Boolean semantics for count nouns and mass nouns

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Lecture 3 Mess mass, measures, and portions.

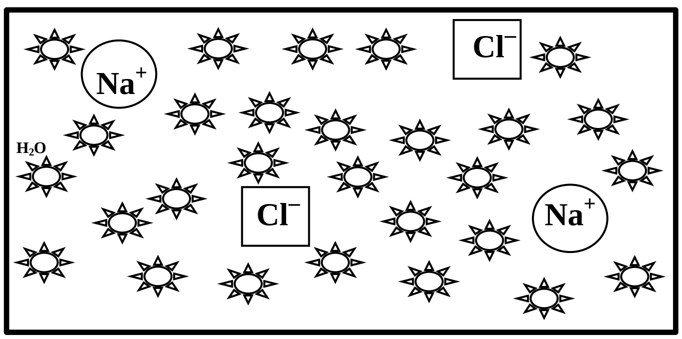
3.1. Mess mass nouns

Nouns can be mess mass in different ways.

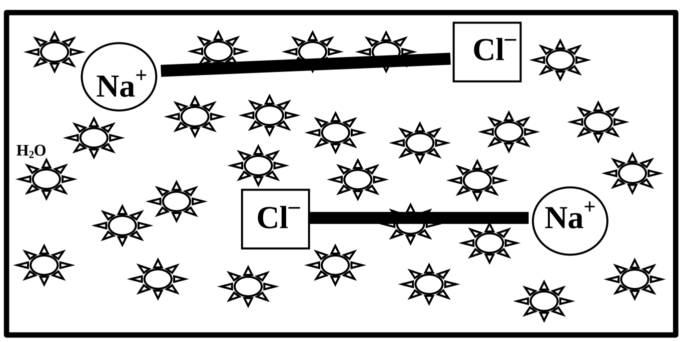
Let *X* be an i-set.
X is *mess* iff **base**(*X*) overlaps and either **base**(*X*) is *not atomic* or even **base**(*X*) is *atomless* or $\mathbf{ATOM}_{\mathbf{base}(X)}$ is *not disjoint*.

Landman 2011: suggestion 1 *Salt* dissolved in water.

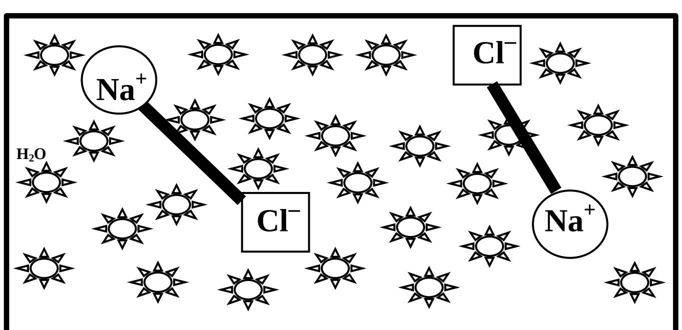
(1) There is ***salt*** in the water, two molecules worth.



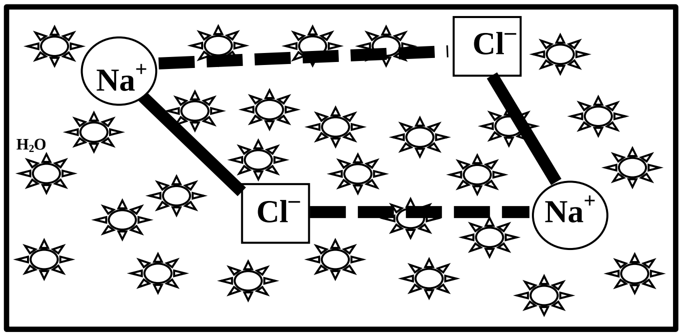
Two molecules worth of salt in the water. But *which* two molecules?



Or



Mess mass answer: Both.



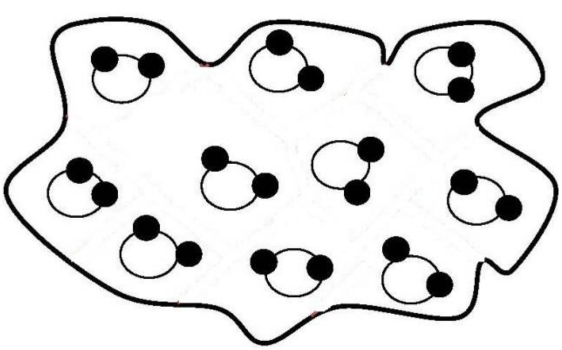
Count perspective: Two ***variants*** of salt, each with two non-overlapping building blocks.
For counting we ***choose*** one of these variants, and we count relative to it.
Mass perspective: We do not make the choice between these variants
We regard the salt as ***built, simultaneously from both variants***.
$\mathbf{ATOM}_{\mathbf{base}(\mathit{SALT})}$ is ***not disjoint***.

Landman 2011: suggestion 2: *meat*

Take a big juicy slab of meat.
With Chierchia 1979: think of this as built from parts that are appropriately minimal in the context.
-The pieces as small as our special meat-cutting machine can cut them: It uses a finegrained sharp lattice to cut very many very small meat pieces: a partition of the meat.
-If I move the lattices slightly, I get a different partition into minimal meat pieces. And there are many ways of moving the lattice.
-All these partitions cut into pieces which, in this context, can count as minimal meat pieces.
-None of these partitions has a privileged status (the 'real' minimal pieces).
The meat is built from all of them: $\mathbf{ATOM}_{\mathbf{base}(\mathit{SALT})}$ is ***not disjoint*.**

Landman 2011: suggestion 3: *water*

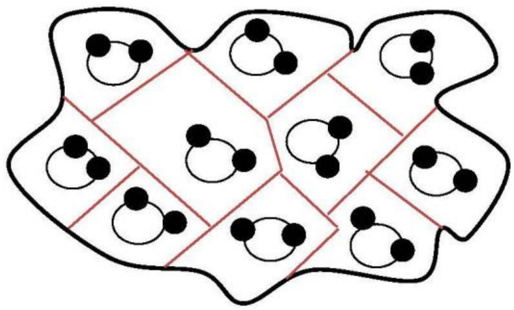
Atomless perspective: Look down into the water of the puddle**:**



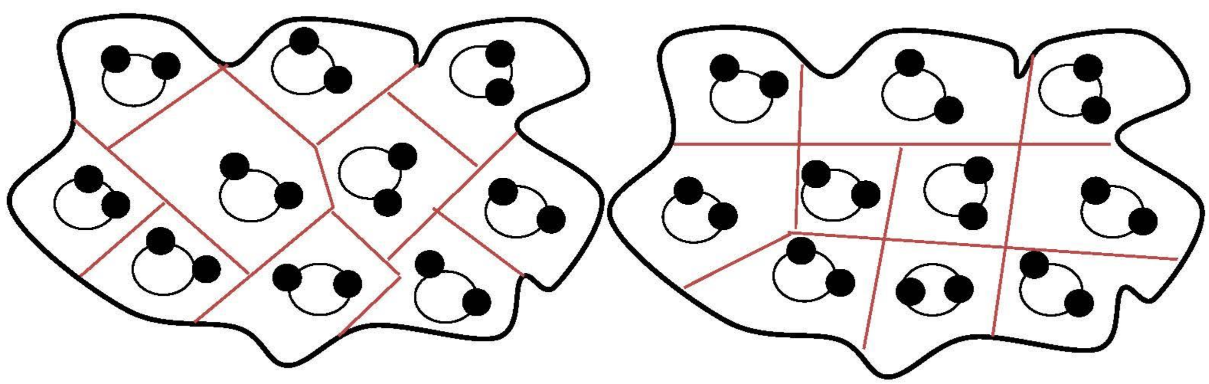
On a count perspective you may see a disjoint set of watermolecules, and in this sense, it is reasonable to regard the water as the (count) sum of its water molecules.

On a mess perspective, you see an object (the puddle) extending in space and its part-of structure is accessed top down: it is assigning a part-of structure which represents its building blocks in the spatiotemporal configurations and relations that they are in.

It is perfectly reasonable to regard the puddle as the sum of building blocks that have a minimal feel to them, like blocks that contain exactly one watermolecule:



But, again, such partitions are not unique, and on the mass perspective no such partition has a special status:



We assume:
water → $WATER_{wt}$ = <**body**($WATER_{wt}$), **base**($WATER_{wt}$)>

Let's assume for this example that **body**($WATER_{wr}$) consists of sums of water molecules ***plus*** regions of space containing these, making up in total the space of the puddle.

> **base**($WATER_{wt}$) is the set of all subregion-sum of water molecules pairs ***that contain a single water molecule.***

The intuition is that a subregion of the water that contains one water molecule counts itself as water, but a subregion that only contains, say, half a molecule does not itself count as water.

So we choose:

water → $WATER_{wt}$ = <***base**($WATER_{wt}$), **base**($WATER_{wt}$)>.

We can derive the following facts:

Fact 1: base($WATER_{wt}$) is ***not disjoint***

This is because many subregions contain the same water molecule.

Fact 2: base(WATER_{wt}) generates WATER_{wt} under sum.

Fact 3: base(WATER_{wt}) has no minimal elements.

This is because of the continuity of space: you can always take away some space from a region containing one watermolecule. The result stays water.

Hence we derive:

Corrollary: $WATER_{wt}$ is a *mess mass* i-set

3.2 Measures and measure interpretation

3.2.1 Measure interpretations are mass *[Rothstein 2011, Landman 2016a]*

Background: well known: partitives with singular DPs patterns with partitives with mass DPs:

(2) a. ✓*much*/#*each* of the wine cf. ✓*each* of the cats
b. ✓***much*/#*one* of the cat** cf. ✓*one* of the cats/✓*all ten* of the cats

Assume: Semantics of partitives disallows singular i-objects.
Then partitives with singular DPs can become felicitous only by ***shifting*** the singular object to a mass object (by changing the base) ***opening up*** internal structure:

(3) After the kindergarten party, ***much of my daughter*** was covered with paint.
(shift opening up the surface area of my daughter + *much* – area measure)

This shift is obligatory for partitives with singular DPs. Plural cases *can* be found:

(4) While our current sensibilities are accustomed to the tans, taupes, grays and browns, in their time ***much of the rooms*** as well as the cathedral proper would have been beautifully painted. [γ]

But plural cases are rare, and not everybody (e.g. Susan Rothstein) accepts cases like (4).

Crucial here: sharp contrasts between plural opening up (5b) and measure phrases (5c):

(5) a. #*Much* **ball bearings** was sold this month.
b. **#?***Much* of ***the ball bearings*** was sold this month.
c. ✓*Much* of ***the ten kilos of ball bearings*** was sold this month.

So: the felicity of (5c) is not to do with *opening up* (as in (5b), but with the measure phrase.
Cf. also (6) (based on examples from Rothstein 2011):

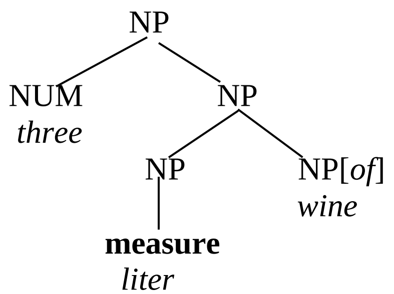
(6) a. **Many** *of the twenty kilos of potatoes* that we sampled at the food show were prepared in special ways. portion-classifier reading: **20 one kilo-size portions - count**
b. **Much** *of the three kilos of potatoes* that I ate had an interesting taste.
measure reading: **potatoes to the amount of 3 kilos - mass**

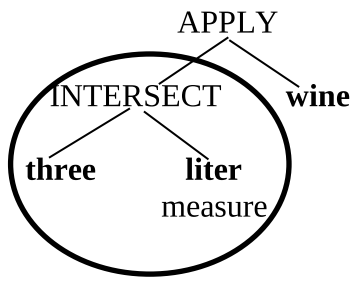
Rothstein 2011: **Partitive NPs with measure phrases pattern with mass nouns.**

Claim: This follows naturally from the Iceberg semantics analysis of measures in Landman 2016.

3.2.2. The body of the measure and the body of the measure phrase (Landman 2016a)

pseudo partitives: *three **liters** of wine*
Classifier structure: mismatched with: **Measure interpretation:**





Semantics follows the semantics proposed in Landman 2004 (which we saw in Lecture 1):

body of the measure phrase: numerical predicate *three* composes with measure *liter*, the result intersects with *wine*:

(**numerical** $\circ$ **measure**) $\cap$ **complement**.
three liters of wine: ($\lambda n.n=3$ $\circ$ $\mathbf{liter}_{wt}$) $\cap$ WINE_{wt}

three liters of wine $\rightarrow$ < **body**, **base**>
body = $\lambda x.\text{WINE}_{wt}(x) \wedge \mathbf{liter}_{wt}(x) = 3$ Wine to the amount of three liters
base: head principle **base** = (**body**] $\cap$ **base**(*HEAD*)

HEAD is the interpretation of measure *liter* : $LITER_{wt}$
body($LITER_{wt}$) = $\mathbf{liter_{wt}}$ measure function
What is **base**($LITER_{wt}$)?

3.2.3 Measure functions

$\mathbb{R}^+ = \{r \in \mathbb{R}: 0 \leq r\}$. Measure functions are functions from B×W×T into $\mathbb{R}^+$ setting 0 to 0:

$\boldsymbol{\mu}_{wt}: B \rightarrow \mathbb{R}^+ \cup \{\bot\}$ where $\boldsymbol{\mu}_{wt}(0) = 0$

For our purposes measures (*liter, meter, broadloom meter,…*) denote ***additive continuous*** measure functions:

Additivity: Standard definition which entails Boolean addition:

$\boldsymbol{\mu}_{wt}(x \sqcup y) = \boldsymbol{\mu}_{wt}(x - y) + \boldsymbol{\mu}_{wt}(y - x) + \boldsymbol{\mu}_{wt}(x \sqcap y)$

Continuity: Standard definition of continuity for measure functions which entails the Intermediate Value Theorem:

Intermediate Value Theorem:

When a body grows from x with measure $\boldsymbol{\mu}_{wt}(x)$ to y with measure $\boldsymbol{\mu}_{wt}(y)$, then between x and y the measure passes through parts with *all* intermediate measure values:

$\forall x, y \in B\ \forall \mathbf{r} \in \mathbb{R}^+$: if $x \sqsubseteq y$ and $\boldsymbol{\mu}_{wt}(x) < \mathbf{r} < \boldsymbol{\mu}_{wt}(y)$
then $\exists z \in B$: $x \sqsubseteq z \sqsubseteq y$ and $\boldsymbol{\mu}_{wt}(z) = \mathbf{r}$

3.2.4 Fitting measures into Iceberg semantics

A function is a set of ordered pairs.
Hence a measure function $\boldsymbol{\mu}_{wt}$ s a set of **object-measure value pairs**
We use this to generalize the notion of i-set to measure i-set:

Measure i-sets:

A **measure *i-set*** is a pair X = <**body**(X), **base**(X)>,
where **body**(X) and **base**(X) are sets of object-measure value pairs,
and **base**(X) generates **body**(X) under sum.

[Requires lifting the Boolean structure of **B** to the set of object-measure value pairs (technical, but trivial).]

Proposal: Interpret measure *liter* as a measure i-set
with as **body** the additive continuous volume measure function $\mathbf{liter}_{wt}$
and find a generating base.

$[_{measure}$ *liter* $] \rightarrow$ <**body**, **base**> with:
1 **body** = $\mathbf{liter}_{wt}$
2. **base** is a subset of $\mathbf{liter}_{wt}$ that generates $\mathbf{liter}_{wt}$ under sum

3.2.5 The Disjoint Base Result

The Disjoint Base Result
If < $\boldsymbol{\mu}_{wt,}$ **base**> is a measure i-set, with $\boldsymbol{\mu}_{wt}$ an additive continuous measure function and **base** is a ***disjoint*** subset of $\boldsymbol{\mu}_{wt}$ then **base** contains only pairs of the form <x,0>.

Proof: This follows from the Intermediate Value Theorem.
Intuition: If **r** > 0 and <x,**r**> ∈ **base** and **base** is disjoint, then proper parts of x with lower values than **r** exist and must be generated under sum by **base**. But then **base** overlaps.

The disjoint base result says that if a base of a measure i-set is disjoint, it can only consist of ***dimensionless*** objects.
The disjoint base result ***almost*** proves that the base of the measure cannot be disjoint, and hence that measures are (mess) mass.

But not quite by itself: The theory does not disallow '***infinitesimal point objects'***:
Think of models for space and time.
We represent time intervals and space solids as infinite sets of points:regular open sets of ***points*.**
If we include these points in the model they don't have positive measure values for volume.

-So we could generalize this to matter and generate all measure values from a disjoint set of points just with ⊔.

But note: these would not be points of time, space, space-time,
they would be ***points of matter***: a bit like the atoms of Demokritos.

Motivation of iceberg semantics:
Try to develop the semantics of mass nouns and count nouns in naturalistic structures.
Try not to *disregard* natural parts and structure. Try not to *include* non-natural structure.

1. Example of less parts than is reasonable: Lønning 1987 ***Homogeneity***:
In Lønning's structures: *liquid* only has parts that are *liquid*
yellow only has parts that are *yellow*
yellow liquid only has parts that are *yellow liquid,*
*e*ven if *yellow* is a property that stuff only has in a certain bulk.

Diagnosis: Natural parts are ignored for the sake of Lønning's definition of homogeneity.

2. Example of more parts than is reasonable: Bunt, ter Meulen, Landman 1991. ***Divisibility***:
water can be partitioned ad infinitum into parts that are themselves water, even if this is physically unintuitive (Homeopathic semantics).

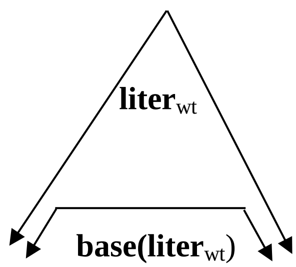
Dogma of Iceberg Semantics:
points of matter are exactly the kind of non-naturalistic objects we want to do without.
Iceberg semantics *rejects* points of matter.

Corollary: A **measure i-set** with as body an ***additive continuous*** measure function can only be ***mess mass*: *the base overlaps by necessity*.**

3.2.6 The base of the measure, a suggestion.

What is **base**($LITER_{wt}$)?
Intuitively: the **base** contains the 'contextually minimal relevant ' stuff that the **body** is made of.

-The above discussion suggests: base is closed under parts.
-measures are extensional (they don't distinguish objects of the same rank)
→ Think of the base as the set of *all* part-measure value pairs whose measure value is smaller than a certain value.



Let **m** (short for $\mathbf{m}_{\mathbf{liter},wt}$) be a **contextually** given measure value.
For concreteness think of **m** as the lowest volume that our experimental precision weighing scales can measure directly (rather than extrapolate).

$\mathbf{liter}\text{-up-to-}\mathbf{m}_{wt} = \{\langle x, \mathbf{liter}_{wt}(x)\rangle : \mathbf{liter}_{wt}(x) \leq \mathbf{m}\}$
The set of object-liter value pairs where the liter value is less than or equal to **m.**

We set:

$[_{measure}\ liter\ ] \rightarrow\ LITER_{wt} = \langle \mathbf{body\ base}\rangle \quad \mathbf{body} = \mathbf{liter}_{wt},$
$\mathbf{base} = \mathbf{liter}\text{-up-to-}\mathbf{m}_{wt}$

Fact 1: $\mathbf{liter}\text{-up-to-}\mathbf{m}_{wt}$ is not disjoint (since it is closed downwards)
Fact 2: $\mathbf{liter}\text{-up-to-}\mathbf{m}_{wt}$ contains no minimal elements (continuity)
Fact 3: $\mathbf{liter}\text{-up-to-}\mathbf{m}_{wt}$ generates $\mathbf{liter}_{wt}$ under sum (⊔ is the **complete** supremum operation)
Fact 4: $LITER_{wt}$ is **mess mass**.

3.2.7 The base of the measure phrase [slightly simplified]

We derive:

three liters of wine : $\mathbf{body} = \lambda x.\text{WINE}_{wt}(x) \wedge \mathbf{liter}_{wt}(x) = 4$
W*ine* to the amount of three liters
$\mathbf{base} = \lambda x.\ x \sqsubseteq \sqcup(\text{WINE}_{wt}) \wedge \mathbf{liter}_{wt}(x) \leq \mathbf{m}$
Stuff that is part of the sum of wine and measures at most **m**

Important note: what is in **base**(***three liters of wine***) is not necessarity *itself* wine
(i.e. note that this base is closed downwards)

Fact: *three liters of wine*, on the measure interpretation, is **mess mass**.

Reason: -The head of the construction is **not** ***wine*** but ***liter*.**
-The base of ***liter*** is of all objects that **measure at most m liter**.
-The base if ***three liters of wine*** is the set of all Boolean parts of the wine that **measure at most m liter**.
-This **base** is not disjoint.

Hence, we derive Rothstein's observation:

Measure interpretations are mess mass interpretations.

Conclusion: mass/count is expressed via the base, not the body:

500 grams of bonbons:
body: Set of sums of *bonbons* that weigh 500 grams.
base: Set of Boolean parts of the sum of bonbons that weigh at most **m** grams.

-the **body** the interpretation of measure phrase *500 grams of bonbons* is a set of pluralities with respect to the **base** of the interpretation of *bonbons*, the set of singular bonbons.
-But *bonbons* is not the head of the measure phrase measure phrase *500 grams of bonbons*, *grams* is the head.
-Hence the **base** of measure phrase *500 grams of bonbons* is not that set of singular bonbons, but a measure base: the set of bonbon-parts weighing lower than **m** grams.
500 grams of bonbons is **mess mass relative to** its measure base.

Crucially: the body is **not** ground into mess mass, it stays a sum of singular bonbons. cf:

(7) *[at Neuhaus in the Galerie de la Reine in Brussels]*
Customer: Ik wou graag 500 gram bonbons. *Shop assistant:* Eén meer or één minder?
I would like 500 grams of pralines. One more or one less?
Customer: 💣Ah, just squeeze enough into the box so that it weights exactly 500 grams.
[where 💣 means: *a terrible faux pas*]

Thus *500 grams of bonbons* is mass:

(8) a. ✓Much of the 500 grams of bonbons
b. #Many of the 500 grams of bonbons ≠ ✓Many of the bonbons

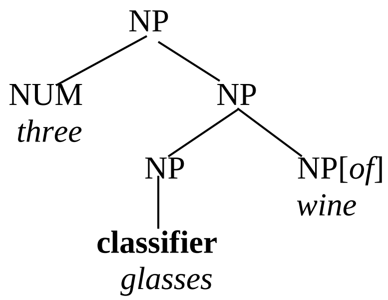
Nevertheless, the 'plural' body interpretation **is** accessible in discourse:

(9) I bought 500 grams of bonbons. I ate ***them*** with great relish
them = ***the bonbons***

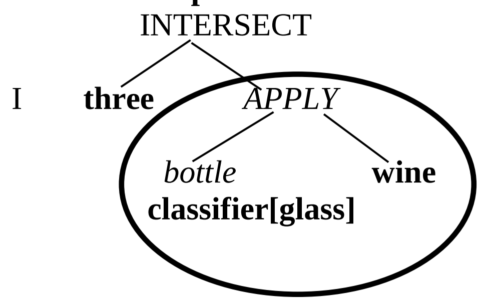
3.3. Semantics of classifiers and portioning.

Pseudo partitives: *three* ***glasses*** *of wine*

Classifier structure:



Classifier interpretation:



3.3.1. Container classifier interpretation

(9) There was also the historic moment when I accidentally flushed a ***bottle of lotion*** down the toilet. That one took a plumber a few hours of manhandling every pipe in the house to fix. [γ]

Semantics: Rothstein 2011, Landman 2016

- Count noun *glass*: $GLASS_{wt}$ **=** <GLASS_{wt}, GLASS_{wt}>, GLASS_{wt} a disjoint set

Basis of container interpretation: $\mathbf{contents}_{\mathbf{w,t}}$ **:** $B \rightarrow B$ specifies in wt for a container the relevant contents (details in Landman 2016a)

-Container classifier c-glass: $\lambda Z.$<c-**glass**(**body**(Z)), **c-glass**(**base**(Z))> where:

c-glass(**body**(Z)) = $\lambda x.\text{GLASS}_{wt}(x) \wedge$ **body**(Z)($\mathbf{contents}_{wt}$(x))
singular glasses containing **body**(*Z*)

c-glass(**base**(Z)) = **(c-glass**(**body**(Z))**]** $\cap$ **base**(*HEAD*)

Head = container classifier *glass* **base**(*HEAD*) = GLASS_{wt}
Hence: **c-glass**(**base**(Z)) = **c-glass**(**body**(Z))

glass of wine $\rightarrow$ <**base**, **base**> with **base** = $\lambda x.\text{GLASS}_{wt}(x) \wedge \mathbf{WINE}_{wt}(\mathbf{contents}_{wt}(x))$
singular glasses containing wine

Fact: The container classifier interpretation of *glass of wine* is **singular count**.

3.3.2. Contents classifier interpretation

(10) I drank three glasses of beer, a flute, a pint, and a stein.

Normality assumption: Let C_{wt} be a disjoint set of containers in wt.
contents is normal on C_{wt} in wt iff
$\forall y \in C_{wt}\ \forall z \in C_{wt} - \{y\}$: $\{\mathbf{contents}_{wt}(y), \mathbf{contents}_{wt}(z)\}$ is **disjoint**.
In a normal context, distinct containers have non-overlapping contents.

In normal contexts $\mathbf{contents}_{wt}^{-1}$ is defined.

-Contents classifier *glass*: $\lambda Z.\langle \mathbf{p\text{-}glass}(\mathbf{body}(Z)), \mathbf{p\text{-}glass}(\mathbf{base}(Z))\rangle$ where:

$\mathbf{p\text{-}glass}(\mathbf{body}(Z)) = \lambda x.\mathbf{body}(Z)(x) \wedge GLASS_{wt}(\mathbf{contents}_{wt}^{-1}(x))$
body(*Z*) stuff contained in singular glasses

$\mathbf{p\text{-}glass}(\mathbf{base}(Z)) = (\mathbf{p\text{-}glass}(\mathbf{body}(Z))] \cap \mathbf{base}(HEAD)$

Head = contents classifier *glass* $\mathbf{base}(HEAD) = \lambda x.GLASS_{wt}(\mathbf{contents}_{wt}^{-1}(x))$

glass of wine $\rightarrow$ $\langle \mathbf{base}, \mathbf{base}\rangle$ with $\mathbf{base} = \lambda x.WINE_{wt}(x) \wedge GLASS_{wt}(\mathbf{contents}_{wt}^{-1}(x))$

Fact: In a normal context the contents classifier interpretation of *glass of wine* is **singular count**.

Reason: The normality condition implies that in normal context wt
$\lambda x.WINE_{wt}(x) \wedge GLASS_{wt}(\mathbf{contents}_{wt}^{-1}(x))$ is a **disjoint set**

We see here how ***Iceberg semantics eliminates the mass-count sorting***:
-*bottle of wine* on the contents interpretation denotes wine, stuff that for Link would have been in domain **M**.
-But *bottle of wine* on the contents interpretation is ***count*** : it denotes wine that in context is portioned into disjoint portions.
-Since the portions are disjoint, they can be counted (in terms of their **base**).
There is no need for sorting.

3.3.3. Measure interpretations

We define a **volume *measure*** $\mathbf{glass}_{wt}$**:** Fix a number **g** that counts as 1 on the ***glass*** measure.

We define: $\mathbf{glass}_{wt} = \lambda x.\ \frac{\mathbf{liter}_{wt}(x)}{\mathbf{g}}$

We assume that *glass* can be interpreted as measure $\mathbf{glass}_{wt}$

This means that we predict the following ***mass*** measure reading:

three glasses of wine → **body** = $\lambda x.\text{WINE}_{wt}(x) \wedge \mathbf{glass}_{\mathbf{wt}}(x)=3$
Wine to the amount of three glasses.
base = $\lambda x.x \sqsubseteq \sqcup\text{WINE}_{wt} \wedge \mathbf{glass}_{\mathbf{wt}}(x) \leq \mathbf{m}$

Difference between measure and portion readings of classifiers:
Portion readings: denote stuff, like mass nouns, but are count.

(11) I have put sixteen glasses of wine ready in a row, of different size, as you can see. We are going to put all of it into the brew in the course of two hours. As you will see, ***most of the sixteen glasses of wine are*** put into the soup during the first half an hour of brewing.

-Container reading is irrelevant in (11): we are not going to put the glasses in the brew.
-Measure reading is irrelevant in (11): we are putting portions of different sizes in the brew.
-In (11) the classifier *glasses* has a portion interpretation:
most in (16) compares the **number of portions of wine**.
This is a count reading, it concerns disjoint portions of wine.

3.3.4 Shape portion classifiers

Shape classifiers (portion classifiers): *hunk, slice, stack (of hay), strand (of hair)*

A ***hunk*** of meat = meat in the shape of a ***hunk***
A ***slice*** of meat = meat in the shape of a ***slice***

Shape classifiers: a hunk of meat is *meat*. Similar to measures: a kilo of meat is meat.
But shape classifiers are count:

(12) a.	I don't eat ✓**mu*ch*** ***/#many meat*** sliced nowadays.	mass
b.	I don't eat **#much** /✓ **many** ***slices of meat*** nowadays	count
c.	Most of the slices of meat are pork	count comparison

i.e. (12c) comparison concerns **the number of slices** of meat; **no mass comparison**.

Semantics: λZ <**slice**(**body**(Z)), **slice**(**base**(Z))>
slice(**body**(Z)) = $\lambda x.\mathbf{body}(Z)(x) \wedge \text{SLICE}_{wt}(x)$ where SLICE_{wt} is disjoint.

slice of meat → <**base**, **base**> where **base** = $\lambda x.\text{MEAT}_{wt}(x) \wedge \text{SLICE}_{wt}(x)$

Fact: The interpretation of *slice of meat* is **singular count.**

3.3.5 Shifting measures to classifiers

[cf. Khrizman, Landman, Lima, Rothstein and Schvarcz 2015]

1. Measures shifted to container classifiers

(13) I broke a liter of milk

Let CONTAINER_{wt} be a contextually provided disjoint set.
We define container classifier **c-liter:**

-Container classifier c-liter: λZ.<**c-liter**(**body**(Z)), **c-liter**(**base**(Z))> where:

c-liter(**body**(Z)) = $\lambda x.\text{CONTAINER}_{wt}(x) \wedge \textbf{body}(Z)(\ \textbf{contents}_{wt}(x)) \wedge \textbf{liter}_{wt}(\textbf{contents}_{wt}(x))\textbf{=1}$

c-liter of wine → <**base**, **base**> where:

base = $\lambda x.\text{CONTAINER}_{wt}(x) \wedge \text{WINE}_{wt}(\textbf{contents}_{wt}(x)) \wedge \textbf{liter}_{wt}(\textbf{contents}_{wt}(x))=1$

disjoint set of containers containing wine to the amount of one liter

2. Measures shifted to portion classifiers

(14) He drank three liters of Soda pop, one in the morning, one in the afternoon, one in the evening.

Let PORTION_{wt} be a contextually provided disjoint set.
We define portion classifier **p-liter:**

-Portion classifier p-liter: λZ.<**p-liter**(**body**(Z)), **p-liter**(**base**(Z))> where:

p-liter(**body**(Z)) = $\lambda x.\text{PORTION}_{wt}(x) \wedge \textbf{body}(Z)(x) \wedge \textbf{liter}_{wt}(x)=1$

liter of wine → <**base**, **base**> where:

base = $\lambda x.\text{PORTION}_{wt}(x) \wedge \text{WINE}_{wt}(x) \wedge \textbf{liter}_{wt}(x)=1$

disjoint set of one liter portions of wine

3. Free portion interpretations for container classifiers.

-Shift *glass* to the measure $\textbf{glass}_{wt}$
-Then take the portion interpretation of the measure, **p-glass:**

glass of wine → <**base, base>** where

base = $\lambda x.\text{PORTION}_{wt}(x) \wedge \text{WINE}_{wt}(x) \wedge \textbf{glass}_{wt}(x)=1$

disjoint set of one-glass-measure portions of wine

(15) Pour three ***cups*** of soy sauce in the brew, the **first** after 5 minutes , the **second** after 10 minutes, the **third** after 15 minutes. I have a good eye and a very steady hand, so I pour **them** straight from the bottle.

-I don't add the cups to the brew.
-The soy sauce is never in a cup when I pour, so it is not the contents of any real cup.
-But I count what I pour in: **cup-size portions** = **free portion interpretation.**

3.4 When mess mass counts

☠☠ *Caveat: Despite appearances,*
no animals were harmed in the research for this section. ☠☠

3.4.1 Distributive adjectives

Dutch and German:
-In context, stubbornly distributive adjectives like ***groot-big*** can modify mess mass nouns like **vlees-meat.**
-In context, cardinal comparison with **de/het meeste**/***most*** is possible for mess mass nouns.
-These are contexts where ***disjoint portioning*** is strongly contextually salient.

(16) Slagerij Franssen, Maastricht: Tips voor het bereiden van ***groot vlees***.
Het bereiden van ***groot vlees*** lijkt voor velen een groot probleem. Liever kiest men dan voor een biefstukje of een filet. Echter, ***groot vlees*** heeft veel voordelen! [γ]

Butcher shop Franssen, Maastricht: Tips for preparing ***big meat***.
Many seem to regard preparing ***big meat*** as a big problem. And so they tend to choose a steak or a filet instead. However, ***big meat*** has many advantages!

(17a): *groot*-**big** is compatible with mess mass nouns like *vlees*-**meat** in Dutch
and has a **distributive** interpretation: (to ***hunks of meat***):

(17) a. Het ***grote vlees*** ligt in de linker vitrine, het ***kleine vlees*** in de rechter vitrine.
The **big meat** lies in the left display compartment, the **small meat** in the right one.

(17b-c) show that **no shift to a *count noun* is involved**:

(17) b. ***#Drie*** groot vlees #***Drie*** grote vlezen
#Three big meat #**three** big meats
c. ✓**Het meeste** van het grote vlees **is** kameel/ **#De meeste** van het grote vlees **zijn** kameel.
✓$\textbf{Most}_{\textbf{[mass]}}$ of the big meat **is** camel #$\textbf{Most}_{\textbf{[count]}}$ of the big meat **are** camel

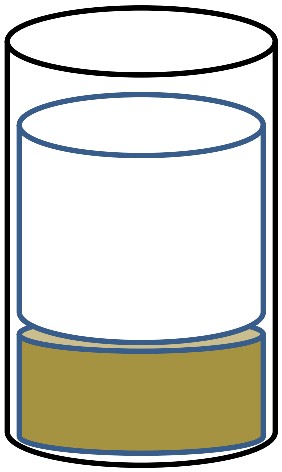
[So this is ***unlike*** count shifted mass nouns like *bier*-**beer** in:
drie bier, alstublieft **-three beers, please**]

3.4.2 Count comparison with mess mass nouns

Example 1: mess mass noun *rijst-rice*

Out of the blue: Dutch does not allow count comparison (like English):

(18) De meeste rijst is bruin.
Most rice is brown



not so many very large grains of white rice

very many very small grains of brown rice

Out of the blue: (18) is false.
Out of the blue: (18) involves ***mass*** comparison in terms of volume, **not *count*** comparison.

Setting up a context triggering count readings: (example from Peter Sutton)

We are playing a game in which we hide small grains of brown rice and very large grains of white rice (to make it not too difficult for the children).
Winner is the one who finds the largest number of grains of rice.
The numbers and sizes are as in the above picture.
Now, as it turns out, Peter is very good at this game.
In fact after the game, we take stock and declare:

(19) De meeste rijst is in het bezit van Peter.
Most rice is in the possession of Peter.

In this context: (19) is true and felicitous, even if Peter only found small grains.

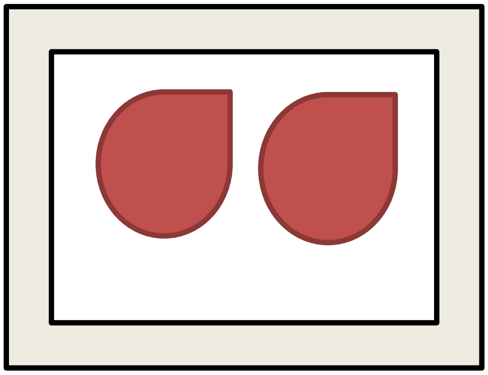
This interpretation involves *count* comparison.

Rationale:
The context has made the **grid** *grain* available:
-Count comparison in terms of the cardinality of elements in the grid.
-Grids are partitionings into disjoint portions.
-Count comparison *via* portions is possible in Dutch for mess mass nouns, when the portioning is made salient in context.

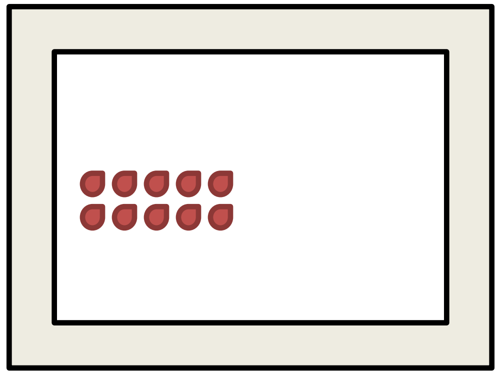
Example 2: mess mass noun *vlees-meat*

Below is the display compartments of our butcher shop:

Left compartment: hunks of veal



Right compartment: hunks of baby duck.



(20) Het meeste vlees ligt in de rechter vitrine.
Most meat lies in the right display compartment.

Out of the blue: (20) is false. (20) requires mass comparison in terms of volume:

Count comparison is not natural at all.

Setting up a context triggering count readings:

Tonight you celebrate your Traditional Family Dinner,
at which the two Parents eat the Traditional Meal of veal
and the twelve Children eat, by Tradition, baby duck.
Hence, you have ordered what is in the above display compartments
(which is in fact all the veal and duck we have left in the shop).

Disaster strikes the butcher shop:
the hunks of baby duck were found out to be infected with worms.
They have to be destroyed, and can't be sold.
I call you with the following message:

(21) Er is een probleem met uw bestelling. *Het meeste vlees* bleek besmet te zijn met wormen. We moesten het wegdoen, en we hebben geen tijd om vandaag nog een nieuwe bestelling binnen te krijgen.

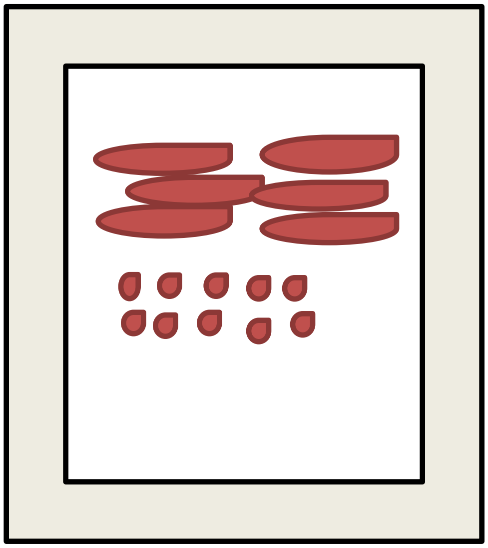
There is a problem with your order. *Most (of the) meat* turned out to be infected with worms.
We had to get rid of it. and we don't have time to get a new order in by today.

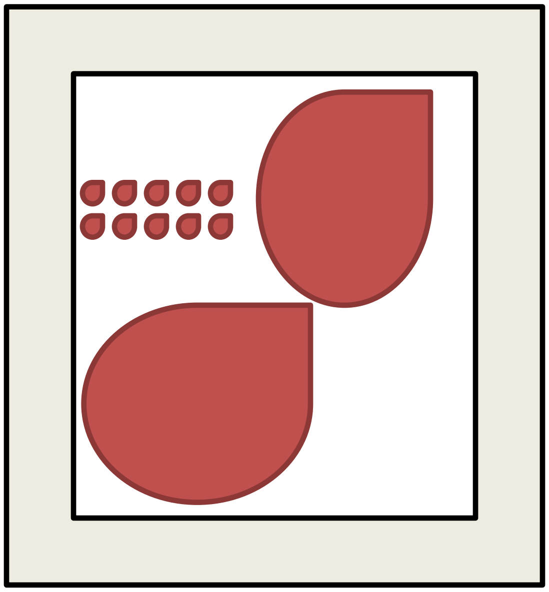
In this context: (21) is felicitous and true. Reading for the mess mass noun that involves *count* comparison in terms of contextual portions, the hunks of meat in the display compartments.
Count comparison is possible.

Example 3: we compare *groot vlees*-**big meat** in the compartments

Left compartment:
Small hunks of baby duck
Big hunks of pork

Right compartment: Exotic meat
Small hunks of baby penguin
Huge hunks of elephant steak





[Out of the blue, with contrastive stress on *groot*-**big**:]

(22) Het meeste *grote* vlees ligt in de linker vitrine.
Most *big* meat lies in the left display compartment.

Out of the blue: (22) is felicitous and true ***without*** extra context:

***Count* comparison of big hunks of meat is possible.**

We observe:

(20) out of the blue: only a mess mass
(21) in context: counting reading possible
(22) with *groot*: counting reading possible out of the blue

Explanation:
-Count comparison with mess mass nouns requires portion shift.

Only available when portions are made explicitly available ((20) versus (21)).

-In (22), semantics of *groot-big* **itself** requires portion shift.
No further context needed to trigger portion shift.

3.4.3. How mess mass counts

1. *mess mass* noun + ***distributive adjective*** is ***mess mass***:

The denotation of *groot vlees*-**big meat** is ***mess mass***.

Explanation: Iceberg semantics:
base(*groot vlees*) is derived via intersection from **base**(*vlees*):

body(*groot vlees*) = meat that comes in big portions
base(*groot vlees*) = the parts of 'minimal size' of the sum of the meat that comes in big portions

This is a mess mass base (overlap).

2. Distribution set is not $\mathbf{D}_{\mathbf{base}(HEAD)}$, but $\mathbf{D}_{\mathbf{Y}}$, where $\mathbf{Y}$ is a ***disjoint set***.

The semantics involving $\mathbf{D}_{\mathbf{Y}}$ *must* provide a ***disjoint*** set, but this doesn't *have* to be **base**(*HEAD*).

Dutch mess mass nouns:

If, in context, PORTION makes a **disjoint set** PORTION_{wt} salient,
then the semantics allows $\mathbf{Y}$ in $\mathbf{D}_{\mathbf{Y}}$ to pick up: **body**(α) $\cap$ PORTION_{wt}, a disjoint set.

3. *Count-comparison* with ***mess mass*** nouns; same point as under 2.

4. ***Count-comparison*** with ***mess mass*** noun + ***distributive*** adjective:

Count-comparison normally requires context to make portioning salient.
But distributive adjective *groot* ***itself*** requires context to make portioning salient.
If *groot* is felicitous, you don't need extra contextual work to make count-comparison felicitous.

Note 1:
Not explained: Why is this easy for Dutch mess mass nouns and hard in English.
Only explained: *what* happens, *if and when* it happens.

Note 2:
The fact that English numericals like *at least three* and English distributor *each* cannot apply to mass nouns is a ***language specific fact*** about English:

English: Counting phrases *less than three*, distributors *each* specify that:

In $\mathbf{D}_{\mathbf{Y(Z)},}$ **Y** = **base**(*HEAD(Z)*)

If so, it should be possible for a language to have *numerical phrases*, *explicit counting expressions*, that do not *force*: In $\mathbf{D}_{\mathbf{Y(Z)},}$ **Y** = **base**(*HEAD(Z)*)
Such a language would allow numerical phrases to apply to prototypical mass nouns, counting portions.

Lima 2014, Khrizman, Landman, Lima, Rothstein and Schvarcz 2015:

This is what happens in the Amazon language Yudja:

No lexical mass-count distinction, all nouns can be counted:

(23) Txabïu apeta pe.
Three blood dripped. (*apeta*: contextually disjoint portions of blood).

See e.g. the discussion in Lima 2014.

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