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Is there anything characteristic about the meaning of a count noun?

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Introduction

In English, some common nouns, like *cat*, can be used in the singular and in the plural, while others, like *water*, are invariable. Moreover, nouns like *cat* can be employed with numerals like *one* and *two* and determiners like *a*, *many* and *few*, but neither with *much* nor *little*. On the contrary, nouns like *milk* can be used with determiners like *much* and *little*, but neither with *a*, *one* nor *many*. These two types of nouns constitute two morphosyntactic sub-classes of English common nouns; cf. for instance Gillon (1992). They have been respectively called count nouns and mass nouns.

In many languages, notably Romance and Germanic languages, one can similarly identify two morphosyntactic subclasses of common nouns, nouns of one class admitting singular and plural number, and nouns of the other being invariable in grammatical number.¹

The question we want to address in this paper is one in *lexical semantics*: Is there anything characteristic about the meaning of a count noun? This question has occupied the mind of many linguists and philosophers. It is comparable in intent to: Can one give a purely semantic definition of verbs? Four proposals have been discussed in the literature:

¹ Cf. for instance Gillon (1992) for English, Krifka (1991) for German, Kleiber (1990) for French and Chierchia (1998) for Italian.

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proposals involving internal structure, atomic reference, boundedness and countability. We consider them in turn.

Our strategy will be to show that these are not necessary (and often not even sufficient) conditions for a common noun to be a count noun. This will lead us to a different type of answer to the question of what is common to the meanings of count nouns.

1. Internal structure

Let us consider first the notion of internal structure. It goes back at least to Aristotle. More recently, it has been analyzed, notably, by Simons (1987). Take a material individual like a cat or a table. Such an individual can be said to be internally structured, in the sense that, at any time of its existence, it has a specific kind of organization: its parts are related to one another in a given manner. For instance, at any moment in the existence of a cat, its parts (typically four legs, a head, a tail and a body) are linked with one another so as to constitute something that is of a single piece—a connected whole—and that has the essential properties of a cat.

By contrast, no internal structure is imposed to instances of substances by the types that they instantiate. Take an instance of **water**. Its type does in no way require that it should have parts linked with one another in a specific fashion.

The distinction internally structured / non-structured also concerns collections of material individuals. A herd is a structured collective individual in that its parts (the animals that constitute the herd) are, for instance, to be fed and taken care of together. On the contrary, an instance of **cattle**—say the cattle that is now in Australia—is an internally non-structured collective individual, because its type, **cattle**, does not by itself require that the animals constituting the cattle bear any specific relation with one another.

Thus, types like **cat** and **herd** differ from types like **water** and **cattle** in that only the former impose a specific relation to the parts of their instances.

In many cases, the grammatical distinction between count nouns and mass nouns applying to material individuals seems to correspond to this

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distinction. This has led authors like Kleiber (1997: 326) and Moltmann (1997: 21) to propose linguistic generalizations like the following: *Count nouns denote types that impose to their instances a certain kind of internal structure.* (On the contrary, mass nouns do not require their instances to have any internal structure.)

This hypothesis seems attractive, given the salience of the contrast indicated above and its ontological importance.

Consider, however, count nouns like *collection*, *ensemble* and (*mathematical*) *space*, *part*, *portion* and *quantity*, or *thing*, *entity*, *individual*, *item* and *object*. Thus, let *x*, *y* and *z* be the parts of a collection *c*. The fact that *c* is a collection does not impose to its parts to have any specific relationship one with another. Likewise, the fact that *u* is a part of *v* imposes nothing to the parts of *u*. And this negative fact holds for a noun like *thing*, this time for the simple reason that this noun does not denote any fixed type of individual. What counts as one thing depends entirely of the context², and if *w* is a thing, this imposes by itself nothing on the parts of *w*. These counter-examples lead us to reject the hypothesis that count nouns require that their instances have a specific internal structure.

2. Atomic reference

Take now atomic reference. According to authors like Bunt (1979), Link (1983) and Ojeda (1993), count terms *refer atomically*:

A noun refers atomically if it does not apply to any part of what it applies to.

Formally, 'Nx' meaning that *N* applies to *x*, and 'Pyx' that *y* is a part of *x*:

(AR) $\forall x \forall y ((Nx \wedge Pyx) \rightarrow \neg Ny)$ ³

Thus, one cannot use the noun *cat* to refer to a part of the cat, like its tail.

The parthood relation used in the property is meant to be the one introduced in the framework of *mereology*, the formal study of the relation

² See section 5.

³ '∀' is the usual symbol for universal quantification, '∧' the symbol for the conjunction **and**, and '¬' the symbol for negation.

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of part to whole. It is characterized by four axioms. They make the relation symmetric and transitive, and warrant the existence of so-called "weak complements" and "generalized mereological sums" [see Simons (1987) and the Appendix]. This extremely general relation concerns material individuals like cats and water, spatial entities like holes and shadows, and geometrical entities like triangles, lines and planes. It also applies to individuals whose essential dimension is time, like events and processes. All these individuals have (mereological) parts.

As formulated, the criterion of atomic reference may seem to suffer of the following exceptions. Consider count nouns like *steak*, *cloud* and *sea*, *forest*, *group* and *herd*, or *piece* and *bit*. None of these nouns, we may think, refers atomically: a division is conceivable that from a big steak makes two small steaks, from a forest two forests, from a bit two bits... Moreover, could not one do something analogous with count nouns that seem perfectly typical like *giraffe* or *cat*? Imagine an accident in which a cat loses its tail. Despite this unfortunate event, would not the cat without its tail still be a cat?

What is at stake in such examples is the fact that one applies a count noun with respect to two distinct states of the world. The noun *cat*, for instance, is used first for the whole cat, and then later, for the cat without its tail. However, 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 *Look! The cat is there!* can be attributed a truth-value. Now, in the first state of the world, one may, if one wished, conceptually define an entity that corresponds to the cat without its tail. Still, one may not say of this entity that it is a cat. The cases we have been considering must hence be thought of as invalid counter-examples.

Indeed, we should understand atomic reference as a constraint on what a noun applies to, each time a state of the world is fixed. To make this clear, we reformulate the property as follows:

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*A noun refers atomically if, whenever it applies to an individual, it does not, at the same time, apply to any of part of it.*⁴

Another potential worry is the following. In our analysis, we have focused on the literal sense of nouns, e.g. the sense of *cat* in which it refers to a certain kind of domestic animal. Yet nouns have other senses and uses.⁵ For instance, the noun *cat* may designate a furtive and agile thief. One may then be tempted to assimilate atomic reference to encyclopedic knowledge about the referents most typically associated with count nouns. However, in any context in which the word *cat* is used as a count noun, it satisfies the property of atomic reference. For instance, the expression *the cat* may refer to a thief, but not to one of his parts, like, say, a leg. Therefore, atomic reference *is* a genuine linguistic property, a property that, according to its friends, would characterize the way count nouns refer or apply to individuals.

This being said, there are real counter-examples to the thesis that count nouns refer atomically.

3. Non-distributive reference

Consider, after Wiggins (1980), the pope's crown. It has three smaller crowns as parts. Hence, the noun *crown* does not satisfy atomic reference. Likewise, certain members of a *team* may well constitute another team at the same time. Other collective count nouns like *company* would present the same problem. And so would many other count nouns:

⁴ To be complete, let us indicate that another manner of taking care of these counter-examples has been proposed. According to Bunt (1979: 262), Mufwene (1984: 203-204) and Gillon (1992: 598), the sense of a count noun would specify what counts as a *minimal part* to which the noun can apply. Take for instance the count expression *a steak*. A part of a steak must be sufficiently big to count as a steak. There would thus exist smallest parts of steak to which the expression *a steak* may apply. However, this thesis is not without difficulties: for a steak minus a molecule is still a steak (this is known as the Sorites' problem).

⁵ Various works on polysemy stress the role of context and encyclopedic knowledge in the interpretation of utterances; see for example Victorri & Fuchs (1996), Récanati (1997) and Kleiber (1999).

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just think of *program* (part of a program may be another program), *sentence*, *thought* or *disc* (understood in its mathematical sense).

As we see, the property of atomic reference is too strong. Can we, on a similar principle, formulate a weaker property that would be satisfied by all count nouns?

Atomic reference is often presented as the counter-part of a property taken to hold of mass nouns, *distributive reference*:

(DR) $\forall x \forall y [(Nx \wedge Pyx) \rightarrow Ny]$

A noun refers distributively if it applies to any mereological part of what it applies to.

Indeed, it is easily checked that count nouns do not refer distributively. For example, if *x* is a crown, at least one of its parts is not a crown. Should we then attribute to count nouns the negation of distributive reference? This is a purely existential property:

$\exists x \exists y (Nx \wedge Pyx \wedge \neg Ny)$

Now, the semantics of a noun must impose conditions that concern all the individuals to which the noun applies, and not merely some of them. For instance, the combination of a count noun with the number word *two* imposes specific semantic conditions that hold in all cases in which the expression *two Ns* is used. Likewise, to hold that count expressions have a certain semantic property is to say this property concerns all individuals to which the expression applies.

Nevertheless, from the negation of distributive reference, we can obtain a property that concerns all individuals in the noun's denotation. Consider:

$\forall x [Nx \rightarrow \exists y (Pyx \wedge \neg Ny)]$

This says that when a noun applies to something, there is at least one of its parts to which it does not apply. This is true of nouns like *cat*, *crown*, *team*, *program* and *disc*.

Yet, count nouns like *atom*⁶, *point* and *real* do not satisfy this property, since, given their meanings, they apply to individuals that do *not* have parts.

⁶ Interpreted as designating an entity that does not have any mereological part.

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What shall we do? In fact, it suffices to impose, in the antecedent of the implication, the condition that the individual the noun applies to should have at least a part. This property, which we will call *non-distributive reference*, is satisfied by all count nouns considered so far:

(NDR) $\forall x [(Nx \wedge \exists z Pzx) \rightarrow \exists y (Pyx \wedge \neg Ny)]$

A noun refers non-distributively if, whenever it applies to an individual that has parts, there is a part of this individual to which the noun does not apply.

However, even this new property suffers from exceptions. Just think of count nouns like *part*, *portion* and *quantity*, *thing*, *entity*, *individual*, *item* and *object*, or *collection*, *ensemble* and (*mathematical*) *space*. For example, any part of a part is a part, any part of a thing is another thing, and any part of a collection is another collection.

Moreover, by definition, non-distributive reference⁷ concerns nouns that denote individuals in domains that have an associated mereology. Yet, there are count nouns and domains to which the notion of mereological part does not seem to apply naturally or meaningfully. Consider spirits (or gods, or deities). What would be a part of a spirit? Or what could a spirit be a part of? Similarly with other individuals, like relations. For what would be a part of a relation? Or what would a relation be a part of? And likewise for causes, virtues, functions, symmetries...

Finally, we can note that non-distributive reference is not a property sufficient for a common noun to be count, since mass nouns like *water* or *furniture* satisfy it. Let *x* be water. A part of *x* sufficiently small is not water anymore. The same is true, even more clearly, if we consider some furniture *x*.

This last problem could be dealt with in the following manner. Instead of considering arbitrary mereological parts of what a noun *N* applies to, one may want to consider only certain parts, namely those that can be described as *a part of the N*. Take indeed a mass noun *N* and an entity *x* that can be referred to as *the N*. It is a linguistic fact that *N* also applies to any entity *y* that can be described as *a part of the N* (cf. Nicolas, to

⁷ Or atomic reference for that matter.

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appear, chapter 3; a useful convention is to call '*N*-parts' the entities that can be designated as *a part of the N*). For instance, anything that we can describe using the expression *a part of the water* is also water.

The idea, then, is that non-distributive reference would concern, not mereological parts, but *N*-parts. Formally, with 'NP' standing for the relation of being an *N*-part of:

(NDR*) $\forall x [(Nx \wedge \exists z NPzx) \rightarrow \exists y (NPyx \wedge \neg Ny)]$

As we just saw, this would exclude mass nouns from the common nouns satisfying the property. However, (NDR*) is a less general property than (NDR), for it is only a constraint on partitive expressions like *a part of the N* or *half of the N*. More importantly, it would not solve the other problems mentioned above. These would remain just as acute. To give just one example, it is perfectly true to say that *any part of a collection is a collection*.

Overall, then, the hypothesis according to which count nouns refer non-distributively cannot be sustained.

So, consider now characterizations in terms of *boundedness*.

4. Boundedness

For researchers like Talmy (1978), Langacker (1987), Jackendoff (1991) and Kleiber (1997), *the meaning of a count noun specifies what it applies to as bounded*. Thus, *cat* and *race* would apply to individuals specified to be bounded.

This proposition, however, faces the following problems.

On the one hand, the universe is, as far as we know, finite, so, in particular, concrete things in it also are bounded: this is true not only of a cat or a race, but also of any instance of water or furniture. Thus, the claim cannot be more than that:

- When a common noun is count, what it applies to *has* to be bounded.
- When a common noun is mass, there is no requirement to that effect; the semantics of the noun is simply mute as to whether what it applies to is bounded or not.

On the other hand, it is reasonable to think that our beliefs and knowledge about the universe have nothing or little to do with semantics. In fact, according to Talmy or Langacker, the use of a count noun would

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present what it applies to as bounded. On the contrary, the use of a mass noun would present what it applies to as unbounded. But this thesis faces serious objections. First, one would need independent and convincing evidence that a mass noun *does present* what it applies to as unbounded. Yet, it is hard to imagine what such independent evidence could be. Second, it does not seem contradictory or in any way difficult to imagine, let us say, an infinite forest. This example points to other count nouns, like *collection, group, plurality, or set*. There seems to be nothing in the meaning of these count nouns requiring that what they apply to be bounded.

Thus, boundedness is not a necessary condition for a noun to be count.

This is not all. By definition, the notion of boundedness applies in domains for which a distance or at least a topology can be defined. It thus concerns nouns like *cat* and *herd, race* and *match, point* and *death*. Yet, topology, just like mereology, concerns only certain domains. For instance, it does not seem to have any necessary connection with or any automatic application to spirits, relations, causes, and functions...

To sum up so far, the properties of internal structure, atomic reference, non-distributive reference and boundedness are not satisfied by, or do not apply to, several types of count nouns, and hence cannot be necessary conditions of a common noun to be count. If there is something characteristic to the meanings of all count expressions, it must correspond to some more general property.

5. Countability

According to thinkers like Laycock (1972), Griffin (1977) and Macnamara (1986), *the meaning of a count noun is such that what it applies to can be counted*. Cats, herds and motorcycle races can indeed be counted.

Counting individuals of a certain type makes sense only if it is possible to identify these individuals and differentiate one from another. This necessary condition is however not sufficient, as the case of substance mass nouns shows. Indeed, although instances of **water** are logically

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identifiable and differentiable, they are not countable.⁸ For instance, should the water in a glass be counted as one instance of **water** or as several, given that one can say of the lower half and of the upper half as well that it is water?

But this analysis does not apply to collective mass nouns, like *furniture* or *silverware*. As remarked by Gillon (personal communication), furniture and silverware can also be counted. The linguistics department chair could ask someone to count the furniture in the main office. This person could straightforwardly answer: ten chairs, five tables, and six lamps. Likewise, the chair's wife may ask him to count the silverware that they have.

Hence, asking about the *metaphysical possibility* of counting what a term applies to will not distinguish count terms from collective mass terms like *furniture* or *silverware*. Together with our previous results, this suggests that one cannot find necessary and sufficient semantic conditions for a noun to be count.

Now, one might well be happy enough to identify semantic conditions that are imposed on all count nouns, that is, necessary but not sufficient conditions. As we have seen, internal structure, atomic reference, distributive reference and boundedness are not good candidates even as necessary conditions. What about countability?

Consider a count noun like *real* (that is, *real number*). As we well know, reals are uncountable. The most that can be done here is to say that we can, sometimes, count certain isolated reals, for instance, the number of reals that are solution of a particular equation. But this is not enough. For we may equally well count the number of instances of water that fill a full bottle in a given room. If there are three bottles, three instances of water will thus be counted. Interpreted that way, countability would become a necessary condition for *all* common nouns. Therefore, we have to revert to the first, stronger understanding of countability. And then recognize that the claim that the meaning of a count noun is such that what

⁸ This characteristic of mass nouns like *water* has been noted by several authors, among which Geach (1962: 39-40, 153), Laycock (1972: 35), Griffin (1977: 66) and Macnamara (1986: 50-62).

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it applies to can be counted has exceptions, including *real*, but also *line*, *disc*, *plane*...

Indeed, there seems to be no metaphysical, grammar-independent property that the requirement of countability would impose on all or even most count nouns.

When the wide range of individuals that count nouns can designate is taken into account, the intuition behind this requirement is seen to correspond to no more than the following *grammatical* condition:

The meaning of a count noun N specifies what is to be taken as one N and what as some Ns (that is, what the linguistic expressions one N and some Ns apply to).

6. Count nouns like *thing* and *entity*

However, even this proves to be too strong. For the meaning of a count noun like *thing*, *entity* or *object* does not specify what it is to be *one N* once and for all. Instead, what counts as *one N* depends on the context. Consider a few examples:

We may distinguish two things here: what comes from ontology, and what comes from grammar, may say Keith.

It is hard to be a chair; I have too many things to do! may sometimes think John.

There are so many things I wish I could buy, Peter may dream from time to time: a ticket for 'Star Wars', a new motorcycle, a program for writing novels...

Clearly, what counts as *one thing* depends on the context in which the noun is used.

Now, the semantics of count nouns impose conditions that must be satisfied by all count nouns. This semantics thus turns out to be extremely under-specified. Only the following is required:

Interpreting a count noun in context involves identifying what is to be taken as one N and what as some Ns.

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Conclusion

Most of the research on count nouns, and on the mass / count distinction generally⁹, has considered only nouns that apply to the material (or sometimes temporal) realm. Now, the mass / count distinction is a morphosyntactic distinction that is found among all common nouns. It is thus important to also study the nouns that do not designate material or temporal individuals. This has been one of our goals.

On the negative side, we have found that the properties of internal structure, atomic reference, non-distributive reference, boundedness and countability are not necessary conditions for a common noun to be count. On the positive side, we have seen that the use of a count noun implies to specify what is to be taken as *one N* and what as *some Ns*.

Now, this result should not be really surprising. As we mentioned at the beginning, from a morphosyntactic point of view, the defining characteristic of count nouns is that they can be used in the singular and in the plural. What we have found is simply the semantic side of this morphosyntactic fact.

In other terms, the semantics of count nouns lies *entirely* in the semantic repercussions of their behavior with respect to grammatical number. Just as the major parts of speech Noun, Verb and Adjective (Lyons 1977), count nouns cannot be given a purely semantic definition. Neither can we identify *necessary* (and not sufficient) semantic conditions for a noun to be count. The condition to which we arrive is one that just points out elementary semantic repercussions of the morphosyntactic characterization of count nouns.

One may wonder what exact semantic import this condition has. Indeed, it seems hard to make this condition more explicit. Yet, the answer to this question can, and in a sense, should be: the semantic import of the condition is no more and no less than what is true, semantically, of the singular / plural distinction.

⁹ For general bibliographies, see Pelletier & Schubert (1989), Krifka (1991) and Nicolas (to appear).

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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 :

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

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

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

- $\sigma_x(Fx)$, 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:

$$\sigma_x(Fx) = \text{def. the } s \text{ such that } \exists z (sOz \leftrightarrow \exists y (Fy \wedge yOz))$$

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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PROPERTY of a common noun <i>N</i>		NOT NECESSARY for a common noun to be count		NOT SUFFICIENT for a common noun to be count Satisfied by certain mass nouns
Definition semantic?	Purely	Not satisfied by certain count nouns	Not applicable to certain count nouns	
<i>Internal structure</i> The parts of what <i>N</i> applies to must be related to one another in a specific fashion	Yes	<i>collection, ensemble, space... part, portion, quantity... thing, entity, object...</i>	<i>spirit, god, deity... cause, virtue... function, symmetry...</i>	
<i>Atomic reference</i> <i>N</i> does not apply to any mereological part of what it applies to	Yes	<i>crown, team, company... program, thought, category disc, space, graph... thing, entity, object...</i>	<i>spirit, god, deity... cause, virtue... function, symmetry...</i>	
<i>Non-distributive reference</i> <i>N</i> does not apply to at least one part of what it applies to	Yes	<i>part, portion, quantity... collection, ensemble, space... thing, entity, object...</i>	<i>spirit, god, deity... cause, virtue... function, symmetry...</i>	<i>water, gold... furniture, silverware... talking, walking...</i>
<i>Boundedness</i> The meaning of <i>N</i> specifies what <i>N</i> applies to as bounded	Yes	<i>?forest, army... collection, group, plurality... category, line, plane, space... thing, entity, object...</i>	<i>spirit, god, deity... cause, virtue... function, symmetry...</i>	<i>?water, gold... ?furniture, silverware... ?talking, walking...</i>
<i>Countability</i> What <i>N</i> applies to can be counted	Yes	<i>real, line, space, set... thing, entity, object...</i>		<i>furniture, silverware...</i>
The meaning of <i>N</i> specifies what <i>one N</i> and <i>some Ns</i> apply to	No: morpho- syntactic and semantic	<i>thing, entity, object...</i>		
The use of <i>N</i> implies to specify what is to be taken as <i>one N</i> and what as <i>some Ns</i>	No: morpho- syntactic and semantic			