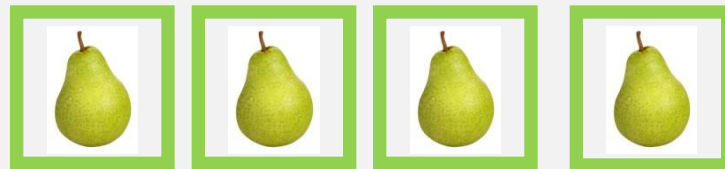
Is the '*at least n*' meaning available at all?

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

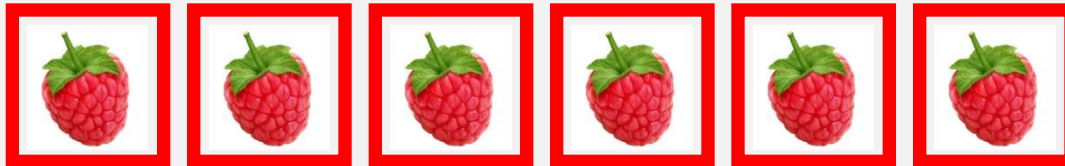
PRT.get a balloon.ACC that who has five card.POSS

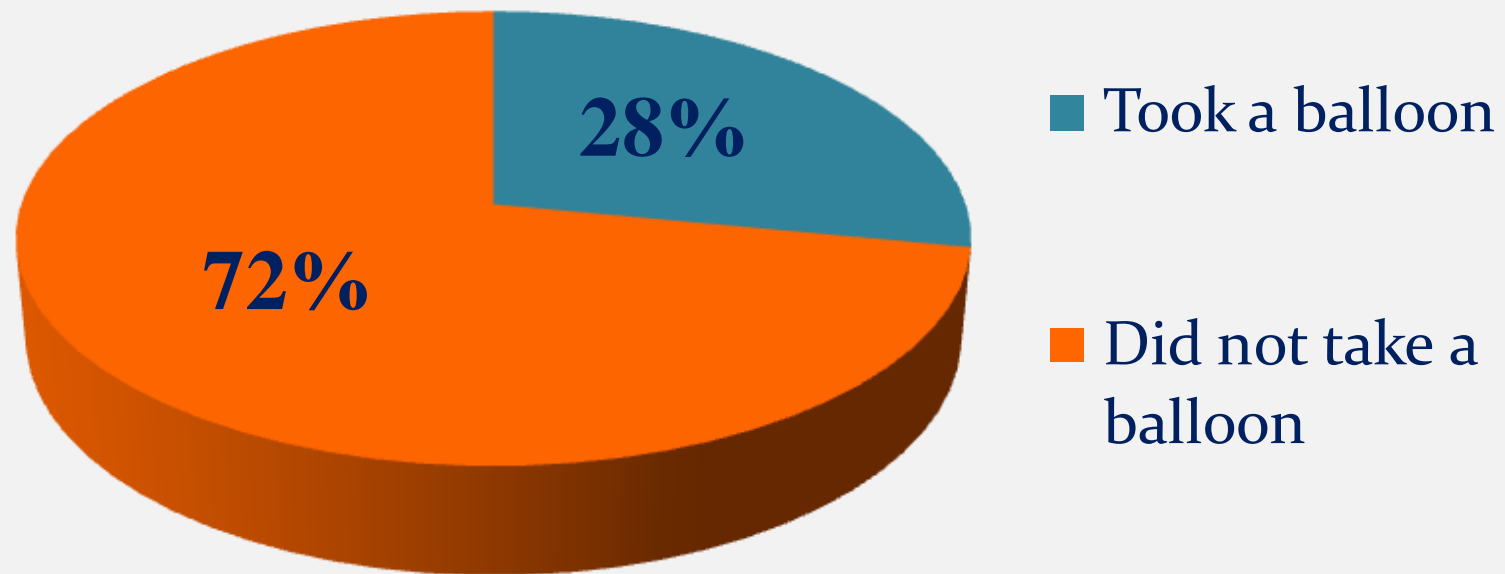
'If anybody has five cards, he or she can take a balloon.'

Hedgehog:



Child:





Explanations:

„I don't have five.”

„I have only six.”

„If this one was not here, I could have one.”

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Conclusion

1. Are Hungarian preschoolers sensitive to the differences between focused and non-focused numerals with respect to the upper versus lower bound interpretation?
 - It seems that they are not, since in the first Experiment in each condition predominantly the '**exactly**' reading was activated – virtually there was no exception.
 - However, it is important to note, that it does not necessarily mean that the '**at least**' interpretation is not accessible for them.
(See Musolino, 2004)

Conclusion

2. Is it indeed the information structure of the sentence that determines how numerals are interpreted in Hungarian or there are other, structure-independent factors responsible for the differences?
 - We found that it was the upper bound reading that children preferred, and the lower bound reading was much less accessible.
 - So it seems, that in children's grammar the information structure of the sentence has no role in determining how numerals are interpreted.

Conclusion

3. How do the results obtained in the experiment contribute to the semantic discussion concerning the default meaning of numerals?
 - One possibility is that the Alternative Approach is right, i.e. the default meaning of numerals is in fact '**exactly n**' and the lower bound interpretation is a pragmatic implicature.
 - A second possibility is that children are unable to decompose a set of entities into smaller subsets which is a prerequisite of understanding the lower bound meaning of numerals. (See Pica and Lecomte, 2008.)
 - Another possibility is that children's preference for the '**exactly**' reading is generated by the task itself.



Thank you for your attention!

References

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