

Against class A treatment of *no more*: Experimental evidence from Czech

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Modified numerals

- previous research on modified numerals established some widely accepted contrasts between comparative modifiers and superlative modifiers (Büring 2008; Geurts and Nouwen 2007; Nouwen 2015; Mayr 2013; Schwarz 2016 a.o.):

1. comparative modifiers don't, but superlative modifiers do give raise to obligatory ignorance implicatures;

- | | | | |
|-----|----|----------------------------------|--------------------|
| (1) | a. | I know at least 10 types of tea. | ignorance impl. |
| | b. | I know more than 9 types of tea. | no ignorance impl. |

Modified numerals

2. comparative modifiers can scope over or under existential modals, but superlative modifiers have to outscope them

(2) The cup of tea can contain less than 30 mg of caffeine.

- a. $\diamond > \textit{less than 30 mg}$ true for black tea (47 mg)
 b. $\textit{less than 30 mg} > \diamond$ true for green tea (28 mg)

(3) The cup of tea can contain at most 30 mg of caffeine.

- a. $*\diamond > \textit{less than 29 mg}$ false for black tea (47 mg)
 b. $\textit{less than 30 mg} > \diamond$ true for green tea (28 mg)

Modified numerals

1. Comparative (or Class A) modifiers:
 - (4) a. more/fewer/less than 10
 - b. under/over 10
 - c. 10 or more/fewer/less

2. Superlative (or Class B) modifiers:
 - (5) a. at least/most 10
 - b. from/up to 10
 - c. minimally/maximally 10

No more construction

- *no more than Num* construction:
- combines negation and comparison as in (6)
- Nouwen 2008, the most developed formal treatment of *no more* claims it to be a class A modifier

(6) No fewer than fifty people showed up.

- or sub-type of Class A, differential quantifier (Nouwen 2010):

(7) no more than 10, many more than 10 Class A, diff-quantifier

no more construction

- Such claims seem to be supported by the comparative morphology of NMC and
 1. English judgments allowing both scopes w.r.t. EM (Nouwen 2008):
 - (8) Cody's paper is allowed to have no more than 20 pages.
 - a. $\diamond > \textit{no more than 20}$
 - b. $\textit{no more than 20} > \diamond$

no more construction

2. to have scalar bounding inference, signalling speaker's well-informedness (ibid)
 - since English *no more* construction (unlike class B modifiers) give raise to equality readings like (=50) for (9)

(9) No fewer than fifty people showed up. =50

Main claims

- I bring new experimental and corpus evidence against both claims, showing that (cross-linguistically):
 1. *no more* construction is interpreted with wider scope than existential modals (very strong preference);
 2. *no more* construction is compatible (mostly) only with speaker's insecurity (or so-called variation) readings as class B

The experimental and corpus evidence comes from Czech.

- English *no more* seems more exception than rule (similarly for English *no* in Blok, Bylinina, and Nouwen 2017)

Design of the experiment

- The experiment followed the observation (Geurts and Nouwen 2007; Blok 2019 a.o.):
 1. class A modifiers allow both wide and narrow scope w.r.t. an existential modal readings
 2. but class B modifiers have to out-scope the existential modals (split-scope).

The research question of the experiment:

- (10) Whether Czech *no more* would behave more like class A or as class B modifier in this environment.

Design

- the experiment was a truth-value judgment task
- the context described a situation strongly preferring the wide scope of the existential modal over the degree quantifiers
- three conditions:
 1. comparative modifier (class A): fewer,
 2. superlative modifier (class B): at-most,
 3. *no more* modifier: no-more

Design

- the subjects judged (Likert scale 1-5, 1: worst, 5: best) the appropriateness of one of the conditions in the context
- 9 items and 9 fillers, 33 subjects participated in the experiment (implemented on IBEX farm), all passed fillers (uncontroversial TVJT)
- an example item in (11)

Example item

- (11) Context: Alex is reading an info at a gas station which states that:

*Jeden litr benzínu Ropák může obsahovat {a.
 one liter fuel.gen.sg Ropák.nom.sg can contain
nanejvýš/b. méně než/ c. ne víc než} 0.5 gramu olova.
 at-most/ fewer than no more than*

‘One liter of the Ropák fuel can contain {a. **at most/b. fewer than/c. no more than**} 0.5 g of lead.’

- a. Alex comments on the info: ‘So, there can be sometimes even 0.6 g of lead in Ropák.’

Results

The mean/median acceptability of the three conditions are the following:

1. at-most: 1.15/1,
2. fewer: 3.6/4,
3. no-more: 1.4/1.

The boxplot representing the variation, means and medians is in the Figure 1.

Boxplot

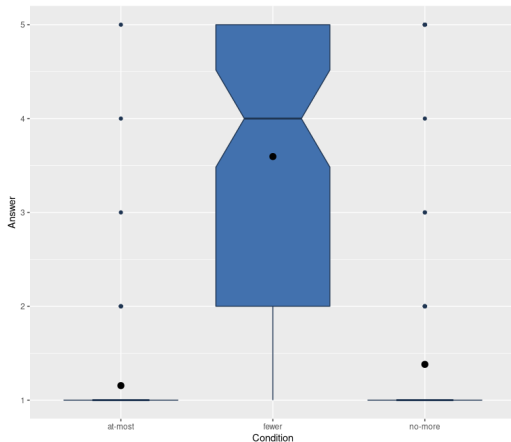


Figure: 1, Boxplot of responses

Results

- The mixed-effects model (R package lme4, subjects and items were random effects, answers were modelled as depending on the fixed-effect, condition) supports the descriptive statistics:
 1. there is a non-significant difference between at-most and no-more (t-value: 1.3, $p = 0.19$),

Results

2. statistically significant difference between at-most and fewer (t-value: 15.12, $p < 2e - 16$),
3. and statistically significant difference between no-more and fewer (t-value: 13.99, $p < 2e - 16$)

Thus, the experiment confirms that the scope behavior of *no more* construction follows the pattern of class B modifiers, not the class A modifiers.

- the narrow scope of *no more* and class B modifiers under existential models was unacceptable

Claim

- the scope behaviour of Czech NMC is a class B profile
- explanation:
- follow original Nouwen's 2008 suggestion to analyze German/Dutch *nicht mehr/niet meer* as negative differential expression (then discarded by Nouwen for *no more*)
- expressing that there is no positive difference in degree between the arguments of the comparative *more*: (12)

Claims

$$(12) \quad \llbracket \text{ne víc } \alpha \rrbracket = \lambda P. \neg \exists d' [\max_d (P(d)) = \alpha + d']$$

- no degree on top of α
- analogically to *mnohem méně než* ‘many more than’
- which seems to be ok even in examples where the only pragmatically conceivable scope is such where the modified numeral outscopes the existential modal (experiments needed)

(13) *Tenhle bus může uvést mnoho méně než 50 lidí.*
 this bus can transport many less than 50 people

‘That bus can transport many more than 50 people.’

- a. $\diamond > \text{much less than } 50$
- b. $\text{much less than } 50 > \diamond$

Claims

- the negative differential analysis is equivalent to the class B at-issue semantics of *at most* (after Kennedy 2015):

(14) a. $\lambda P. \neg \exists d' [max_d(P(d)) = \alpha + d'] =$ ne víc než α
 b. $\lambda P. max_d(P(d)) \leq \alpha$ at most α

- applied to Czech experimental data it correctly derives the similar scope behavior of *no more than* and class B modifiers

ne víc \approx at most

1. the wide scope of the *no more than* and class B modifiers in the experiment then is explained
 2. that is incompatible with Alex's continuation and predicts low acceptability of *no-more* and *at-least* in the experiment
 - *mnohem méně než* 'many more than' seems to behave as class A though
- (15)
- a. One liter of Ropák can contain no more than 0.5 \approx
 - b. One liter of Ropák can contain at most 0.5
 - c. $\max_d(\diamond \text{contain}(1\text{LRopak}, d)) \leq 0.5g$

Claim

- the weak surface scope which allows 'more than' reading is allowed only for class A modifiers
- that explains the high acceptability of *fewer* (whatever the reasons for an obligatory wide scope of class B modifiers over existential modals are, see Blok 2019).

- (16) a. One liter of Ropák can contain fewer than 0.5
 b. $\diamond[\max_d(\text{contain}(1\text{LRopak}, d)) \leq 0.5g]$

Consequences

1. the scope behavior of Czech *no more* then shows that semantically *no more* behaves as class B modifier
 - despite its comparative morphology
2. pragmatic properties of Czech *no more* are similar as class B modifiers (contra Nouwen 2008): data below

Consequences

All the corpus occurrences of Czech NMC (Czech national corpus, ČNK) seem to appear either in

1. anti-specific contexts (in the sense of Nouwen 2015: the speaker cannot mean some specific number) like (17)

(17) *Nevím, kolik má metrů čtverečních, určitě ne víc než padesát.*
 neg-know how-much has meter square certainly no
 more than 50

‘I don’t know how many square meters it has, certainly no more than fifty.’

Consequences

2. or in non-epistemic, generic variation readings like (18)

(18)

průměrnou délku denních přesunů, zpravidla ne víc než
 average length day transports normally no more than
pět až šest km
 5 to 6 km

‘average length of daily transports, regularly no more than 5 to 6 km.’

Pragmatic differences of *ne méně než* and *mnohem více než*

Astronomical fact: Jupiter has 79 known moons

- person with this knowledge can say (19) but not (20)

(19) *#Jupiter má ne víc než 100 měsíců.*

jupiter has no more than 100 moons

'Jupiter has no more than 100 moons.'

(20) *Jupiter má mnohem méně než 100 měsíců.*

jupiter has many fewer than 100 moons

'Jupiter has no more than 100 moons.'

Consequences

- Such pragmatic behavior is more compatible with ignorance implicatures usually attributed to class B modifiers
- with stronger alternatives like {exactly n , at most $n-1$ } accounting for speaker's insecurity/variation
- assertion of *ne víc než* seems to lead to the ignorance and variation implicature

Summary

- Czech *ne* in modified numerals switches the class A to class B
- unlike *much/fewer than*
- tentative explanation:

$$\lambda P. \neg \exists d' [\max_d (P(d)) = \alpha + d'] = \lambda P. \max_d (P(d)) \leq \alpha$$
- nothing similar seems possible for *much more than*
- In sum, it seems that English *no more* is more exceptional type of the construction (see Blok, Bylinina, and Nouwen 2017 for a similar observation concerning English *no*).

Thank You for Your Attention!

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