

Counting, Measuring and the Interpretation of Classifier Phrases.

1. Introduction: This paper argues that the mass/count distinction between nouns reappears at the level of the classifier phrase, and shows up in the contrast between individuating and measure readings of phrases like *two boxes of sand/books*. On the individuating reading, this phrase has count semantics and on the measure reading, it has mass semantics. This ultimately supports the analysis of the count/mass distinction as a typical distinction, as in Rothstein (2010).

2. The issue: It has long been noticed (e.g. Doetjes 1997, Chierchia 1998, Landman 2004) that classifier phrases are ambiguous between individuating (1a) and measure readings (1b); the measure use of the classifier has an interpretation equivalent to the explicit *N+ful* (1c):

- (1) a. Mary, bring two glasses of water for our guests!
- b. Add two glasses of water to the soup!
- c. Add two cups(ful) of wine to the soup.
- d. Bring two cups(#ful) of wine for our guests.

On the individuating reading, *two glasses of water* denotes actual glasses containing water. On the measure reading *two glasses of water* denotes quantities of water to the measure two glasses. Rothstein (2009) gives compositional interpretations for these readings. On the individuating reading, *glasses* is a count relational nominal, taking an internal argument to which it assigns the thematic role CONTAIN. The structure of the individuating classifier phrase is (2a) and the interpretation is (2b). The count noun *glasses* is head of the phrase.

- (2) a. $[[\text{two}]_D [[\text{glasses}]_N [\text{of} [\text{water}]]_{PP}]_{NP}]_{DP}$
- b. $[[\text{two glasses of water}]] = \lambda x. \text{GLASSES}(x) \wedge \text{CONTAIN}(x, \text{WATER}) \wedge \text{CARD}(x) = 2$

On the measure reading, *glasses* is analysed as an explicit measure phrase like *kilo*, which is analysed in Krifka 1989 as a function from numbers to predicates (3a), which then shifts to the predicate modifier reading (3b). Assume that the mass noun denotes a kind, which shifts in this context to the set of instantiations of this kind (Carlson 1977, Chierchia 1998). The measure classifier phrase then has the structure in (4a), and the interpretation in (4b).

2 glasses is a modifier, and the mass noun *water* is head of the phrase.

- (3) a. $\text{kilo} = \lambda n \lambda x. \text{MEAS}(x) = \langle n, \text{KILO} \rangle$; $2 \text{ kilos} = \lambda x. \text{MEAS}(x) = \langle 2, \text{KILO} \rangle$
- b. $\lambda P \lambda x. P(x) \wedge \text{MEAS}(x) = \langle 2, \text{KILO} \rangle$
- (4) a. $[\emptyset [[2 \text{ glasses}]] [(of) \text{water}]_N]_{NP}]_{DP}$
- b. $\lambda x. \cup \text{WATER}(x) \wedge \text{MEAS}(x) = \langle 2, \text{GLASS} \rangle$

These structures are supported empirically by data in English, Russian and Modern Hebrew. This analysis predicts two things. (i) Since the count noun *glass(es)* is head of the individuating classifier phrase in (2), these individuating phrases should have a count interpretation and behave grammatically like count nominals. In (3/4), the mass noun is the head of the phrase and the whole phrase is mass. (ii) Since *2 kilos* and *2 glasses* in (3/4) are modifiers of mass nouns, the analogous phrases *2 kilos of books* and *2 boxes of books* (on its measure reading) should also be mass, and *books* must have a mass noun interpretation.

3. In support of these predictions: We show that both predictions are correct by applying the tests which distinguish count from measure (i.e. mass) readings to the classifier phrases.

(i) **count readings of classifier phrases are modified by many, measure readings by much.**

- (5) a. Not many of the twenty bottles of wine that we bought were drunk/opened.
- b. Not much of the twenty bottles of wine that we bought was drunk/#opened.
- (6) a. I have (not) read many of the ten boxes of books that we sent.
- b. I have not read much of the ten boxes of books that we sent.

(5a) has the count reading, in which the 20 bottles of wine are individuated. In (5b) *much of the 20 bottles of wine* makes reference to the quantity of wine. The same meaning difference shows up in (6). Note that (6a) and (6b) are not truth-conditionally equivalent. If most of the boxes are small and have a few books in them, and only some of the boxes have a lot of

books in them, then *I have not read many of the ten boxes of books* does not entail (6b), and the converse entailment does not hold either.

(ii) predicate selection is sensitive to the measure/individuating contrast.

In (5a), the classifier phrase denotes individual bottles of wine, and *was opened* can be predicated of it since it denotes a property of individual containers of wine. In (5b) the classifier phrase denotes quantities of wine and *opened* is not a possible predicate.

(iii) reciprocal resolution and other distributive phenomena.

In English, reciprocals take plural count nouns, but not mass nouns, as antecedents:

- (7) a. The shoes bumped against each other in the suitcase.
b. #The footwear bumped against each other in the suitcase.

On the count reading, the classifier phrase is the antecedent for the reciprocal. In (8a) the antecedent for *each other* is *20 boxes of flour*, and in (8b) it can only be *42 boxes of books*.

- (8) a. 20 boxes of flour were piled on top of each other.
b. 42 boxes of books were piled on top of each other on the shelves. (Antecedent = the boxes. Only reading: the boxes are on top of each other.)

When the classifier phrase is a measure phrase, then neither the classifier phrase nor the complement nominal (by hypothesis a mass noun) can be antecedents for the anaphor.

- (9) a. #Twenty litres of wine are standing next to each other on the shelf.
b. #Twenty kilos of books are lying on top of each other on the floor.
c. 20 boxes of books stood next to each other on the shelves. (Antecedent = the boxes)
d. #3 boxes of books were piled on top of each other on different shelves.

(9a/b) are infelicitous unless in (9a) we use litres to refer to litre bottles). In (9c/d) only the count reading is possible. (9d) is infelicitous because it is contradictory: three boxes cannot both be top of each other and on different shelves.

4. The analysis: Individuating classifier phrases are headed by relational count nouns; their count status is explained. The mass status of *two glasses/litres of water* is also explained, since the phrase is headed by the mass noun *water*. The problem is the mass status of *two kilos/boxes of books*, where *books* has apparently shifted to a mass interpretation. We analyse this as follows: Unlike mass nouns, which denote kinds, count nouns are inherently predicates. Following Rothstein (2010), we take count nouns to be predicates denoting sets of pairs consisting of entities and an index k indicating the counting context in which they count as atoms. They are of type $\langle d \times k, t \rangle$, and show up as such in all non-bare contexts, e.g. *two books*. As bare plurals, they have a kind interpretation, of the same type as mass nouns. In *two boxes of books*, *books* denotes the kind expression BOOK which shifts to the predicate \cup BOOK, the set of instantiations, or quantities of books. This is of type $\langle d, t \rangle$, and thus a mass predicate like \cup WATER in (4b), and distinct from the count reading at type $\langle d \times k, t \rangle$. This is why measure expressions take only bare nouns, as complements: *three boxes of ten books* has only the count reading and **three kilos of ten books* is ungrammatical.

5. Numerical partitives: Numerical partitives occur with count nouns but not mass nouns e.g. *three of the pieces of furniture*/**three of the furniture(s)*. Surprisingly, we find examples like (10) with the number *three* apparently modifying the mass nominal *six kilos of flour*.

- (10) We have used *three of the six kilos of flour*.

We argue that (10) is analysed with an implicit measure expression following *three*, and thus has the interpretation *three kilos of the six kilos of flour*. This means that the mass expression *the six kilos of flour* is not modified by the number *three* but by the measure predicate of mass expressions *three kilos*. Support for this comes (11a), where the explicit measure expression is obligatory, and from (11b), where higher and lower measure expressions are not identical. Details of the compositional analysis are given in the paper.

- (11) a. Two *(kilos) of the flour that I bought are left over.
b. 50 kilos of the 2 tons of coal that we bought was unusable.