Counting in Context

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Abstract

A major factor in the grounding of the mass/count distinction is the resolution/non-resolution of overlap in context. In order to support this thesis, we argue, also inspired by Rothstein (2010) and Landman (2011), that the interpretation of nouns relative to counting contexts also enforces a resolution of overlap in their denotations, which facilitates counting. We further argue for a typal difference between mass and count nouns (in line with Krifka 1989, and Rothstein 2010): namely, the lexical entries of mass nouns specify the null context as the context for evaluation, which allows for overlap making mass nouns uncountable, whereas the lexical entries of count nouns do not, which allows for the counting context for count nouns to vary from utterance to utterance. Adopting this semantics has three major benefits. We can predict on semantic grounds, for a large class of nouns, when we should expect to find mass/count variation cross- and intralinguistically. Second, we can explain why superordinate "object mass nouns" resist mass-to-count coercion, and third, why prototypical count nouns are harder to shift in count-to-mass coercion.

1. Main idea

The domain in which (concrete) mass and count nouns are interpreted forms a Boolean semilattice. While all nouns denote a set of ordered pairs, where the first member is a number-neutral property and the second the putative counting base, there is a typal distinction between the two (in line with Krifka 1989, and Rothstein 2010). The lexical entries for mass nouns are saturated with the null context that allows overlap, and hence blocks counting (inspired by Landman's (2011) notion of overlap); the counting context for count nouns may vary from utterance to utterance, which yield contextually coerced maximally disjoint (non-overlapping), and hence countable sets for the denotation of count predicates. In a nutshell then, the mass/count distinction is a matter of the (NON-) RESOLUTION OF OVERLAP IN CONTEXT. The proposed account allows us to motivate the behavior of context-sensitive count nouns like *fence* and mass nouns like *furniture* (aka "aggregate mass terms" in Payne and Huddleston (2002)), which pose some of the most intractable puzzles at the heart of the mass/count distinction, but also it has the perhaps surprising outcome that it offers a principled analysis of many instances of MASS/COUNT VARIATION, both intra- and crosslinguistic, which belongs to one of the outstanding problems in the domain of countability (see Chierchia, 1998, 2010; Rothstein, 2010; Landman, 2011, among others)). Moreover, it helps explain the restriction on 'packaging' readings for superordinate "aggregate mass terms" (e.g., # *three furnitures/footwears/kitchenwares*).

2. Background

Although the context-sensitivity of the mass/count distinction has been acknowledged since at least Pelletier (1975), only recently has it been systematically integrated into theoretical accounts. Of main interest here are two related implementations, Rothstein (2010) and Landman (2011), both motivated by the observation that the mass/count distinction cannot be reduced to individuation inherent in the meaning of nouns *per se*, i.e., to "stable atomicity" along the lines of Chierchia (1998) or context-independent "Natural Unit (NU)" function in Krifka (1989,

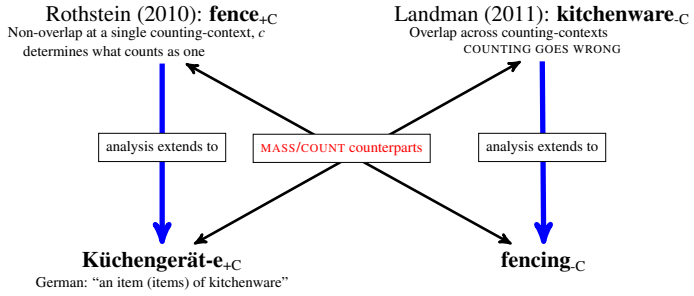
1995), for instance. It is not necessary, given that there are count nouns like *fence* that fail to denote inherently individuated units; neither is it sufficient, given that there are "aggregate" mass nouns like *kitchenware* that have individuated units in their denotation (pots, pans, cups). Focusing on count nouns like *fence, line, wall*, Rothstein (2010) argues that all count nouns uniformly denote sets of individuals indexed for the context in which they count as 'one', and hence are of the type $\langle e \times k, t \rangle$ (predicates of indexed individuals), and "semantically atomic". In contrast, mass nouns are of the type $\langle e, t \rangle$ (predicates of individuals). This amounts to a semantic typal difference between mass and count, and counting as a linguistic (grammatical) operation is sensitive to semantic atomicity, i.e., atomicity relative to a counting context. Landman's (2011) main interest lies in motivating the puzzling nature of "aggregate" mass nouns like *furniture, kitchenware*. He defines the set of generators, $\mathbf{gen}(X)$, of the regular set *X*, as the set of "the things that we would want to count as one" (Landman, 2011, p. 26) relative to a context. Count nouns have non-overlapping generator sets. Mass nouns have overlapping generator sets, and therefore counting in the mass domain 'goes wrong'. There are two sorts of mass nouns, distinguished by the location of the overlap. "Mess" mass nouns like *water, salt* denote regular sets whose minimal elements are overlapping, while "neat" mass' nouns like *furniture, kitchenware* specify regular sets whose set of minimal elements are non-overlapping, but includes elements that overlap with minimal elements in the generator set.

3. MASS/COUNT as the (non-)resolution of overlap in context

Rothstein's counting contexts force a choice which ensures a well defined NON-OVERLAPPING set for a grammatical counting operation. Landman's simultaneous "contexts" force no choice, but instead allow, simultaneously, all possible non-overlapping variants (partitions) of a generator set, which together form a simultaneous multiplicity of overlapping building blocks, none of which has a privileged status when it comes to counting. But notice that each of Landman's non-overlapping variants (partitions) of a generator set corresponds to one particular counting context in the sense of Rothstein. Hence, denotations in Landman's contexts (c_l) can be seen as the union of the denotations of Rothstein's contexts (c_r):

$$[\![\phi]\!]^{c_l} = \bigcup [\![\phi]\!]^{c_r} \text{ for all } c_r \in \mathcal{C}$$

Via this association, the count/mass distinction can be understood as THE RESOLUTION/NON-RESOLUTION OF OVERLAP IN CONTEXT. Moreover, as the figure below helps show, each account can be extended to cover the mass/count counterparts of nouns treated by the other account (vertical arrows), but which cannot be accommodated by either taken separately:



Context-sensitive count nouns like *fence* that Rothstein's analysis can accommodate are precisely those that tend to have intralinguistic mass (-C) counterparts: *fencing*. Furthermore, the "neat" mass nouns like *kitchenware* that Landman's analysis can accommodate are precisely those that tend to have intra- and crosslinguistic count (+C) counterparts: *shoes*$_{+C,\ PL}$, and *Küchengerät-e*$_{+C,\ PL}$ ('kitchenware', lit.: 'kitchen.appliance-s', German).

4. Formal analysis

Models are tuples $\langle \mathcal{I}, \mathcal{D}, \mathcal{C}, \mathcal{W} \rangle$, an interpretation function, domain, set of contexts and set of worlds (worlds will be suppressed below). Entities of type $e \in \mathcal{D}$ form a Boolean semilattice closed under mereological sum $\sqcup$. Nouns are interpreted as pairs $[\![\text{N}]\!] = \langle N, \mathbf{IND}(N) \rangle$, where N is a mereological semilattice forming the number-neutral denotation of N, and $\mathbf{IND}(N)$ is the set of individuated entities forming the putative counting base (what qualifies as 'one' for the purposes of counting). If the $\mathbf{IND}$ set of a predicate is X, then for COUNTING CONTEXTS $c_1, ..., c_n$, there is a constraint on the interpretation of any set at any context:

$$X_{c_i} = \{Y : Y \subseteq X, \text{ for all } x, y \in Y, x \sqcap y = \varnothing \text{ and for all } x \in X \text{ and some } y \in Y, x \sqcap y \neq \varnothing\}$$

In words, the interpretation of a predicate at a counting context is a maximally disjoint subset, and hence non-overlapping countable subset. If Y is a maximally disjoint subset of X, then Y is a subset of X, disjoint, and all elements of X overlap with some element of Y. Contexts are treated as indices, rather than as subsets of the domain (Rothstein, 2010), and the set of contexts $\mathcal{C} = \{c_0, c_1, c_2, ..., c_n\}$ includes COUNTING CONTEXTS $c_1, c_2, ..., c_n$, where c_0 is the NULL CONTEXT. The null context c_0 is defined from the rest of the context set:

$$X_{c_0} = \bigcup X_{c_i} \text{ computed from all } c_i \in \mathcal{C} - c_0$$

Since the null context allows overlap, it blocks counting. Generally, the lexical entries for mass nouns specify the null context as the context for their evaluation, but count nouns do not, and hence their counting context may vary from utterance to utterance. This amounts to the claim that there is a typal difference between mass and count nouns, similarly as in Krifka (1989) and Rothstein (2010). Given this general typal difference, we may also capture the variation in the mass/count encoding within a particular language, as in *fencing/fence*, and across different languages, as in *kitchenware*$_{\text{-C,SG}}$ versus the German count *Küchengerät*$_{\text{+C,SG}}$ ('item of kitchenware') / *Küchengerät-e*$_{\text{+C,PL}}$ ('items of kitchenware'). For the latter, for instance, we have:

$$\begin{aligned} [\![\text{kitchenware}]\!]^{c_i} &= \langle \text{KITCHENWARE}, \mathbf{IND}(\text{KITCHENWARE})_{c_0} \rangle \\ [\![\text{Küchengerät}]\!]^{c_i} &= \langle \text{KITCHENWARE}, \mathbf{IND}(\text{KITCHENWARE})_{c_i} \rangle \\ [\![\text{Küchengeräte}]\!]^{c_i} &= \langle \text{KITCHENWARE}, {}^{*}\mathbf{IND}(\text{KITCHENWARE})_{c_i} \rangle \end{aligned}$$

Assuming that counting in the mass domain (of *kitchenware*$_{\text{-C,SG}}$) is blocked by the overlap in the $\mathbf{IND}$ set at the null context, but not in the count domain (inspired by Landman's (2010) use of the notion of overlap), we have:

- N is mass: $[\![\text{N}]\!]^{c_i} = [\![\text{N}]\!]^{c_0}$ for all $c_i \in \mathcal{C}$, and $\mathbf{IND}(N)_{c_0}$ is not disjoint.
- N is count: $\mathbf{IND}(N)_{c_i}$ is disjoint.

The English *kitchenware* is not countable because $\mathbf{IND}(\text{KITCHENWARE})_{c_0}$ is not disjoint. For example, it may contain pestles and mortars, but also sums consisting of a pestle and a mortar together. The German *Küchengeräte* ('item of kitchenware') is countable, because its counting base is interpreted at a counting context, and so is disjoint, because at any counting context, its counting base will contain EITHER only individual pestles and mortars OR only pestle-mortar sums. The interpretation of the plural *Küchengeräte* has as its counting base the upward closure under sum '*' of the counting base for *Küchengeräte*.

5. Consequences and challenges

By synthesizing the contextual assumptions of Rothstein (2010) and Landman (2011), our proposal not only improves on each taken separately, but also has the following additional advantages. First, we can identify one broad class of nouns that are predicted to manifest

high tendency for cross- and intralinguistic variation in mass/count encoding: namely, the nouns for which the set of entities that count as 'one' may overlap, which, on our account, include count nouns like *fence* and mass nouns like *kitchenware*. Second, unlike Rothstein's account, on which mass/count is purely type-based and a matter of unconstrained lexical choice, our account predicts differential preferences for count-to-mass shifts exhibited by different classes of nouns: for instance, it will be harder to shift the meanings of prototypical count nouns like *person, cat, chair* into mass meanings, since they have disjoint **IND** sets at all counting contexts, and so thereby also at the null context. This prediction is borne out when considering the distribution of mass/count encoding across languages with a grammatical mass/count distinction. Third, our account could help to explain why coerced 'packaging' readings are so hard to access in languages with superordinate "aggregate" mass nouns, despite these nouns having standardized functional or perceptually discrete portions/units: # *I bought three kitchenwares/furnitures/footwears.* On Rothstein's and Landman's accounts, it is unclear why such nouns cannot be coerced into a meaning like *three items of ...*, for instance, since picking any counting context/maximally disjoint variant would facilitate counting. However, if, as we claim, these nouns come out of the lexicon already saturated with the null context, then we should not expect a replacement of this context with some other, sanctioning, say a type-shift from $\langle e, t\rangle$ to $\langle c, \langle e, t\rangle\rangle$ or some other coercion operation. This contrasts with prototypical mass-to-count shifts (e.g. *three waters*). Prototypical mass nouns may have conventionalized container/quantity readings (e.g. GLASS (OF) / BOTTLE (OF) *water*), which when contextually supplied yield non-overlapping portion readings. However, for *furniture* type nouns, the conventionalized units are the items that count as one, and so the fact that they are saturated with the null context prevents a mass-to-count shift. Fourth, we predict that count-to-mass shifts of denotations of nouns like *fence* should be easier and more frequent than those of prototypical count nouns like *person, cat, chair*, since prototypical count nouns denote non-overlapping sets at the null context.

The above account cannot, however, cover all cases of count/mass variation. For example, granular and fibrous nouns such as *lentils, beans, hair, noodles* commonly have crosslinguistic mass/count counterparts, but intuitively none denote overlapping individual units (single beans and hairs do not overlap with others). It could be that a different form of context sensitivity is at play here (perhaps similar to Chierchia (2010)). Furthermore, all cases we have considered are concrete nouns, and it is unclear how/if the resolution/non-resolution of overlap in context could be extended to the abstract nominal domain.

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