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Partitivity and Measurement in NP

1 Recap

(1) *The semantics of measure phrases*

a. $[\![\text{meter}]\!] = \lambda d : d \in Dom(\mathbf{long}).d = \mathbf{long}(m)$ m = the Paris meter stick
b. $[\![\text{meters}]\!] = {}^*[\![\text{meter}]\!] = \lambda d.d$ *is an i-sum of meter-length degrees*
c. $[\![\text{two}]\!] = \lambda P \lambda d. {}^*P(d) \wedge d$ *consists of (at least) 2 atoms*
d. $[\![\text{two meters}]\!] = \lambda d. {}^*[\![meter]\!](d) \wedge d$ *consists of (at least) 2 atoms*
$= \lambda d.d =$ two-meters

(2) *Schwarzschild's Generalization*

a. MPs in (pseudo-)partitives are acceptable only if they measure a property that is *monotonic* with respect to the head.
b. MPs in compounds are acceptable only if they measure a property that is *non-monotonic* with respect to the head.

(3) *Monotonicity*
A property is monotonic if it tracks part-whole relations.

(4) *Schwarzschild's analysis*

a. $[\![\text{MP}]\!]/[_{N^{max}} \_\_ \text{N'}] = \lambda P \lambda x.P(x) \wedge [\![\text{MP}]\!](\mu(x))$
CONDITION: μ is monotonic on P
b. $[\![\text{MP}]\!]/[_{N'} \_\_ \text{N'}] = \lambda P \lambda x.P(x) \wedge [\![\text{MP}]\!](\mu(x))$
CONDITION: μ is not monotonic on P

Some questions:

1. What is responsible for Schwarzschild's Generalization? (Why is monotonicity relevant to the expression of measurement in NP?)
2. Where do the measure functions in (4a-b) come from?
3. Do we have the right syntactic structures?

2 Measurement in NP: More data

2.1 Pseudopartitive recursion

Examples like those in (5) appear to indicate that the unit nominals in MPs can be iterated.

(5) a. many/three/several truckloads of baskets of heads of cabbage
b. many/three/several boxes of reams of sheets of paper
c. many/three/several tons of palettes of crates of wine

The 'counter' always comes at the top:

(6) a. many truckloads of (*several) baskets of (*three) heads of cabbage

b. several boxes of reams of (*a bit/a lot) of paper
c. three tons of (*50) palettes of crates of wine

On the other hand, maybe these are ‘classifier’ constructions. But then, maybe classifier constructions and pseudopartitives are the same thing! We’ll have to hold off on this question until next time; what’s important to us today is that these facts appear to fall under the domain of Schwarzschild’s Generalization.

(7) a. ??4 reams of (a) box of paper
b. a 4 ream box of paper
c. a box of paper that holds/?measures 4 reams

(8) a. many truckloads of 6 bushel baskets of heads of cabbage
b. ??many truckloads of 6 bushels of baskets of heads of cabbage

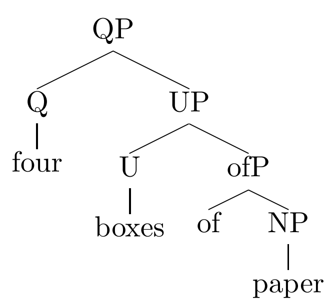
(9) a. four 16 oz. glasses of water
b. ??16 oz. of glasses of water

Are the following synonymous?

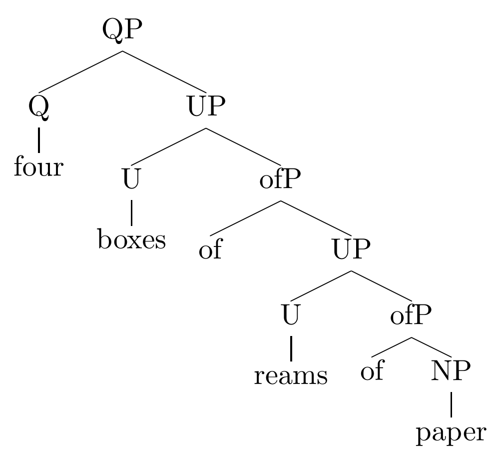
(10) a. four ice-cold glasses of water
b. four glasses of ice-cold water

What all this suggests is that the constituent structure we should be considering — at least for the ‘classifier constructions — is something more like (11), where U(nit)P can itself be the argument of another UP.

(11) a.

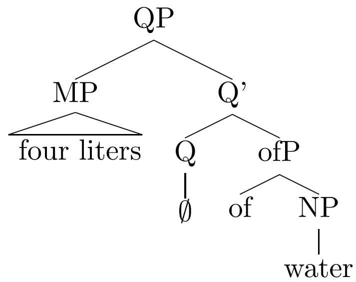


b.



Can we extend this structural analysis to ‘basic’ pseudopartitives as well? So instead of Schwarzschild’s structure in (12a), we would have the one in (12b).

(12) a.



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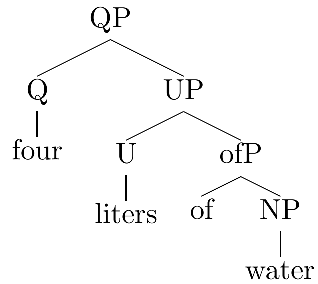


If (12b) is the right structure, then we don't have measure 'phrases' at all in pseudopartitives! Alternatively, the whole NP is the measure phrase! One way or another, we'll need to rethink our semantics for pseudopartitives a bit. But first, some observations about 'compounds'.

2.2 Overt adjectives in compounds

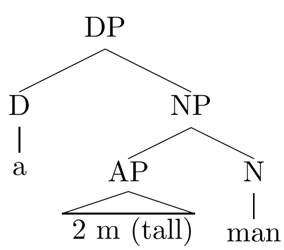
Sometimes the MP in a 'measure compound' can come with an adjective: (13a) and (13b) seem to mean the same thing.

(13) a. a six foot shovel
 b. a six foot long shovel

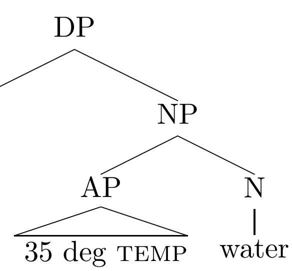
This suggests that MPs in compounds are not adjectives themselves (as Schwarzschild suggests), but rather just the degree arguments of (possibly implicit) adjectival/measure function heads.

(14) a. a 2 meter (tall) man
 b. a 3 hour (long) class
 c. 35 degree (*temperature) water
 d. a 7 lb (*heavy) baby

(15) a.



b.



If this is right, then in compounds at least, it may be the case that the measure function needed by the measure phrase comes from an implicit adjectival element, rather than from the MP itself. Does this bear on monotonicity?

2.3 Scale nominals

When the head names a scale, we seem to get both pseudopartitives and compounds.

(16) a. 6 degrees of separation
 b. a 6 degree separation

c. a separation of 6 degrees

(17) a. 2 liters of volume
b. a 2 liter volume
c. a volume of 2 liters

(18) a. 6 feet of height
b. a 6 foot height
c. a height of 6 feet

I'm not sure what Schwarzschild would predict about these. If these terms name the relevant scales, then it seems like the (b) examples should be bad: surely the unit terms are monotonic for the scales! However, it's possible that these terms are count/mass ambiguous. Note that the different constructions are not in free variation:

(19) a. I placed the mirror at *(18a)/(18b)/(18c).
b. John has (18a)/?(18b)/(18c)

The following examples combine scale terms and object nouns:

(20) *Mass N plus monotonic MP*
a. 2 liters of oil
b. ??(some) 2 liter oil
c. oil of 2 liters ?(of volume)
d. a (2 liter) volume of oil

(21) *Mass N plus nonmonotonic MP*
a. ??100 degrees of oil
b. (some) 100 degree oil
c. oil of 100 degrees (of temperature) (cf. Spanish, Dutch)
d. *a (100 degree) temperature of oil

(22) *Count N (plus nonmonotonic MP)*
a. ??6 feet of shovel
b. a 6 foot (long) shovel
c. a shovel of 6 feet (of length)
d. ??a (6 foot) length of shovel

Is it true that the (d) form needs to be OK in order for the pseudopartitive to be OK? Does this give us a handle on the monotonicity constraint?

A potentially interesting contrast:

(23) a. *(some) exactly/almost/just over 100 degree oil
b. (some) oil of exactly/almost/just over 100 degrees (of temperature)

(24) a. *an exactly/almost/just over 6 foot tall man
b. a man of exactly/almost/just over 6 feet ?(of height)

I suspect that this is telling us something about the syntax of the 'compound' construction. Maybe these are 'true' measure phrases?

2.4 Your guess is as good as mine

Finally, are 'inverted' degree constructions at all relevant?

(25) a. I took too big (of) a piece of pie
b. I didn't write as long (of) a paper as I expected to.
c. How small (of) a car did you buy?

What about 'N of an N' constructions?

(26) a. For if you see Tom O'Neill as he is, not as conformity forces us to see, then there is coming into the room a lovely spring rain of a man. *NYTBR*/3.11.01
b. This was a three ring circus of a game. *NYT*/4.15.02

3 Reanalysis

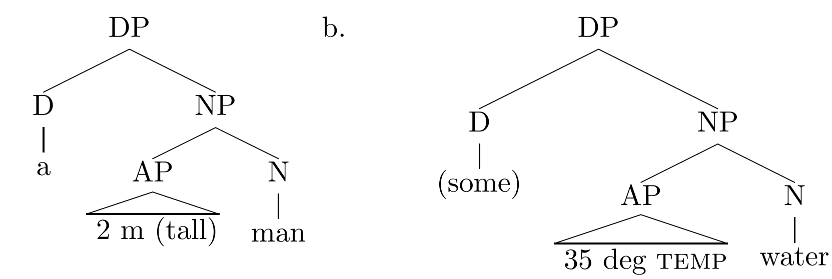
Do the new facts presented above help us understand what is going on here? Let's first consider compounds, then (pseudo-)partitives.

3.1 Compounds

The new structures we are positing for (27a-b) are (28a-b).

(27) a. a 2 meter (tall) man
b. (some) 35 degree (*temperature) water

(28) a.



If these are right, then the simplest analysis is one in which the APs in (28) denote properties of individuals (i.e., they have the same analysis they'd have in predicative position), in which the measure function is provided by the (possibly implicit) adjectival element.

(29) a. $[\![[_{AP}\ 2\text{ m tall}]]\!] = \lambda x.\mathbf{tall}(x) = \mathit{2\ m}$
b. $[\![[_{AP}\ 35\text{ degree }(\textsc{temp})]]\!] = \lambda x.\mathbf{temp}(x) = \mathit{35\ degrees}$

(30) a. $[\![[_{NP}\ [_{AP}2\text{ m tall}][_{N}\ man]]]\!] = \lambda x.\mathbf{tall}(x) = \mathit{2\ m} \wedge man(x)$
b. $[\![[_{NP}\ [_{AP}\ 35\text{ degree }(\textsc{temp})][_{N}\ water]]]\!] = \lambda x.\mathbf{temp}(x) = \mathit{35\ degrees} \wedge water(x)$

This doesn't seem to require non-monotonicity, however. But maybe this is not a bad thing? (31a-b) seem pretty much synonymous — but *analysis* has both count and mass uses.

(31) a. 60 minutes of analysis
b. a 60 minute (long) analysis

RS's argument that attributives are not monotonic:

(32) a. ??2 ft^3 dirt
b. $\lambda x.\mathbf{volume}(x) = \mathit{2\ ft^3} \wedge dirt(x)$

(33) a. ??2 liter water
b. $\lambda x.\mathbf{volume}(x) = \mathit{2\ liters} \wedge water(x)$

Is it possible that only certain types of measure functions — those that are nonmonotonic — can apply to undifferentiated masses? We could stipulate this, but of course it would just be a restatement of the problem.

Let's come back to this after we rethink pseudopartitives.

3.2 (Pseudo-)partitives

Before we address the case of pseudopartitives, and in particular the revised structures we considered above, let's take a closer look at the semantics of 'true' partitives. Recall that some bad pseudopartitives are OK as true partitives:

(34) a. ??6 inches of shovel
b. 6 inches of the shovel

3.2.1 Partitives

Jackendoff (1977) argues that the head of a partitive construction must be 'definite':

(35) a. some of the books
b. many of those books
c. each of these books
d. two of John's books

(36) a. *some of all books
b. *many of no books
c. *each of few books
d. *two of books
e. *one of a lot of books

Ladusaw (1982) explains this restriction in terms of a semantic analysis of 'partitive *of*' as a relation that takes an object that has part structure as its input and returns back a property that is true of parts of that object:

(37) $[\![\text{of}_{prt}]\!] = \lambda x \lambda y.y \preceq x$

The difference between the (embedded) NPs in (35) and those in (36) is that the former can be analyzed as sums (in Link's (1983) sense), and so provide good arguments to the partitive relation. The NPs in the latter denote generalized quantifiers or sets, and so are not of the right type to be subjected to this relation.

(38a-b) provide a crucial minimal pair:

(38) a. one of the two boys
b. *one of both boys

As shown by the examples in (39)-(39), *both* does not allow collective interpretations.

(39) a. The two boys are an interesting pair.
b. The two boys separated.
c. The two boys love each other.

(40) a. *Both boys are an interesting pair.
b. *Both boys separated.
c. *Both boys love each other.

What about partitives with singular NPs?

(41) a. half of the book
b. most of John's skin
c. all of me

The analysis is the same: we just need an 'individual' as input to the partitive relation. When the individual is a plurality, the subparts correspond to individual parts; when the individual is atomic, the parts are material parts.

Aside: It's not clear to me that some of the 'problems' that have been presented for this analysis really are problems. Ladusaw discusses how to handle the cases in (42); the ones in (43) can be handled by scoping out the quantifier.

(42) a. (This book could belong to) one of three people.
b. (This is) one of a number of counterexamples to the PC

(43) a. (I ate) half of a cookie.
b. (I read) most of every book (on the syllabus).

3.2.2 Pseudopartitives

Does the analysis of partitives shed any light on the monotonicity constraint in pseudopartitives? Schwarzschild says that the *of* in pseudopartitives is not partitive-*of*, but what if it were? In other words, maybe MPs in pseudopartitives are sensitive to the part-whole structure of their NPs because these are 'real' partitives!

What if we adopt the following assumptions:

1. $[\![\text{of}_{pseudoprt}]\!] = [\![\text{of}_{prt}]\!] = \lambda x \lambda y . y \preceq x$
2. Mass nouns and bare plurals denote names of substances and kinds, respectively (or at least are ambiguous between properties of quantities/pluralities and names of substances/kinds, as suggested in **?**), and so have the type of individuals.

3. Count nouns denote properties of atomic objects, and so are not the type of individuals.

These assumptions by themselves will rule out count nouns from (pseudo-)partitives. At the same time, we will end up with meanings like the following for pseudopartitive *of*-phrases:

(44) a. $[\![\text{of water}]\!] = \lambda y.y \preceq water = \lambda y.y\ is\ a\ quantity\ of\ water$
b. $[\![\text{of rocks}]\!] = \lambda y.y \preceq rocks = \lambda y.y\ is\ a\ quantity\ of\ rocks$

These are the sorts of thing we want to go about measuring: quantities of water and rocks.

Now we need a few more assumptions:

1. The structures we posited above are correct.
2. 'Monotonic' unit nominals incorporate a measure function into their meanings (or are ambiguous), which means they can take individuals as arguments.
3. 'Nonmonotonic' unit nominals are properties of degrees, which means they need to be augmented with a measure function in order to combine with an individual.

It's not totally clear why the latter two assumptions should hold, but if they do, then we can posit the meaning (or meanings) in (45) for e.g. liter, but only the one in (46) for e.g. degree.

(45) a. $[\![\text{liter}]\!] = \lambda d.d = s_l$
b. $[\![\text{liter}]\!] = \lambda x.\mathbf{volume}(x) = s_l$

(46) $[\![\text{degree}]\!] = \lambda d.d = s_d$

The consequence of these assumptions is that only the monotonic 'MPs' will show up in (pseudo-)partitives.

3.2.3 Back to compounds

Here are the assumptions we need:

1. Count nouns and mass nouns have the interpretations positied above.
2. There are only certain ways of measuring substances: they can be measured for e.g. temperature but not e.g. volume.

(47) a. Water is 32 degres.
b. ??Water is 1,000,000,000 liters.

(48) a. This water is 32 degrees.
b. This water is 1,000,000,000 liters.

I think everything else works out when we go through the composition, though we'll have to see that on the board.

4 Conclusion

We need to think more about this, and we need to look at classifiers to see if our syntactic assumptions are justified, but this feels like progress at least....
Don't forget Roger's colloquium this Friday!

References

Jackendoff, Ray. 1977. *$\bar{X}$-bar syntax: A stude of phrase structure*. Cambridge, Mass.: MIT Press.

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Link, Godehard. 1983. The logical analysis of plurals and mass terms: A lattice theoretical approach. In *Meaning, use, and the interpretation of language*, ed. R. Bäuerle, C. Schwarze, and A. von Stechow, 302–323. Berlin: de Gruyter.