Singular Count NPs in Measure Constructions

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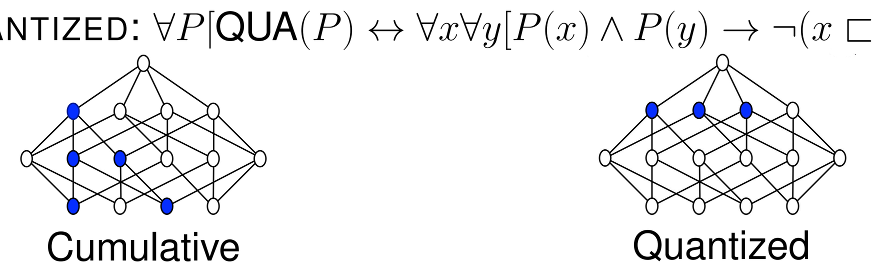
MAIN IDEA

- **Two kinds of count Ns**
  - QUANTIZED COUNT Ns: lexically determine their CRITERION OF INDIVIDUATION at all contexts (lexically fix what is 'one' in their denotation for all contexts) - *cat, lentil*;
  - NON-QUANTIZED COUNT Ns: lexically do not uniquely determine their CRITERION OF INDIVIDUATION (what is 'one' in their denotation varies with context) - *fence, twig, line.*
- **Key evidence**: Only *fence*-like count Ns, just like mass Ns, occur in measure (pseudo-partitive) DPs: *?three pounds of cat*$_C$ *three yards of fence*$_C$ *three inches of snow*$_M$

BACKGROUND

Krifka (1989)

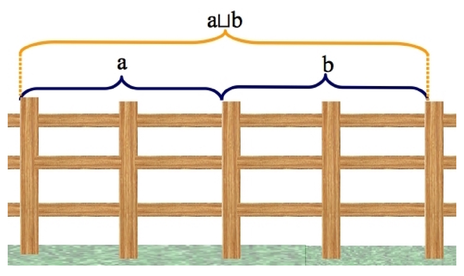
- **Two Mereologically-based Predicate Types**
  - CUMULATIVE: $\forall P[\text{CUM}(P) \leftrightarrow \forall x \forall y[P(x) \wedge P(y) \rightarrow P(x \sqcup y)]]$ *water, apples*
  - QUANTIZED: $\forall P[\text{QUA}(P) \leftrightarrow \forall x \forall y[P(x) \wedge P(y) \rightarrow \neg(x \sqsubset y)]]$ *(an) apple, two liters of water*



From Krifka (2007)

- **Lexical Mass Ns** denote CUMULATIVE sets, only specify a qualitative criterion of application: $\lambda x[\mathbf{WATER}(x)]$
- **Lexical Count Ns** denote QUANTIZED sets, specify a qualitative and a quantitative criterion of application: $\lambda n \lambda x[\mathbf{APPLE}(x) \wedge \mathbf{NU}(\mathbf{APPLE})(x) = n]$, where NU (**'natural unit'**) is a kind of extensive measure function, contributing the quantitative criterion
- **Extensive Measure Function** μ (e.g. LITER, KILO) is a function relative to a sum operation $\sqcup_P$ on a part structure P, iff it maps substances to positive real numbers such that: $\neg x \circ_P y \rightarrow [\mu(x \sqcup_P y) = \mu(x) + \mu(y)]$ (additivity).
- **Quantizing Modification:**
  $\forall P \forall Q[\text{QMOD}(P, Q) \leftrightarrow \neg\text{QUA}(P) \wedge \text{QUA}(Q(P))$ *two liters (of), four kilos (of)*
  - require a $\neg$QUA(P) and derive a QUA(P): *(an) apple, two liters of water*

Problem: *fence*



- QUANTIZATION not necessary for Ns to be grammatically count (Krifka 1989:87, Partee, p.c.)
- **fence**-like count Ns: *sequence, line, wall, band, bouquet, plane, hedge ...*

Rothstein (2010)

- **Lexical Mass Ns** of type $\langle e, t \rangle$
- **Lexical Count Ns** of type $\langle\langle e \times k\rangle, t\rangle$
  (lexical count Ns indexed to counting contexts)

  How many fences are there in the picture?
  - In context k_1:
    $|\{\langle a, k_1\rangle, \langle b, k_1\rangle, \langle c, k_1\rangle, \langle d, k_1\rangle\}| = 4$ (two fences)
  - In context k_2: $|\{\langle a \sqcup b \sqcup c \sqcup d, k_1\rangle\}| = 1$ (one fence)
- Counting is counting entity-context pairs

Problem

- Assimilating the analysis of count Ns like *cat* under context-sensitive count Ns like *fence* raises the question why we have only one licensed individuation schema for *cat*, but multiple ones for *fence*?

Landman (2011)

- For object mass nouns (Landman's 'neat' mass Ns), generator sets = entities that count as 'one': e.g., $\mathbf{gen}(\text{KITCHENWARE}) = \{\text{teacup}, \text{saucer}, \text{teacup} \sqcup \text{saucer}, \text{pestle}, \text{mortar}, \text{pestle} \sqcup \text{mortar}\}$
- Overlapping entities count as 'one' SIMULTANEOUSLY IN THE SAME CONTEXT
- Different maximally disjoint subsets (Landman's VARIANTS) yield different cardinalities
  $\Rightarrow$ COUNTING GOES WRONG

EMPIRICAL EVIDENCE

Prototypical count Ns like *cat* and *fence*-like Ns

- **Similarities**
  (i) direct modification by numerical expressions;
  (ii) pluralization: *three cats, three fences*;
  (iii) arguments of quantifiers that select for count Ps: *each boy, each fence*;
  (iv) not bare in argument positions: *Kim bought *apple/*fence yesterday.*
  (v) aspectual composition: yield complex predicates of quantized sets (accomplishments):
    (a) *write a letter* [QUANTIZED] $\rightarrow$ QUANTIZED VP
    (b) *write a sequence of numbers* [NOT QUANTIZED] $\rightarrow$ QUANTIZED VP
- **Differences**
  Measure (aka pseudo-partitive) DPs with extensive measure functions admit *fence*-like Ns, which denote $\neg$QUA(P), but not prototypical count Ns, which denote QUA(P):

(1) (a) ? 6 kilograms of baby
    (b) ?? You can find a heavy piece of baby in the nursery.
(2) (a) 3 km of fence, 100 yards of hedge
    (b) On the other side of town, we saw several more pieces of wall.
    (c) You can find a great many lengths/stretches of dry stone wall across NE England.

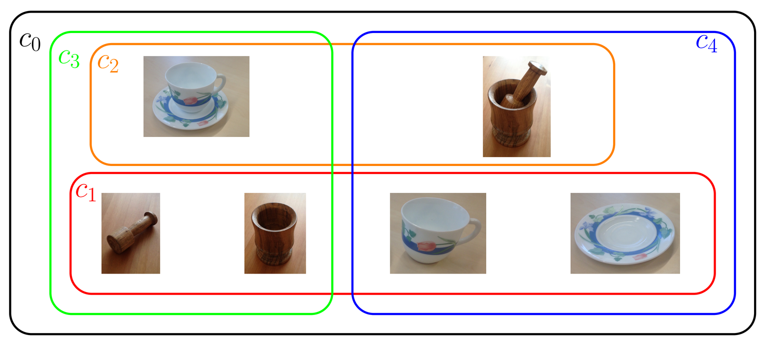
Puzzle for a uniform semantic analysis of count Ns (Rothstein 2010, and also Krifka 1989)

- Why are count nouns like *fence* felicitous in measure (pseudo-partitive) DPs when they pattern, grammatically, with count nouns like *cat* in other contexts?

ANALYSIS

Basic Assumptions

- **Measure Phrases** formed with extensive measure functions that are applied to $\neg$QUA(P).
  - see above **Quantizing Modification** (Krifka (1989))
  - Measure functions ONLY exclude singular QUA(P)s (also Schwarzschild (2002), *pace* claims in recent unpublished work of Rothstein and Landman that measure functions require 'mess' mass Ps as arguments).
- **Null Counting Context** c_0: $X_{c_0} = \bigcup_{c_{i>0}} X_{c_i}$ (Sutton and Filip (2016)).
  - The interpretation of a predicate at the null counting context c_0 is the union of the interpretations of that predicate at all specific counting contexts $c_{i>0} \in C$.



– *Specific counting contexts* are like counting contexts (Rothstein (2010)), or variants (maximally disjoint, hence countable subsets) (Landman (2011)).
– *The null counting context* allows overlaps among its countable/maximally disjoint subsets.

Lexical Entries for Nouns

- **A pair** $\langle \mathbf{P}, \mathbf{IND(P)}(c_i)\rangle$
  - P: number neutral predicate
  - $\mathbf{IND(P)}(c_i)$: the set of P-individuals at counting context of utterance c_i

CONSEQUENCE: Count/mass properties are derived from the disjointness of the IND-set at c_i, rather than being a purely type-based distinction, as in Rothstein (2010).

Count N entries have a counting context argument $c_{i>0}$, meaning that their denotations are evaluated relative to a counting context of utterance that uniquely determines what is 'one'.

cat: $[\![\text{cat}]\!]^{c_i} = \lambda x.\langle \text{CAT}(x), \mathbf{IND}(\text{CAT})(c_i)(x)\rangle$

- The IND-set for CAT is disjoint (and hence quantized) at every specific counting context $c_{i>0}$
  - Grammatically count.
  - Captures the context-independence of its inherent criterion of individuation
- Prototypical count Ns (*cat*) are also quantized at c_0
  - The set of single cats is the same disjoint set at all counting contexts, hence also disjoint at the null counting context

fence: $[\![\text{fence}]\!]^{c_i} = \lambda x.\langle \text{FENCE}(x), \mathbf{IND}(\text{FENCE})(c_i)(x)\rangle$

- IND-set for FENCE is disjoint (so quantized) at every specific counting context $c_{i>0}$
  - makes *fence* grammatically count
- BUT: the IND-set for FENCE overlapping at the null counting context c_0
  - Lexically does not uniquely determine its criterion of individuation
  - *Fence*-like Ns are not quantized: fences at some specific counting contexts are proper parts of fences at other specific counting contexts
  - Hence both parts and sums are fences at the null counting context
- This makes *fence* grammatically measurable, but *cat* infelicitous in in a pseudo-partitive (measure) DP

Mass N entries are saturated with the null counting context c_0

- Substance Ns are not inherently individuated. IND-sets for substance Ns reflect a simultaneous multiplicity of individuation schemas.

water: $[\![\text{water}]\!]^{c_i} = \lambda x.\langle \text{WATER}(x), \text{IND}(\text{WATER})(c_0)(x)\rangle$

- The counting base for WATER is overlapping at all counting contexts, and so, not quantized
  - This makes *water* grammatically mass, and felicitous in a measure phrase

Measure Phrases

- Apply extensive measure function to the counting base of the argument predicate
- Also saturate the base with the null counting context

meter: $[\![\text{meter}]\!]^{c_i} = \lambda n.\lambda P._{\langle e, \langle t \times t\rangle\rangle} \lambda x.\langle \pi_1(P)(x), \mu_{\text{meter}}(\pi_2(P)(c_0)(x)) = n\rangle$

- A function from a numeral to a function from an N predicate to a predicate for a measure DP.
  - π_1, π_2 such that if $X : \langle a \times b\rangle$, then $\pi_1(X) : a$ and $\pi_2(X) : b$
  - Interpretable only if the counting base of the resulting expression is not quantized

$[\![\text{two meters of cat}]\!]^{c_i} = \lambda x.\langle \text{CAT}(x), \mu_{\text{meter}}(\mathbf{IND}(\text{CAT})(c_0)(x)) = 2\rangle$ Not Interpretable!
$[\![\text{two meters of fence}]\!]^{c_i} = \lambda x.\langle \text{FENCE}(x), \mu_{\text{meter}}(\mathbf{IND}(\text{FENCE})(c_0)(x)) = 2\rangle$
$[\![\text{two meters of water}]\!]^{c_i} = \lambda x.\langle \text{WATER}(x), \mu_{\text{meter}}(\mathbf{IND}(\text{WATER})(c_0)(x)) = 2\rangle$

- $\mathbf{IND}(\text{CAT})(c_0)$ is quantized, but $\mathbf{IND}(\text{FENCE})(c_0)$ and WATER$)(c_0)$ are NOT quantized
  - Hence, *fence*-like Ns are felicitous in measure phrase DPs. In summary:

Measure phrase and QUA(P) at the null counting context c_0

	Cumulative	Quantized at $c_{i>0}$	Quantized at c_0	Felicitous in a measure phrase
cat	No	Yes	Yes	No
fence	No	Yes	No	Yes
water	Yes	No	No	Yes

CONCLUSIONS

- Why do we find NL predicates that are $\neg$QUA(P), and also $\neg$CUM(P)?
  - Because they admit a multiplicity of contextually determined disjoint individuation schemas.
- Consequence: An explanation for the admissibility of count P's as arguments of measure phrases.

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