Plural Quantification and The Homogeneity Constraint

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1. Introduction. (1a-b) illustrates Winter's 2002 generalized version of Dowty's 1986 puzzle regarding *all*:

(1) a. All the/most of the students are meeting in the hall. b. *All the/most of the students are a good team.

(1a-b) shows that only a sub-class of the predicates that select pluralities ('collective predicates' henceforth) allow quantificational DPs, in particular *most of DPs*, on which I will concentrate. The core empirical claim of the paper will be that the contrast (1a) vs (1b) is parallel to (2a) vs (2b), which illustrates the Homogeneity Constraint (HC) on Mass Quantification stated in (3):

(2) a. All the/most of the water is liquid/dirty. b. *All the/most of the water is heavy/weighs one ton.

(3) The predicate in the nuclear scope of a mass quantifier must be homogeneous. **(HC)**
(Bunt 1979, 1985, Lønning 1987, Higginbotham 1994)

The main theoretical claim will be that the Roeper-Lønning-Higginbotham analysis of mass quantifiers extends to *plurality* quantifiers: such quantifiers do not denote relations between sets but rather relations between *plural entities*.

2. The non-integrativity constraint (NIC). The canonical definition of Homogeneity (*A predicate is homogeneous iff it is both cumulative and distributive*) is reputedly problematic, being confronted with the 'minimal-elements' problem. [Note: A granularity-based weakening of the HC (Champollion 2010) would not help here since the HC is concerned with distinguishing between homogeneous and non-homogeneous predicates which – if real – cannot be defined in terms of granularity]. I will therefore restate the HC as the Non-Integrativity Constraint (NIC):

(3’) The predicate in the nuclear scope of a mass quantifier cannot be integrative. **(NIC)**

NIC depends on the distinction between integrative and non-integrative predicates (for a somewhat similar distinction see Löbner (2000) on integrative and summative predication):

(4) a. Integrative predicates describe entities that qualify as 'integral wholes'. (Simons 1987).
Ex: *heavy, tall, cover a large space, mad*
b. Non-integrative predicates describe parts of integral wholes. Ex: *liquid, dirty, yellow*

The difference in descriptive content correlates with a difference in denotation:

c. Integrative predicates denote sets (no inherent ordering relation among the elements).
d. Non-integrative predicates denote join semi-lattices (inherent part-whole order).

My next proposal will be that the distinction between integrative and non-integrative predicates is relevant for collective predicates:

(5) a. Integrative collective predicates denote sets of pluralities (no inherent ordering relation).
Ex: *mafia, team, committee, numerous*
b. Non-integrative collective predicates denote join semi-lattices (sets of pluralities ordered by the part of relation).
Ex: *meet, love each other, be friends, be neighbours, be similar*

The contrast in (1a-b) can now be viewed as illustrating a generalized version of the HC restated as the NIC:

(6) A collective predicate in the nuclear scope of a plural quantifier must be non-integrative.

The rest of the presentation will provide the details of the proposal and some answers to potential worries.

3. Entity Quantifiers

3.1 Mass Quantifiers as relations between entities. According to Roeper 1983, Lønning 1987 and Higginbotham 1994, mass quantifiers are not set-quantificational, but instead should be defined as in (7):

(7) Mass quantifiers denote relations between *entities* (type e).

According to this analysis, (2a) is true iff (2'a) is satisfied; μ notates a measure function and ∩ is the general lattice-theoretic operation *meet* (*intersection* is *meet* applied to sets), which in this case applies to two entities (type e); capital X notates a variable that ranges over non-atomic entities:

(2’) a. μ ([[the water]] $\cap \sum X$. dirty(X)) > μ ([[the water]]- [[the water]] $\cap \sum X$. dirty(X))

In words, the measure of the meet of [[the water]] and (the maximal sum of the dirty parts in the domain) is bigger than the measure of the relative complement of the outcome wrt [[the water]]. According to Higginbotham 1994 this analysis explains why mass quantifiers are subject to the HC: computing truth conditions of the type in (2’) depends on applying the Σ operator (Σ is the fusion operator, which applies to a set and picks up the supremum; Σ is not defined for sets that do not have a supremum) to the nuclear scope; non-homogeneous (or rather integrative) predicates are disallowed, because they denote unordered sets, to which Σ cannot apply (because unordered sets do not have a supremum). In what follows I will assume the basic idea of this explanation, but revise the details: in addition to (i) relying on integrativity (instead of non-homogeneity) I will assume that (ii) the relevant nominalizing operator is not the fusion operator but rather the intensional iota operator (Chierchia's 1998 Down) and (iii) no nominalizing operator applies to the restrictor; rather an entity restrictor must be provided by the syntax itself.

3.2 Plurality Quantifiers. Let us now assume that the plural quantifiers in (1) resemble mass quantifiers in so far as they are not set quantificational, but instead denote relations between entities:

(8) Plurality quantifiers denote relations between *pluralities* (plural entities).

Given (8), the *most*-example in (1a) is true iff (1'a) holds:

(1') a. μ ([[the students]] $\cap$ ιX. met(X)) > μ ([[the students]]- [[the students]] $\cap$ ιX. met(X))

Because we are in a count domain, the measure function is the cardinality function; I nevertheless use the μ notation in order to bring out the similarity between the formulae in (1') and (2'). Examples (1b) are unacceptable, because their truth conditions cannot be computed: *good-team* denotes a set of elements that are not ordered by the part-of relation and by definition, the intensional ι cannot apply to unordered sets (because unordered sets lack a maximal element).

3.3 Plurality Quantifiers and pluralized predicates. The main predicates in examples of the type in (9) are integrative, which seems to go against the NIC:

(9) a. Most of my students are hard-working. b. Most of my classes are good teams.

These examples are not problematic, since the ι operator applies to the join semi-lattice denoted by the pluralized predicates **hard-working* and **good team* (*notates Link's pluralization operator). Correspondingly, these examples necessarily take distributive readings (compare the collective readings of plurality quantifiers built with collective predicates in the nuclear scope, e.g., (1a)). Selectional restrictions explain the unacceptability of **Most of my students are good teams.*

4. The set-relational *most*. The examples in (10) differ from those examined so far in that the restrictor is not filled with a DP (type e) but rather with a NP (<e,t> type):

(10) a. Most students of mine are hard-working. b. Most mafias will meet tomorrow.
c. *Most students of mine will meet in the hall.

Assuming that type-shifting in the restrictor is prohibited (independent evidence will be provided in favor of this constraint, which distinguishes my analysis from Higginbotham's (see (iii) at the end of § 3.1)), examples of this type will be analyzed as relying on the set-quantificational *most*, for which the standard GQT will be assumed:

(10') a. $\mu(\{x: student(x)\} \cap \{hard\text{-}working(x)\}) > \mu(\{x: student(x)\} \cap \{not\text{-} hard\text{-}working(x)\})$

b. $\mu(\{x: mafia(x)\} \cap \{meet\ tomorrow(x)\}) > \mu(\{x: mafia(x)\} \cap \{not\text{-}meet\text{-}tomorrow(x)\})$

(10'a) requires the cardinality of hard-working students of mine be larger than the cardinality of the non-hard-working ones; (10'b) requires that the cardinality of mafias-that-meet-tomorrow (this is the set obtained by intersecting the set of mafias with the set of pluralities who meet tomorrow) is larger than the cardinality of mafias-that-do-not-meet-tomorrow; (10c) is unacceptable because it violates selectional restrictions. Note that the acceptability of (10b) forces us to assume that - in this type of example at least - *meet* is an integrative predicate that denotes an unordered set of pluralities of meeting people (rather than a join semi-lattice of pluralities of meeting people). This systematic shift - due to pluralization - from non-integrative to integrative status, which can also be observed with atomic predicates (e.g., *yellow*, which is non-integrative in *Most of this gold is yellow* but integrative in *Most daffodils are yellow* or *This daffodil is yellow*) can be viewed as being due to coercion, which is triggered by the impossibility of applying pluralization to non-integrative predicates (the mass to count coercion pertains to this general phenomenon).

5. Brief discussion of Winter's (2002) Account. The proposal made in this abstract will be briefly compared with Winter's account, which establishes no correlation between plural and mass quantification.

Selected References. Bunt 1985 *Mass Terms and Model-Theoretic Semantics,* CUP; Champollion, L. (2010). Parts of a whole: Distributivity as a bridge between aspect and measurement, University of Pennsylvania dissertation; Dowty, D. (1986). Collective predicates, distributive predicates and all. In *Proceedings of ESCOL3* ; Higginbotham 1994. Mass and count quantifiers. L&P 17; Löbner, S. (2000). Polarity in natural language: predication, quantification and negation in particular and characterizing sentences. *L&P 23*(3), 213-308 ; Lønning, Jan Tore 1987. Mass terms and quantification. L&P 10; Roeper, P. 1983. Semantics for mass terms with quantifiers. Noûs 17; Winter 2002. Atoms and Sets: a characterization of semantic number. *LI*, 33.