

Pragmatic inferences attested homogeneously with Class B numeral modifiers

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Introduction. This paper presents results from an experiment that investigates the availability of pragmatic inferences triggered by upper-bound Class B modified numerals (MNs), building on recent experimental work on lower-bound Class B MNs. It is concluded that the pragmatic similarity Class B MNs exhibit when unembedded (Nouwen, 2010) extends to certain embedded contexts as well. Crucially, it is further demonstrated that upper-bound and lower-bound Class B MN should be accounted for uniformly.

Background. Based on observations concerning unembedded occurrences of MNs, Nouwen (2010) proposes two classes of MNs: Class B (mostly represented by superlative MNs), which triggers ignorance inferences, and Class A (e.g., comparative MNs), which does not trigger those. Ignorance inferences disappear in (some) embedded contexts, to be replaced by *variation* effects, akin to free choice effects. The specific contexts where variation inferences are favored, as Nouwen (2015) shows, are the scope of generics, of plurals, of certain modals and of universal nominal quantifiers. Below you see an example of those inferences arising via the interaction of *at least/at most* and a plural definite DP.

(1) The computers we sell have at least 2GB/at most 32GB of memory. (Nouwen, 2010). When the MNs take narrow scope w.r.t. the DP *The computers*, (1) asserts that the minimal/maximal number of GB the computers in that store have is 2/32, respectively. The variation inference that arises in both cases says that the number of GB of memory varies w.r.t. the computers. So, for instance, at this store one can find computers with 2GB of memory, others with 4GB, with 8GB, ..., as well as computers with 32GB. Coppock and Brochhagen (2013) offer a pragmatic account for variation inferences both with *at least* and *at most*. Those inferences are also derived by Mayr's (2013) and Schwarz's (2013) pragmatic accounts of *at least* when embedded. Importantly, the former authors offer an account for both lower- and upper-bound MNs, contrary to the latter, who, similarly to the majority of MN literature, do not take into account upper-bound MNs.

Experiment. The present study investigates the availability of variation inferences in Dutch when upper-bound Class B MNs, such as *maximaal n* 'maximally *n*' and *n of minder* '*n* or fewer', interact with the universal nominal quantifier *elk* 'every'. This builds on Alexandropoulou's (to appear) experimental work on the same inferences triggered by lower-bound MNs, which showed that those inferences are indeed available and pragmatic in nature. Participants in the current experiment read short dialogues between a researcher and an interviewer, where the researcher makes a claim and the interviewer follows up with a question. Next, they have to rate how well the interviewer has understood the researcher's claim on a Likert scale from -3 (*the claim is not understood*) to +3 (*the claim is understood*). Below you see a translation of one of the target items.

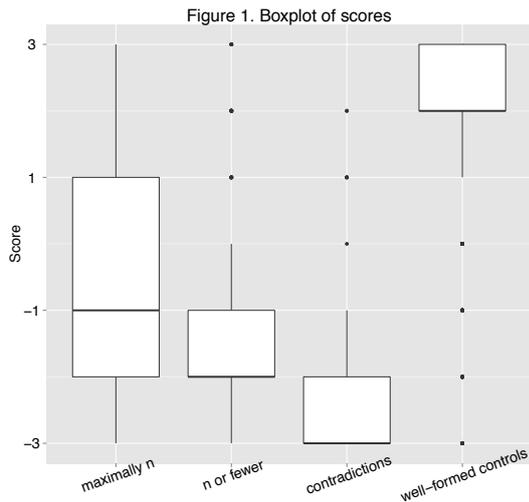
(2) RESEARCHER: Every professor supervises *maximally 4/4 or fewer* Bachelor theses.

INTERVIEWER: Do they all supervise the same number of Bachelor theses?

The interviewer's question above targets the variation inference of the researcher's claim, that is, the reading *the number of Bachelor theses varies w.r.t. the professors*, or more accurately, *it is not the case that every professor supervises the same number of Bachelor theses*. More precisely, s/he asks whether the exact opposite of the variation reading is the case, thus, making an infelicitous and inconsistent follow-up.

All experimental items (N=6) were rotated through lists in a standard way, so that each participant only sees one condition per item. Semantically and pragmatically well-formed control items (N=13) as well as contradictory control items (N=6) were included. Fillers were added to every list too. Data from 57 native speakers of Dutch were collected and

are summarized in the boxplot in Figure 1. Obtained scores were analyzed with mixed-effects ordered probit regression models with intercept random effects for subjects and items. The *maximally* items were rated significantly lower than the semantically and pragmatically well-formed control items ($\beta=1.808$, $SE=.166$, $p<.0001$) and significantly higher than the contradictory control items ($\beta=-.071$, $SE=.204$, $p<.0001$). Similarly, the *n or fewer* items received scores significantly lower than those in the well-formed control condition ($\beta=2.043$, $SE=.168$, $p<.0001$) and significantly higher than those in the control condition of contradictions ($\beta=-.836$, $SE=.203$, $p<.0001$). Finally, the scores of the *maximally* items were marginally higher than those of the *n or fewer* items ($\beta=-.235$, $SE=.137$, $p=.085$).



control items shows us whether variation inferences are available with *maximally n* and *n or fewer*, when embedded, for the following reason. In the target items, the only inconsistency that arises between the researcher’s claim and the interviewer’s question is the one that is due to the variation reading triggered by the former. Since semantically and pragmatically well-formed control items involve no inconsistency, a significant difference between the experimental conditions and those controls reveals the availability of variation effects. Hence, the relevant results reported above indicate that variation effects become available

when both *maximally n* and *n or fewer* interact with a universal nominal quantifier. Next, the comparison of the experimental conditions with the contradictory control items tells us what the nature of those inferences is. Given that the latter involve contradictions, the finding that both experimental conditions were significantly higher than those contradictions demonstrates that subjects did not treat them as bad as contradictions. Therefore, the inconsistency of the target items is not a contradiction, thus, the variation reading it targets is not a semantic inference, but rather a pragmatic inference. Last, the low ratings that the disjunction-seeming *n or fewer* items got and, as a result, their marginal difference from the *maximally* items was very likely due to an effect of the low scores the contradictory items obtained, which also involved disjunction interacting with *every*.

Conclusions and Implications. It is concluded that variation inferences arise with both upper-bound Class B MNs tested (i.e., *maximally n* and *n or fewer*) when embedded under a universal nominal quantifier, and that those inferences are pragmatic in nature. That is exactly what Alexandropoulou (to appear) shows for the lower-bound Class B MNs *minstens* ‘at least’ and *n of meer* ‘n or more’ in Dutch. Combining those results, we infer that variation pragmatic inferences are triggered homogeneously with Class B MNs in certain embedded contexts. This strengthens Nouwen’s (2010) relevant classification, and also constitutes an extension of the pragmatic similarity of Class B MNs in unembedded contexts (ignorance implicatures) to certain embedded contexts (variation pragmatic inferences). Moreover, while Alexandropoulou’s (to appear) findings are in line with all existing pragmatic accounts of variation inferences with lower-bound Class B MNs (cf. Coppock and Brochhagen, 2013; Mayr, 2013; Schwarz, 2013), when combined with the present findings, they suggest that there is no reason to think that a theory that lacks a prediction that upper-bound and lower-bound expressions have the same profile is worth entertaining, thereby corroborating Coppock and Brochhagen’s (2013) account.

Selected References: Alexandropoulou, S. (to appear). Testing the nature of variation effects with modified numerals. *Proceedings of SuB 19*. Coppock, E. and Brochhagen, T. (2013). Raising and resolving issues with scalar modifiers. *Semantics & Pragmatics*, 6:1–57. Mayr, C. (2013). Implicatures of modified numerals. *From grammar to meaning: The spontaneous logicality of language*, 139–171. Nouwen, R. (2010). Two kinds of modified numerals. *Semantics & Pragmatics*, 3:1–41. Schwarz, B. (2013). At least and Quantity Implicature: Choices and Consequences. *Proceedings of the 19th Amsterdam Colloquium*, 187–194.