
Mixed Comparatives: Assimilating Count Nouns to Mass Nouns

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1 Introduction

Count nouns (CNs) may sometimes have surprisingly “massy” interpretations. One extreme case is with singular CNs. A sentence like *the floor is covered in bicycle* may refer to a garage loaded with bicycle parts. This kind of interpretation is derived using the (in)famous ‘Universal Grinder’ (Pelletier, 1975), which generates a mass noun from what is normally treated as a CN. More nuanced mass-like interpretations appear for plural CNs. One example is pseudopartitives like *20kg of carpets*. Rothstein (2011, 2017) analyzes such cases using an operation that maps CNs like *carpets* to mass denotations, but without the subatomic elements characterizing lexical mass terms like *carpeting*.

Relevant but less familiar data come from *mixed comparatives* as in the following sentences:

- (1) a. Sierra Leone produces *more diamonds than gold* / *more gold than diamonds*.
- b. Bezos has *more money than friends* / *more friends than money*.

Although one of the nouns in these comparatives is a plural count noun, they involve measurement rather than counting. This contrasts with CN-only comparatives like *Sue has more friends than lovers* or *Sue has more friends than Dan*, which only involve counting. We analyze the apparent empirical conflict by considering two opposing approaches. Bale & Barner (2009) propose that CNs unambiguously specify cardinality as the measure of comparison. This proposal is satisfactory for comparatives that only contain CNs, but is problematic for mixed comparatives like (1a-b). By contrast, Rothstein’s mapping provides an analysis of mixed comparatives, but gives no immediate account of cardinality-only measuring in ‘discrete’ comparatives.

To inform the theoretical choice, we discuss three other phenomena of “massy” interpretations of plural CNs: (i) underspecified ‘how much/many’ determiners like Dutch *hoeveel* (Doetjes, 1997); (ii) the underspecified mass/count quantifier *most* (Landman, 2011); (iii) CN-based denominal adjectives, as in *Dakar is more multilingual than NYC*, where the comparison involves mass-like measuring (‘having more multilingualism’) rather than counting (‘more languages’). In all three domains, we find evidence for a mass-like interpretation of CNs. This supports Rothstein’s general approach. The apparent problem with CN-only comparatives is avoided using a standard ‘last resort’ application of type-shifting (Partee & Rooth, 1983; Cheng et al., 2008). Studying the details of the mapping, we show evidence against Rothstein’s assumption that her count-to-mass mapping should be semantically distinguished from ‘grinding’. Rather, we claim that the mass-like interpretation of CNs like *jewels* is identical to that of corresponding object mass term *jewelery*. Differences as the one between *carpets* and *carpeting* are attributed to object/material polysemy, and not to any inherent distinction in reference.

2 Mixed comparatives – measuring CNs without counting them

McCawley (1975) was apparently the first to recognize that comparatives can be used to probe into the denotations of CNs and mass nouns (MNs). More recently, this test has been profitably used in examples like the following (Barner & Snedeker, 2005; Bale & Barner, 2009):

- (2) a. Esme has more shoes/ropes than Seymour.
- b. Esme has more butter/rope than Seymour.

The experimental work by Barner & Snedeker supports the introspective judgement that while (2a) involves counting, (2b) involves non-cardinal measuring. Barner & Snedeker's experiments also show strong preference for counting with *object mass nouns* (OMNs) – MNs that intuitively refer to discrete atomic entities:

- (3) Esme has more footwear than Seymour.

Despite the grammatical mass status of *footwear*, sentence (3) semantically patterns with the CNs in (2a) rather than with the MNs in (2b). Similar results hold for OMNs like *furniture*, *clothing* and *jewelry*. From this kind of evidence, Bale & Barner (2009, pp.226-7,246-7), Wellwood (2019, p.90) and others deduce a categorical generalization:

- (4) Plural CNs and OMNs trigger counting in comparatives. Other MNs block counting and trigger non-cardinal measurement in terms of weight, volume etc.

Generalization (4) also holds in sentences like the following:

- (5) a. Esme has more shoes than socks.
- b. Esme has more butter than cream.

The prominent readings of (5a-b) involve counting and non-cardinal measurement, respectively, as expected by generalization (4).

Grimm & Levin (2012) and Rothstein (2017) argue against what (4) claims on OMN data. According to their proposals, OMNs do not require cardinality-based comparisons, and other criteria may be easily triggered by contextual factors, as in the following example by Rothstein:

- (6) John has more furniture than Bill, so he should use the larger moving truck.

Rothstein argues that the prominent interpretation of (6) involves comparison in terms of volume, not cardinality. She proposes that with all mass nouns, including OMNs, comparatives are interpreted in terms of measurement. However, for Rothstein, one of the available ways of measuring quantities is by *cardinality estimation*. On the basis of psychological evidence, Rothstein argues that cardinality estimation is different from counting: unlike counting, which is grammatically encoded in CNs, cardinality estimation is extra-grammatical, and is available with OMNs despite their non-countable grammatical status (Rothstein 2017, p.133).

Examples like (3) and (6) which constitute the center of the debate involve comparisons of referents formed using one noun. Here we also examine comparisons between CNs/OMNs and non-discrete MNs as in the following (online) examples:

- (7) a. To obtain wealth beyond measure, seek to make *more friends than money*.
 - b. The first 100 days of the Narendra Modi government offer *more worries than hope*.
 - c. Pirates' treasures usually contained *more gold than diamonds*.
 - d. While the juveniles prefer insects to greens, adults will need to eat *more vegetation than insects*.
 - e. There is around 40% *more livestock than humans*. [in a text discussing biomass]
- (8) a. Self storage is a great solution when you have *more furniture than space*.
 - b. Adorned with *more jewelery than clothing*, the former Maxim model is decked out in several pieces from her own collection.

In these examples, a non-discrete MN is compared to a CN (7) or to an OMN (8). These comparisons do not invoke counting, as the non-discrete MN is either inherently non-countable (*hope*, *gold*), or has discernable discrete elements but does not involve counting in the given context (in the context of (7f) *livestock* concerns biomass, not numbers of animals; *clothing* in (8b) focuses on measuring the model's garments collectively rather than counting specific clothes).

Sentences (7)-(8) are evidence against Bale & Barner's generalization (4). In these sentences, the only way of comparing the referents of the CNs and OMNs to a non-discrete MN is using a non-cardinal scale, which does not involve counting. Examples (8a-b) are interpreted as expected in Rothstein's and Grimm & Levin's approaches. Since an OMN is mass, their proposals allow measuring it on the basis of volume, weight or other dimensions, and not necessarily cardinality.¹ Examples as in (7) are not analyzed in these works, and our goal is to see if, and how, Rothstein's approach can be modified in order to treat them.

A priori, there are two methods we might use for measuring CN denotations:

- (i) *Measure directly*: Apply a measure function μ to the CN denotation ("place whole objects on the scales").
- (ii) *Grind first*: Map the CN denotation to a mass denotation, and then apply μ ("grind the objects and measure what you got").

In Rothstein's analysis of other measuring constructions with CNs, she rejects (i) ("at least tentatively" p.144) and opts for her version of (ii), discussed in section 4 below. Examples as in (7) are new evidence for strategy (ii) as opposed to direct measuring (i). If comparatives allowed non-cardinal measuring of CNs, we might reasonably assume it to be a free operation. That would leave us with no account of the unambiguously cardinal interpretation of sentences like (2a) and (5a). By contrast, there is ample evidence for applying 'grinding' of discrete elements as a type-shifting operation, which is only triggered as a last resort in cases where direct interpretation fails (Partee & Rooth, 1983). Specifically, Cheng et al. (2008) support such a view based on lack of 'ground' readings in Mandarin Chinese, Brazilian Portuguese and Gungbe. Below we will see comparable evidence about English. Thus, in (7) grinding must apply before comparison can take place. By contrast, in CN-only comparisons like (2a) and (5a) the comparative employs the default counting strategy, and no 'grinding' is triggered.

We should note that non-cardinal measurement in mixed comparatives does not prevent CNs from supporting ordinary counting within lower syntactic levels. Consider for instance the mixed comparative in the following example:

- (9) A king is worthy of *more gold than these few trinkets*.

In (9), the common noun *trinkets* licenses the count quantifier *few*, but the referent of *these few trinkets* is compared in terms of the gold it contains, without any counting of trinkets. Thus, mixed comparatives do not undermine Bale & Barner's standard assumption that CNs *denote* atomic entities; they only stand in the way of their assumption that comparatives with CNs obligatorily involve counting.

3 Other cases where CN denotations are (not) measured

This section briefly reviews other constructions where CN denotations are measured, as well as cases where they might be measured but are not. This will serve as a background for the theoretical conclusions in section 4.

¹Cases like *Esme has more equipment than furniture* (cf. (5)) are another challenge for generalization (4). Such cases do not require counting, apparently not even as a preference, although both MNs are OMNs. The semantics of OMNs is not our focus here, but this is another piece of evidence for the Grimm & Levin/Rothstein approach.

3.1 Pseudopartitives

Rothstein (2017:p.143) argues that pseudopartitives with CNs (*five kilos of books*) are interpreted similarly to MNs (*five kilos of rice*). She attributes the unacceptability of *#five kilos of three books* to the requirement that measure phrases like *five kilos* take a mass complement. However, Rothstein does not explain what blocks her grinding operation from applying to NPs like *three books*. Furthermore, in (9) we saw that a grinding operation is needed for *these few trinkets*. We conclude that the unacceptability of *#five kilos of three books* should better be derived by syntactic considerations, and not by restricting the grinding operation to bare nouns.

3.2 Underspecified determiners

Question words like Dutch *hoeveel* (Doetjes, 1997) are possible with both CNs and MNs (wit. *hoeveel boeken/geld heb je* ‘how many books/how much money do you have’). When used in embedded questions, *hoeveel CN* strongly prefers counting over measuring. For instance:

- (10) Jan weet hoeveel boeken Piet heeft
Jan knows how many/much books Piet has
“Jan knows how many books Piet has”

In (10) Jan must know the number of Piet’s books. If Jan knows that Piet has five boxes or five kilos of books but does not know their exact number, sentence (10) becomes deviant. A similar fact is observed with the interpretation of the unspecified determiner *most (of)*, as in the following examples by Rothstein (2017, p.123, following Landman 2011):

- (11) a. In terms of volume, most livestock is cattle.
b. #In terms of volume, most farm animals are cattle.

Unlike the OMN *livestock*, non-cardinal measuring in (11) is odd with the CN *animals*. Thus, as in (10), an underspecified determiner requires cardinal measuring when combined with a CN.

3.3 Denominal adjectives

Adjectives like *multicultural*, *monolingual*, *polycentric* and *monosyllabic* are gradable and are often used with a non-discrete scale:

- (12) a. Is the U.K. *more multicultural* than America? The US may well have a higher percentage of different races [than the UK] but that it is only part of how multiculturalism works.
b. A flat rank-size distribution is *more polycentric* than a steep one.
c. Australia is far *more monolingual* than it really should be.

These examples show that despite their naive “count-based” semantics (e.g. *multicultural* \approx ‘involving many cultures’), CN-based denominal adjectives have dense scalar interpretations, a property which is cross-linguistically associated with mass measurement (Francez & Koontz-Garboden, 2017; Wellwood, 2019).

4 Unifying massy denotations

We have seen some cases where CNs receive a mass-like interpretation, and other cases where they could in principle receive such an interpretation but do not. To summarize:

Mass-like interpretation: mixed comparatives (*more friends than money*), singular mass environments (*much rabbit*), pseudopartitives (*five kilos of books*), denominal adjectives (*multilingual*).

No mass-like interpretation: CN-only comparatives (*more shoes than socks*), underspecified determiners (*most animals*).

What is common to the cases with mass-like interpretations is that any count-interpretation is ruled out syntactically and/or semantically. For instance: *much* is a mass determiner, hence a counting interpretation of *much rabbit* is ruled out; in *more friends than money*, counting friends would not give us a semantically well-defined comparison with the non-countable noun *money*. A similar point holds for pseudopartitives and denominal adjectives, where measure phrases and dense scales require mass denotations. By contrast, with CN-only comparatives and underspecified determiners, counting is both syntactically and semantically licensed. This generalization supports using ‘grinding’ as a last-resort operation, in the spirit of Partee & Rooth.

How is grinding to be defined? Rothstein (2017) proposes two grinders. One operator is for mass usages of singular CNs like *much rabbit* (‘GRIND’, p.192), which is triggered by coercion (p.183). Another shifter is used for deriving mass denotations of plural CNs, with triggering mechanisms that are not fully described (‘SHIFT’, p.144). Without giving many technical details here, it is important to note an important difference between these two operators: while the GRIND operator leads to subatomic parts of individuals, the SHIFT operator only erases the individuation of the entities in the CN denotation. In Rothstein’s system, as in (Chierchia, 1998), mass denotations have atomic parts, but their individuating criteria are invisible to grammar. Rothstein models individuation using a contextual index k . Thus, for the noun *bicycle* with a count denotation $\{a_k, b_k\}$ containing two bicycles, we have:

- The minimal parts of $\text{GRIND}(\{a_k, b_k\})$ are $a_k^1, \dots, a_k^n, b_k^1, \dots, b_k^m$, where for each $i \leq n$ and $j \leq m$: a_k^i is a minimal part of the bicycle a_k , and b_k^j is a minimal part of the bicycle b_k .
- The minimal parts of $\text{SHIFT}(\{a_k, b_k\})$ are only a and b , with the contextual individuation removed.

Rothstein does not give any clear linguistic motivation for this distinction between GRIND and SHIFT, and between the two different “massy” denotations that they derive for CNs. For the sake of measuring CNs, either operation will do.

Additionally, Rothstein assumes that CNs must be referentially distinguished from corresponding OMNs: while OMN denotations are directly derived from the noun’s root, CN denotations are context dependent, and may constitute a subpart of the OMN denotation. The motivation for this third kind of “massy” denotations comes from MNs like *carpeting* and *fencing*, which can refer to the material from which carpets and fences are made (Rothstein 2017:p.111). In Rothstein’s system a room may contain *more carpeting than carpets*, and a yard may contain *more fencing than fences*. However, this prediction only intuitively describes a restricted class of OMNs, as witnessed by the infelicity of the following examples:

(13) #The room contains more *hair* than *hairs*/more *rope* than *ropes*/more *jewelry* than *jewels*.

The sentences in (13) are contradictory. This goes against Rothstein’s idea that CNs must be referentially distinguished from corresponding OMNs. Instead, we propose that OMNs like *carpeting* and *fencing* involve a lexeme-specific polysemy, which allows them to refer to either individual entities or material that can be used for making them. Thus, we converge on two general principles, which give rise to a more parsimonious setup of Rothstein’s system:

- (i) There is only one grinding operator from count to mass. This operator can be either SHIFT or GRIND, or a variation thereof, depending on your favorite mass ontology.
- (ii) All roots initially have mass denotations. CN denotations are (context-sensitive) discrete divisions of the same stuff referred to by their root, as well as any MN that is regularly derived from it.

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