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COUNTING, MEASURING AND THE SEMANTICS OF CLASSIFIERS

ABSTRACT: This paper makes two central claims. The first is that there is an intimate and non-trivial relation between the mass/count distinction on the one hand and the measure/individuation distinction on the other: a (if not the) defining property of mass nouns is that they denote sets of entities which can be measured, while count nouns denote sets of entities which can be counted. Crucially, this is a difference in grammatical perspective and not in ontological status. The second claim is that the mass/count distinction between two types of nominals has its direct correlate at the level of classifier phrases: classifier phrases like *two bottles of wine* are ambiguous between a counting, or individuating, reading and a measure reading. On the counting reading, this phrase has count semantics, on the measure reading it has mass semantics.

1. INTRODUCTION

This paper explores the syntax and semantics of counting and measuring, extending the results of Rothstein (2009, 2010), and showing that these together make some perhaps suprising predictions about the interpretation of classifier expressions, which nonetheless seem to be empirically supported. In Rothstein (2009), I argued that measure and

counting readings of classifier expressions such as *two bottles of wine* have different syntactic structures and different compositional interpretations. I argued, based largely on evidence from Modern Hebrew, that on the measure interpretation *two bottles of wine* has the syntactic structure [[two bottles](of) [wine]]. The mass noun wine is the head of the phrase, and the expression *two bottles* is an intersective predicate which denotes the set of entities whose quantity equals the quantity usually contained in two standard bottles (of wine).[1] Measure predicates of this kind thus express dimensional properties of quantities. The count interpretation of *two bottles of wine* has the syntactic structure [two [bottles (of) wine]]. Here, the count noun *bottles* is the head of the phrase, and *wine* is the complement of the head. The numerical two is a modifier and gives the cardinality of the plural entities in the denotation of *bottles of wine*, the phrase that it modifies. A consequence of this account, which was not discussed in my earlier work, is that in measure classifier phrases, the classifier is semantically the head only of the measure predicate and not of the nominal itself, while the semantic head of the measure classifier phrase is a mass noun. This is on the face of it surprising, since, along with expressions like *two bottles of wine* and *two litres of wine*, we also have measure expressions like *two kilos of books*, *two boxes of books*, which look as if they are headed by the plural count noun *books*. I shall show however, that there is good reason to argue that predictions of the original analysis are correct, and that in these expressions, *books* behaves like a mass noun. If we pursue this idea, we see that an expression like *books* though naturally count (in English) can in certain circumstances shift to a mass interpretation. This strengthens the case for the often cited slogan that the mass/count distinction is a grammatical distinction and not a conceptual or real world distinction: we show that the normal count interpretation of *books* and the type shifted mass interpretation of *books* are two different ways of presenting the same 'real world' objects: the mass presentation gives us access to quantities of books, where the overall dimensions of the quantity (but not of the individual books) can be measured, while the count presentation gives us access to sets of plural individuals, in which case the number of atoms in each plural individual can be counted. This allows us a new perspective on the contrast between mass nouns and count nouns: mass nouns denote entities in a way which allows them to be measured, while count nouns present them grammatically in a way which allows them to be counted.

The structure of the paper is as follows. In the next section, I review the results of Rothstein (2009), and show why measure and individuating, or counting, interpretations of *two bottles of wine* have different structures. In section 3, I show that there is good reason to argue that individuating uses of the classifier expressions have the semantics of count nouns, while measure interpretations of the same expressions have the semantics of mass nouns, even when headed by nouns like *books*. In section 4, I give a semantic analysis of the interpretation of these two types of classifier expressions in the framework of Rothstein (2010), in which the measure/count interpretations of classifier phrases differ in such as way as to make explicit the mass semantics of measure classifier phrases and the count semantics of individuating classifier phrases. In section 5, I briefly discuss partitive measure constructions such as *three of the six kilos of flour that we bought*, and in section 6 I draw some conclusions and mention a number of open questions for further research.

2. INDIVIDUATING AND MEASURE READINGS OF CLASSIFIER CONSTRUCTIONS

2.1. Data

In typical mass/count languages, numeral modifiers modify count nouns directly. In many languages, with numerals greater than *one* the nominal is marked as plural as in (1):

(1) three flowers/four books/∗three flour(s).

Classifiers, that is expressions which occur as heads of pseudopartitives, like *box(es) of N, cup(s) of N* are used to count mass nouns (2):

(2) ∗three flours vs. three cups of flour

Measure expressions, which occur in the same configurations, may also be used to count mass nouns (3):

(3) three kilos of flour

Quantities of plural nouns can be counted, as in (4), where the classifier is used to ‘repackage’ pluralities into higher order entities which can then be counted:

(4) three boxes of books, three kilos of books

Now, it has often been observed, (Selkirk (1977), and more recently in Carlson (1997), Chierchia (2008), Landman (2004) and others) that classifier phrases like *two glasses of water* are ambiguous between an individuating reading, which is illustrated in (5a) and a measure reading illustrated in (5b):

(5) a. Mary, bring two glasses of water for our guests!
b. Add two glasses of water to the soup!

On the individuating reading in (5a), the speaker asks Mary to bring two different glasses filled with water. On the measure reading in (5b), the speaker instructs the listener to add to the soup water in a quantity equal to twice that contained in a standard glass. If Mary brings a bottle containing water in that quantity in response to (5a), or if she puts two glasses full of water in the soup in response to (5b), then she has radically misunderstood the instructions.

The two different uses of the expression *two glasses of water* can be disambiguated contextually, as (5) in fact showed, and can also be disambiguated linguistically. Here, I give three tests for disambiguating the two readings. The first test is lexical. On the measure reading, the suffix *-ful* can be added to the classifier, while on the counting reading this is infelicitous.

(6) a. #Bring two glassfuls of wine for our guests.
b. Add two glass(ful)s of wine to the soup.

The second test is that distributive markers can be felicitously added to a predicate which is predicated of a classifier phrase on its counting use, but not with a classifier phrase used in a measure sense. We illustrate this with the distributive marker *each*:

(7) a. The two glasses of wine on the tray cost 2 Euros each.
b. #The two glasses of wine in this soup cost 2 Euros each.

The third test comes from relative clause formation, as discussed in Carslon (1977a), Heim (1987), Grosu & Landman (1998)). In English, relative clauses denoting sets of individuals can be headed by *that* or *which*, while relative clauses denoting quantities are headed only by *that*. *Bottle* as a classifier is naturally ambiguous between an individuating and a measure reading and thus either complementiser is acceptable, as shown in (8a). However, when the complementiser *which* is used, only the individuating/counting reading is possible. In contrast to the nominal classifier *bottle*, the term *litre* naturally has only a measure reading, therefore only a relative clause headed by *that* is acceptable, as in (8b). And since bottles of wine can only be drunk once, (8c) can have only the measure reading while (8d) is infelicitous:

(8) a. I would like to be able to buy the bottles of wine that/which they bought for the party. (ambiguous)

b. I would like to be able to buy the litres of wine chat/∗which they bought for the party.

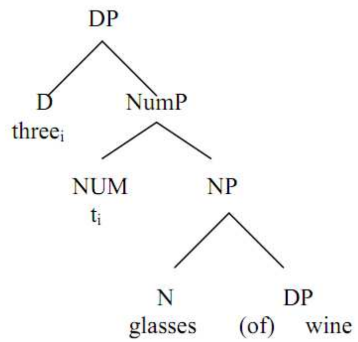
c. It would take us a year to drink the bottles of wine that they drank that evening.

d. #It would take us a year to drink the bottles of wine which they drank that evening.

2.2. Analysis (based on Landman 2004)

Having established that there really are two different readings of these classifier phrases, we examine what the syntactic structures of the two readings are. On the individuating reading: *two glasses of wine* denotes actual glasses containing wine, while on the measure reading: *two glasses of wine* denotes wine to the measure two glasses. Under the natural assumption that the head of the nominal phrase determines what entity/entities the phrase denotes, we assume that in the individuating reading, glasses is the nominal head of the phrase, as in (9)

(9)

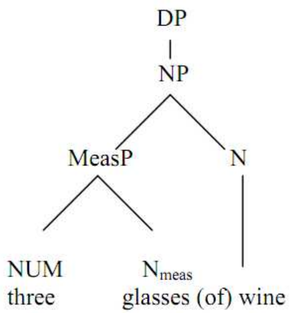


Following Landman (2003, 2004), we assume that the numeral is essentially adjectival, and is generated in NUM, raising to the determiner position if this head is empty. Landman (2003) shows that if the determiner is filled, and the adjective does not need to raise, permutation with other adjectives is possible:

(10) We sent the ferocious three lions to Blijdorp and kept the mild three lions at Artis.

However, in the measure reading, the nominal denotes quantities of wine, and *two glasses* is a modifier giving the property that the relevant quantities of wine have. The term *glasses* is analogous to explicit measure phrases such as *litre* and *kilo*. Landman (2004) argues that these expressions are of type <n, <d, t>> (where d is the type of individual entities and n is the type of numbers). So measure phrases like *kilo* combine first with the numeral to form a predicate which shifts to the modifier type and modifies the nominal head. Thus is illustrated in (11): *glasses* combines first with the numeral *three* (which does not raise) to form the expression *three glasses*, and this complex modifier then applies to the nominal head *wine*:

(11)



In both (9) and (11), *of* -insertion is a late phenomenon satisfying (not well understood) surface constraints.

Assuming that interpretation is compositional, these structures suggest the following natural interpretations:

The head of the DP phrase in (9) is the noun *glasses*. We assume that singular count nouns are predicates denoting sets of entities, thus *glass* denotes GLASS, the set of singular glasses. Following Link (1983), the plural noun *glasses* denotes the set of pluralities PL(GLASS) = GLASSES. This is derived from GLASS via the plural operation PL(P) = $\{x: \exists Y \subseteq P: x = \sqcup Y\}$. Thus GLASSES is the set $\{x: \exists Y \subseteq \text{GLASS}: x = \sqcup Y\}$, or equivalently the function $\lambda x.\exists Y \subseteq \text{GLASS}: x = \sqcup Y$. In (9) the complement of *glasses* is the bare nominal *wine*. We assume that the bare NP is an argument expression denoting the kind, type **k**, following Carlson (1977b), Chierchia (2008), and that a kind-denoting expression may shift to a predicate interpretation via the $^{\cup}$ operation, which maps kinds onto the set of (singular and plural) entities which instantiate the kind. Thus *wine* denotes the kind $\text{WINE}_{\mathbf{k}}$ and $^{\cup}\text{WINE}_{\mathbf{k}}$ denotes the set of quantities of wine. Since *wine* is the complement of head noun *glasses*, glasses must type shift into a relational meaning, via a type-shifting operation REL. REL shifts the function $\lambda x.\exists Y \subseteq \text{GLASS}: x = \sqcup Y$ into the relational container-noun meaning, $\lambda z \lambda x.\exists Y \subseteq \text{GLASS}: x = \sqcup Y \wedge \text{CONTAIN}(x,y)$. We assume that this function can apply to kinds as well as other sorts of individuals. We further assume that the CONTAIN relation is distributive. An entity stands in the contain relation to a kind $P_{\mathbf{k}}$ if all its atomic parts contain instantiations of the kind. The interpretation of (9) is as follows:

(i) *interpretation of individuating classifier phrases based on (9)*

[[glasses]] = GLASSES = $\lambda x.\exists Y \subseteq \text{GLASS}: x = \sqcup Y$.
[glasses of wine]] = [[glasses]] ([[wine]]) = GLASSES($\text{WINE}_{\mathbf{k}}$) =
(REL(GLASSES)) ($\text{WINE}_{\mathbf{k}}$) =
$\lambda z \lambda x.\exists Y \subseteq \text{GLASSES}: x = \sqcup Y \wedge \text{CONTAIN}(x,z)$ ($^{\cup}\text{WINE}_{\mathbf{k}}$) =
$\lambda x.\exists Y \subseteq \text{GLASSES}: x = \sqcup Y \wedge \text{CONTAIN}(x,z) \wedge x \in {}^{\cup}\text{WINE}_{\mathbf{k}}$[[three glasses of wine]] =
$\lambda x.\exists Y \subseteq \text{GLASSES}: x = \sqcup Y \wedge \text{CONTAIN}(x,z) \wedge x \in {}^{\cup}\text{WINE}_{\mathbf{k}} \wedge \text{CARD}(x) = 3$

i.e. the set of entities in GLASSES which have three atomic parts all of which contain instantiations of the WINE kind.

(ii) interpretation of measure classifier phrases based on (11)
We assume that a scale is a triple, <Dim, U, n>, where the first element is a dimension (volume, weight, price, etc.), the second element is a unit in which the particular dimension is calibrated (*litre, kilo, euro*, etc.) and the third is a number. Measure values, defined for a particular scalar dimension, are ordered pairs <U,n>, with U the unit of measurement in which the scale is calibrated and n a numerical value for the number of units. The measure value thus indicates a position on the dimensional scale. Measure expressions such as litre combine with a number to give a measure property, the property of having a particular measure value on a certain dimensional scale. Thus *litre*, defined for the scale of volume, is of type <n,<d,t>> and combines with a number to give the measure property of having the value n litres on the scale of volume. Plural marking on the measure word *litre*, is not semantic, which is to say that the plural marked is not semantically interpreted, but is an agreement phenomenon.

[[*litre*]] = $\lambda n \lambda x.\ \text{MEAS}_{\text{volume}}(x) = \langle \text{LITRE}, n \rangle$
[[*3 litre*]] = $\lambda x.\ \text{MEAS}_{\text{volume}}(x) = \langle \text{LITRE}, 3 \rangle$

(We will usually omit the dimension subscript in what follows.) In expressions such as *three glasses of milk*, the noun *glass* is being used as a measure expression, analogous to *litre* and it is thus of <n,<d,t>>.

The measure expression glass combines first with a number word to form a predicate, and this then applies to a predicate nominal head via standard intersective modification operations.

We assume that the basic lexical entry of glass is a predicate denoting the set of glasses as in (9). The operation which turns *glass* from a one-place predicate nominal to a measure expression is introduced either explicitly by *-ful* or by a null correlate of *-ful*.[2]

$[[\text{Glass(ful)}]] = \lambda n \lambda x.\text{MEAS}_{\text{volume}}(x) = \langle\text{GLASS}, n\rangle$
$[[\text{three glasses}]] = \lambda x.\text{MEAS}_{\text{volume}}(x) = \langle\text{GLASS}, 3\rangle$
$[[\text{three glasses of wine}]] = \lambda x.x \in {}^{\cup}\text{WINE} \wedge \text{MEAS}(x) = \langle\text{GLASS}, 3\rangle$

Glass(ful) denotes a function from numbers into a measure predicate. The measure predicate *three glasses* denotes (the characteristic function of) the property of having the measure value <GLASS, 3> on the scale of volume. *Three glasses of wine* denotes the set of quantities of wine which have this measure value.

2.3. *Syntactic support for this analysis*

There is some explicit syntactic support for this analysis based on adjectival modification facts.

Normally, adjectival modifiers come between the determiner and the nominal head, as in *a blue car, the heavy book*. If on the individuating reading, the classifier is a nominal head and the number is a determiner, we expect an adjectival modifier to be felicitous in a position between the number and the classifier, as illustrated in (12a). On the measure reading, where Num+N is a measure predicate, we do not expect an intervening adjective to be felicitous. This also seems to be correct, as (12b) shows.

(12) a. The waiter brought three expensive glasses of cognac.
b. #She added three expensive glasses(ful) of cognac to the sauce

Conversely, when Num+N form a complex measure predicate, we predict that this complex measure predicate can scope under another adjective. In an individuating construction this isn't possible:

(13) a. You drank/spilled an expensive three glasses of wine!

b. #The waiter brought an expensive three glasses of wine!
c. An expensive ten seconds of silence on the international telephone line followed. (Sarah Caudwell: *Thus was Adonis Murdered*)

While these facts are quite convincing, even clearer evidence in support of the two different structures for the two different readings comes from Modern Hebrew. This is discussed in detail in Rothstein (2009), and I will only summarise the discussion here.

In Modern Hebrew classifier expressions are associated with two different syntactic structures, an absolute, or free genitive (FG) form, illustrated in (14a), and a construct state (CS) construction illustrated in (14b). (14a) seems to be parallel to the English *glasses of wine* construction.

(14) a. šloša bakbukim šel yayin
three bottles of wine
b. šloša bakbukei yayin
three bottles wine

However, while the construct state construction in (14b) is ambiguous between the individuating and the measure reading, the free genitive in (14a) is associated only with the individuating reading. This is clear from the interpretations available for (15):

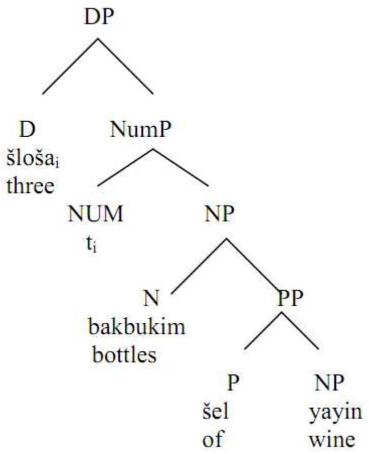
(15) ha-im yeš od marak?
Q there more soup?
"Is there more soup?"
ken, yeš od **šaloš ka'arot marak** / #**šaloš ka'arot šel marak**
Yes, there more three bowls soup (CS) three bowls of soup(FG)
ba -sir
in-DEF- pot
"Yes there are three more bowls of soup in the pot"

The free genitive form would be natural in the following context, where the individual bowls filled with soup are actually present:

(16) ken, yeš od **šaloš ka'arot šel marak** al ha-magaš
Yes, there more three bowls of soup on DEF-tray
"Yes there are three more bowls of soup on the tray"

We assume that the free genitive construction is a variant of the structure in (9):

(17)



The crucial difference between (17) and (9) is that in Hebrew *šel* is a real preposition and projects a node in the tree. It is semantically interpreted, and expresses a thematic relation between the nominal *bakbukim* and the complement *yayin*. Unlike English *of*, it cannot be used to mark grammatical complements in partitive constructions, and in complex nominal constructions it can only express a restricted range of thematic relations, including possession and containment (for details see Rothstein 2009).

But now we can explain why Free Genitive classifier constructions have only the individuating reading. If *šel* is a genuine preposition expressing a genuine thematic relation between the head and the complement, then the nominal must be interpreted as a relational head, and thus (17) is the only syntactic structure available for the phrase, and only the individuating or counting interpretation is possible.

The construct state contrasts with this. The syntax of the construct state has been discussed in detail by many researchers (e.g. Ritter 1991; Borer 1999, 2008; Shlonsky 2004, Danon 2008). In its simplest form, it is essentially a structure in which two bare nouns form a "syntactic word", which we can represent crudely as $[N_1\ N_2]$.[3] Certain morphosyntactic features characterise this syntactic word, in particular there is phonological reduction on the N_1, modifiers of N_1 must follow the whole syntactic word and cannot intervene between N_1 and N_2,

and definiteness is marked only on the N2 but percolates to the whole phrase, as in (18). The relation between the two Ns is only partially determined. When N_1 is head and N_2 is a complement, the thematic relation is underdetermined, and (18a) is several ways ambiguous, with *ha-rofe* interpreted as theme or agent, as it is in English.

(18) bedikat ha-rofe
examination the-doctor
"the examination by/of the doctor"

However, the underspecification is not restricted to the nature of the thematic role. Borer shows that the complement in the construct state can be interpreted as a modifier of the head, as in examples such as (19a)–(19b). (19c) is ambiguous between a reading in which N_2 is interpreted as the possessor, and a reading in which N_2 is a modifier giving the purpose of the room. This latter use is illustrated in (19d):

(19) a. bet ha-etz
house DET-wood
"the wooden house"

b. ananey ha-noca/ ananey ha-noca/
clouds feather/clouds DEF-feather
"feather-like clouds/the feather-like clouds"

c. xeder ha-morim
room DEF teachers
the teachers' room

d. yeš po heder morim ve-xeder studentim.
there here room teachers and-room students
"There is here a room for teachers and a room for students."

Borer argues that in these modificational construct state forms, N_2 is an NP, rather than a DP. While she does not discuss the interpretation of the NP, it is reasonable to assume that it is interpreted as a predicate. According to her tests, N_2 in classifier construct state forms is also an NP.

However, the ambiguity between individuating and measure readings which we can see in construct state classifier constructions is different from the ambiguities in (18) and (19). We look again at example (14b), *šloša bakbukei yayin*, "three bottles of wine". Rothstein (2009) argues that on the individuating reading, classifier constructions in the construct state form should be analysed with N_1 interpreted as head and N_2 interpreted as complement thematically related to the head by the thematic CONTAIN relation. Thus on the individuating reading of (20), illustrated in (20a), N_1, *bakbukey*, is the head and N_2, *yayin*, is the complement. On the measure reading, however, the syntactic word can be reanalysed with N_2 as the head. Thus on this reading, illustrated in (20b), N_2, *yayin*, is the head, while *šloša bakbukey* is a complex modifier of the head. Since, according to Borer's tests, N_2 in these constructions is a predicate nominal, there is no problem interpreting the construction as modificational in this way:

(20) šloša bakbukey yayin
three bottles wine

a. Individuating reading
[šloša [bakbukey$_{HEAD}$ yayin$_{COMPLEMENT}$]]
[3 [bottles wine]]

b. Measure reading:
[[šloša bakbukey$_{MODIFIER}$][yayin$_{HEAD}$]]
[[3 bottles] wine]

These are the structures required to get the interpretations for the individuating and the measure readings proposed in section 2.2.

This account of the interpretation of the construct state makes a strong prediction, namely that if it is impossible to construe the Number + N_1 as a complex predicate which modifies N_2, the measure reading will be impossible. This prediction is born out in two ways:

First, we look at definite numerical construct state constructions, which contrast syntactically with the indefinite numerical constructions which we have been discussing so far. In indefinite numerical construct state constructions, such as (20), or the even simpler numerical construction in (21), the number word modifies its sister, as it does in English.

(21) šloša bakbukim
three bottles
"three bottles"

However, with definite numerical expressions, things are different. The only way to construct definite numerical expressions such as "the three bottles" is via a construct state form headed by the numerical:

(22) šlošet ha-bakbukim
3 DEF-bottles
"the three bottles"

These numerical-headed construct states have all the properties of nominal-headed construct states: the head *šlošet* is phonologically reduced, definiteness is marked on N_2 and percolates to the whole expression, and no material may intervene between the number-head and its complement. When the definite numerical is part of a classifier construction, as in the Hebrew equivalent of *the three bottles of wine*, the number word not only heads a construct state form, but takes an embedded classifier construct state as a complement:

(23) šloša bakbukey yayin
three bottles wine

a. šlošet bakbukey$_{N1}$ ha-yayin$_{N2}$
three bottles DEF-wine
"The three bottles of wine"

b. [šlošet [bakbukey$_{N1}$ ha-yayin$_{N2}$]]
3 bottles DEF-wine

The syntactic analysis for (23a) can only be as in (23b), that is *bakbukey ha-yayin* must be analysed as a constituent which is the complement of the numerical head *šlošet*. In such a structure, it is not possible to analyse *bakbukey* "bottles" as a measure expression which takes the number word as a sister and combines with it to form a complex predicate. And, as predicted, only the individuating and not the measure reading of (23) is available. (24) gives a context in which the desired definite measure reading is impossible in Modern Hebrew, but possible in English:

(24) hizmanti esrim orfim ve- hexanti esrim ka'arot marak be- sir gadol.
I invited twenty guests and I prepared twenty bowls soup in- pot big
"I invited twenty guests and I prepared twenty bowls of soup in a big pot"

rak šiva-asar orxim higiu, ve- nišar marak le-šloša anashim
only seventeen guests came, and was left soup for three people
#**šaloš ka'arot ha- marak (ha- axaronot)** nišaru b- a- sir.
three bowls DEF soup DEF last remained in DEF pot

The intended but impossible reading (which is of course perfectly felicitous in English) is; "Only 17 guests arrived, and enough soup was left for three people. **The (last) three bowls of soup** remained in the pot." The individuating reading is possible, but inappropriate in this context. We can use the example only to assert that three concrete bowls containing soup were still in the pot.

The second prediction is the following. If a definite construct state nominal does not allow a measure reading syntactically but the content of the construct state only allows a measure reading semantically, then we will get conflict between syntax and semantics. This should result in an ungrammatical construction. This is indeed the case. Indefinite construct state constructions are possible with measure heads such as *kilo* as in (25a), but the definite forms are not grammatical.

(25) a. xamiša kilo kemax
five kilo kemax
"five kilos of flour"

b. ∗xamešet kilo ha- kemax
five kilo DEF- flour
Intended reading: "the five kilos of flour"

Our conclusion therefore is that there is empirical evidence to support the hypothesis that there are different types of classifier phrases with the surface form *N of NP*: individuating classifier phrases have the structure in (9) while measure classifier constructions have the structure in (11). And while 'classifier' is commonly used to describe the N expression in English *N of NP* strings, two different kinds of expression may fill the N position: N is relational nominal in individuating classifier phrases, and a measure expression in measure classifier constructions.

3. CLASSIFIER PHRASES AND THE MASS/COUNT DISTINCTION

3.1. The prediction

The account of individuating and measure classifier phrases in the previous section makes the following prediction.

If the measure phrase *two kilos* or *two glasses* is an intersective predicate and modifies a mass expression, as in the structure in (11), then

an expression like *two kilos of flour* or *two glasses of water* should be the same semantic type as its head. Since *flour* and *water* are mass terms, *two kilos of flour* or *two glasses of water* should also be mass expressions. In contrast, if the expression *two glasses of water* is an individuating expression, as in (9), headed by the count nominal *glasses (of)*, then the whole expression should be a count expression. Intuitively, this seems right: measure phrases give properties of quantities, which are denotations of mass expressions, while as an individuating classifier head, a noun phrase such as *glasses of* NP picks out individual entities containing NP, and these glasses are entities which can be counted. In the rest of section 3, we show that there is good evidence to support this claim.

3.2. Measure readings vs. individual readings of e.g. two glasses of milk

As we indicated at the beginning of this paper, there are a number of classical tests for distinguishing mass nouns from count nouns.

(i) count nouns can be directly modified by numerals, while mass nouns cannot, as in *three flowers* vs. ∗*three flour(s)*.

(ii) count nouns can be marked for plural, and the verb then gets plural morphology through agreement, while this is not the case for mass nouns as in *the flowers are on the table* vs. *the flour(∗s) is/∗are on the table*. (Note we are ignoring the reading where a mass N marked plural is interpreted as denoting a plurality of subkinds of N).

(iii) mass nouns and count nouns co-occur with different determiners, both in Det+N constructions such as *many/∗much flowers* vs. *much/∗many flour* and in partitives, such as *three/many of the flowers* vs. *much/∗three of the flour*.

(iv) reciprocals (in English) take as antecedents plurals of count nouns as in *the boys like each other* or conjunctions of proper names or definites as in *John and Mary/the boy and the girl like each other*. But (in English), a mass noun cannot be the antecedent for a reciprocal, although a conjunction of definite mass nouns is a possible antecedent. This is illustrated in (26):

(26) The furniture was piled on top of each other.[4]

Gillon (1992) points out that this leads to the following minimal contrast:

(27) a. The carpets and the curtains resemble each other.

b. The carpeting and the curtaining resemble each other

(27a) is ambiguous between the reading where the maximal sums (the sum of carpets and the sum of curtains) resemble each other, and the reading where the atomic parts of these sums, that is the individual curtains and carpets all resemble each other. In (27b), the reciprocal cannot distribute over the parts of the sums, and only the first reading is available.

We now use these tests to examine classifier phrases like *six bottles of wine/four packs of flour*. We will see that on the measure interpretation of these classifier phrases, they show properties of mass nouns, while on a counting interpretation, they pattern with count nouns.

The first test, direct modification by numerals, is not relevant, since we are discussing constructions in which the bare noun directly follows the classifier. Pluralisation also does not distinguish between the readings in English, since the classifier is always marked plural. However, agreement does: in the counting reading, where the plural count classifier is the lexical head of the phrase, the verb must be plural, as in (28a). In the measure reading, where the classifier has shifted to a modifier taking a plural number argument, the mass noun is head of the phrase and the verb may be (and is possibly preferred to be) singular, as in (28b) (Examples are marked 'C' and 'M' depending on whether the count or measure readings are available.)

(28) a. The two bottles of wine that we carried here were/#was heavy. (C)

b. The two teaspoons/50 mililitres of wine we added to the sauce gives/?give it an extra flavour. (M)

As we already pointed out above (example (7)), Carlson (1997) shows that in Dutch, plural morphology does partially indicate measure vs. individuating readings, but only in cases where the classifier is a true measure predicate such as *liter* rather than a nominal classifier such as *fles* 'bottle'. Measures expressions such as *liter* do not take plural marking even when they combine with a number above 'one', as in (29a). Plural agreement on a measure predicate is an indication that it has shifted to an individualised quantity reading. Thus, while in (29a) *twintig liter frisdrank* is an expression denoting a quantity of soft drink

20 litres in volume, in (29b) *twintig liters frisdrank* naturally denotes pluralities consisting of twenty individual bottles of soft drink. (30a) gives an example with the classifier phrase in subject position, and shows that on the measure reading, where the classifier is not marked plural, the verb must be singular, while on the counting reading, when the classifier is marked plural, the verb must be plural too.

(29) a. Ik heb twintig liter frisdrank bezorgd voor het feestje.
I have 20 liter soft-drink delivered for the party.
"I have delivered 20 liters of soft-drinks for the party."

b. Ik heb twintig liters frisdrank bezorgd voor het feestje.
I have 20 liter-pl soft-drink delivered for the party.
Preferred reading: "I have delivered 20 liter-bottles of drink for the party."

(30) a. Twintig **liter** water **staat**(sg) in de kelder.
20 litre water stand in the basement (Measure reading only)

b. Twintig **liters** water **staan**(pl) in de kelder.
20 litres water stand in the basement (Individualised litre bottles reading only)

The third test concerns the sensitivity of determiners to mass/count distinction. English *many* selects only plural count nouns, and as a correlate, in partitive constructions it selects *the* + plural count noun, as in *many of the chairs/∗many of the furniture*. Now, if individuating classifier expressions are headed by a relational count noun, then we expect these unproblematically to appear following *many* in partitive constructions. However, if measure expressions such as *two bottles/two litres* are intersective modifiers modifying a mass expression, then we do not expect them to be felicitous in partitive constructions with *many*. Conversely since *much* selects a mass noun and thus, in a partitive construction is followed by *the* + mass noun, we expect measure classifiers constructions to appear after *much* in partitives. As the data in (31) show, this is exactly what happens. Note that verbal agreement with *many* + partitive is plural and with *much* + partitive is singular.

(31) a. Not many of the twenty bottles of wine that we bought were drunk/opened. (C)

b. Not much of the twenty bottles of wine that we bought was drunk. (M)

c. Not much of the twenty bottles of wine that we bought was #opened. (M)

d. I have used much/∗many of the ten kilos of flour that there was in the cupboard.

Note that in order to be interpreted as a measure modifier, the classifier must apply first to a number argument. This is because a measure expression is of type <n, <d, t>>. Without a number word to combine with, the measure reading is not (usually) available, and thus (32b) contrasts with (31b):

(32) a. Not many of the bottles of wine that we bought were drunk/opened. (C)

b. #Not much of the bottles/litres of wine that we bought was drunk. (M)

(32a) uses *the bottles of wine* in a context in which in principle either the count or measure interpretation is possible, but as the determiner is *many*, the count reading is felicitous. (32b) is infelicitous since, while the context naturally supports the measure reading and the determiner is *much*, the lack of a number for the *bottles/litres* to apply to makes the measure interpretation of the classifier dispreferred.[5] The fourth test for distinguishing mass from count readings is reciprocal resolution. As we saw above, atomic individuals and atomic parts of individuating classifier denotations are antecedents for reciprocals. Measure readings do not provide such atomic parts as antecedents for reciprocals, as the minimal contrast between the measure phrase *three kilos of flour* and the individuating phrase *three kilo-packs of flour* in (33) shows:

(33) a. The cook mixed three kilo-packs of flour with each other.

b. #The cook mixed three kilos of flour with each other.

This contrast shows up again in (34), which are the classifier analogues of Gillon's example in (27):

(34) a. The twenty bottles of wine and the twenty bottles of beer we had not yet opened stood next to each other on the shelf. (C)

b. #The twenty liters of wine and the twenty liters of beer that we bought stood next to each other in the cellar. (M)

(34a) is a counting context where the classifier phrase is a conjunction of individuating expressions, and the reciprocal can distribute over atomic parts of the subject, namely the individual beer bottles and the individual wine bottles. There are therefore no constraints on how the beer bottles and wine bottles are arranged with respect to each other. In (34b), the classifier phrase is a conjunction of measure expressions, and it denotes the sum of a quantity of wine and a quantity of beer. As a consequence, the reciprocal relation is constrained to hold between these two quantities, and thus the sentence asserts that the beer (as a quantity) is standing next to the wine (as a quantity). In Dutch, this shows up even more clearly because morphological agreement (or lack of it) clarifies the distinction between the individuating and measure uses of the classifier phrases.

(35) a. De vijftien **liters** melk en de vijftien **liters** jus d'orange liggen op
the fifteen litres milk and the 15 litres orange juice lie on
elkaar gestapeld in de kelder.
each other piled in the basement.
"The 15 litres of milk and the 15 litres of orange juice are stacked on top of each other in the basement".

b. De vijftien **liter** melk en de vijftien **liter** jus d'orange liggen op
the fifteen litres milk and the 15 litres orange juice lie on
elkaar gestapeld in de kelder.
each other piled in the basement.
"The 15 litres of milk and the 15 litres of orange juice are stacked on top of each other in the basement".

(35a) asserts either that the 30 individual litre packs containing juice or milk are stacked on each other or that (all) the milk is stacked on top of (all) the orange juice (or vice versa), depending on whether the antecedent for the reciprocal is the set of individual litre packs, or the two sums of milk and orange juice. In (35b), where the classifier phrase denotes a sum of two quantities, only the second reading is available.

Our conclusion is that there is good evidence that when a mass noun is the complement of a measure classifier, the Classifier Phrase as a whole has the properties of a mass nominal, and when the mass noun is the complement of an individuating classifier, the whole Classifier Phrase has the properties of a count nominal.

3.3. *Measure readings of classifiers with count noun complements*

A more complicated version of the same issue arises with examples like *two kilos of books/two boxes of books*. In the previous section, we showed that an intersective measure modifier like *two glasses/two litres* did not change the mass status of the complement, and thus *two glasses of wine* is a mass expression. But what happens when the complement of the classifier is not a mass noun, but a bare plural count noun, as in examples like (36)?

(36) a. When we left for the Netherlands we sent 16 kilos of books.

b. When we left for the Netherlands we sent four boxes of books.

Our prediction is that if measure phrases consistently modify mass nouns, then the measure phrase *16 kilos*, and *four boxes* on its measure reading, should modify a mass noun. This means that in (36a) *books* should be a mass noun modified by the unambiguous measure modifier *16 kilos* and that (36b) should be ambiguous between two readings:
(i) the counting reading when *boxes* is the nominal head of the phrase, taking *books* as its complement. On this reading *four boxes of books* has the interpretation of a count noun.
(ii) the measure reading when *books* should be mass and *four boxes* is interpreted as a intersective measure phrase which modifies *books*. On this reading *four boxes of books* has the interpretation of a (complex) mass noun. Despite the possibly suprising nature of the prediction, we show in this section that there is evidence that *books, 16 kilos of books* and *four boxes of books* on its measure reading, are mass expressions. In section 4 of the paper, we will show how to derive the interpretation of *books* as a mass noun, and in the concluding section of this paper we discuss the implications of the analysis.

We will go through exactly the same tests as we did in the previous section. First, pluralisation and agreement show that when the classifier phrase is individuating, the verb agreement must be plural.

(37) The twenty boxes of books that we sent were/∗was in the study.

When the classifier phrase is plausibly a measure expression, judgments vary. Singular agreement is possible in the examples in (38) and is possibly even preferred:

(38) a. The twenty boxes of books that we sent has kept my daughter supplied with reading matter for the whole year.

b. Twenty kilos/boxes of books was/were put through the shredder that night.

c. The five boxes of books/twenty kilos of books that we sent was not enough to keep my daughter supplied with reading matter.

(38c) also shows that the classifier phrase is a natural subject of a measure predicate headed by *enough*.
In (39) plural verbal agreement seems to be obligatory, but the only possible reading of the classifier phrase is individuating, and asserts that the boxes were piled directly on the shelves, rather than making an assertion about the books which had come out of the twenty boxes.

(39) The twenty boxes of books that we brought were/#was piled on the shelves.

In Dutch, with the measure phrase *kilo*, singular or plural agreement on the verb are both acceptable, as illustrated in (40a), with a slight preference for singular. Predictably, plural marking on the classifier, *kilos* is never possible.

(40) a. Twintig **kilo** boeken werd/?werden door de
20 kilo-**sg** books was-sg/?were-pl through the
papiervernietiger gemalen.
papershredder ground.
"Twenty kilos of books was ground through the paper-shredder"

b. #Twintig **kilos** boeken werd/werden door de
20 kilo-**sg** books was-sg/were-pl through the
papiervernietiger gemalen.
papershredder ground.

With respect to determiners, we get the results our hypothesis predicts. When the classifier phrase has an individuating reading, it can be embedded under the count determiner *many*. When it has a measure reading, it can be embedded under the mass determiner *much*. Note that *much* induces singular agreement as expected.

(41) a. I have read many of the twenty boxes of books that we sent: (C)

b. #I have read many of the twenty kilos of books that we sent (C)

c. I have(n't) read much of the twenty boxes/kilos of books in our house. (M)

d. A little of the twenty boxes/kilos of oranges that we picked was/#were enough to satisfy our desire to eat citrus fruit.

It is important to see that the mass and count readings of *I read twenty boxes of books* do not entail each other, as the readings of (42) show:

(42) I have read much/many of the twenty boxes of books that we sent.

Suppose most of the twenty boxes that we sent are small and have a few books in them, and only two or three of the boxes are big and have a lot of books in them, and suppose that I have read all the books in the big boxes and few of the books in the small boxes, then *I haven't read many of the twenty boxes of books we sent* is true, but *I haven't read much of the twenty boxes of books that we sent* is false. The lack of entailment in the other direction follows if I have read all the books in quite a lot of the small boxes, but I haven't touched any of the books in the big boxes.

Note also that here too, as we noted in example (32), if there is no number expression for the classifier to apply too, it is much harder get the measure reading for the classifier, (except when a null number expression meaning 'huge quantity' is indicated via intonation).

(43) a. I haven't read many of the boxes of books that we sent.

b. #I haven't read much of the boxes/kilos of books that we sent.

The last test that we discussed was reciprocal resolution. Here too we get the predicted results. Individuating (i.e. count) classifier phrases provide natural antecedents for the reciprocal. In (44) *each other* takes *boxes (of books)* as its antecedent. The complement nominal *books* is not available since the relevant individuating accessible antecedent is the plural set of boxes and not the entities it contains. So (44a) asserts that the boxes are piled on top of each other.

(44) a. 42 boxes of books were piled on top of each other on the shelves. (Only: the boxes are on top of each other.)

b. #3 boxes of books were piled on top of each other on different shelves.

(44b) confirms that only the set of boxes is available as the antecedent for the reciprocal. It is infelicitous because you need at least 4 boxes in order for the boxes to be to be piled on top of each other on different shelves. If the complement *books* was available as a potential antecedent, an alternative felicitous reading should be available. But it isn't.

In measure classifier phrases such as *twenty kilos of books* and *twenty boxes of books* on its measure reading, the classifier *boxes* cannot provide the antecedent, because as we saw already, it is a measure predicate. However, since *twenty kilos/twenty boxes* by hypothesis is an intersective modifier which should modify a mass noun, we predict that *books*, like other mass predicates, cannot provide an antecedent for the reciprocal either. This is why (45a) is felicitous, but (45b) where the predicate contains a reciprocal is infelicitous.

(45) a. Twenty kilos of books are lying in a heap on the floor.

b. #Twenty kilos of books are lying on top of each other on the floor.

The examples in (46) further illustrate the same point. In (46a) the only possible antecedent is the set of boxes, while in (46b) there is no grammatical antecedent, and the sentence is infelicitous.

(46) a. The twenty boxes of books are standing next to each other on the shelves.

b. #The twenty kilos of books are standing next to each other in a row.

When *twenty kilos* can be interpreted as an individuating expression meaning "twenty kilo-packs", the reciprocal can take this individuating expression as an antecedent.

(47) The twenty kilo-packs of flour/the twenty kilos of flour are standing next to each other in a row on the shelf of the grocery store.

So measure classifier phrases cannot provide antecedents for reciprocals. *Twenty boxes of books* can be the antecedent for a reciprocal only on its individuating reading, as (44a) illustrated, while *twenty kilos of books* makes no antecedent available at all. This is good evidence for two points: first that while *twenty boxes* is ambiguous between the measure and individuating interpretation, *twenty kilos* is always a measure expression and second, that as the complement of these measure expressions, a plural count noun like *books* is interpreted as a mass expression.

We complete this section with one extra point. Measure classifiers take only bare noun complements as (48a) shows. This is natural, since the complements of measure classifiers are noun heads which are to be modified. Individuating classifiers take a wider range of complements, which can be modified by number as in (48b,c). This is expected since these complements are arguments of a relational noun head.[6] Note that in (48b) and (48c), the measure reading is not available, as manipulation of the choice of verb shows.

(48) a. On the floor were piled four kilos of (∗ten) books.
b. #On the floor were stacked four boxes/piles of ten books.
c. I unpacked/#read three boxes of ten books.

4. ANALYSIS

4.1. *An account of the mass/count distinction (based on Rothstein 2010).*

The data presented in the previous section presents us with a challenge. Apparently, *books* can, in certain contexts, have an interpretation as a mass noun instead of as a count noun. This means that we need an account of the mass/count distinction which allows us to explain what is the shift in meaning from *books* as a count noun to *books* as a mass noun, and we need also to explain why it can shift in the contexts described in section 3, while such a shift is impossible in examples like (49).

(49) a. #Much of the books were lying on the ground.
b. #I read much of the books in the library.
c. #I painted much of the rooms in the house red.

In this section I will present an account of the mass/count distinction based on Rothstein (2010), which allows us to explain the data discussed in section 3. But it is important to stress that the claim that a term like *books* is mass in examples like (41c) is independent of the

particular theory in which I choose to work out a semantics for its interpretation. One of the questions that any theory of the mass/count distinction will have to answer is where the mass-like properties of plural count nouns come from in these contexts.

Rothstein (2010) argues for a typal distinction between mass nouns and count nouns. The argument that the mass/count distinction is typal is based on the following points:
– mass nouns (e.g. *stone/furniture*) and count nouns (e.g. *stones/pieces of furniture*) get their denotations with respect to the same entities (Chierchia 1998).
– some mass nouns (e.g. *furniture*) are naturally atomic, i.e. denote plural sets which are de facto the closure under sum of a set of inherently individuable entities. Rothstein 2010 calls these sets 'naturally atomic'.
– some count nouns (e.g. *fence, wall, sequence*) are not naturally atomic, and the set of atoms in their denotation varies from context to context.

The conclusion is that the distinction between mass and count nouns lies in how they represent entities grammatically, and not in the properties of the entities themselves. Count nouns present entities as countable, but countability is a grammatical phenomenon, and not a property of entities in and of themselves. There is a distinction between natural atomicity, which is a property of mass nouns like *furniture, jewellery* and *cutlery*, as well as of count nouns like *boy, book*, and *cup*, and semantic atomicity which is a property of count nouns. (I argue in Rothstein (2010) that all definite NPs and proper names are also semantically atomic.) Since count nouns are not necessarily naturally atomic, as *fence, wall* and *sequence* show, natural atomicity is neither a necessary nor sufficient condition of semantic atomicity or countability.

Rothstein (2010) argues that counting is a context dependent operation: we count, in a particular context, the entities which in that context are considered atomic entities. Counting is putting entities into one-to-one correspondence with the natural numbers and presupposes a contextually determined decision as to what counts as an atomic entity. Countable entities are those which are the atoms **in a relevant context** and count nouns are grammatically countable because they denote sets of atoms (or pluralities of atoms) relative to a particular context and encode this contextual dependence grammatically. This context dependence must be grammatically encoded for nouns like *boy* and *cup*, where the sets of atoms are stable across contexts, as well as for nouns like *fence* and *wall* where the denotations are not stable across contexts. Mass nouns, even if they are naturally atomic predicates, are not countable, because the contextual parameter is not grammatically encoded.

This is expressed grammatically in the following way.

1. Nominals are interpreted with respect to a complete atomic Boolean algebra M. Intuitively, M is the mass domain. $\sqcup$M, the sum operation on M, is the complete Boolean join operation; $\sqsubseteq$M is the part of relation on M. We assume with Chierchia (2008) that the set of atoms A of M is not fully specified, vague. (Nothing rests on this choice of mass domain; we assume it for simplicity.)

2. All nouns are associated with an abstract root noun. The denotation of a root noun, N_{root}, is a subset of M, defined as follows:

For some set of atoms, $A_N \subseteq A$, $N_{root} = *A_N$, where $*X = \{m \in M: \exists Y \subseteq X: m = \sqcup_M Y\}$

Root nouns are the input to operations deriving N_{mass} and N_{count}. Mass nouns are root nouns, i.e, $MASS(N_{root})$ is the identity function on N_{root}. (Singular) count nouns denote a set of semantic atoms derived from the root noun relative to a particular context.

Definition 1:
$MASS(N_{root}) = N_{root}$

3. Count nouns allow direct grammatical counting because they presuppose a context dependent choice as to what counts as one entity. This choice of what counts as one entity is encoded in the notion of (counting) context k, which intuitively collects together the entities which count as atoms in k.

Definition 2:
A **context** k is a set of objects from M, $k \subseteq M$; K is the set of all contexts.

The set of count atoms determined by context k is the set
$A_k = \{<d,k>: d \in k\}$

4. Singular count nouns are derived from root nouns by a count operation $COUNT_k$ which applies to the root noun N_{root} and picks out the set of ordered pairs
$\{<d,k>: d \in N \cap k\}$, i.e. the set of entities in N_{root} which count as one in context k.

Definition 3:
For any $X \subseteq M$: $COUNT_k(X) = \{<d,k>: d \in X \cap k\}$
The interpretation of a count noun N_{count} in context k is:
$COUNT_k(N_{root})$.

We use N_k as short for $COUNT_k(N_{root})$, the interpretation of a count noun in context k.

5. Plural count nouns are derived by applying the standard plural operation $*$ to the first projection of N_k. $*(N_k)$, the plural of the set of ordered pairs denoted by N_k, is the set of ordered pairs whose first projection is the plural set derived from the first projection of N_k, and whose second projection is the (same) value k.

Definition 4:
Assume: $\pi_1(N_k) = \{d: <d,k> \in N_k\}$
$\pi_2(N_k) = k$
In default context k: $PL(N_{count}) = *N_k = \{<d,k>: d \in *\pi_1(N_k)\}$

Examples: $[[stone_{mass}]] = MASS(STONE_{root}) = STONE_{root}$
$[[stone_{count}]] = COUNT_k(STONE_{root}) =$
$\{<d,k>: d \in STONE_{root} \cap k\}$

So *stone*$_{mass}$ denotes a set of quantities of stone, while *stone*$_{count}$ denotes a set $\{<d,k>: d \in STONE_{root} \cap k\}$ of type $< d \times k, t>$ i.e. the set of indexed entities which count as one in context k.

We assume, following Carlson (1977b), that mass nouns in argument position denote kinds. We assume a shift from N_{root} to $^{\cap}N_{root}$, i.e. the kind associated with N_{root}. For simplicity we assume that argument position is a DP and that the shift from N_{root} to $^{\cap}N_{root}$ is triggered by a null determiner. Following Chierchia (2008), we assume that kinds are defined via the maximal entity in the denotation of N_{root}. Kinds are functions from worlds/situations onto the maximal entity instantiating Nroot in that world/situation. Thus for any N_{root} and world/situation s: $^{\cap}N_{root} = \lambda w. \sqcup_M (N_{root,w})$. We restrict ourselves to extensional contexts here and assume that the denotation of a kind term is $(^{\cap}N_{root})(w_0)$ (with w_0 the world of evaluation). This means that we can assume that the denotation of kind terms is of the type of entities, type d, (which simplifies the derivations considerably).

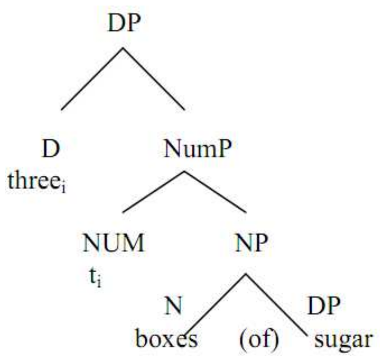
> **Definition 5:**
> $^{\cup}$ is the function from kind(-extensions) to sets of individuals such that
> for every kind(-extension) $\mathbf{d}(w_0)$: $^{\cup}\mathbf{d}(w_0)) =$
> $\{x.\ x \sqsubseteq_M \mathbf{d}(w_0)\}$

4.2. Derivations

4.2.1. Individuating (i.e. counting) classifier phrases

We now check how the various derivations work in this framework, beginning with individuating, or counting, classifier phrases such as *two boxes of books/two boxes of sugar/three cups of water*. We assume the syntactic structure in (9) from section 2.

(9)



We use y as variable of type d (including kinds) and $\boldsymbol{y}$ as a variable of type d × k. $\mathbf{y}$ is a variable over both types.

The basic meaning of box as a common noun at type d × k is as follows:

$BOX_k = \{\boldsymbol{x}\text{: } \pi_1(\boldsymbol{x}) \in BOX \wedge \pi_2(\boldsymbol{x}) = k\}$
(We omit the conjunct "$\pi_2(\boldsymbol{x}) = k$" in what follows. It is not relevant since we are dealing only with simple container classifiers here, which also denote atoms in k.)
Box as an individuating classifier takes a mass noun or a plural count noun as its complement:

(50) Three boxes of sugar/books

We assume that *box* (or *boxes*) shifts to the relational type, and assigns a thematic role CONTAIN to a direct object.
$BOXES_k = \lambda\mathbf{y}\lambda\boldsymbol{x}\pi_1(\boldsymbol{x}) \in *BOX \wedge CONTAIN(\pi_1(\boldsymbol{x}),\mathbf{y})$
(See Partee and Borschev (2010a,2010b) for a discussion of some of the subtleties of the CONTAIN relation, as mentioned in note 2.) The argument of CONTAIN can be either an argument at type d (including a mass noun at the kind interpretation) or d × k, or a generalised quantifier derived via quantifying in.

The derivation of *three boxes of sugar* on the individuating reading is as follows:

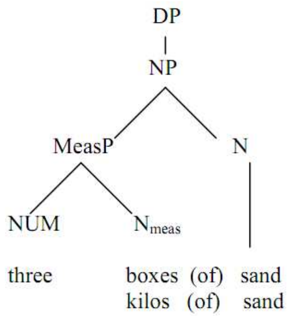
Three boxes of sugar:
boxes of sugar:$\lambda\boldsymbol{x}.\pi_1(\boldsymbol{x}) \in *BOX \wedge CONTAIN(\pi_1(\boldsymbol{x}), {}^{\cap}SUGAR_{root})$
three (boxes of sugar)[7]:
$\lambda P\lambda\boldsymbol{x}.\pi_1(\boldsymbol{x}) \in P \wedge CARD(\pi_1(\boldsymbol{x})) = 3\ (\lambda\boldsymbol{x}.\pi_1(\boldsymbol{x}) \in *BOX \wedge CONTAIN(\pi_1(\boldsymbol{x}), {}^{\cap}SUGAR_{root}))$
$= \lambda\boldsymbol{x}.\pi_1(\boldsymbol{x}) \in *BOX \wedge CONTAIN(\pi_1(\boldsymbol{x}), {}^{\cap}SUGAR_{root}) \wedge CARD((\pi_1(\boldsymbol{x})) = 3$

Three boxes of books: This is interpreted in the same way under the assumption that bare plurals denote kinds too.
$\lambda\boldsymbol{x}.\pi_1(\boldsymbol{x}) \in *BOX \wedge CONTAIN(\pi_1(\boldsymbol{x}), {}^{\cap}BOOKS_k) \wedge CARD((\pi_1(\boldsymbol{x})) = 3$
Individuating classifiers with non-kind complements arguments are interpreted similarly.
Crucially, since the classifier *box* is a relational noun derived from the count noun *box*, the count status of the classifier phrase follows automatically.

4.2.2. Measure classifier phrases

We assume the syntactic structure in (11) for measure classifier phrases, as proposed in section 2.

(11)



We look first at measure phrases with mass complements such as (51):

(51) three kilos of sand

Since sand is not an argument position, the mass noun is interpreted at type <d, t> and is modified directly by the measure predicate:

Three kilos of sand

Kilo is a expression of type <n, <d, t>>:	$\lambda n \lambda x.\text{MEAS}(x) = \langle\text{KILO}, 3\rangle$
three kilo<d, t>:	$\lambda x.\text{MEAS}(x) = \langle\text{KILO}, 3\rangle$

three kilos shifts to the modifier type <<d, t>, <d, t>>:

three kilos$_{<<d,t>,\ <d,t>>}$:	$\lambda P \lambda x.x \in P \wedge \text{MEAS}(x) = \langle\text{KILO}, 3\rangle$
three kilos of sand:	$\lambda x.x \in \text{SAND}_{root} \wedge \text{MEAS}(x) = \langle\text{KILO}, 3\rangle$

three kilos of sand denotes quantities of sand that measure three kilos.

Three boxes of sand

This works in the same way. The root meaning of BOX is BOX_{root}. The measure reading is at type <n, <d,t>, and is derived from the root meaning in the same way that GLASS-ful is derived from GLASS (see

note 1). In English, the operation which turns *box* from a nominal to a measure expression is introduced either explicitly by *-ful* or by a null correlate of *-ful*.

$$ful(\text{BOX}_{root}) \Rightarrow \lambda n \lambda x.\ \text{MEAS}(x) = \langle\text{BOX}, n\rangle$$

So the measure expression *box(-ful)* combines first with a numeral to form a predicate and then shifts in the normal way to the modifier reading to apply to a nominal head. Agreement is morphological, and not a semantic reflection of a pluralisation operation.

box(ful) (measure expression):	$\lambda n \lambda x.\text{MEAS}(x) = \langle\text{BOX}, n\rangle$
three boxes(ful):	$\lambda x.\text{MEAS}(x) = \langle\text{BOX}, 3\rangle$
three boxes(ful)$_{MODIFIER}$	$\lambda P \lambda x.x \in P \wedge \text{MEAS}(x) = \langle\text{BOX}, 3\rangle$
three boxes(ful) of sand:	$\lambda x.x \in \text{SAND}_{root} \wedge \text{MEAS}(x) = \langle\text{BOX}, 3\rangle$

Crucially: while relational nominals take arguments at type d or d × k (or <<d,t>t>), measure phrases modify mass noun predicates, i.e. expressions of type <d,t>.

We extend this to measure phrases with bare plural complements: *three boxes/kilos of books*

When the complement of the measure phrase is a count noun, the count noun must shift from the count type to the mass type. This is triggered by the measure modifier. At its count denotation, a plural count noun is a predicate of type <d×k,t>. *books*$_k$ denotes $\{\langle x,k\rangle : x \in *(\text{BOOK}_{root} \cap k)\}$ However, measure phrases modifier predicates at type <d,t>, so the plural count noun denotation must shift to this type.

This shift makes use of the π_1 function.

$$\begin{aligned}\text{SHIFT}_{MEAS}(\{\langle x,k\rangle : x \in *(\text{BOOK}_{root} \cap k)\}) &= \\ \pi_1(\{\langle x,k\rangle : x \in *(\text{BOOK}_{root} \cap k)\}) &= \\ *(\text{BOOK}_{root} \cap k)&\end{aligned}$$

The shift operation applies to a set of ordered pairs $\{\langle x,k\rangle : x \in$

$*(\text{BOOK}_{root} \cap k)\}$, which is the denotation of the plural noun *books* and gives back the set of unindexed d entities which are the first projection of the ordered pairs. So what makes *books* mass is removing the index which the COUNT_k operation added. The resulting unindexed expression can be directly modified by a measure predicate.

(52) three kilos of books

kilo:	$\lambda n\lambda x.\text{MEAS}(x)=<\text{KILO, n}>$
three kilos:	$\lambda x.\text{MEAS}(x)=<\text{KILO,3}>$
three kilos$_{MODIFIER}$:	$\lambda P\lambda x.x \in P \wedge \text{MEAS}(x) = <\text{KILO, 3}>$
Three kilos of books:	$\lambda P\lambda x.x \in P \wedge \text{MEAS}(x) = <\text{KILO, 3}>[\text{SHIFT}(\text{BOOKS}_k)]$
	$= \lambda P\lambda x.x \in P \wedge \text{MEAS}(x) = <\text{KILO, 3}>*(\text{BOOK}_{root} \cap k)$
	$= \lambda x.x \in *(\text{BOOK}_{root} \cap k) \wedge \text{MEAS}(x) = <\text{KILO, 3}>$

For completeness, we give the derivation of (53):

(53) three boxes of books

box(ful):	$\lambda n\lambda x.\text{MEAS}(x)=<\text{BOX, n}>$
three boxes(ful):	$\lambda x.\text{MEAS}(x)=<\text{BOX,3}>$
three boxes(ful)$_{MODIFIER}$:	$\lambda P\lambda x.x \in P \wedge \text{MEAS}(x) = <\text{BOX, 3}>$
three boxes of books:	$\lambda P\lambda x.x \in P \wedge \text{MEAS}(x) = <\text{BOX, 3}>[\text{SHIFT}(\text{BOOKS}_k)]$
	$= \lambda P\lambda x.x \in P \wedge \text{MEAS}(x) = <\text{BOX, 3}>*(\text{BOOK}_{root} \cap k)$
	$= \lambda x.x \in *(\text{BOOK}_{root} \cap k) \wedge \text{MEAS}(x) = <\text{BOX, 3}>$

5. NUMERICAL PARTITIVES IN MEASURE PHRASES

Before drawing some general conclusions from the above discussion, we need to discuss the question raised in note 3. Why do numerical partitives occur with measure expressions as in (54)?

(54) We have used up three of the six kilos of flour that I bought.

The problem is the following. As is well-known, partitives occur with both mass-headed and count-headed DPs as in (55):

(55) Some of the furniture/pieces of furniture that I bought will be delivered this afternoon.

However, numerical partitives are restricted to count-headed DP partitive complements:

(56) a. *Three of the furniture that I bought will be delivered this afternoon.
b. Three of the pieces of furniture that I bought will be delivered this afternoon.

So if measure-classifier-expressions are mass nouns, why do numerical partitives occur felicitously with measure expressions in examples like (54)?

Rothstein (2010) shows that the restriction of numerical partitives to definites headed by count nouns follows naturally from the semantics of count expressions given above. In partitive constructions, an operation PARTITIVE applies to the denotation of *the N* and recovers the set of its parts. When N is a count noun, the set of parts is a set of count entities and can be counted by the number, as in *three of the boys*. When N is a mass noun, the set of parts is a subset of M and cannot be counted, as in *#three of the furniture*. The details of the analysis are as follows:

– *the* is interpreted following Link (1983) in terms of the σ operation:
For Boolean algebra B: $\sigma_B(X) = \sqcup_B(X)$ if $\sqcup_B(X) \in X$, otherwise undefined
This applies directly to mass nouns i.e. for mass nouns *the N* denotes $\sigma(N) = {}_M(N)$.
For count nouns *the N* denotes $\sigma(N_k) = <\sigma_M(\pi_1(N_k)), k>$

We recover the denotation of the predicate head from the DP via an operation PARTITIVE on definite DPs which gives the set of parts of $\sqcup_M N$, N the lexical head of DP.

The schema for the partitive operation follows the following definition schema, operating on a definite complement and giving the set of its parts:

$$\text{PARTITIVE}(\sigma N) = \{X: X \sqsubseteq_M (\sigma N)\}$$

For a mass predicate: $\text{PARTITIVE}(\sigma(N_{mass})) = \{x: x \sqsubseteq_M \sigma(N_{mass})\}$, which is N_{mass} itself.
For a count predicate we lift the part-of relation on ordered pairs in M $\times$ K from M:

$<x_1,k> \sqsubseteq_k <x_2, k>$ iff $x_1 \sqsubseteq_M x_2$
PARTITIVE(σ(N_k)) is again lifted from M:

$$\text{PARTITIVE}(\sigma N_k) = \{<x,k>: <x,k> \sqsubseteq_k <\sigma(\pi_1(N_k)), k>\}$$

Numerical partitives occur with PARTITIVE(*the N*) when the set of parts of the denotation of *the N* is of type $<d \times k, t>$. We thus correctly expect numerical partitives to occur with individuating classifier expressions as in (57):

(57) I carried in three of the boxes of books

The set of parts of *the boxes of books* is the set of plural k-indexed box individuals, which are parts of the maximal entity in the denotation of *boxes of books*. This set is count and a numerical partitive should be possible. But we **wrongly** predict *three of the six kilos of flour* in (54) to be ungrammatical, since *six kilos of flour* is a mass expression and the set of parts of the denotation of *the six kilos of flour* is a set in the mass domain.

The solution is as follows. Numerical measure partitives are not interpreted in the same way as numerical count partitives. In measure expressions, the number *three* in *three of the six kilos of flour* has a null complement *kilo*, which is deleted under identity with the embedded measure phrase, so (58a) and (58b) are equivalent:

(58) a. Three of the six kilos of flour that we bought have already been used up.
b. Three kilos of the six kilos of flour that we bought have already been used up.

This proposal is supported by the following facts. First, 'ordinary' numerical partitives are impossible with mass nouns, as in (59a), but are fully grammatical when the measure head is explicit in the partitive, as in (59b), This contrasts with the infelicitous (59c).

(59) a. ∗Two of the flour that I bought...
b. Two kilos of the flour that I bought
c. ∗Two boys of the class

Second, the two measure expressions need not be identical, as in (60):

(60) a. 500 grams of the two kilos of fruit that I bought was rotten.
b. 50 kilos of the 2 tons of coal that we bought was unusable.

This suggests that the higher measure head is not copied from the lower DP, but is independently generated, and may be deleted under identity with the lower measure head.

This leads to the following analysis for *three(kilos) of the six kilos of flour*, with *three kilos* interpreted as a measure expression which shifts to the modifier type $<<d,t>,<d,t>>$:

(61) three (kilos) of the six kilos of flour

the six kilos of flour: σ(SIX KILOS OF FLOUR)
three kilos: $\lambda P \lambda x.x \in P \wedge \text{MEAS}(x)=<\text{KILO},3>$
three kilos of the the six kilos of flour:
$\lambda P \lambda x.x \in P \wedge \text{MEAS}(x) = <\text{KILO}, 3>(\text{PARTITIVE}(\sigma(\text{SIX KILOS OF FLOUR}))$
$= \lambda P \lambda x.x \in P \wedge \text{MEAS}(x) = <\text{KILO}, 3>\{x: x \sqsubseteq_M \sigma(\text{SIX KILOS OF FLOUR})\}$
$= \lambda x.x \sqsubseteq_M \sigma(\text{SIX KILOS OF FLOUR})\} \wedge \text{MEAS}(x) = <\text{KILO}, 3>$

Note that I am not proposing a general copy theory of partitives. On the contrary, Rothstein (2010) presents some arguments against such a theory. I assume that in general the syntactic structure of partitives is as it seems, namely *Det of the N*, and that the only head that can come between *Det* and *of* is a measure head. This means that there are structurally distinct counting and measuring partitives, along with structurally distinct counting and measuring classifier phrases and structurally distinct count and mass nouns.

6. CONCLUSIONS

I have argued in this paper that counting and measuring are two different operations, and that this is reflected in the different syntactic structures assigned to counting and measuring classifier phrases. Counting is a context dependent operation which puts entities which count as atoms in the relevant context in one-to-one correspondence with the natural numbers. Measuring is an operation which ignores the atomic structure of a quantity (if it has one), and assigns a value to that quantity, reflecting its dimension in terms of specified units on a dimensional scale.

In the course of this paper we made a close empirical examination of classifier phrases. We showed that individuating and measure classifier phrases are syntactically distinct. Individuating classifier phrases allow us to repackage mass and plural count entities via containers, and in these phrases the classifier, which denotes the container, is the head of the phrase. Individuating classifier phrases are countable and show the same grammatical behaviour as simple count nouns, but it is the container denoted by the classifier which is counted, and the mass or count status of the complement of the classifier is irrelevant.

Measure classifier phrases such as *three kilos of flour* are very different. Here the head of the classifier phrase is the mass noun kilo and the number + classifier together form a predicate which modifies the mass noun head. The whole expression behaves like a simple mass noun. Crucially, *three kilos of books* behaves the same way, leading us to posit a grammatical operation on *books* which allows us to ignore the atomic structure of the predicate and treat *books* as mass i.e. as denoting a subset of M. The trigger to this operation is the measure phrase *three kilos* which can apply only to mass expressions. Thus, it is only in this context that *books* can shift to a mass interpretation, explaining the infelicity of the examples in (49). Since the real-world objects which witness assertions about *books* are the same objects whether the noun is count or mass, we have further support for the claim that the mass-count distinction is not a distinction between different kinds of entities, but a distinction in the way entities are presented grammatically. It is more plausible to present naturally atomic entities from a grammatically atomic perspective and substances from a non-atomic perspective, but this is a preference, and the relation between natural and semantic atomicity is not grammaticised.

The account presented so far opens many further questions. We have examined only container classifiers in this paper, and there are other kinds of classifiers, including group classifiers and partitioning classifiers as in *a group of children* and *a piece of cake*, that have different syntactic constraints and different semantic interpretations. Examining the semantics of these is the obvious next step.

However, the discussion so far gives considerable insight into the complexity of classifiers and into what the difference between mass and count nouns actually is. Abstracting away from the particular the-

ory of mass and count nouns presented here, the results of section 3 and section 5 lead to the suggestion that mass nouns denote entities in such a way as allows them to be measured, while count nouns denote entities in such a way as allows them to be counted. This is not a truism, or a triviality, rather it suggests that there is a fundamental conceptual distinction between measuring and counting which is reflected grammatically. This contrasts with the approach in Krifka (1989), who suggests that counting is a particular kind of measure function. Furthermore, the fact that *books* can have a mass interpretation without involving a Universal Grinder function makes it clear that mass interpretations of *boy* and *book* which make use of the Universal Grinder are not default interpretations of the basic noun.[8] Minimal pairs like (63) have different truth conditions, with (62a) making an assertion about book-stuff (ground matter) which weighs five kilos, while (62b) makes an assertion about quantities of whole books which weigh five kilos.

(62) a. The dog ate five kilos of book
b. The dog ate five kilos of books.

Suppose the fundamental conceptual distinction is between measuring and counting, and the difference between mass and count nouns is a reflection of this. Then, since there are many things which can be both measured and counted, the difference between a mass noun and a count noun is the perspective from which the objects referred to are presented. We would then expect to find the same differences in presentation at the level of the classifier phrase and the partitive phrase too. The data examined in this paper indicate that this is exactly what we do find.

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Notes

[1] Standard bottles for wine are of course different in size from standard bottles for medicine or milk or orange juice.

[2] An obvious question is whether measure *glassful* is a 'standard' measure or a context dependent measure, related to some specific glass. Partee and Borschev (2010a, 2010b) discuss these issues in some detail. They suggest that a context-dependent measure requires existential quantification over glasses, and propose the following:
$\lambda n \lambda x.\exists y.\text{GLASS}(y) \wedge x$ fills y n times
The contrast between standardized measures and context dependent measures, and the relation between both kinds of measure and the meaning of the basic noun is an important one, and gets even more complicated when we consider expressions with non-standard containers such as *a mouthful of soup*, *a handful of sand*, and *a pocketful of money*, which are non-standardized measures, but which don't seem to involve existential quantification over mouths, hands or pockets. I will not explore the topic further here, but assume that a proper exploration of the semantics of *-ful* would elucidate at least some of the issues.

[3] Borer (1999) shows that construct state morphology (i.e. phonological reduction on the first noun and definiteness marking only on the second noun) occurs both with true syntactic construct state forms such as *beyt ha-mora*, literally 'house$_{sg}$ the-teacher$_{pl}$' and with lexical compound such as *beyt ha-xolim*, literally 'house$_{sg}$ the-sick$_{pl}$'. But with the true construct state, the semantic interpretation is compositional, while with the lexical compound this is not the case: *beyt ha-mora* means 'the teacher's house' while *beyt ha-*

xolim can only mean 'the hospital'. Borer shows convincingly that lexical compounds and true construct states display consistently different syntactic behaviour with respect to modification, anaphora and etc. In this paper we are concerned only with true construct state forms.

[4] It is important to note that this is a parameter at which languages differ. For example, in Portuguese (Brazilian and European) a mass noun can be an antecedent for a reciprocal, and (i) minimally contrasts with (26):
(i) Mobília (dessa marca) encaixa uma na outra.
Furniture (of+this brand) fits one in+the other
"Pieces of furniture (of this brand) fit into each other."
These examples are discussed in Rothstein (2010) and Pires de Oliveira & Rothstein (2011), where it is argued that Portuguese allows the reciprocal to distribute over the naturally atomic elements in the denotation of the mass noun as well as over the atoms in the denotation of a count noun (and atoms denoted by definites and proper names), while English allows reciprocals to distribute only over the latter kind of atoms, i.e. entities whose atomic status is grammatically encoded. For discussion see references cited.

[5] Note though that we can get numerical partitives headed by numbers (instead of *much/many*) in each case. We discuss these in the section 5.
(i) Three of the bottles of wine that we bought were opened. (C)
(i) About three of the six bottles/litres of wine that we bought was drunk (all in all). (M)

[6] There are restrictions on what kind of DPs can be complements of classifier heads, which are not at all understood. For example, numerical quantifiers are for most people infelicitous in these positions, and universal quantifiers can only be interpreted as quantifiers over kinds (if they have an interpretation at all)
(i) ?I sent twenty boxes of 10 books (each).
(ii) I sent ten boxes of #every book in the shop/?every wine in the shop.

[7] Note that the denotation of e.g. *three* given above is simplified: the complete definition given in 2010 encodes the context dependence of the counting operation. I repeat it here for completeness. *Three* denotes a function from count noun denotations into count noun denotations and is of type <<d×k, t>, <d×k, t>>. It applies to a set of ordered pairs N_k and gives the subset of N_k, such that all members of $\pi_1(N_k)$ are plural entities with three parts each of which is an (atomic) entity in k. $\pi_2(\mathcal{P})$ is the context parameter on the parameterized cardinality function which is dependent on the context relative to which the count predicate has been derived. ($\mathcal{P}$ is a variable over predicates of type <d×k, t>):
(i) $[[\text{Three}_{<<d\times k,t>,\ <d\times k,t>>}]] = \lambda \mathcal{P} \lambda \boldsymbol{x}.\boldsymbol{x} \in \mathcal{P} \wedge |\pi_1(x)|_{\pi_2(\mathcal{P})} = 3$
"*Three* denotes a function which applies to a count predicate of type <d×k, t> and gives the subset of the count predicate i.e. a set of ordered pairs where the first projection of each ordered pair has three parts which count as atoms in k."

[8] For more on this see Rothstein (ms).

References

Borer, H. 1999. 'Deconstructing the construct'. In K. Johnson & I. Roberts (eds.) 'Beyond Principles and Parameters', 43–89. Dordrecht: Kluwer publications.

——. 2008. 'Compounds: the view from Hebrew'. In R. Lieber & P. Stekauer (eds.) 'The Oxford Handbook of Compounds', 491–511. Oxford: Oxford University Press.

Carlson, G. 1977b. *Reference to Kinds in English*. Ph.D. thesis, University of Massachusetts at Amherst.

——. 1997. *Quantifiers and Selection*. Ph.D. thesis, University of Leiden.

Carslon, G. 1977a. 'Amount relatives'. *Language* 53: 520–542.

Chierchia, G. 2008. 'Plurality of mass nouns and the notion of 'semantic parameter''. In S. Rothstein (ed.) 'Events and Grammar', 53–103. Dordrecht: Kluwer.

Danon, G. 2008. 'Definiteness spreading in the Hebrew construct state'. *Lingua* 118: 872–906.

Gillon, B. 1992. 'Toward a common semantics for English count and mass nouns'. *Linguistics and Philosophy* 15: 597–640.

Grosu, A. & Landman, F. 1998. 'Strange relatives of the third kind'. *Natural Language Semantics* 6: 125–170.

Heim, I. 1987. 'Where does the Definiteness Restriction Apply? Evidence from the Definiteness of Variables'. In A. ter Meulen & E. Reuland (eds.) 'The Linguistic Representation of (In)definiteness', 21–42. Cambridge: MIT Press.

Krifka, M. 1989. 'Nominal reference, temporal constitution and quantification in event semantics'. In R. Bartsch, J. van Bentham & Peter van Emde Boas (eds.) 'The Linguistic Representation of (In)definiteness', 75–155. Dordrecht: Foris.

Landman, F. 2003. 'Predicate-argument mismatches and the Adjectival theory of indefinites'. In M. Coene & Y. d'Hulst (eds.) 'From NP to DP Volume 1: The Syntax and Semantics of Noun Phrases', 211–237. Amsterdam: John Benjamins.

——. 2004. *Indefinites and the Type of Sets*. Oxford: Blackwell.

Link, G. 1983. 'The logical analysis of plurals and mass terms: a lattice-theoretic approach'. In Rainer Bäuerle, Urs Egli & Arnim von Stechow (eds.) 'Meaning, Use and the Interpretation of Language', 303–323. Berlin: de Gruyter.

Partee, B. H. 2010b. 'Bare 'milk' in 'glass of milk' in English and Russian'. Handout, Workshop on Bare NPs, Bar-Ilan University.

Partee, B. H. & Borschev, V. 2010a. 'Sortal, relational and functional interpretations of nouns and Russian container constructions'. To appear in *Journal of Semantics*.

Pires de Oliveira, R. & Rothstein, S. 2011. 'Bare singulars are mass in Brazilian Portuguese'. To appear in *Lingua*.

Ritter, E. 1991. 'Two functional categories in noun phrases: evidence from Modern Hebrew'. In S. Rothstein (ed.) 'Perspectives on Phrase Structure', 37–62. New York: Academic Press. Syntax and Semantics vol 25.

Rothstein, S. 2009. 'Individuating and Measure Readings of Classifier Constructions: Evidence from Modern Hebrew'. *Brill Annual of Afroasiatic Languages and Linguistics* I: 106–145.

——. 2010. 'Counting and the mass/count distinction'. *Journal of Semantics* 27, no. 3: 343–397.

——. ms. 'Bare nouns, mass nouns and the universal grinder'. Ms based on talk presented at the Workshop on Bare Nouns, Université Paris VII, November 2009.

Selkirk, L. 1977. 'Some remarks on noun phrase structure'. In P. Culicover, T. Wasow & A. Akmajian (eds.) 'Formal Syntax', 285–316. New York: Academic Press.

Shlonsky, U. 2004. 'The form of Semitic nominals'. *Lingua* 114.12: 1465–1526.