

## **HOMOGENEITY AND THE METAPHYSICS OF MASS NOUNS**

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Talk in honour of Emmon Bach  
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In the spirit of Emmon's *Informal Lectures on Formal Semantics*, this talk has no formulas: all the technique (and there is a lot) is suppressed.

## 1. The metaphysics of mass nouns in the 1980ies: Landman's orthodoxy

"What are the minimal parts of water?

Chemistry tells us that they are the water molecules.

But water molecules can be counted, while water cannot be counted.

This shows that natural language semantics does not incorporate the insights of chemistry in its models: in our semantic domains, the water molecules are not the minimal parts of water.

In fact, the real semantic question is: is there any evidence, semantic evidence, to assume that mass entities like water are built from minimal parts at all, either from minimal parts that are water, or from minimal parts that aren't water?

If there is no such semantic evidence, it is theoretically better to assume that the semantic system does not impose a requirement of minimal parts.

Since there is no semantic evidence for minimal parts, we should assume non-atomic structures for the mass domain.

That has the added bonus that we can nicely explain why we cannot count mass entities, because counting is counting of atoms."

Paraphrase of Landman 1991, *Structures for Semantics*, pp 312-313

## 2. The counter-argument from neat mass nouns: Chierchia's revolution

(Terminology and examples based on Landman 2011.)

Neat mass nouns: *furniture, kitchenware....*

Chierchia 1998:

**neat mass nouns pattern with mass nouns:**

*#three furniture/✓ much furniture*

**but neat mass nouns have minimal parts:**

*furniture is built from items of furniture*

### Argument One:

- (1) a. I moved the furniture around.  
b. I moved the items of furniture around (the chairs, the dresser, and the piano).  
c. I switched the top drawer and the middle drawer in the dresser.

Judgement: (1a) and (1b) are equivalent; (1c) does not entail (1a).

**Argument Two:** Neat mass nouns can be *implicitly* counted:

- (2) a. On the farm there are 100 chickens and 50 cows. The chickens are inside, the cows outside in summer. The cumulative weight and volume of the cows is bigger than that of the chickens.  
b. Most livestock is inside in summer.  
c. Most farm animals are inside in summer.

The natural reading of (2b) splits *livestock* into two sets that are compared in terms of *number of items of livestock*, i.e. exactly like the count noun *farm animals*. i.e. on its natural interpretation, (2b) is true, like (2c).

Arguments One and Two argue that neat mass nouns like *livestock* are built from minimal items of *livestock* much like count nouns *animal/animals*.

**Argument Three** (against Chierchia's recent counterreformation in Chierchia 2010)

But neat mass nouns are **true** mass nouns: unlike count nouns they **can** be compared with mass measures.

- (3) d. In terms of biomass, most livestock is outside in summer.  
e. # In terms of biomass, most farm animals are outside in summer.

*livestock* allows comparison for *most* in terms of volume/biomass, like mass nouns, unlike count nouns: *most livestock* **allows** mass comparison, *most farm animals* **only allows** count comparison.

### 3. Mess mass nouns: is the 1980ies orthodoxy even conceptually plausible?

**Argument One:** What my biology teacher taught me about when spermatozoa were discovered:



Fig. 24. Hartschoek's drawing of a human spermatozoon.

They thought that inside the spermatozoon was a little man (sic!) inside whose spermatozoa was a little man, inside whose.... And this went on until so small that they said: That's impossible. And, according to my Biology teacher, some clever person calculated from that when the Apocalypse was due.

The naïve mind doesn't find infinite or unbounded divisibility natural. So why should Natural Language Metaphysics incorporate it?

**Argument Two:** The microscope argument.

(4) There *salt* on the viewing plate of the microscope, one molecule's worth.

Felicitous use of mess mass noun *salt*.

Orthodoxy: *salt* is divisible and has no minimal parts.

**Homeopathic semantics** is to postulate arcane semantics structures solely to avoid counting: we "dilute" the *salt* so far that not a single molecule remains, yet it counts as *salt*, because the spirit of salt hovers over the waters (homeopathy).

Orthodoxy **invents** an infinite structure of non-existent salt parts that are themselves in the denotation of *salt*, without support of solid intuitions about the data.

#### 4. Iceberg semantics: count nouns, neat mass nouns and mess mass nouns

Iceberg Semantics does without atoms. In Iceberg Semantics, **disjoint** sets replace sets of atoms. Nouns come with a denotation set and a generator set:

<i>NOUN</i>	=	<DENOTATION,	GENERATOR SET>
<i>cat</i>		<i>cat</i>	<i>cat</i>
<i>cats</i>		<i>cats</i> (* <i>cat</i> )	<i>cat</i>
<i>kitchenware</i>		<i>kitchenware items</i>	<i>kitchenware items</i>
<i>meat</i>		<i>meat</i>	<i>contextual minimal meat parts</i>

A noun is **count** iff the generator set consists of **non-overlapping elements (disjoint)**  
A noun is **mass** iff the generator set consists of **overlapping elements (not disjoint)**

*cat*, *cats* are count.

*kitchenware* and *meat* are mass.

*kitchenware*: the four *cups*, the four *saucers*, the four *cup-and-saucers*, the *teapot* and the *teaset* are all items of kitchenware.

The generator set of *kitchenware* contains **simultaneously** the teapot and the teaset. These overlap.

Hence, the distinction between singulars and plurals is not articulated in the generator set.

Counting = counting of generators

Counting of overlapping generators leads to a wrong count.

**Count nouns: generator set = set of minimal generators (disjoint)**

**Kitchenware: generator set ≠ set of minimal generators (not disjoint)**

#### Two kinds of mass nouns:

A mass noun is **neat mass** iff the **minimal generators** do not overlap

A mass noun is **mess mass** iff already the **minimal generators** overlap

**Neat mass nouns: Vertical overlap in the generator set:**

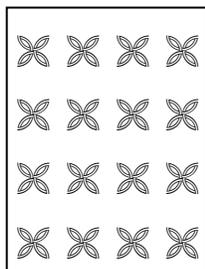
the *teapot* and the *teaset* overlap

**Mess mass nouns: Horizontal overlap:** the set of **minimal generators** is not disjoint.

In English, the class of neat mass nouns is relatively small. Landman 2011 follows Rothstein 2010 in assuming that in Mandarin all nouns that are 'conceptually count' are neat mass nouns. So in Mandarin, the class of neat mass nouns is large.

## 5. The minimal parts of mess mass nouns: *bloemetjesbehang*

Mess mass noun: *bloemetjesbehang* – *flower-patterned wallpaper*

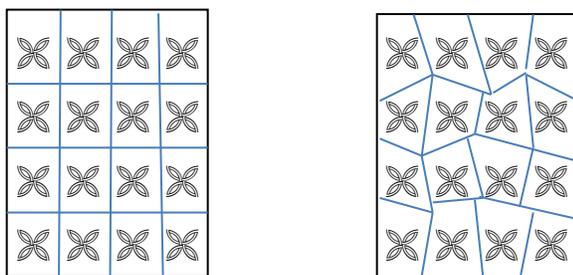


Contextual minimal parts:

A **minimal part** is any part that cannot be split into **two** parts that **each** count as *bloemetjesbehang*.

(Why **two** parts? Because even count objects like Fred can be split into two parts one of which is still Fred and the other is not. It's called **shaving**.)

Observation: since you divide **pattern + space** there are infinitely many ways to divide this piece of *bloemetjesbehang* into 16 minimal parts:



**Proposal:** the denotation of the mess mass noun *bloemetjesbehang* is generated from **all these minimal parts** simultaneously.

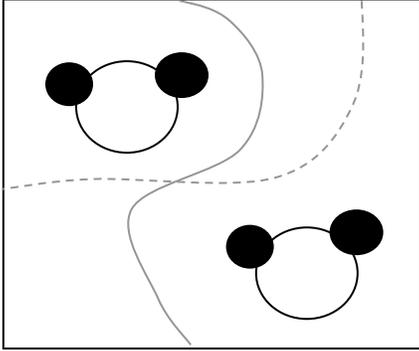
Motivating intuition: none of these partitions has a privileged status over the other partitions: their parts have equal right to count as minimal parts of *bloemetjesbehang*. So, democratically, we assume that they **do count as minimal parts of** *bloemetjesbehang*.

**Consequence:** the minimal generators of mess mass nouns indeed overlap.

(Note: you *can* actually cut through a flower and still call the result *bloemetjesbehang*. For this reason I use *triangle-patterned wallpaper* as my example in Landman 2011: a piece of wallpaper which has only a bit of triangle-corner on it hardly counts as *driehoekjes-behang*. Also with flowers, we are unlikely to count a piece with no recognizable flower pattern on it as *bloemetjesbehang*.)

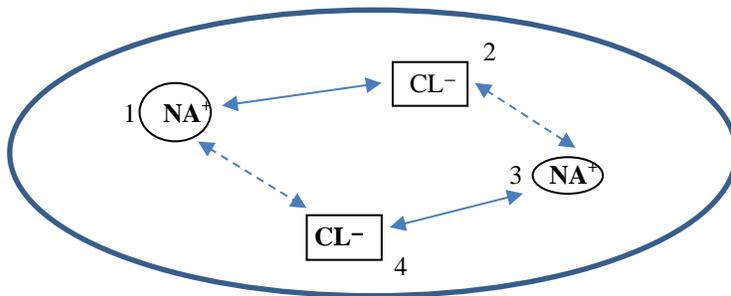
## 6 *Water* and *salt* and *meat* and *rice*.

*water*



Two molecules worth of *water*  $\neq$  two mickey mouse molecules of *water*.  
The mass noun *water* denotes the *stuff* water, which is **molecules + space**:  
The space between and inside the molecules is part of the body of water and shouldn't be ignored. Since we can divide space in many ways, we can divide *water* in many ways into minimal parts. Like *bloemetjesbehang*.

(5) There is **salt** in the water, two molecules worth



The salt is dissolved in the water.

Which *salt* molecules form the salt in the water?

Answer: the salt is built from **all** minimal salt parts.

If in context we are strict about not counting salt-ions as salt, then the salt is built from 1-2 and 3-4 but also from 1-4 and 2-3. There is no privileged choice here.

And note, by the way, that salt + salt is not always salt: 1-2 + 1-4 wouldn't count as salt. (if you're strict).

### **Meat**

Contextual minimal parts: pieces as small as a professional butcher or a cutting lattice can cut them: move the lattice-knife a bit to the side: you get a different partition of the meat into contextual minimal parts: both partitions (and many others) cut into minimal meat-parts: the slab of meat is built from all of them.

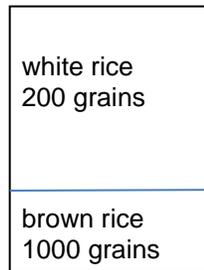
## Rice

Mass nouns can show grid: *rice* comes in the form of *grains of rice*.

Grid should not be confused with the itemization of neat mass nouns.

The difference is: the grains of *rice* uncontroversially consist of *rice*: the rice is generated from parts smaller than grains: grains of rice are not rice-items.

And indeed, with respect to count-comparison, *rice* patterns with mess mass nouns and not with neat mass nouns. The picture below shows a pot of rice, containing 1000 grains of small brown rice and 200 grains of extra large white rice, with the size of the blocks indicating relative volume and weight.



(6) Most rice is brown.

In the situation sketched, (6) clearly is false: (6) does not have a (count-comparison) interpretation on which it is true, showing indeed that *rice* is mass, and that grid cannot be taken as itemization.

**General Moral:** neither count nouns, not neat mass nouns, nor indeed mess mass nouns are vertically homogeneous (divisible). Also for mess mass you always reach a level where you say: *that* small is impossible, and you calculate the Apocalypse.

## 7. Homegeneity of processes (activities).

Event domain: identification of homogeneity with divisibility was always a problem, because of the problem of pauses. Activities like *waltzing* allow pauses where no waltzing goes on.

Dowty 1979 assumed divisibility for activities down to 'reasonably large' subintervals:  
If Fred waltzes at interval  $i$ , Fred waltzes at all reasonably large subintervals.

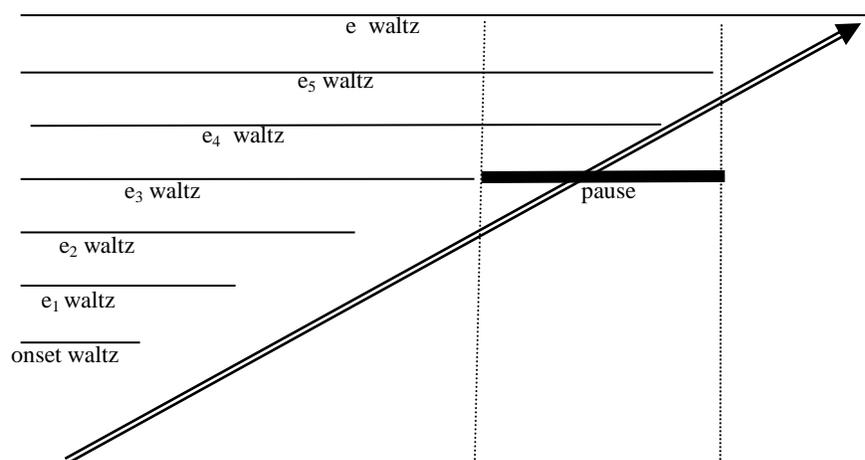
Rothstein 2004: untenable because of processes involving bare plurals and achievements:

(7) Guests arrived *for six hours/all night long*

The felicity of *six hours/all night long* indicates a process interpretation for *guests arrived*.

But the pauses are (normally) *much bigger* than the actual arrival events, so they **surely** ought to count as 'reasonably large', refuting Dowty's proposal.

Landman 2008, Landman and Rothstein 2009, 2012 (expanding upon Landman 1992):  
Processes like *waltzing* are **incrementally homogeneous**:



A process of **waltzing**  $e$  is incrementally homogeneous because every subinterval of the running time of  $e$ , which **incrementally** extends the running time of the onset of that waltzing contains a waltzing stage of  $e$  (a waltzing event cross-temporally identical to  $e$ ).

An **inertia stage** is a stage consisting of a lot of swirling around **followed by** some temporary inaction (catching our breath before continuing).

Inertia stages explain why processes allow pauses: pauses are **not there** incrementally, they indicate inertia stages which **continue to** count as waltzing because of **the accumulated waltzing activity in their initial part**.

(so, the pause is not waltzing, but the waltzing is incrementally carried over the pause by inertia stages).

(7) Guests arrived *for six hours/all night long*

For (7), Landman and Rothstein 2009, 2012 assume that the process reading involves a shift operation which shifts the achievement interpretation to an interpretation as an incrementally homogenous process *witnessed* by the (achievement) arrival events, i.e. events of instances of *guests* arriving.

## 8. So what about homogeneity?

### Neat mass nouns and plural count nouns: ↑

Cumulativity: **upward vertical** homogeneity (Krifka 1989's form of homogeneity)

cats + cats = cats

furniture + furniture = furniture

No downward vertical homogeneity (divisibility)

### Mess mass nouns: ← →

No vertical homogeneity upwards or downwards

Already Krifka 1989 pointed out that cumulativity only holds upwards for non-overlapping elements.

Horizontal homogeneity: you can shift the partitioning lattice to some degree horizontally left or right and stay in the denotation (i.e. as long as you don't cut through any flowers in the pattern, or split the water molecules, because that is sure to bring about the Apocalypse).

### Process events: ↗

No vertical homogeneity upwards or downwards

waltzing + waltzing = waltzing only if they are from the start regarded as part of one and the same waltzing process cross-temporally identical stages of waltzing)

Incremental homogeneity: diagonal up, **following the arrow of time.**

**Stative events:** ↖ ↑ ↗ Fred was in Pisa last week.

← →

↙ ↓ ↘

Only stative eventualities seem to be unproblematically homogenous upward, homogeneous downward (to points of time), homogeneous left, right and center.

Almost thirty years ago, Emmon in his *Algebra of Events and Natural Language Metaphysics* papers (both Bach 1986) pointed at similarities between the nominal domain and the verbal domain, and homogeneity played an important role in that. With all our acquired subtlety of thirty years of theory formation, homogeneity is an ontological mess, and the connections between homogeneity in the verbal domain and in the nominal domain are far from clear.

We want some notion of homogeneity as invariance under semantic or ontological transformations, but it isn't clear what notion.

We need someone to clear up this mess for us.

Emmon, we need you!

## 9. Envoi

Shake Emmon awake  
Don't give him a break  
Let him shake'n bake our batch  
of objects and events,  
until the buggers match.

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