Proportional quantifiers and partitivity Luka Crnič, MIT

Synopsis – There is a puzzling asymmetry between English partitive and non-partitive *most*-phrases: only the partitives participate in cumulative/collective readings. We argue that this is due to (i) the generic nature of sentences with the non-partitive *most*, and (ii) the unavailability of cumulative/collective readings in generics.

Data – A. It has been observed that non-partitive *most*-phrases do not allow collective readings with mixed predicates, while their partitive counterparts do (1) (Nakanishi & Romero 2004).

(1) [Scenario: 60% of the boys in the room jointly lifted the piano]
a. #Most boys lifted the piano b. Most of the boys lifted the piano

B. Non-partitive *most*-phrases do not participate in cumulative readings with numeral DPs (2-a) (Zweig 2008). However, this does not extend to sentences with *most of the NP* (2-b) (confirmed in an informal survey, cf. Beck and Sauerland 2000 for pragmatic factors in cumulativity).

(2) [Scenario: 60% of the boys each kissed one girl, a total of two girls were kissed by a boy]
a. #Most boys kissed the two girls. b. Most of the boys kissed the two girls

C. Non-partitives do not participate in cumulative readings even in environments where these are available for distributive quantifiers like *every NP*; partitives are not subject to this restriction. One such environment are sentences where the quantifier is the direct object of a transitive verb (3) (Kratzer 2003). (3) and (4) suggest that the non-cumulativity observed with non-partitives cannot be due simply to their generalized quantifier semantics (e.g. Nakanishi & Romero 2004).

(3) [Scenario: three boys between them admired every girl, though each one admired girls of a different type] Three boys admired every girl

(4) [Scenario: as above, though only 70% of the girls are admired]
a. #Three boys admired most girls b. Three boys admired most of the girls

D. There is a systematic set of exceptions to the above generalizations about the non-partitive *most*: if the bare plural complement of *most* is modified by an episodic relative clause, the non-partitive does participate in cumulative/collective readings. This is illustrated in (5), where a collective interpretation of the mixed main predicate is possible.

(5) Most people who were sitting there lifted the piano

Partitive and non-partitive *most* – The partitive and the non-partitive *most* have the same semantics: their first argument is an individual, while their second argument is a predicate (Matthewson 2001). However, there is a difference between what sorts of individuals feature in the two cases. This correlates with an observation by Cooper (1996) and Matthewson (2001) which says that sentences with non-partitive *most*-phrases tend to be generic and that *most* does not allow contextual restrictions. An example of this pattern is given in (6).

(6) a. Most linguists are millionaires (Matthewson 2001)
b. #Most linguists went to New Zealand for Christmas last year

Following Matthewson (2001), we assume that the bare plural sister of the non-partitive *most* denotes a kind, while the first argument of the partitive *most* is a regular plural individual (*of* is semantically vacuous). Since kinds are of argumental type e (Chierchia 1998), we propose that *most* has the uniform lexical entry in (7) (in the following, a superscript k for kinds is used for readability).

(7) $[\![\text{most}]\!] = \lambda x_e.\lambda P_{\langle e,\langle v,t\rangle\rangle}.\lambda e_v.\ \exists y{\leq}x.\ P(e,y) \wedge [\mu(y) > \frac{1}{2}\mu(x)]$

Finally, if a non-kind-level predicate applies to a kind, it can only be generic or a derived kind predicate (cf. Chierchia 1998 for derived kind predication). The latter option is pragmatically precluded in the cases at hand because *most dogs barked* would have the same meaning as the simpler *(some) dogs barked* (8). This explains the genericity effect with the non-partitive *most*.

(8) $\exists e.\exists y^k{\leq}dogs^k.\ \exists z[R(y^k,z) \wedge bark(e,z)] \wedge [\mu(y^k) > \frac{1}{2}\mu(dogs^k)] \equiv \exists e.\exists z.[dogs(z) \wedge bark(e,z)]$

Partitive *most* and cumulation – The cumulative/collective readings are derived using the approach to plurality developed in Kratzer (2003) in which lexical predicates are plural (** indicates cumulation). The derivation of the cumulative reading of (2-b) is illustrated in (9). Analogous derivations deliver collective readings of mixed predicates, whereby the relevant cumulated predicate is the respective activity head (cf. Brisson 1998, Nakanishi and Romero 2004). This explains the partitive data in **A**-**C**.

(9) a. [most (of) [the boys]] kiss [the two girls]
b. $\exists e.\exists y.[y \leq \iota boys \wedge **ag(e,y) \wedge **kiss(e,\iota 2girls) \wedge [\mu(y) > \frac{1}{2}\mu(\iota boys)]]$

Non-partitive *most* and genericity – It holds that when a generic predicate applies to a kind, it distributes over all its minimal realizations that are in the domain of the predicate (10).

(10) Students {∅ / mostly / always} kiss two girls
≉ When there are students, they between them (mostly) kiss two girls

This mandatory distribution to all minimal realizations of a kind – together with the characterization of the meaning of *most* (7) – is the reason why, as shown in **A**, collective readings are impossible with the non-partitive *most*. An explicit derivation is in (11): the meaning of the generic predicate is in (11-a); the truth-conditions of (1-a) are computed in (11-b), whereby the minimal realizations of a subkind of *students* that are in the domain of *lift* are atomic individuals. Derivations of non-cumulative readings with non-partitives described in **B** proceed analogously.

(11) a. $[\![\text{Gn [lift the piano]}]\!] = \lambda x_e.\lambda e_v.\forall z \forall e' \in Acc_e[R_{min}(x^k,z) \wedge in(e',z) \rightarrow **lift\_\iota piano(e',z)]$
b. $[\![\text{[most students] Gn [lift the piano]}]\!] = 1$ iff $\exists e.\exists y^k \leq students^k.\ \forall z \forall e' \in Acc_e$
$[R_{min}(y^k,z) \wedge in(e',z) \rightarrow **lift\_\iota piano(e',z)] \wedge [\mu(y^k) > \frac{1}{2}\mu(students^k)]$

The reason for the behavior of non-partitives sketched in **C** is the same. The fact that distributive generalized quantifiers can receive cumulative interpretations in such configurations (3) follows from a neo-Davidsonian association of external arguments (Kratzer 2003 for analysis).

Non-partitive *most* and non-kinds – It has been noticed that the non-partitive *most* sometimes allows a non-generic interpretation, e.g. *Most people who came to the party left early* (Matthewson 2001). We claim that this is due to the fact that the bare plural in these cases cannot denote a kind (cf. the discussion of *parts of that machine* in Carlson 1977) and is assigned a choice-functional interpretation. Correspondingly, *most* takes a regular individual argument. According to the above proposal, the collective and cumulative readings should be possible. This prediction is indeed borne out (5) and this accounts for **D**.

Dependent plurals – Zweig (2008) argued that the infelicity of (2-a) – together with the felicity of *Most boys kissed girls* in contexts where the boys each kissed only one girl – is an argument against reducing dependent readings of bare plurals to cumulative readings. The above analysis accounts for the non-cumulativity of (2-a). The 'cumulativity' of the example with the bare plural, on the other hand, follows from the genericity of the sentence and the usual number-neutral interpretation of bare plurals in generics. This explains the illusion of non-reducibility of dependent plurals to cumulative readings.

Further questions – 1. An obvious question is whether other intriguing contrasts (12) that Zweig (2008) uses to argue for the non-reduction of dependent plurals to cumulative readings could be explained in a similar way. It is suggestive that both sentences in (12) are generic.

(12) a. Seven trains leave every day to Amsterdam from this station (#cumulative)
b. Trains leave every day to Amsterdam from this station (✓dependent plural)

2. Non-partitive mass *most*-phrases are subject to a homogeneity restriction: they can only combine with predicates that are cumulative and divisive (13-a) (cf. Lønning 1987, Moltmann 1997). The partitive *most*-phrases are more lenient in this respect (13-b) (cf. Bunt 1985, Moltmann 1997 for facts with *all*). On the one hand, the homogeneity with non-partitives arguably follows from genericity and the fact that there are no cognitively relevant minimal realizations of masses (cf. Soja, Carey and Spelke 1991 and others), resulting in distribution over all the realizations. On the other hand, heterogeneous readings with partitives can be derived analogously to (9).

(13) a. #Most water contains ten grams of salt
b. [Scenario: 2 out of 3 bottles of water in front of us each contain 10g of salt]
Most of the water (in front of us) contains ten grams of salt

Selected references – Beck, S. and U. Sauerland (2000) "Cumulation is needed." *NLS* 8. Cooper, R. (1996) "The Role of Situations in Generalized Quantifiers." In: *Handbook of Contemporary Semantic Theory.* Kratzer, A. (2003) *The Event Argument and the Semantics of Verbs.* UMass. Lønning, J.T. (1987) "Mass terms and Quantification." *L&P* 10. Matthewson, L. (2001) "Quantification and the nature of crosslinguistic variation." *NLS* 9. Moltmann, F. (1997) *Parts and wholes in semantics.* OUP. Nakanishi, K. and M. Romero (2004) "Two Constructions with *Most* and their Semantic Properties." *NELS* 34. Zweig, E. (2008) *Dependent Plurals and Plural Meaning.* Ph.D. thesis, NYU.