

Why do modified numerals resist specific interpretation?

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It is well-known that bare numerals license a specific reading, whereas modified numerals do not. For example, *three boys* in (1a) can take wide scope over the subject NP whereas *at least three boys* in (1b) cannot. Following standard accounts *three* and *at least three* both constitute determiners to combine with nominals, thus raising the question of why the bare numeral and the modified numeral differ in interpretation. Contrary to the standard accounts, Krifka (1999) suggests to interpret *at least* as a focus-sensitive adverb operating on a set of alternatives evoked by focus. It will be shown in this talk that Krifka's interpretation of *at least*, although intended for a different problem, provides a straightforward explanation for the fact that the modified numeral in (1b) resists specific interpretation.

- (1) (a) Every girl visited three boys.
(b) Every girl visited at least three boys.

Beghelli and Stowell (1997) and Szabolcsi (1997) account for the data in (1) by allowing bare numerals to be interpreted as either quantifiers or (group-)individuals yielding wide scope, whereas modified numerals only have a quantifier interpretation. Szabolcsi poses two semantic conditions for a numeral to receive an individual type interpretation: First, the NP has to be monotonic increasing, guaranteeing that the minimal witness set of the NP denotation can be used as a referent without affecting truth conditions. Secondly, the NP has to support non-maximal reference, establishing a discourse referent solely by the help of the noun denotation. Support of non-maximal reference is demonstrated in (2).

- (2) (a) Two boys were selling coke. They were wearing black leather jackets.
Perhaps there were others also selling coke, but I didn't notice.
(b) At least two boys were selling coke. They were wearing black leather jackets.
Perhaps there were others also selling coke, but I didn't notice.

In (2a), the NP *two boys* supports non-maximal reference, which means that the pronoun *they* may refer to a subset of the boys selling coke. There may have been more than two boys selling coke, but the pronoun *they* need not refer to all of them, which is indicated by the continuing sentence "*Perhaps there were others ...*". In contrast, in (2b) the NP *at least two boys* supports only maximal reference, which means that the pronoun must refer to the entire set of boys selling coke. This is the reason why the continuation "*Perhaps there were others...*" is not felicitous. Support of non-maximal reference provides an adequate characterization of the interpretation difference between bare numerals and modified numerals. However, it does not provide an explanation why the two kinds of numerals differ the way they do. There is still the question of why modified numerals support only maximal reference. Or, to put it in terms of a typed framework, why do bare numerals license an individual (type e) interpretation, whereas modified numerals have to be interpreted as quantifiers ($\langle\langle e, t \rangle, t \rangle$)?

De Swart (1999) approaches this question making use of a partitioning of the domain. Assuming a join semi-lattice ontology for (group-)individuals, de Swart proposes to view the cardinality of the (group-)individuals as imposing a partitioning of the domain into cells of the same size. Referential (type e) indefinites, including bare numerals, are characterized by their ability to identify a particular cell. Since modified numerals are not able to identify such a cell, they do not qualify for a referential (type e) interpretation. This idea raises the question of why, e.g., *some boys*, does license a referential interpretation (and supports non-maximal reference)

although it fails to identify a cell of the partitioning. De Swart concedes that in order to extend her idea to *some N* and *many N* some room for vagueness has to be allowed in the way the partitioning is built up. However, if the partitioning is weakened to allow for *some N* to identify a particular cell, then there is no obvious reason why *at least three N* should not do so. Attributing the lack of a referential interpretation to the failure of identification of a suitable cell seems to shift the burden to the partitioning of the domain without providing the answer to the problem.

Krifka (1999) is concerned with the problem that bare numerals trigger an implicature due to the maxim of quantity while modified numerals do not. For example, “*Three boys left.*” triggers the implicature that no more than three boys left, but “*At least three boys left.*” does not. Krifka suggests to interpret *at least* as a focus-sensitive adverb similar to *only* thus accounting for the fact that (i), its interpretation is sensitive to focus and (ii), it combines with proper names, adjectives and VPs etc. in addition to numeral expressions. He suggests a general meaning for *at least* which makes use of alternative sets, where alternative sets are assumed to be partially ordered. The meaning of *at least* consists in a disjunction of those alternatives which are greater than the ordinary meaning. For example, assuming that the alternatives induced by $THREE_F$ boys are ordered according to the ordering of natural numbers the meaning of “*At least THREE_F boys left.*” can be paraphrased as “*three boys or four boys or ... left*”. In general, the ordinary meaning of “*at least α* ” consists in collecting the alternatives induced by α which are greater than the ordinary meaning of α , viz. $\cup\{P \mid \langle [\alpha]^0, P \rangle \in [\alpha]^A\}$, where $\langle [\alpha]^0, P \rangle$ iff P is greater than the ordinary meaning of α . The collection of alternatives is performed by the generalized join operation defined by Keenan and Faltz (1985).

This analysis offers a straightforward answer to our question. Note that the general join operation requires arguments to be of type t , $\langle e, t \rangle$, $\langle \langle e, t \rangle, t \rangle$ etc., and is not defined for e-type arguments. The result of the join operation is of the same type as the argument. According to the definition of the general join operation *at least* cannot take an e-type argument and cannot return an e-type result. Therefore, the modified numeral *at least N* is precluded from being interpreted as an individual. Adopting Krifka's interpretation of *at least* as a focus-sensitive operator performing a general join of the alternatives thus yields an obvious explanation for the fact that *at least N* doesn't have an e-type interpretation: You cannot build a group of individuals via disjunction.

Krifka's analysis of *at least* provides a neat solution for the problem it was intended for, i.e. the problem of the missing implicature. In brief, “*Three boys left.*” triggers a set of alternatives giving rise to the implicature that the (proper) alternatives are rejected, while “*At least three boys left.*” doesn't project any alternatives and thus doesn't trigger the implicature. Beyond, Krifka's analysis offers a simple and elegant answer to a problem not mentioned in his paper, i.e. the question of why *at least N* cannot have an e-type interpretation. Solving a widely discussed problem by way of a side effect seems substantial evidence for the interpretation of *at least* as a focus-sensitive operator. In the talk, the analysis will be extended to other (increasing) modified numerals.

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