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DO MASS NOUNS CONSTITUTE A SEMANTICALLY UNIFORM CLASS?

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Abstract: Research on mass nouns has focused on concrete terms. So, are there semantic properties shared by all mass terms? We first consider concrete nouns like *milk* and *furniture*. Contra Cheng (1973), we show that they can be held to refer distributively (i.e. to apply to any part of what they apply to) only if this property is understood with a new part-relation, that of *N-part*. In addition, they refer cumulatively: when they apply to each of two things, they also apply to the two things considered together. We then turn to abstract mass terms like *beauty* and *love*. We find, surprisingly, that they too refer distributively and cumulatively.

Introduction

Mass nouns, like *milk, furniture, chaos* and *beauty,* constitute a morpho-syntactic subclass of common nouns. They can be used with determiners like *much* and *less,* but neither with *a, many,* or *few,* nor with cardinal numerals. They are invariable in number, mostly singular. Count nouns have a complementary distribution, admitting for instance singular and plural number. They constitute the other morpho-syntactic subclass of English common nouns (Gillon 1992). Such a distributional distinction between two subclasses of common nouns exists not only in English, but also in many other Indo-European languages, including French (Kleiber 1990), German (Krifka 1991) and Italian (Chierchia 1998).

Researchers studying the semantics of mass nouns have focused on concrete terms (see the reviews of Pelletier & Schubert 1989 and Krifka 1991), ignoring abstract ones. By concrete terms here, we mean terms that denote material entities, like water, furniture, cats and herds; abstract terms are those that do not qualify as concrete. This ontological distinction cuts across the distributional distinction between mass nouns and count nouns.

The question we want to address in this paper is whether these unfamiliar abstract mass terms, like *chaos*, *love* and *beauty*, share any semantic property with the more familiar concrete mass nouns. To answer this question, we proceed in two steps. First, what are the basic semantic properties of concrete mass terms? Then, do abstract mass terms have the same properties as concrete ones? We will show in conclusion that these properties have a bearing on two other types of phenomena: the collective and non-collective interpretations to which are liable

sentences in which mass nouns appear; and the telic and atelic aspects of certain sentences.

I. Concrete Mass Nouns

Let us, then, begin by examining the semantic behavior of concrete mass terms, like *milk* and *furniture*. What are their basic semantic properties? Two semantic properties, distributive reference and cumulative reference, have been attributed to these nouns.

1) Distributive Reference. Following Cheng (1973: 286-287), several authors have proposed that mass nouns refer distributively. According to Cheng: 'Any part of a mass object which is W is itself W.'

To formulate this property in general terms, we require a preliminary notion of what it is for a noun to apply to an entity. We will say that a noun *N* 'applies to' an entity if a definite nominal expression having *N* for head can be used to designate this entity. Consider for instance the milk in a cup. It is referred to by the subject of *The milk in the cup is for the cat*. The noun *milk* hence applies to the milk in the cup. This being specified, the following definition of distributive reference can be proposed:
A noun refers distributively if it applies to any part of what it applies to.
For instance, if one considers only the milk in the lower half of a full bottle, one can refer to it by saying:
The milk in the lower half of the bottle is for the cat.

At first sight, it may seem reasonable to identify the parthood relation used in the definition with the relation introduced in the formal study of the relation of part to whole, the relation of *mereological part*. This relation is very general; it applies notably to the material and temporal domains. It is characterized by four axioms, which make the relation anti-symmetric and transitive, and warrant the existence of so-called weak complements and generalized mereological sums; see Simons (1987) and the Appendix.

But consider again the case of milk. Any part of the milk in a bottle is still milk. But this is really true only if the parts considered are perceivable; under the size of a molecule, for instance, one is not anymore in presence of milk. Moreover, there are many mass nouns to which the property, even if restricted to perceivable parts, does not apply. Consider the furniture of a room. A chair is furniture, but a leg of chair is not, even if the leg is part of the chair. For authors like Bunt (1979) and Gillon (1992), the property of distributive reference would thus not be true of mass nouns in general.

An important point made by these authors is that semantics has no exception (unless otherwise explainable by well-understood independent reasons). Therefore, the basic semantic properties of mass nouns must be properties shared by all mass nouns. From this point of view, nouns like *gold, milk* or *sand* are in no way the best instances of their species. Nouns like *furniture* and *silverware* and nouns like *chaos, love* and *beauty* are mass nouns on an equal footing. What we have discussed shows that the conceptual notion of homogeneity found with names of substance is in no way characteristic of mass nouns.

Should we then altogether dispense with the property of distributive reference, as urged by Bunt and Gillon? In fact, all depends on how the notion of part is understood. Cheng says: 'Any part of a mass object which is W is itself W.' But what constitutes, for a noun *N*, part of a 'mass object' to which the noun *N* applies? Besides the interpretations that have just been proposed, another interpretation is possible, which we put forward in our work (see also Nicolas, to appear). In such an interpretation, the parts mentioned in the property of distributive reference are those to which the linguistic expression *part of the N* applies. Take a sentence like:
They have stolen part of the furniture last night!
What counts as part of the furniture is one or several pieces of furniture, but not the leg of a chair; the leg constitutes part of the chair, but not part of the furniture.

As we can see, the interpretation of the expression *part of the N* depends on the noun *N* considered. This is a semantic fact. To each common noun *N* is associated a specific relation that corresponds to the interpretation of the expression *part of the N* and that holds only among certain entities of the domain of discourse. Let us call this the *N*-part relation. This relation is satisfied by two entities y and x if the expression *part of the N* can be applied to y while the nominal expression *the N* designates x.

We remark that concrete mass nouns (but not concrete count nouns) impose the following condition on the interpretation of the expression *part of the N*, a condition that we therefore propose to assimilate to distributive reference:
A noun N refers distributively if it applies to any N-part of what it applies to.

This property is indeed satisfied by all concrete mass nouns, be they nouns like *water* or nouns like *furniture*. And it is not satisfied by concrete count nouns. For instance, the tail of a cat can be said to be part of the cat, but not to be a cat.

Another semantic characteristic has been attributed to mass nouns, to which we now turn.

2) Cumulative Reference. Quine (1960: 91) seems to be the first author to have proposed that mass nouns refer cumulatively: 'So-called mass terms like *water* [and] *furniture* have the semantic property to refer cumulatively: any sum of parts which are water is itself water.' Quine's observation is generally accepted. However, given the ambiguity of the term *sum*, it can be interpreted in two ways. We present a first interpretation and show what problems it faces.

According to this first interpretation, the property of cumulative reference can be formulated as follows:
A noun refers cumulatively if, whenever it applies separately to each of two things, it is possible to constitute a whole of which each thing is a part and such that the noun applies to the whole itself.
This property is satisfied both by mass nouns like *water* and by mass nouns like *furniture*. For instance, one could put the furniture of a room and the furniture of another room of the same house in the hall. In the hall, one would then have furniture, of which the furniture that was in each room would constitute a part.

The problem with this interpretation is that there are count nouns, which would then seem to refer cumulatively. One counts among them count nouns like *herd*, *cloud* and like *glass of whisky*. Indeed, two herds can mix with one another and constitute a bigger herd. And, seeing that he has served too many glasses of whisky for his guests and himself, would not Captain Haddock be tempted to pour one glass into another, thereby obtaining a glass containing more whisky for himself?

What is at stake in such examples is the fact that one constitutes a whole from two things to which the noun applies. Without this operation of constitution, the whole does not exist; for instance, there is not one herd, but two herds. It is thus relative to two distinct states of the world that a noun like *herd* is applied, first to each original herd, then to the herd constituted from these herds. Now, such a change of world in the course of interpretation is illicit: it is always relative to a given state of the world that a nominal expression refers and that a simple empirical claim like *The herd is pasturing* can be attributed a truth value. The cases we have been considering must hence be thought of as invalid counter-examples.

With this in mind, one can understand the cumulativity criterion as a constraint on what a noun applies to, each time a state of the world is fixed. Take, in a given state of the world, two entities x and y. These two things can be considered together: x and y is an entity distinct from x and from y, which exists in the same world as x and y. This allows us to reformulate the cumulativity criterion as follows:
A noun refers cumulatively if, whenever it applies separately to each of two things, it also applies to the two things considered together.

With this new formulation of the criterion, count expressions like *herd*, *cloud* or *glass of whisky* turn out not to refer cumulatively: when they apply to each of two things, they do not apply to the two things considered together. We thus have a second property characteristic of mass nouns, at least concrete ones.

II. Intensive Nouns

So, consider abstract mass nouns, like *chaos, jealousy* or *beauty.* Do these nouns have the same properties as concrete mass terms?

1) Quantification in Terms of Intensity. We may refer to these nouns as 'intensive nouns', following the work of Danièle Van de Velde (1995). These nouns are semantically characterized by the fact that their quantification concerns, not matter, but the intensity to which what they apply to manifests itself. Compare:
Our guest would like more wine.
What incredible chaos there is in the apartment!
Mary feels a lot of jealousy towards her brother.
Paulina found little beauty in the painting.
The first sentence describes a quantity of beverage, while the other three concern the intensity of a state (chaos), of a feeling (jealousy) or of a quality (beauty).

Now, from a distributional point of view, intensive nouns are simply mass nouns. They can indeed be freely used in all mass constructions: *too much chaos, less jealousy, little beauty*. While their apparition in count constructions is constrained and may coerce a change in meaning: one may talk of *an incredible chaos, a devastating love,* or *a rare patience,* but it is much harder to talk of ??*twenty disorders* or ??*fifteen jealousies*.

What semantic properties, if any, do intensive nouns have in common with the other mass nouns? We have seen that concrete mass nouns refer distributively and cumulatively. Is this equally true of intensive nouns?

2) Distributive Reference. Notice first that the notion of *N*-part does apply to intensive nouns. Expressions of the form [*part of the N*+modifier] are perfectly interpretable with all intensive nouns:
I could only admire part of the disorder that you left behind you.
Part of the joy that you will feel will come from God.
During the day one can only see part of the beauty of Paris.

Moreover, the intensive noun employed then applies to what the expression [*part of the N*+modifier] applies to: this, indeed, is already something, *some N*, which manifests itself at some intensity.

This is illustrated by the following dialogue with the noun *chaos*:
John: *What you see here is only part of the chaos that the children created in the apartment.*
Lucy: *This chaos is already more than enough for me. Call the children at once!*

Similarly for *love*:
What Juliet felt when meeting Romeo was only part of the love that he had for her. But this love was already too much for her.

And for *beauty*:
Nadia: *What you see in Paris is only part of the beauty that there is in France.*
Keith: *This beauty is more than enough for me. I do not want to go anywhere else.*

We conclude that intensive nouns refer distributively. We can check that abstract count nouns, like *idea*, do *not* refer distributively:
John: *What you are hearing is only part of the idea that I have.*
Lucy: ??*This idea is already more than enough for me.*
Lucy cannot refer to part of John's idea as *this idea.*

3) Cumulative Reference. But do intensive nouns refer cumulatively? When an intensive noun applies separately to each of two things, does it also apply to these things considered together?

Imagine a situation in which one can talk of *the chaos in John's room* and of *the chaos in the kitchen*. Then one can talk of them together as *the chaos in John's room and in the kitchen*.

Similarly, cumulative reference is exhibited by the interpretations of sentences like:
John and Lucy's love (at the same time) was more than Ted could handle.
John and Lucy's beauty was more than Marc could handle.

As we see, intensive nouns refer cumulatively. Again, these tests, when applied to abstract count nouns, show that these do not refer cumulatively, the property is true of only mass nouns:
John finally understood the role played by the category of Kant and Husserl in contemporary philosophy.
The phrase *the category of Kant and Husserl* refers to a single category shared by Kant and Husserl; it cannot refer to a category that would consist in that of Kant and that of Husserl taken together.

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Conclusion

So, do mass nouns constitute a semantically uniform class? Our study suggests that they do: be they concrete or intensive, mass nouns refer distributively and cumulatively.

The property of distributive reference may appear to be quite specific: a constraint on the interpretation of the partitive construction *part of the N* when *N* is a mass term. In fact, a similar constraint is imposed on the interpretation of all partitive constructions with mass nouns. Consider expressions like *all of, much of, some of, half of,* or *most of*, followed by a definite nominal expression. When the nominal expression is mass (*the furniture, the love*), it applies to what the partitive construction applies to. But when it is count (*the cat, the idea*), it does *not* apply to what the partitive construction applies to.

How is what precedes linked to other phenomena in which mass nouns are involved? What we have studied are basic semantic properties of mass nouns (distributive and cumulative reference) that constrain their denotation. This denotation plays of course a crucial role in the determination of the truth conditions of sentences where mass nouns appear.

In particular, such sentences are often liable to several construals, including collective and non-collective interpretations (Gillon 1992). Now, non-collective interpretations are available only because of the noun's peculiar denotation. Consider: *This foliage is touching that wiring*, an example due to Lauri Carlson (1980). One interpretation is collective: there is a single pile of foliage that touches a piece of wiring. But there are also non-collective interpretations, in which there are several piles of foliage and pieces of wiring, each piece of wiring touching a single pile of foliage. Such non-collective interpretations are available only because parts of foliage are foliage and parts of wiring are wiring. That is, they stem from the peculiar denotation of mass nouns, which in turn is due to the properties of distributive and cumulative reference.

Also, the telic or atelic aspect of certain sentences depends on the nominal expressions used. As noted by Verkuyl (1993), sentences like
Lucy ate chocolate / much chocolate / a croissant / croissants / many croissants
are atelic only if the direct object of the verb is a bare mass noun (*chocolate*) or a bare plural count noun (*croissants*). Now, bare mass nouns and bare plurals are the only nominal expressions that apply both distributively and cumulatively. So, these two properties are jointly necessary for getting an atelic interpretation, at least with verbs of consumption and creation.

Appendix: A Formal Characterization of the Relation of Mereological Part

The relation of mereological part, P, is usually characterized by four axioms (cf. Simons 1987). To state them, the following relations must be defined first:

- w is an *improper mereological part* of x ('wIPx') if w is identical to x or if w is a mereological part of x:

$wIPx =_{def.} (w=x) \vee wPx$

- y and x *overlap* ('yOx') if they have a common improper mereological part:

$yOx =_{def.} \exists w\,(wIPy \wedge wIPx)$

- $\sigma x\,(Fx)$, the *generalized mereological sum* of the individuals satisfying a given predicate F, is the individual s such that for any individual z, s and z overlap if and only if there exists y satisfying F and such that y and z overlap:

$\sigma x\,(Fx) =_{def.}$ the s such that $\exists z\,(sOz \leftrightarrow \exists y\,(Fy \wedge yOz))$

The relation of mereological part is then characterized by the following axioms:

(P1) $\forall x\,\forall y\,(yPx \rightarrow \neg xPy)$	Anti-symmetry
(P2) $\forall x\,\forall y\,((zPy \wedge yPx) \rightarrow zPx)$.	Transitivity
(P3) $\forall x\,\forall y\,(yPx \rightarrow \exists z\,(zPx \wedge \neg zOy))$	Weak complementation
(P4) $\exists y\,(Fy) \rightarrow \exists!\,\sigma x\,(Fx)$	Existence and uniqueness of the generalized mereological sum

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