Countability in the nominal and verbal domains

Chierchia and the Vagueness of Mass Nouns

&

Rothstein on the Semantic Atomicity and the Role of Context

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Advanced Course
Chierchia and the Vagueness of Mass Nouns
  Background: Chierchia (1998) on Mass Ns
  Formal and Informal details of Chierchia (2010)
  Counting and Measuring
  Puzzles and Complications

Rothstein on the Semantic Atomicity and the Role of Context
  Inadequacy of Divisity and Natural Atomicity
  Natural Atomicity and Semantic Atomicity
  Formal and Informal details of Rothstein (2010)
  Remaining Puzzles

Chierchia and Rothstein: Coverage and Comparison
Chierchia and the Vagueness of Mass Nouns
Chierchia (1998): Mass Ns are Inherently Plural

- Denotations of Mass Nouns are whole sub-lattices
- Inherently plural
- “For a mass noun the difference between singular and plural is quite literally neutralized.” (p. 69)

Vagueness is: “...orthogonal to the mass/count distinction” (Chierchia 1998, p. 68)
- Complete revision in Chierchia (2010)
The Semantic Triad

- type \( \langle s, e \rangle \): the cat kind
- type \( \langle e, t \rangle \): number neutral property
- type \( \langle e, t \rangle \): atomic property

- Cats are common.
- Those are cats.
- Felix is a cat.
- Rice is common.
- I ate some rice yesterday.
- # That is a rice.
The Semantic Triad

\[ \begin{align*}
\text{CAT}_w &\quad \text{type } \langle s, e \rangle \quad \text{the cat kind} \\
\cup &\quad \text{type } \langle e, t \rangle \quad \text{number neutral property} \\
\cap &\quad \text{type } \langle e, t \rangle \quad \text{atomic property} \\
\end{align*} \]

\[ \begin{align*}
\text{AT}(\text{CAT}_w) &= \{ x \in \text{CAT}_w : \forall y \in \text{CAT}_w[y \sqsubseteq x \rightarrow x = y] \} \\
\star \text{cat}_w &= \lambda x. \exists Q. [Q \subseteq \text{cat}_w \land x = \sqcup Q] \\
\sqcap \text{CAT}_w &= \lambda w'. [\iota x. \text{CAT}_{w'}(x)] \\
\sqcup c &= \lambda w. \lambda y. [y \sqsubseteq c_w] \\
\end{align*} \]


\[ \begin{align*}
\text{N} &\Rightarrow [+\text{arg}, -\text{pred}] \quad \text{e.g. Chinese, Ns of type } \langle e \rangle \\
\text{N} &\Rightarrow [+\text{arg}, +\text{pred}] \quad \text{e.g. English, Ns of type } \langle e \rangle \text{ and } \langle e, t \rangle \\
\text{N} &\Rightarrow [-\text{arg}, -\text{pred}] \quad \text{e.g. French, Ns of type } \langle e, t \rangle \\
\end{align*} \]
Stable Atoms

“Stable atomicity” of any count N sanctions counting

I.e. Any count N has at least some elements that are atomic across all admissible precisifications
Unstable Entities

Vagueness about what minimal elements are (single indivisible atoms)

- Vagueness in mass Ns blocks counting
  - Mass Ns have *unstable individuals* in their denotation
  - I.e., atoms (minimal entities) on some precisifications are not minimal on others
Contextual Variation

We don’t have any cats. (always false)

I’ve eaten (all) my rice. (sometimes true)

I’ve cleaned (all) the mud off my boots. (sometimes true)

Main idea: This kind of contextual variation patterns with mass nouns.

▶ Counterexamples (Grimm & Levin pc.)
  ▶ Single defeating contexts
  ▶ More on this later
Contextual Variation and Vagueness of Rice

- Contextual variation:

  - rice flour
  - half a grain of rice
  - a single grain of rice
  - a few grains
  - a bowl of rice

Sometimes TRUE

- Translates into vagueness:

  - RICE−
  - negative extension

  - gap

  - RICE’s vagueness band

  - RICE+
  - positive extension

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For some (...) purposes, we might consider a grain of rice, rice [allergy testing, cereal cultivation, HF]. But, then that applies to half grains as well. And to quarters of grains. In certain cases, we may regard rice flour as rice (as when we say there is rice in this cake). The point is that there is no systematic basis for deciding which rice amounts qualify as rice atoms” (p.117-8).

“rice has contextually supplied smallest parts, but lacks stable atoms (because the vagueness of the smallest rice parts will be resolved differently in different precisifications) (p. 123).
Chierchia’s Unstable Entities

On a supervaluationist semantics, vague predicates have a positive and negative extension, and also an extension gap. (Defined as a partial model)

- A schematic example:
  - \( D = \{a, b, c, d, a \sqcup b, a \sqcup c, b \sqcup c, a \sqcup b \sqcup c\} \)
  - \( ^+P = \{a \sqcup b \sqcup c\} \) (This is the “Ground Context”)
  - \( ^-P = \{d\} \)

- But \( P \) can be precisified to include smaller sums/quantities. (Partial model is extended by classical completions of the model)

- In this case, there are three possible precisifications:
  - \( P_{c_0} = \{a \sqcup b \sqcup c\} \quad \text{At}(P_{c_0}) = \{a \sqcup b \sqcup c\} \)
  - \( P_{c_1} = \{a \sqcup b, a \sqcup c, b \sqcup c, a \sqcup b \sqcup c\} \quad \text{At}(P_{c_1}) = \{a \sqcup b, a \sqcup c, b \sqcup c\} \)
  - \( P_{c_2} = \{a, b, c, a \sqcup b, a \sqcup c, b \sqcup c, a \sqcup b \sqcup c\} \quad \text{At}(P_{c_2}) = \{a, b, c\} \)
Chierchia’s Unstable Entities cont.

\[
\begin{align*}
At(P_{c_0}) &= \{a \sqcup b \sqcup c\} \\
At(P_{c_1}) &= \{a \sqcup b, a \sqcup c, b \sqcup c\} \\
At(P_{c_2}) &= \{a, b, c\}
\end{align*}
\]

- A ‘Definitely’ operator, \(D\):
  - \([D(\phi)]^{M,c,g} = 1\) iff for all \(c'\) of \(c\), \([\phi]^{M,c',g} = 1\)

- Stable Atoms
  - \(\text{AT}(P) = \lambda x. D[\text{AT}(P)(x)]\)

- There are no entities \(x\) in \(At(P_{c_1}), At(P_{c_0}), At(P_{c_2})\) that make \(D[\text{AT}(P)(x)]\) true.

There are no entities that are atoms relative to all precisifications, so there are no \textit{Stable Atoms} to form a counting base.
Mass and Count N Denotations

- Ns map onto Number Neutral properties (or Kinds)
- Count Ns are built from STABLE ATOMS
  - If N is count, $\mathcal{AT}(N)_{M,g,c} \neq \emptyset$
    - Count Ns have stable atoms (adjusted defn.)
- Mass Ns are built from UNSTABLE ENTITIES
  - If N is mass, $\mathcal{AT}(N)_{M,g,c} = \emptyset$
    - Mass Ns lack stable atoms
Direct Numeral Attachment: Example

Simple idea: Restrict Number Phrase interpretations to apply only to interpretations of Ns with stable atoms

- \([\text{NumP}n[\text{cats}]] = \lambda x[\mu_{\text{AT},\text{cats}}(x) = n]\)
  - For any \(x\) and any \(P\), \(\mu_{\text{AT},P}\) is defined only if:
    i. \(P(x)\)
    ii. \(P\) has stable atoms.
  - \(\mu_{\text{AT},P}\) = the number of stable \(P\)-atoms that are part of \(x\)
    (if defined)

- Three cats are purring
- \(\exists x[\mu_{\text{AT},\text{cats}}(x) = 3 \land \text{purring}(x)]\)
Count/Mass Variation

Why a problem?

- If only vagueness explains MASS, then how could there be variation?

Intralinguistic Variation: rope vs. rope

- Assume ‘primary’ reading of rope is Mass. Derive Count reading of rope via a partition on +Rope in terms of “standardized bounded units”

Crosslinguistic Variation: kichenware[−C] vs Küchengerät-e[+C]

- “fake mass” Ns arise from a ‘copycat’ effect in number marking languages

Crosslinguistic Variation: lentil-s[+C] vs. čočka[−C]

- “standardized partitions are more readily available” in some languages (e.g. English) than others (e.g. Czech)

But now we have 3 different explanations for [+COUNT]/[-COUNT] variation...
Problem: Equivocation, substance and ‘granular’ Ns

Recall: cat versus rice / mud

We don’t have any cats. I’ve eaten (all) my rice. I’ve cleaned (all) the mud off my boots.
(always false) (sometimes true) (sometimes true)

But: rice versus mud

- We Can and Do distinguish minimal salient elements in the denotation of Ns denoting granular (rice, lentils) and fibrous (hair) entities
  - And these nouns vary wrt COUNT and MASS
- “Substance” nouns are different: e.g. water, blood
  - And these nouns are stably MASS
- Formal atomicity insufficient. Need something more like INDIVIDUATION (‘counting as one’)

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Problem: Supervaluationism

- There are contexts e.g. in which having 1 cat does not count as ‘having cows’ (Grimm & Levin pers. comm.)
  - The large-scale dairy farmer: Having one cow does not count as ‘having cows’
  - But then there is one context $c'$ in which $AT(COW_{c'})$ excludes singles cows.
  - But that would mean that cow is mass!

- Generalized: Requires only one defeating context to make a noun mass

- However, this is an artifact of supervaluationism, not of a vagueness-based approach

- Solution: Go for gradience
  - Either degree supervaluationism.
  - Or, e.g. probabilistic (Sutton and Filip 2016a,b,c)
Summary

- A significant departure from Chierchia (1998)
- The first detailed proposal to follow intuitions in Chierchia (1998); Rothstein (2010) that there is something vague about (some) count Ns
- Addresses the question of where and why to expect [+C]/[-C] variation within and across languages.
  - Explanation not very parsimonious
  - (As we’ll see with Landman (2011)), doesn’t explain all ‘fake’ mass noun behaviour.
- Problems:
  - Supervalueisationism and single ‘defeating’ contexts
  - Equivocation between granular and substance nouns
## Overview of Chierchia (2010)

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Rothstein on the Semantic Atomicity and the Role of Context
Recap: Divisivity & Problems with Divisivity

- Divisivity not necessary for mass. (*pea soup*, *fruitcake* etc.).

- Divisivity not sufficient for mass. (*fence*, *line* etc.).
Types of Atoms and the Inadequacy of Natural Atomicity

Rothstein distinguishes three types of atoms:

▶ Natural Atoms: Inherently individuable entities
▶ Formal Atoms: $\forall x[At(x) \iff \neg\exists y[y \sqsubseteq x]]$
▶ Formal $P$-Atoms: $\forall x[At(P)(x) \iff \neg\exists y[P(x) \land P(y) \land y \sqsubseteq x]]$
▶ Natural Atomicity is neither necessary not sufficient for being a count $N$:
  ▶ Not sufficient: Some naturally atomic $N$s are mass (furniture)
  ▶ Not necessary: Some non-naturally atomic $N$s are count (fence).
What Barner and Snedeker’s (2005) Results Show

Comparison Qs with *more* can trigger either **CARDINALITY** or **MEASURE** comparisons:

Who has more dirt?

Who has more furniture?

Who has more stone?

Who has more stones?

“You can say ‘B has more furniture than A’, but not ‘B has two more furnitures than A’. This means that what is relevant for counting judgments is not relevant for linguistic expressions of counting. In other words, the conceptual apparatus of individuation and the grammatical mechanism that allow direct counting are distinct.” (Rothstein 2010, p. 358)

► The count/mass distinction is grammatical not ontological or purely conceptual
Rothstein’s Observations and Conclusions (Summary)

(O1) Salient ‘countable’ entities $\rightarrow$ grammatically countable.

(O2) Grammatical countability $\rightarrow$ natural atomicity.

(C1) Cannot define the mass/count distinction in terms of denotations (alone) or a presumption of atomicity.

(C2) Natural atomicity is neither necessary nor sufficient for being a count noun.

(C3) Explanation must be in terms of how Ns refer. The mass/count distinction is grammatical not ontological.
Object Mass, Substance Mass, and Count: Informal outline

Object Mass (furniture)
- Naturally atomic (inherently individuable entities).
- Choice of atoms may be vague/context sensitive.
- Atomic elements not lexically accessible (as in Chierchia (1998))

Substance Mass (mud)
- Not Naturally atomic (no inherently individuable entities).
- Choice of atoms (always?) vague/context sensitive.
- Atomic elements not lexically accessible (as in Chierchia (1998))

Count (fence)
- Not necessarily naturally atomic (may have inherently individuable entities).
- Choice of atoms context sensitive, but DETERMINED IN CONTEXT.
- Atomic elements are lexically accessible (albeit contextually determined).
Mass N Denotations

Mass N denotations are Root N denotations (Rothstein 2010)

- \( N_{\text{mass}} = N_{\text{root}} \subseteq M \)
- e.g. a sub-lattice lattice of the domain (cf. Chierchia 2010)

\[ \text{furniture}_{\text{root},w} = \{ \} \]

A more recent proposal:
Mass Ns denote Kinds (Oliveira and Rothstein 2011)

- \( N_{\text{mass}} = \text{MASS}(N_{\text{root}}) = \lambda w. \sqcup_M (N_{\text{root},w}) \)
- e.g. The supremum of the sub-lattice (albeit intensionalised)

\[ \text{MASS}(\text{furniture}_{\text{root},w}) = \{ \} \]
[\text{++COUNT}] \text{ means semantically atomic}

Singular count N denotations:

\begin{itemize}
  \item $N_k \subseteq M \times \{k\}$
  \item Atomicity relative to a context $k$, where $k$ is a set of entities that ‘count as one’ in a given context.
\end{itemize}

\[
F = \begin{cases}
  f_1 \sqcup f_2 \sqcup f_3 \sqcup f_4 & \quad f_1 \sqcup f_2 \sqcup f_3 \sqcup f_4 \\
  f_1 \sqcup f_2 \sqcup f_3 & \quad f_1 \sqcup f_2 \sqcup f_4 \\
  f_2 \sqcup f_3 & \quad f_2 \sqcup f_4 \\
  f_3 & \quad f_4
\end{cases}
\]

\begin{itemize}
  \item $N_{\text{count}} = \text{COUNT}_k(N_{\text{root}})$
  \item $\text{COUNT}_k(F) = \{\langle d, k \rangle : d \in F \cap k\}$
  \item $k_1 = \{f_1, f_2, f_3, f_4, g_1, g_2, \ldots\}$, \quad $k_2 = \{f_1 \sqcup f_2 \sqcup f_3 \sqcup f_4, g_1, g_2, \ldots\}$
  \item $\text{COUNT}_{k_1}(F) = \{\langle f_1, k_1 \rangle, \langle f_2, k_1 \rangle, \langle \{f_3, k_1\}, \langle f_4, k_1\rangle\}$ \quad \Rightarrow \text{Four fences}
  \item $\text{COUNT}_{k_2}(F) = \langle f_1 \sqcup f_2 \sqcup f_3 \sqcup f_4, k_2 \rangle \Rightarrow \text{One fence}$
\end{itemize}
Mass Ns and Count Ns differ typically

Mass Ns
- $\langle d, t \rangle$
- Mass Ns (at a world) denote functions from entities in the domain to truth values

Count Ns
- $\langle d \times k, t \rangle$
- Count Ns (at a world) denote functions from pairs of entities in the domain AND CONTEXTS to truth values
Direct Numeral Attachment: Example

First, pluralise the count N:

\[ FENCE_{\text{root}} = \begin{cases} \{ \text{\ldots} \} \end{cases} \]

\[ k = \{ \text{\ldots} \} \]

\[ FENCE_k = \begin{cases} \{ \langle \text{\ldots}, k \rangle \text{\ldots} \} \end{cases} \]

\[ *FENCE_k = \begin{cases} \{ \langle \text{\ldots}, k \rangle \text{\ldots} \} \end{cases} \]
Direct Numeral Attachment: Example

Then apply the Numeral.

\[ *FENCE_k = \left\{ \begin{array}{c} \langle \overline{d \times k}, k \rangle \\ \langle \overline{d \times k}, k \rangle \\ \langle \overline{d \times k}, k \rangle \\ \langle \overline{d \times k}, k \rangle \\ \end{array} \right\} \]

Where \( x \) is of type \( \langle d \times k \rangle \):

\[ \text{Two}_{\langle \langle d \times k, t \rangle, \langle d \times k, t \rangle \rangle} = \lambda P \lambda x [P(x) \land |\pi_1(x)|_{\pi_2(P)} = 2] \]

\[ \text{Two}(*FENCE_k) = \{ \langle \overline{d \times k}, k \rangle, \langle \overline{d \times k}, k \rangle, \langle \overline{d \times k}, k \rangle, \ldots \} \]
A Puzzle about Cross- and Intralinguistic Variation

- Rothstein rejects salience as sufficient criteria for lexical accessibility of atoms.
- But then what’s the difference between furniture$_{mass}$ and huonekalu-t$_{count}$, PL (furniture, Finnish)?
  - Rothstein: A difference in semantic type
- But why should some languages encode this as count and others as mass?
  - Seems to be decided by fiat (in the lexicon) when an N is encoded as $\langle d, t \rangle$ and when as $\langle\langle d, k \rangle, t \rangle$
  - It would be preferable to have a semantic and/or cognitive criterion for when a N will/can be mass/count.
  - However, this is recognised by Rothstein (p. 394)
Cross- and Intralinguistic Variation II

Looks like context sensitive Ns are also display mass/count variation within languages.

- fence  fencing  carpet  carpeting
- rope  rope  hair  hair-s
- (Pseudo) mathematical expressions (line, plane) always count?

But there are other Ns display variation even though they are not context sensitive in the relevant sense

- shoes  footwear
- meubel-s  meubilair (furniture, Dutch)

Coming up next: Landman (2011)

- Maybe object mass nouns, furniture, footwear etc. are more context sensitive that Rothstein supposes
- How many items of furniture are there in each picture?
Rothstein addresses and explains the behaviour of a class of count Ns that were previously inadequately analysed (fence, hedge, wall).

The notion of a counting context is an intuitive one (And will come up again tomorrow!)

But, arguably misses the connection between context-sensitive count Ns (fence, rope) and superordinate Ns (furniture, footwear).
## Chierchia and Rothstein: Coverage and Comparison

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<td>Type-based distinction is too weak to</td>
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<td>(Difference in semantic type.)</td>
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<td>predict count/mass variation</td>
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References


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