

Towards a Grammar of Counting and Measuring

Susan Rothstein
Bar-Ilan University/Leiden University
susan.rothstein1@gmail.com

Goals of the talk:

- (i) to elucidate the semantic difference between measure and individuation readings of classifiers in English in expressions such as *two glasses of water*.
- (ii) to propose a syntactic analysis which will allow for two different compositional semantic interpretations: in individuating readings, the classifier is the head of the nominal, while in measure readings it is a modifier.
- (iii) to show that Modern Hebrew provides evidence that individuating and measure readings are syntactically distinct and that the analysis proposed in (ii) is the correct one.
- (iv) to draw some general conclusions about the conditions under which classifiers can be interpreted as measure phrases, and to give some preliminary cross-linguistic evidence in support of these conclusions: crucially the complement of the classifier must be analysable as a predicate.

Part I: Individuating vs measure readings in classifier constructions:

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 (1):

Classifiers like *box of N*, *cup of N* are used to count mass nouns (2):

Measure expressions may also be used to count mass nouns (3):

Quantities of plural nouns can be counted as in (4).

- (1) three flowers, four books.
- (2) *three flours vs three cups of flour
- (3) three kilos of flour
- (4) three boxes of books, three kilos of books

Observation 1: (Doetjes 1997, Chierchia 1998, Landman 2004 and others) classifier phrases like *two glasses of water* are ambiguous between an ‘individuating’ reading (5a) and a ‘measure’ reading (5b):

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

Observation 2: lexical measure heads may have distinct properties from nominal heads on either the individuating or classifying readings:

Evidence: Dutch (Doetjes 1997) measure expressions such as *liter*, *kilo* can be distinguished from classifiers since they do not necessarily agree in number.

- (6) a. Jan heeft twee kilo('s) pruimen gekocht.
Jan has two kilo(-PL) plums bought.
Jan has bought two kilos of plums.
- b. Jan heeft twee zak*(ken) pruimen gekocht.
Jan has two sack-PL plums bought.
Jan has bought two sacks of plums.
- c. Drie liter water / Drie liters water
Three **liter** water/ Three **liters** water
- d. Drie pond gerookte worst/ Drie ponden gerookteworst
Three **pound** smoked sausage/ Three **pounds** smoked sausage

Note the semantic correlate of the two options in (6a): when *kilo* is marked plural, then the preferred reading is individuating. When it is not marked plural, there is no such implication: (7a) makes no commitments to the number of items delivered. In (7b) the preferred reading is that 20 x 1 liter-bottles were delivered:

- (7) a. Ik heb twintig liter frisdrank bezorgd voor het feestje.
I have 20 liter soft-drink delivered 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 litre-bottles of drink for the party.
- (8) a. *twintig halve liters bier* = 20 half-liter bottles of beer,
b. *#twintig halve liter bier* = infelicitous: *halve liter* is not a natural measure unit.

German shows the same distinctions as Dutch, but with the addition that in some dialects (at least), the agreement phenomenon may show up with some nominal classifiers too (p.c. Franz d'Avis: Mosel-Fränkisch dialect):

- (9) a. zwei Glas Wasser (measure reading)
b. zwei Gläser Wasser (ambiguous)
c. zwei Kiste*(n) Bücher

So we have two distinctions:

- a semantic difference between measure and individuating readings of classifiers (see ex. 5)
- a lexical distinction between measure classifiers and nominal classifiers (see ex. 6-9)

Can we disambiguate the individuating/measure reading in English?

(i) *measure suffixes*:

On the measure reading, the suffix *-ful(s)* can often be added to the classifier.

- (10) a. Add two cup(ful)s of wine to the soup.
b. Bring two cup(#ful)s of wine for our guests.
c. We needed three bucket(ful)s of cement to build that wall.
d. Three bucket(#ful)s of mud were standing in a row against the wall.

(ii) *pronominalisation* Plural individuating classifiers are natural antecedents for individuating pronouns:

- (11) There are two cups of wine on this tray.
a. They are blue.
b. They (each) contain 100 millilitres.
c. They (each) cost 2 Euros.

- (12) There are two cups of wine in this soup.
a. #They are blue.
a. #They (each) contain 100 millilitres.
a. #They (each) cost 2 Euros.
a. It adds flavour/??They add flavour.

(iii) *grammatical agreement*. Plural individual classifiers requires plural agreement, measure phrases may allow singular agreement, especially in existential and copular constructions.

- (13) a. There are two cups of wine on this tray.
b.* There is/There's two cups of wine on this tray.

- (14) a. There are two cups of wine in this soup.
b. There's two cups of wine in this soup.

- (15) Two pieces of cake are/is enough for you to eat.

(iv) *distributive operators* operate on the individuals in the denotation of individuating classifier expressions and are unacceptable with measure phrases.

- (16) a. Two packs of flour cost 2 euros each.
b.#Two kilos of flour cost 2 euros each.
c. The two cups of wine(#in this soup) cost 2 Euros each.

(v) *relative clause formation* (Carlson 1977, Heim1987, Grosu and Landman 1998). 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 ambiguous between an individuating and a measure reading, so either classifier is in principle acceptable as in (17a), but choice of *which* forces the individuating reading:

- (17) a. I would like to be able to buy the bottles of wine that/which they bought for the party.
b. I would like to be able to buy the litres of wine that/*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.

Conclusion: individuating/measure contrast in the interpretation of classifiers is a genuine semantic ambiguity, but is not grammatically encoded in the classifier itself in English.

Part II. Syntactic and Semantic Analysis

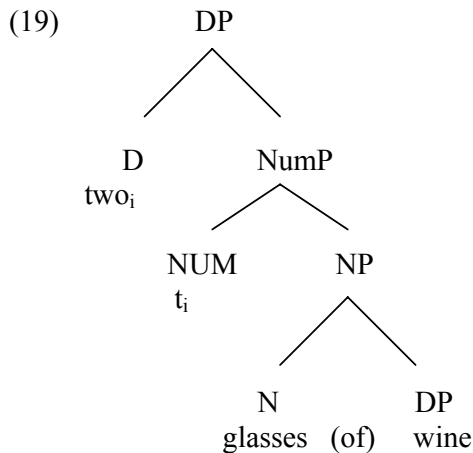
On the individuating reading: *two glasses of wine* denotes actual glasses containing wine.
On the measure reading: *two glasses of wine* denotes wine to the measure two glasses.

The individuating reading:

The nominal raises from a one-place predicate of individuals in (18a) to the relational noun in (18b):

- (18) a. $\lambda x. \text{GLASSES}(x)$
- b. $\lambda y \lambda x. \text{GLASSES}(x) \wedge \text{CONTAIN}(x, y)$

This relational nominal *glasses* is the head of the NP in the individuating reading as in (19):



Following Landman (2003, 2004) we assume that the numeral in this use is adjectival. It begins in NUM at type n , shifts to the modifier type $\lambda n.n=2$ and composes with the cardinality function $| \cdot |$ to give the predicate modifier in (20):

(20) $\lambda x. |x| = 2$

The numeral raises from NUM to the determiner in argument position if the determiner phrase is empty, as in (19). Landman (2003) shows that if the determiner is filled, and the adjective does not need to raise, permutation with other adjectives is possible:

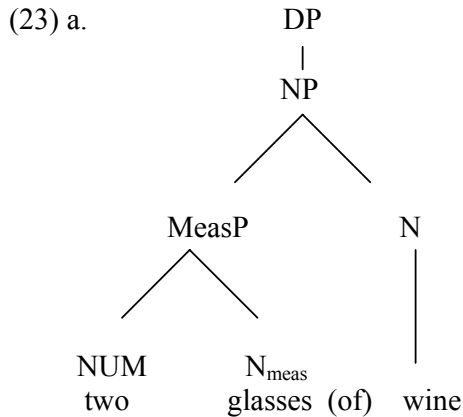
(21) We sent the ferocious three lions to Blijdorp and kept the mild three lions at Artis.

The measure reading:

Landman 2004 with Krifka 1989, and Chierchia 1998 treats expressions like *kilo* as denoting measure functions of type $\langle n, \langle d, t \rangle \rangle$: i.e. they combine with a number of type n , to give a predicate of individuals

- (22) a. $\| \text{kilo} \| = \lambda n \lambda x. \text{MEAS}_D(x) = \langle n, \text{KILO} \rangle$
- b. $\| \text{two kilo(s)} \| = \| \text{kilo} \| (\| \text{two} \|) = \lambda x. \text{MEAS}_D(x) = \langle 2, \text{KILO} \rangle$

We apply this to the measure reading of nominal classifiers too: In the measure reading *glasses* is a modifier, which combines first with the numeral *two* (which does not raise). The complex modifier then applies to the nominal head *wine* (23):



In both cases, *of*-insertion is presumed to be a late phenomenon satisfying surface constraints.

This is semantically plausible, but needs syntactic support. Possible syntactic support. If *three glasses* is a modifier, then it should be able to scope under another modifier:

- (24) a. You drank/spilled [an [expensive [three glasses] of wine]]!
 b. #The waiter brought an expensive three glasses of wine!

If the classifier is a nominal head, then it should be independently modifiable. And in (25a) *three glasses* is separated by the adjective *expensive*. But, the measure classifier should not be independently modifiable since NUM + classifier form a constituent, as in (25b)

- (25) a. #She added three expensive glasses of cognac to the sauce
 b. The waiter brought three expensive glasses of cognac.
 c. That was an expensive three glasses(ful) of cognac that you added to the sauce!

These structures offer the following interpretations:

SEMANTICS BOX 1: **Individuating interpretation based on the structure in (19)**

three glasses of wine: [[[[three]_{NUM} [glasses [wine]_{DP}]_{NP}]_{NumP}]_{DP}

Basic meaning of *glass* $\lambda x.GLASS(x)$

Glass is an individuating classifier of type $\langle e, \langle e, t \rangle \rangle$. It assigns a thematic role CONTAIN to a direct object (see Borschev and Partee 2004)
 Its (plural) form is as follows:

glasses (nominal head): $\lambda y \lambda x. [GLASSES(x) \wedge CONTAIN(x, y)]$

glasses of wine: $\lambda x. GLASSES(x) \wedge CONTAIN(x, WINE)$

three (glasses of wine):
 $\lambda P \lambda x. P(x) \wedge CARD(x) = 3 \ (\lambda x. GLASSES(x) \wedge CONTAIN(x, WINE))$
 $= \lambda x. GLASSES(x) \wedge CONTAIN(x, WINE) \wedge CARD(x) = 3$

This can be raised to the generalised quantifier reading like any other indefinite, as necessary.

SEMANTICS BOX 2: **Measure interpretation based on the structure in (23):**

three glasses of wine: [[[three]_{NUM} glasses]_{NumP} [wine]_N]_{NP}]_{DP}

Basic meaning of *glass* $\lambda x.GLASS(x)$

Glass is a measure expression, of type $\langle n, \langle \langle e,t \rangle, e,t \rangle \rangle$.
(Krifka 1989, Landman 2004)

It combines first with a numeral and then applies to a predicate nominal head.
The operation which turns *glass* from a nominal to a measure expression is introduced either explicitly by *-ful* or by a null correlate of *-ful*.

glasses (measure expression): $\lambda n \lambda P \lambda x. P(x) \wedge MEAS(x) = \langle n, GLASSFUL \rangle$

three glasses (predicate modifier expression):
 $\lambda P \lambda x. P(x) \wedge MEAS(x) = \langle 3, GLASSFUL \rangle$

three glasses of wine: $\lambda x. WINE(x) \wedge MEAS(x) = \langle 3, GLASSFUL \rangle$

Note 1: In the measure reading, I have analysed *wine* as a predicate. This is crucial to the analysis. In the individuating reading, I have analysed wine as a DP denoting a kind, and thus obviously an argument. I did this for simplicity. It is also possible to analyse it as an indefinite nominal. Its just a bit harder to read. What is important is that in the individuating reading, the complement nominal is an argument, whether an indefinite or a kind term.

Note 2: Crucially, *of* is not semantically interpreted and the surface syntactic complement of *of* is interpreted as the complement of the classifier (Chomsky 1981).

Part III: Evidence from modern Hebrew:

Data: Modern Hebrew (MH) provides independent evidence that measure use of classifiers is modificational. Classifier expressions in MH are associated with two different syntactic structures, a construct state (CS) construction (26a), and an absolute or free genitive (FG) construction (see 26b). (26b) seems to be parallel to English *glasses of wine* construction.

- (26) a. šaloš kosot yayin
 three cups wine
 b. šaloš kosot šel yayin
 three cups of wine

However, the CS construction is ambiguous between the individuating and the measure reading, but the free genitive is associated only with the individuating reading.

- (27) ha-im yeš od marak?
 Q there more soup? Reading: “Is there more soup?”
 ken, yeš od šaloš ka’arot marak / # šaloš ka’arot šel marak ba-sir.
 Yes, there more three bowls soup (CS) three bowls of soup (FG) in-DEF-pot
 “‘Yes there are three more bowls of soup in the pot”

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

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

More examples: I am in a restaurant, and there are no sugar pots left. I say to the waitress:

- (29) tavi-i lanu kos im arba kapiot (#šel) sukar
bring-f-sg. us cup with four(f) teaspoons(f.pl) (#of) sugar
"Bring us a cup with 4 teaspoons of sugar in it."

Or, on moving house:

- (30) arba'im ve- štaim kufsaot (šel) sfarim lo nixnasot la-madafim šelanu
forty and two boxes (of) books no enter(f.pl) to-shelves of-us
"Forty-two boxes of books don't fit on our shelves".

arba'im ve- štaim kufsaot sfarim (CS): the books don't fit on our shelves.

arba'im ve- štaim kufsaot šel sfarim (FG): the boxes don't fit on our shelves (in an archive)

Hypothesis:

- (a) **Individuating readings involve a head/complement relation between classifier and 'substance' noun.**
(b) **Measure readings involve num+classifier to be interpreted as a modifier of the 'substance' noun**

Outline of the Argument:

- (i) In the **Free Genitive constructions**, the *šel* preposition introduces a thematic relation between head and complement. Thus the classifier must be interpreted as a theta-assigning head, and semantically only the individuating reading is possible.
(ii) In **indefinite Construct State constructions**, it is possible to interpret the classifier as either a head or a modifier. This follows from the syntactic structure of the indefinite construct state. Individuating or measure readings are possible.
(iii) In **definite Construct State constructions**, it is not possible to interpret the classifier as a modifier for independent structural reasons. Only the individuating reading of these examples is possible. This follows from the syntactic structure of the definite construct state.
(iv) **Definite Construct State constructions with measure heads**, where the head is an explicit measure term and thus semantically a modifier, but where it is not possible to interpret the head syntactically as a modifier, are correctly predicted to be ungrammatical.

Detailed Analysis:

(i) Free genitive constructions:

Unlike *of*, the preposition *šel* in MH is a genuine preposition expressing a thematic relation which is either the possessive, or is determined by the lexical head. Evidence:

- (i) unlike *of*, *šel* cannot be used where case-marking is required but no thematic role is assigned. *šel* is impossible in partitive constructions (31a) and 'headed partitives' (31b):

(31) a. *šloša šel ha-yeladim (OK: šloša me- ha- yeladim)
 three of DEF-class (Three of DEF children from DEF-class)
 “three of the children”

b. *axalti šaloš xatixot šel ha- uga (OK: šaloš xatixot me- ha-uga)
 ate-I three pieces of DEF-cake (three pieces from DEF-cake)
 “three children from the class”

(ii) *šel* can marginally introduce a container relation with an ‘unusual’ container:

(32) a. kova male pitriot
 hat full mushrooms

b. ?kova šel pitriot (Free Genitive)
 hat of mushrooms

c. * kova pitriot (Construct State)
 hat mushrooms
 ‘a hat-ful of mushrooms’

Note in English this is not possible with *of*:

(33) #a hat of mushrooms. OK: A hat-ful of mushrooms

Since *šel* is thematically interpreted and denotes a thematic relation between the denotations of the head and complement, the classifier head must be interpreted as a head. The complement is an argument, the kind WINE. The structure for (26b) *šaloš kosot šel mayim* is (34a), and the interpretation is given in (34b):

(34) a. [[[šaloš]_{NUM} [kosot [šel [yayin]_{DP}]_{PP}]_{NP}]_{NumP}]_{DP}
 b. $\lambda x.CUPS(x) \wedge CONTAIN(x,WINE) \wedge CARD(x) = 3$

- *kos* "cup" is the nominal head. It normally denotes $\lambda x.CUP(x)$.

- In (29a) it shifts to the extended relational meaning $\lambda y \lambda x.CUP(x) \wedge CONTAIN(x,y)$
 (see SEMANTICS BOX 1) (NB: there is one word for cup/glass in Modern Hebrew)

The difference between (34a) and *three glasses of wine* is that ***šel* is a genuine thematic preposition while *of* is not.**

Since *šel* is a genuine thematic preposition, relating the head and its complement, the classifier head must be interpreted as a head, and it is NOT possible to reanalyse the nominal classifier head *kos* as a measure modifier.

So the ambiguity in English derives from the fact that *of* is not a genuine preposition, and does not mediate a theta relation. The syntactic structure which is interpreted is (35a). It is naturally a head-complement relation, but can be reanalysed as a modificational relation as in (35b) :

(35) a. [three [glasses [wine]]]
 b. [[three glasses][wine]]

This reanalysis is impossible in the Free Genitive in Modern Hebrew because *šel* assigns a thematic role, and therefore **requires** the classifier *kos* to be interpreted as a head.

(ii) Indefinite construct state constructions:

Borer 2008: construct state forms are of two kinds: modifying constructions and referential constructions. Both measure and individuating CS constructions are modifying:

- they do not allow modification of the complement by a definite adjective, (36a):
- an indefinite complement can only be modified by a property modifier, (36b):
- and the complement cannot occur with a numeral modifier, (36c):

- (36) a. *šaloš kufsaot ha- sfarim *haxadašim*
 “the three boxes of (*new) books”;
 b. *kos mitz saxhut/??yakar*
 “a cup of fresh pressed/??expensive juice”
 c. *xavilat (*esrim) gulot*
 a packet of (*20) marbles).

Borer (1999, 2008) argues that the complement of the construct state head here is an NP. The modificational construct state is a syntactic context which enables a head noun to take a bare NP complement via some syntactic reanalysis mechanism. (Borer 1999, 2008). We assume that the complement is a predicate nominal NP. Other obligatorily indefinite NP complements have been analysed the same way (van Geenhoven 1998).

The individuating reading of the construct state: The content of the semantic relation between head and complement is chosen from a contextually determined range, and not expressed through a preposition. If the head nominal assigns an internal theta-role, this will normally determine the content of the semantic relation. Since *glass/cup* is associated on its classifier reading with the thematic role “CONTAIN”, the effect is identical to the Free Genitive reading: The CS nominal (26a) has the structure in (37a) and the interpretation in (37b). This is semantically equivalent to (34b).

- (37) a. $[[\text{šaloš}]_{\text{Num}} [\text{kosot} [\text{yayin}]_{\text{NP}}]_{\text{NP}}]_{\text{NumP}}$
 b. $\lambda x. \exists y [\text{CUPS}(x) \wedge \text{WINE}(y) \wedge \text{CONTAIN}(x, y) \wedge \text{CARD}(x) = 3]$

The measure reading: In the construct state form *[kosot yayin]* head and complement are juxtaposed as in the English structure (35). There is no lexical preposition introducing a thematic relation. The complement is a predicate nominal: The measure interpretation takes advantage of this to reanalyse the head *kosot* as a modifier, modifying the syntactic complement, the predicate nominal *yayin*.

- (38) [N N] : possibility (i): head (complement)
 possibility (ii): (modifier(head))

In (ii), *kosot* “cups” combines first with the numerical expression *šaloš*, “three” to form the complex modifier, *šaloš kosot* “three cups”, and this expression modifies *yayin* “wine”.

Derivation for (ii): the syntactic structure is (39).

- (39) $[[\text{šaloš kosot}]_{\text{NumP}} [\text{yayin}]_{\text{NP}}]_{\text{NP}}$

As in English *kos* is a measure phrase and denotes:

(40) $\lambda n \lambda x. \text{MEAS}(x) = \langle n, \text{CUP-FULS} \rangle$

It combines first with the numeral *šaloš* "three" and shifts to the predicate modifier:

$\lambda P \lambda x. P(x) \wedge \text{MEAS}(x) = \langle 3, \text{CUP-FUL} \rangle$.

This applies to the nominal *yayin* "wine", giving (41).

(41) $\lambda x. \text{WINE}(x) \wedge \text{MEAS}(x) = \langle 3, \text{CUP-FULS} \rangle$

General prediction: measure readings are possible ONLY when the syntactic environment allows reanalysis of the classifier as a modifier expression. Since the Free Genitive does not allow this reanalysis, only the individuating reading is possible.

Further evidence that measure readings are modificational:

High register (and Biblical Hebrew) uses the full nominal (i.e. not a construct state) agreeing with the numeral:

(41) a. hu kana xamiša argazim tut
he bought five box(m.pl.) strawberry
"He bought five boxes of strawberries"

b. lakaxti šloša yamim xofeš.
took-I 3 day(m.pl.) vacation.
"I took three days vacation"

c. kaniti arba'a kilogramim kemax.
bought-I four kilograms flour
"I bought four kilograms of flour"

This is the only constructions in which a nominal not in the construct state is immediately followed by another nominal expression. The construction is disappearing from MH. Analysis: the structure is as (42):

(42) $[[\text{xamiša argazim/kilogrammim}]_{\text{MeasP}} [\text{tut}]_{\text{NP}}]_{\text{DP}}$

(iii) Definite numerical construct state constructions

Definite numerical construct state constructions further support the above prediction.

The numerical heads its own construct state in the definite form (43b):

Definite numerical CS classifier constructions (43c) are "double" CS constructions.

(43) a. šloša babbukim
3 bottles
"three bottles" (indefinite: absolute form)

b. $[[\text{šlošet}]_{\text{Adj}} [\text{ha-babbukim}]]$
three the-bottles
"the three bottles" (definite: construct state form)

c. [[šlošet]_{Adj} [[bakbukey [ha-mayim]_{NP}]_{NP}]_{AP}
 three bottles DEF-water
 "The three bottles of water" (definite: multiple embedded construct state forms)

d. [[šloša]_{Adj} [[bakbukey [mayim]_{NP}]_{NP}]_{AP}
 three bottles water
 "Three bottles of water"

The numerical head *šlošet* heads its own CS construction and has the CS nominal [*bakbukey ha-mayim*] as a complement.

Hypotheses: since *šlošet* “3” is the head of its own phrase, with a construct state complement, the whole phrase *bakbukey hamayim*, we predict correctly that the nominal head *bakbukey* “bottles” cannot combine first with the numerical expression 3 and modify the expression *mayim* “water”. (NB. We will have more to say about this in PART IV.)

So (43c) has only an individuating and not a measure reading.. This contrasts with (43d), the indefinite construct state, and where *šloša* is an adjoined modifier, and both individuating and measure readings are possible.

(44) gives a context in which the desired definite measure reading is impossible in Modern Hebrew, but possible in English:

(44) hizmanti esrim orxim 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 higu, ve- šaloš ka’arot ha- marak ha- axronot nišaru
 only seventeen guests came, and three bowls DEF soup DEF last remained
 b- a- sir.
 in DEF pot.

Intended reading: “Only 17 guests arrived, and **the last three bowls of soup** remained in the pot”

This sounds bizarre, as if the bowls of soup themselves were in the pot. There is no simple way to express this felicitously using the definite, and a circumlocution has to be used. As the intended reading shows, the corresponding English expression is quite felicitous.

(iv) Definite measure expressions in construct state constructions

The final prediction that we make is the following:

If a definite construct state construct does not allow a measure reading **syntactically** but the content of the construct state **only** allows a measure reading **semantically**, then we will get an ungrammatical construction. This prediction is born out. Indefinite construct state constructions are possible with measure heads such as *kilo* as in (45a), but the definite forms are not grammatical.

(45) a. xamiša kilo kemax
 5 kilo kemax
 “five kilos of flour”

- b. *xamešet kilo ha- kemax
 five kilo DEF- flour
 intended reading: “the five kilos of flour”

(In the free genitive cases, measure heads can occur with *šel*, but this gives an strictly individuating reading as (46c) shows. I assume that this reading is derived from the construction where *šel* forces *kilo* into an individuating semantics, and that this reading is not derivable in the absence of *šel* in the CS constructions.)

- (46) a. kani-ti **arba'a kilo kemax** (be-štey sakiot šel šney kilo)
 Bought-I 4(m) kilo flour (in- 2-f bag-pl-f of 2(m) kilo).
 "I bought 4 kilos of flour in 2 bags of 2 kilos."

- b. kani-ti **arba'a kilo šel kemax**
 Bought-I 4(m) kilo of flour
 "I bought four kilos of flour". (implication: in kilo packages).

- c. #kani-ti **arba'a kilo šel kemax** be-štey sakiot šel šney kilo.
 Bought-I 4(m) kilo flour (in- 2-f bag-pl-f of 2(m) kilo).

Summary of Part III:

Modern Hebrew indefinite construct states allow reanalysis of the classifier head as a modifier. Measure readings of these classifiers are optionally available. Free genitive constructions do not allow this reanalysis and only the individuating readings are possible.

Question: What exactly are the conditions under which this reanalysis is possible?

PART IV: Some cross linguistic observations on measure readings

Hypothesis: measure readings of classifier phrases need a syntactic context in which the num+classifier can be reanalysed as a modifying the complement. To be modified, the complement must be (i) a predicate NP; (ii) not the complement of a thematic preposition:

A. Russian

1. Borschev and Partee 2004: Measure classifiers take genitive complements in Russian:

- (47) a. stakan moloka
 glass-NOM.SG milk-GEN.SG
 ‘glass of milk’
- b. jaščik jablok
 box-NOM.SG apples-GEN.PL
 ‘box of apples’.

These are ambiguous between an individuating and a measure reading.
 There is a second construction with the ‘container’ as head:

- (48) stakan s molokom
 glass-NOM.SG with milk-INST.SG

This only has the individuating reading.

As far as I can see, *s* “with” is a ‘real’ preposition: we have also:

- (49) kofe s molokom
coffee-NOM.SG with milk-INST.SG

So far this parallels the Modern Hebrew data nicely.

2. Borschev and Partee (2004) plus Borschev et.al (2006, 2008) argue that the Russian Genitive denotes a property expression, i.e. a predicate nominal of type $\langle e, t \rangle$.

This is what we have been arguing for complement NP in the construct state form in Hebrew.

B. Brazilian Portuguese

Classifier constructions with count nouns can take plural or bare singular complements:

- (50) a. Arrumei **duas caixas de livro** no armário.
 Place+past two boxes of book+Ø in+the bookshelf
 b. Arrumei **duas caixas de livros** no armário.
 Place+past two boxes of book+PL in+the bookshelf

The bare singular complement (50a) is ambiguous between measure and individuating reading. (50b) seems only to have the individuating reading. If bare singulars are not full DPs (i.e. have no D or Num projection), then they are candidates for modifiable NPs. We assume that *de* like *of* is not thematic.

C. English

The implication of this is that the English construction [N (of) NP] is more like the Hebrew construct state construction than we might originally have thought, and that possibly ‘of’ complements are at the very least ambiguous between argument and predicate types. Note that in the other Germanic languages mentioned earlier (Dutch and German), the complement of the classifier is immediately adjacent to the classifier head, as we saw in the Dutch and German examples earlier.

- (51) Twee zakken pruimen/ Drie liter(s) water
 two sack-PL plums /three litre(PL)water
 “two sacks of plums” / “three liters of water”

In English, bare NP complements are found in recipes, and are unambiguously measure readings. (52) come from a selection of recipe and diet contexts found on the internet.

- (52) Two glasses water, one piece fresh fruit, two slices wholewheat bread

D. Mandarin Chinese

Further evidence that measure interpretations are modificational: In Mandarin Chinese, obligatory measure interpretations of classifiers are marked by DE, normally assumed to mark modifiers. Cheng and Sybesma (1998)

- (53) a. zhuozi-shang you san wan tang
 table-top there-is three CL-bowl soup
 'There are three bowls of soup on the table'
- b. zhuozi-shang you san wan- de tang
 table-top there-is three CL-bowl-DE soup
 'There is enough soup on the table to fill three bowl'

“The picture evoked by [53b] is that the soup is all over the table, spilled, there are no bowls. The default interpretation of [53b]) on the other hand is that there are three bowls, filled with soup, standing on the table.” Crucially, DE is a marker of **modification**.

DE marked classifiers constructions are obligatorily interpreted as measure expressions. Non- DE marked classifier constructions are ambiguous between measure and individuation reading. Li (in progress) notes this is true of individuating classifiers as well as container classifiers, which can shift a measure reading in e.g. (54)

- (54) wo zai shali li fang le yi ge yangcong, ban ge bai yangcong,
 I at salad in put Perf one CL onion: half CL white onion
 ban ge zi yangcong.
 half CL purple onion
 'I put an onion into the salad: half of a white onion and half of a purple onion.'

PART IV: Conclusions:

Modern Hebrew provides independent evidence that:

(i) individuating and measure readings of classifiers are read off syntactically different structures

(ii) measure readings require the classifier head to be reanalysed as a modifier (strictly, a function from numbers into a nominal modifier, which combines with a number to give a modifier) and the complement of the classifier to be analysed as a predicate.

Generally there is evidence that:

(iii) **individuating readings of classifiers** require the classifier to be analysed as a nominal head assigning a theta-role CONTAIN to its complement. In some cases, the theta-role is assigned via a thematic preposition (Hebrew *šel*, Russian *s*). In other cases, the thematic relation is not mediated via a preposition. In Germanic (Dutch, German, English), it is never mediated by preposition. Hebrew, Russian have both options.

(iv) **measure readings of classifiers** are modificational, requiring the classifier head to be reanalysed as a modifier. This reanalysis is possible only when the language allows the classifier to take a predicate NP complement of type <e,t>.

Different languages use different mechanisms to licence the direct NP predicate complement option: Hebrew uses the construct state, Russian uses Genitive Case marking, English uses *of* insertion. Lexical prepositions take arguments and so do not allow measure interpretations of the head they are related to.

In sum: Measure interpretations of classifier constructions are possible when the following syntactic conditions hold:

- (i) the complement of the classifier can be interpreted at type <e,t>

(ii) there is no thematically interpreted preposition which forces the classifier to be interpreted as a theta-assigning head.

Assume that prepositions take complements at the argument type e (or $\langle\langle e, t \rangle t \rangle$), then condition (ii) is a necessary condition of condition (i) holding. i.e complements of prepositions cannot be interpreted at the property type. Complements of nominal (and verbal) heads can be interpreted at the property type.

References:

- Borer, H (1999) Borer, H. (1999) Deconstructing the construct. In K. Johnson and I. Roberts (Eds.) *Beyond Principles and Parameters*. Dordrecht: Kluwer publications
- Borer, H (2008) Compounds: the view from Hebrew. R. Lieber and P. Stekauer eds. *The Oxford Handbook of Compounds*. OUP.
- Borschev, Vladimir, and Partee, Barbara H. (2004). Genitives, types, and sorts. In *Possessives and Beyond: Semantics and Syntax*, eds. Ji-yung Kim, Yury A. Lander and Barbara H. Partee, 29-43. Amherst, MA: GLSA Publications.
- Cheng, L.L and R. Sybesma, (1998): “yi-wan tang, yi-ge Tang: Classifiers and massifiers,” *Tsing Hua Journal of Chinese Studies* 28, 385-412.
- Chiechia, G, (1998). Plurality of mass nouns and the notion of 'semantic parameter'. In S. Rothstein (ed.) *Events and grammar*, Dordrecht: Kluwer.
- Doetjes, J. (1997) *Quantifiers and Selection*. Ph.D. diss., U. Leiden;
- van Geenhoven, V, 1998: *On the argument structure of some noun incorporating verbs in West Greenlandic* PhD diss., U. Tübingen.
- Landman, Fred, (2003), 'Predicate-argument mismatches and the Adjectival Theory of Indefinites,' in: Coene, Martine and Yves D'Hulst (eds.), *From NP to DP, Volume 1: The Syntax and Semantics of Noun Phrases*, John Benjamins, Amsterdam.
- Landman, F. (2004) *Indefiniteness and the type of sets*. Blackwell.
- Li, XP. (in prep.) *On the semantics of classifiers in Mandarin Chinese*. Ph.D. diss. Bar-Ilan..
- Rothstein, S. (in press) Individuating and Measure Readings of Classifier Constructions: Evidence from Modern Hebrew. *Brill Annual of AfroAsiatic Languages and Linguistics Vol 1*.