Against Class A Treatment of *no more*: Experimental Evidence from Czech

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Basic Contrasts

1. bare numerals

(1) This chocolate contains 25 grams of sugar.

1. comparative modifiers (class A) (*more than, less than, over, ?no more than, ...*)

(2) This chocolate contains more than 25 grams of sugar.

2. superlative modifiers (class B) (*at most, at least, minimally, maximally, ...*)

(3) This chocolate contains at most 25 grams of sugar.

extensive research: Büring 2008; Geurts and Nouwen 2007; Nouwen 2008; Nouwen 2010; Cummins and Katsos 2010; Kennedy 2015; Alexandropoulou et al. 2016

Modified Numerals and Existential Modals

Comparative modifiers can scope under or over existential modals.

(4)　This bus can carry fewer than 45 people.

　　a.　◇ > *fewer than 45*　　　　true - coach bus: 55 people

　　b.　*fewer than 45* > ◇　　　　true - city bus: 30 people

Modified Numerals and Existential Modals

Superlative modifiers have to outscope existential modals.

(5)   This bus can carry at most 45 people.

    a.   *◊ > *at most 45*   false - coach bus: 55 people

    b.   *at most 45* > ◊   true - city bus: 30 people

Geurts and Nouwen 2007; Blok 2019

Ignorance Implicatures

- sometimes related to the Maxim of Quantity: logically weaker sentences can signal speaker's ignorance
- comparative modifiers without ignorance implicature

(6)   This chocolate contains more than 25 g of sugar.   no II

- superlative modifiers with ignorance implicature

(7)   This chocolate contains at most 25 grams of sugar.   II

Testing Czech *no more than*

Nouwen 2008 claims that *no more than* is a comparative modifier since:

- both scopes in the existential modal env.
- no ignorance implicature (and with scalar bounding reading)

(8) Cody's paper is allowed to have no more than 20 pages.

English *no* can act as an determiner:

(9) a. No man arrived.

    b. Every/the man arrived.

Unlike Czech *no* in *ne víc* which seems to be a focus particle

(10) *#Ne/✓žádný muž nepřijel.*
      no/any   man arrived

Slavic focus particles (FP) have to (Jasinskaja 2012 a.o.):

- c-command their associated F-marked expression
- be adjacent to the F-marked constituent
- Czech *no* behaves like all other FPs, as exemplified in (11) and (12) with a prototypical FP *pouze* 'only'

(11) *Já se choval   [seriózně]_F *ne/pouze.*
      I   SE behaved seriously   no/only.

(12) a.   I behave only [seriously]_F.

      b.   I only behave [seriously]_F.

      c.   *Já *pouze/*ne jsem se choval   [seriózně]_F.*
           I   *only/*no   AUX SE behaved seriously

      d.   *Já jsem se choval   pouze/ne [seriózně]_F.*
           I   AUX   SE behaved only/no   seriously

But the comparative morphology in Czech *no more* is present: *víc* is a comparative of *mnoho*, *než* is used in the comparatives

(13) a. *Petr měří   ne víc   než dva metry.*
          Petr measures no more than two meters

     b. *Petr je   starší než Marie.*
          Petr AUX older than Marie

Summary of *no more* vs. *ne víc* diffs: both are build on comparative base but *no* is a determiner while *ne* focus particle (constituent negation).

1. Nouwen 2008; Nouwen 2010: based on the morphology, *no more than* – comparative modifier
2. Kennedy 2015: the difference between comparative and superlative modifiers comes from the ordering (semantics) – strict (comparative) vs. non-strict (superlative)
   - comparative *fewer than 3*: $max < 3$ strict ord.
   - superlative *at most 3*: $max \leq 3$ non-strict ord.
   - *no more than*: can be treated as superlative modifier

		$\Diamond >$ *no more than*	*no more than* $> \Diamond$
Predictions	NMC as CM	✓	✓
	NMC as SM	*	✓

(14) If *no more than* is SM, it should sound odd in a context
preferring $\Diamond >$ *no more than* interpretation.

Consequences:

- theoretical: support for one type of (modified) numerals
  theory;
- distinguishing two types of differentials:
  1. regular: *slightly less*
  2. morphologically comparative but semantically superlative
     (Czech *no more than*)

Experiment

- joint work with Hana Krajíčková
- two experiments and two research questions:

(15) a. Does Czech *no more* behave more like a comparative or superlative modifier (in the modal environment)?

  b. Does Czech *no more* behave like other differential quantifiers?

Further: exp 2 – it included all the conditions of exp 1

- Czech native speakers
- Likert scale 1-5
- the appropriateness of one of the conditions in a context
- truth-value judgment task where a context described a situation strongly preferring the wide scope of the existential modal over the degree quantifiers

- 16 items and 16 fillers,
- 98 subjects participated in the experiment (implemented on L-Rex), all of them passed fillers (uncontroversial TVJT)
- four conditions

Design

4 conditions:

1. standard comparative modifier (*méně než* 'fewer than'): FEWER
2. standard superlative modifier (*nanejvýš* 'at most'): AT-MOST
3. *no more* modifier (*ne víc než* 'no more than'): NO-MORE
4. standard differential comparative modifier (*trochu méně než* 'slightly less than'): SLIGHTLY-LESS

- FEWER and AT-MOST tested the acceptability of modified numerals without differential
- SLIGHTLY-LESS, NO-MORE tested the presence of a differential (vague and zero degree differential)

Design

The design was 2x2 factorial:

- comparative vs. superlative modifier (CLASSA,CLASSB) x
- absence/presence of a differential (DIFFYES,DIFFNO)
- the main conditions:
    1. FEWER: [+CLASSA,-DIFF]
    2. AT-MOST [-CLASSA,-DIFF]
    3. NO-MORE [-CLASSA,+DIFF]   contra Nouwen 2008
    4. SLIGHTY-LESS [+CLASSA,+DIFF]

Example item

Context: Alex is reading the following sentence on a chocolate bar packaging:

(16) *Toto balení může obsahovat*
    this packaging can   contain

    a.   FEWER
        méně než
        fewer than

    b.   AT-MOST
        nanejvýš
        at-most

Example item

Context: Alex is reading the following sentence on a chocolate bar packaging:

(17) *Toto balení může obsahovat*
    this packaging can contain

    a.   NO MORE
    ne víc než
    no more than

    b.   SLIGHTY LESS
    trochu méně než 60 gramů cukru
    slightly less than 60 grams of-sugar

Alex says: 'So, in this chocolate bar there can be sometimes even 65 grams of sugar.'

- mixed-effects linear model with subject and item intercept+slope random effects (R package LMERTEST)
- dependent variable was the subject's response
- several models, and the one that describes data the best (the less fitting models included models with main effects only and models where *no more* was treated as a CM):
- the model with independent variable conditions CLASSA/B vs. DIFFYES/NO and their interaction

Results

- negative main effect of CLASSB (SM) (t-value: -11.004, $p < 0.001$)
- positive effect of the absence of a differential (t-value: 3.946 $p < 0.001$)
- a negative interaction of CLASSB (SM) by DIFFNO (t-value: -3.129, $p = 0.002$)
  - AT-MOST was less acceptable than FEWER considering that both of them are without differentials

- Tukey's pairwise comparison of the conditions: only AT-MOST and NO-MORE were statistically indistinguishable (t-value: -0.478, $p = 0.964$)
- all other pairs: differed significantly
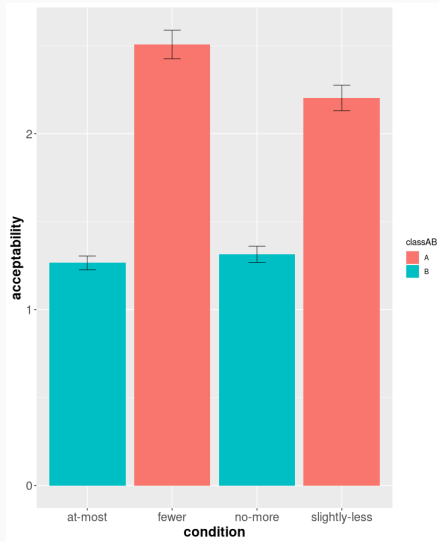- the boxplot representing means and SEs below

Figure 1: Boxplot of responses

The experiment confirms:

- the scope behavior of Czech *no more* construction follows the pattern of superlative, not comparative modifiers
- ↔ subjects rejected NO-MORE to the same extent as AT-LEAST
- the significant difference between NO-MORE and SLIGHTLY-LESS
- ↔ *no more* is a superlative differential quantifier and *slightly less* as a comparative diff quant.

Results

Surprising result:

- low acceptability of all conditions: even the most default comparative modifier without a differential (cond FEWER) had μ=2.51 (SD: 1.61, SE: 0.04)
- possibly priming effect of the most frequent everyday contexts like (18), which strongly prefer the $max_d > \Diamond$ reading, just the opposite against the contexts described in our exp.

(18) *Tato elektrokoloběžka může jet méně než 25 km/h.*
       this electric-scooter   can   run fewer than 25 km/h.

Analysis

The scope behaviour of Czech NMC is of an superlative modifier profile

- generally: our exp confirms Kennedy 2015
- implementation: there is no positive difference in degree between the arguments of the comparative *more*
    1. following Nouwen 2008: analyze German/Dutch *nicht mehr/niet meer* as a negative differential expressing
    2. $[\![\text{nicht mehr } \alpha]\!] = \lambda P. \neg \exists d'[max_d(P(d)) = \alpha + d']$

Analysis

- the negative differential analysis is equivalent to the superlative at-issue semantics of *at most*
- in Kennedy's style of class A/class B analysis, we can classify Czech *no more* as a superlative modifier

(19) a. $\lambda P.\neg\exists d'[max_d(P(d)) = \alpha + d']$

b. $\approx \lambda P.max_d(P(d)) \leq \alpha$ (after Kennedy 2015)

Analysis applied

The analysis correctly derives:

1. the wide scope of the class A modifiers NO MORE and AT-MOST:
   $max_d(\lozenge\mathrm{contain}(\mathrm{ChocBar}, d)) \leq 65g$
2. incompatible with Alex's continuation and predicts low acceptability of NO-MORE and AT-MOST

The weak surface scope

$$\Diamond[max_d(\text{contain}(\text{ChocBar}, d)) \leq 65g]$$

allowed only for comparative modifiers

- explains the higher acceptability of FEWER and SLIGHTLY-LESS (whatever the reasons for obligatory wide scope of SM over existential modals are, see Blok 2019)

1. morphology isn't always the right clue: Czech *no more* behaves as class B, despite its comparative morphology

2. the experiment brings support for the CM vs. SM theory presented by Kennedy 2015: the distinction between class A/B = the type of ordering relation (strict vs. non-strict) – semantics
   - Czech *no more* can be interpreted as $\neg$ (strict) $\rightarrow$ ordering entailments of non-strict ordering
   - regular differential quantifiers (SLIGHTLY-LESS) remain strictly ordered, thus class A

So far: three types of NMC-languages:

1. *no more* as class A, English type of NMC (bounding inferences and both scopes w.r.t. existential modals)
2. *no more* as class B, Czech type of NMC (only $max_d > \Diamond$, lack of bounding inferences: Dočekal 2017)
3. languages where NMC depending on its realization behaves as CM or as SM (Hungarian according to Balázs Surányi (p.c.))

The variation seems to be related to the morpho-syntactic status:

1. a focus particle/constituent negation in NMC (Czech) behaves as a superlative modifier
2. a negative quantifier (English) in NMC leads to the comparative modifier behaviour

Thank You for Your Attention!

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