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*The Semantics of Mass-Predicates**

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I. Introduction

Along with many other languages, English has a relatively straightforward grammatical distinction between mass-occurrences of nouns and their count-occurrences. To illustrate, consider the distinction between the role of 'hair' in (1) and (2):

(1) There is hair in my soup.
(2) There is a hair in my soup.

In (1), 'hair' has a mass-occurrence; in (2), a (singular) count-occurrence.

Some nouns standardly have only mass-occurrences, e.g. 'snow', 'wine', 'mud', 'gold', 'trash', 'gravel', 'clothing', 'furniture', 'music', and 'information'.[1] Some standardly have only count-occurrences, e.g. 'thunderstorm', 'river', 'person', 'circle', 'molecule', 'word', 'line', and 'definition'. Others standardly have both kinds of occurrences, e.g. 'hair', 'chicken', 'carrot', 'apple', 'proof' and 'truth'. In each group, there are some nouns which denote concrete things (e.g. 'snow', 'river', 'chicken') and some which denote abstract entities (e.g. 'information', 'line', 'proof').[2]

What are the semantic differences between these two kinds of noun-occurrences? Although the existing literature on the mass/count distinction is quite extensive and spans several decades, it is fair to say that there is still no consensus on how this question ought to be answered.[3] The aim of this paper is to develop the outlines of what I believe to be an attractive new account.[4]

The semantic analysis of nouns in their count-occurrences is not generally perceived as posing special problems, at least as long as the nouns in question occur in the singular rather than the plural. A sentence like 'Socrates is a man' is thought to be true just in case the predicate 'is a man' is true of the subject,

Socrates; that is, just in case Socrates is one of the items in the extension of the predicate 'is a man'. There is relatively widespread agreement that nouns in their singular count-occurrences should be treated as playing the semantic role of a predicate.

In contrast, the semantic analysis of nouns in their mass-occurrences is considerably less straightforward. It is much less obvious to which semantic category these nouns-occurrences should be assigned. Do they play the role of a name? That of a predicate? Do they play both roles? As we shall see, the difficulty with nouns in their mass-occurrences is that some of their properties would intuitively make us class them with names, while others point in the direction of predicates. Nouns in their mass-occurrences, in some ways, seem to fall in between names and predicates.

There are, in the literature, three general strategies concerning the semantics of nouns in their mass-occurrences:

> *Name View*: When a noun has a mass-occurrence, it always functions semantically as a name.
> *Predicate View*: When a noun has a mass-occurrence, it always functions semantically as a predicate.
> *Mixed View*: When a noun has a mass-occurrence, it functions semantically either as a name or as a predicate.

It is fair to say that, among these three options, the name view has enjoyed the most popularity. Among its proponents are Quine (1960), Parsons (1970), Moravcsik (1973), Bunt (1979), (1985), Chierchia (1982), Link (1983), Lønning (1987), and Zimmerman (1995). Versions of the mixed view can be found in Quine (1960) and ter Meulen (1981). The predicate view is explicitly defended in Burge (1972); other (more or less clear) examples of this view are: the work of Helen Morris Cartwright (especially H.M. Cartwright (1963), (1965), (1970)), Montague (1973), Pelletier (1974), Bennett (1977), Sharvy (1980), Pelletier & Schubert (1989), and Higginbotham (1994).[5]

The structure of this paper will be as follows. As the mass/count distinction, in my view, is best drawn between occurrences of expressions, rather than expressions themselves, it becomes important that there be some rule-governed way of classifying a given noun-occurrence into mass or count. The project of classifying noun-occurrences is the topic of Section II. Section III, the remainder of the paper, concerns the semantic differences between nouns in their mass-occurrences and those in their count-occurrences. As both the name view and the mixed view are, in my opinion, subject to serious difficulties (discussed in Section III.1), I defend a version of the predicate view. Traditionally, nouns in their singular count-occurrences are also analyzed as playing the semantic role of a predicate. How, then, does the predicate view preserve the intuitive difference between nouns in their mass- and those in their count-occurrences? I suggest, in Section III.2, that there are different kinds of predicates: mass-predicates (e.g. 'is hair'), singular

count-predicates (e.g. 'is a hair') and plural count-predicates (e.g. 'are hairs'). Mass-predicates and count-predicates, in my view, are not reducible to each other. The remainder of Section III takes a closer look at the differences and interrelations between these different kinds of predicates. Mass-predicates and count-predicates differ from each other truth-conditionally (Section III.2), and these truth-conditional differences turn out to have interesting implications, in particular concerning the part/whole relation (Section III.3) and our practices of counting (Section III.5). But mass- and count-predicates are also related to each other through systematic entailment relations; these entailment relations are examined in Section III.4.

The view that mass-predicates are a non-reducible class of predicates in their own right takes some getting used to. Historically, there has been a strong and lasting presumption in favor of the singular count-predicate among those concerned with the formal analysis of natural language. This explains the frequent attempts in the literature at reducing mass-predicates like 'is hair' to singular count-predicates such as 'is a quantity of hair'. As I show in Section III.1, such attempts at reduction are not only unnecessary but also unhelpful. Sections III.2-5 are intended to take away from the mystery surrounding the idea of a mass-predicate by exploring their characteristics in relation to their count-relatives. The main goal of this paper is thus to extend our horizon beyond the singular count-predicate, as this has already been done by recent work on the semantics of plurals.

II. Classifying Occurrences

Though the emphasis of this paper is on the semantic differences between the two kinds of noun-occurrences, I begin with some preliminary remarks concerning our object of analysis as well as the methodology employed.

There are different ways of drawing the mass/count distinction.[6] According to the approach taken here, the mass/count distinction is viewed as a distinction between occurrences of expressions, rather than expressions themselves. According to this approach, (1) and (2) contain two occurrences of one and the same noun, 'hair'. On this view, the lexicon therefore only contains a single entry under the noun 'hair'; this single lexical item can appear in grammatical contexts in two distinct ways, a mass-way and a count-way. This, however, is by no means the only possible approach. In fact, a more common way of characterizing the contrast between (1) and (2) would be that they exhibit a lexical ambiguity. According to this competing approach, the lexicon contains two separate entries for 'hair': the mass-noun, 'hair', and the count-noun, 'hair'. These are different nouns, despite the fact that they look and sound the same (perhaps somewhat, but not quite, like 'bank'). I comment on the relative merits of these two approaches briefly below. For now, let's simply assume the first approach and turn to the question of how to classify particular noun-occurrences into mass and count.

Here, again, there are different ways of proceeding. As has often been remarked, the different noun-occurrences can be marked off from each other, at

least in part, on the basis of such features as pluralization and quantification. In what follows, I give some sample rules of classification based on considerations of this sort.

(R1) Any bare (unquantified) singular occurrence of a noun (with the exception of proper names) is a mass-occurrence.

For example, consider the contrast between the occurrence of 'snow' in (3) and that of 'chair' in (4):

(3) Snow is white.
(4) *Chair is a useful piece of furniture.

Since 'chair' does not standardly have mass-occurrences, it cannot have a singular occurrence in this position.

(R2) Any plural occurrence of a noun is a count-occurrence.[7]

It is a consequence of (R2) that the following occurrence of 'wine' would be classified as a count-occurrence, even though 'wine' is thought of as a noun that standardly has only mass-occurrences:

(5) Some believe that the best wines in the world now come from California.
(R3) Any occurrence of a noun next to a mass quantifier is a mass-occurrence.
(R4) Any occurrence of a noun next to a count quantifier is a count-occurrence.

(R3) and (R4) presume that we can group quantifiers into mass and count.[8] Examples of the first kind that are often noted in this respect are 'much', 'little', the unstressed 'some' (usually written 'sm'; 'sm' is the mass-equivalent of the indefinite article), measures of amount phrases, such as 'two gallons of', and the like.[9] Familiar examples of the second kind are 'many', 'few', the indefinite article, numerical phrases such as 'three hundred', and the like.

Some linguistic contexts are ambiguous between a reading in which the noun in question has a mass-occurrence and one in which it has a count-occurrence, e.g. (6) and (7):

(6) Mary had a little lamb.
(7) The apple in my dessert is moldy.

In (6), the ambiguity results from two different roles played by the string 'a little'. According to one reading, 'a little' plays the role of a quantifier (as contrasting with 'a lot'), meaning roughly 'a little bit of'. 'A little', in this function, would appear in a more complete list of mass quantifiers; the occurrence of 'lamb' following it is therefore classified by (R3) as a mass-occurrence. Secondly, the string 'a little' can be read as the indefinite article 'a' combined with the adjective

'little', meaning roughly 'a small'. In this case, the occurrence of 'lamb' following it is classified as a count-occurrence by (R4), since the indefinite article appears in the list of count quantifiers. The two readings of (6) have different syntactic structures associated with them.[10]

(7) brings us to the interesting topic of the definite article, which, as illustrated in (7), can appear with both mass- and count-occurrences of nouns (similarly, 'this', 'that', 'the same', etc.). (7) has two readings, one in which 'apple' has a count-occurrence and one in which it has a mass-occurrence; but the determiner looks and sounds the same in both cases. Let's assume, for present purposes, that the Russellian analysis of definite descriptions is correct for the first case (for more detail, cf. Neale (1990)). How is the definite article to be analyzed in the second case? Both Sharvy (1980) and Higginbotham (1994, Sect.4.2, pp.472-4) point out that the crucial difference between definite mass descriptions and definite count descriptions lies in the uniqueness assumption. While definite (singular) count descriptions carry with them both existence and uniqueness conditions, the latter fails for definite mass descriptions. Even if there is a single salient big chunk of apple in my dessert, proper parts of it are also apple in my dessert. If there are two salient big chunks of apple in my dessert, the mass description 'the apple in my dessert' applies to both of them, along with their proper parts. What the definite mass description 'the apple in my dessert' seems to apply to, then, is roughly the maximal quantity of apple in my dessert. Both Sharvy (1980) and Higginbotham (1994) capture this intuition by analyzing the definite article for the mass system as like a universal quantifier, but with existential import. Sharvy (1980, pp.614-5) suggests the following as a general analysis of definite descriptions:

(8) $\exists x\,[G(x)\ \&\ \forall y(G(y) \rightarrow y \leq x)]$

where '$\leq$' is the relation 'is a (proper or improper) part of'. (8) is meant to capture both definite (singular) count descriptions and definite mass descriptions. For the mass system, (8) reads 'sm G that all G is part of'; for the count system, (8) reads 'a G that every G is part of', and '$\leq$', in this second case, reduces to '$=$' (thereby generating the uniqueness condition). The Russellian definite description thus emerges as a special case. Although there is much more to be said about this, let's assume that some such strategy is available to distinguish the two readings of (7). (More details on logical forms will be given in Section III, below.)

An interesting ambiguity of a different kind is exhibited in the following pair of sentences:

(9) Fish floated in the water.
(10) Deer lay all around the campfire.

Intuitively, both the subject term and the verb, in (9) and (10), are ambiguous. 'Fish' and 'deer' belong to a special group of nouns (along with 'police', 'sheep',

etc.) which do not take overt plural morphology; the ambiguity is furthermore preserved by the past tense verb form, which is itself ambiguous between third person singular and plural. Thus, the present tense equivalent of (9) could be either (11) or (12):

(11) Fish floats in the water.
(12) Fish float in the water.

Depending on which reading is intended, the occurrence of 'fish' and 'deer', in (9) and (10), is classified either as a mass-occurrence by (R1) or as a plural count-occurrence by (R2). At the same time, it is of course entirely possible that a given context is not specific enough to disambiguate between these two readings, in which case the ambiguity should simply be preserved by generating two different logical forms.

I hope that (R1)-(R4), along with the brief discussion of some sample ambiguities, have given the reader at least a rough idea of how an occurrences view might approach the project of classifying particular noun-occurrences into mass and count. Because the present study is concerned primarily with the semantic dimensions of the mass/count distinction, I will not attempt to finetune and extend these rules any further. But before leaving behind the topic of classification behind entirely, I return briefly to an issue left hanging earlier: the relative merits of the two approaches to classification mentioned above, the occurrences approach and the lexical ambiguity approach.

One important feature which, on the face of it, seems to speak in favor of an occurrences approach is the relative ease with which a noun that presently has only one kind of occurrence can acquire the other kind.[11] The noun 'car', for example, used to have only count-occurrences, until it started to be used in ways such as the following:

(13) The BMW 300 series is not much car for your money.

The same kind of usage is also illustrated in a recent TV commercial in which the car company, Hyundai, praises their new model, the Elantra, for providing more of just about everything one could hope for in a new car: more headroom, more legroom, more comfort, more speed, and so on. All of these added features make the new Elantra, as they say, "more car". (There is a similar commercial for one of their wagons, which concludes with "more wagon".) If these kinds of mass-occurrences of the noun 'car' have already become fairly standardized, it is easy to imagine a similar extension of usage in the case of other nouns (e.g. 'more truck/motor/house/dishwasher/tool/... for your money').

To go the other way, from mass to count, is equally straightforward. For example, the noun 'e-mail', which until recently had only mass-occurrences, is now often found to have count-occurrences, as in (14):

(14) I sent you an e-mail yesterday.[12]

This flexibility in language is an important reason why I conceive of the mass/count distinction as one between occurrences of expressions, rather than expressions themselves. The occurrences approach emphasizes nicely that there is a strong connection between mass- and count-occurrences of one and the same noun, as in (1) and (2), repeated here:

(1) There is hair in my soup.
(2) There is a hair in my soup.

For suppose a speaker has only ever come across count-occurrences of 'hair'. The speaker now finds that 'hair' also has mass-occurrences. Intuitively, it does not seem as though he must now go through the trouble of learning a new word if he has already mastered part of the use of 'hair' and understands the difference between mass- and count-occurrences of nouns.[13]

However, while these considerations may count as prima facie evidence against the lexical ambiguities approach, they fall short of a knock-down argument. For there may be ways for the lexical ambiguity approach to capture the systematic relation between (in their terminology) 'hair', the mass-noun, and 'hair', the count-noun, even if they appear as two separate entries in the lexicon. Compare, for instance, (15) and (16):

(15) John ate.
(16) John ate his dinner.

Suppose current linguistic theory dictates that the lexicon contains two separate lexical entries for the verb 'to eat', one of which does not take a direct object (as in (15)), the other of which does (as in (16)). Surely, the connection between these two verbs 'to eat' must be represented somewhere.[14] To the extent that this can be achieved in a satisfactory way in this case, a similar strategy may be available for the lexical ambiguity theorist in the previous case as well.

In what follows, I phrase my discussion in terms of the occurrences approach, but I do not consider the issue to be settled. I have presented some prima facie evidence in favor of the occurrences approach, but more work remains to be done to weigh the advantages and disadvantages of these two views. The choice between the two approaches would seem to be at least to some extent an empirical issue: the lexical ambiguity approach holds that there are two separate lexical entries, i.e. two separate representations in a speaker's linguistic knowledge, where the occurrences approach sees only one. This difference suggests a number of empirical predictions: if the lexical ambiguity approach is correct, we might expect the two forms to be acquired separately by children; to be lost separately in aphasia; to be lexicalized differently in other languages; or to drift apart further in the subsequent history of English. Empirical considerations of this sort might help adjudicate between the two approaches to classification. For present purposes, however, all that is required is the assurance that *some* successful method

of classifying our object of analysis is available, whether in terms of occurrences of expressions or expressions themselves; the exact nature of this method is of less concern to us at present.

III. Anti-Reductionist Predicate View

III.1.1 Difficulties for the Rival Views: Section II was concerned with the question of classifying noun-occurrences into mass and count. We now shift our focus, for the remainder of this paper, to the semantic differences between these different noun-occurrences. As pointed out earlier, it is generally agreed that nouns in their (singular) count-occurrences play the semantic role of a predicate. But to which semantic category do nouns in their mass-occurrences belong? The trouble is that some of these occurrences intuitively have a more name-like flavor, while others seem to be more akin to a predicate. For example, consider the contrast between the following groups of sentences:

(17) *Snow* is white.
(18) *Water* is a fluid.
(19) *Furniture* is often made of wood.

(20) Most *snow* is white.
(21) There is some *water* in the sink.
(22) I bought exactly the same *furniture* again after my house burned down.

'Snow', 'water' and 'furniture' have mass-occurrences in all of these sentences. Nevertheless, the underlined nouns in the first group intuitively seem to be playing a different role from those in the second. The ones in the first group are more akin to the occurrence of 'John', in (23),

(23) John is intelligent.

while the ones in the second group appear in the hallmark context inaccessible to names: next to a quantifier.[15] What to do, in the face of this apparent semantic double life?[16]

I said earlier that there are three general strategies proposed in the literature: the name view, according to which nouns in their mass-occurrences play the semantic role of a name; the predicate view, according to which they function as predicates; and the mixed view, according to which they can play both roles, depending on the linguistic context. Below, I defend a version of the predicate view. But something needs to be said first to justify this choice. I turn now to some crucial difficulties with the two rival views.

III.1.2 The Name View: The name view works best with respect to sentences like those of the first group mentioned above ((17)-(19)). These sentences are viewed by the proponent of the name view very simply and elegantly as being of

subject/predicate form. For example, the occurrence of 'snow' in (17), on this view, functions semantically as a name, referring to the totality of the world's snow or some other such 'big' object;[17] the predicate 'is white' is then applied directly to the entity referred to by the subject term. The name view thereby does a nice job of preserving the intuitive similarity between (17)-(19) and (23).

However, not all sentences containing nouns in their mass-occurrences speak of totalities. In fact, this is true only of a very special class of sentences, to which the sentences in the first group above belong: the class of generic sentences. Generic sentences assert a certain kind of property—some sort of (law-like) generalization, general tendency, disposition, characteristic, or regularity—of a kind of thing in general.[18] For example, (17) says that it is a characteristic property of the stuff, snow, to be generally white.

Generic sentences are the only kind of sentences which intuitively appear to attribute properties to a totality as a whole. All other kinds of sentences single out individual instances of the kind of thing in question. How does the name view deal with these?[19] In general, there is only a single manoeuver available, though different versions of the name view may differ in how they fill in the details. To single out individual instances from a totality, the name view needs to introduce a reference-dividing relation of some sort, such as 'is a quantity of', 'is a bit of', 'is a piece of', and the like.[20] Once such a reference-dividing relation is in place, all those mass-occurrences in which the noun appears to be playing the role of a predicate of the form 'is N' can now be re-analyzed as being elliptical for 'is a ... of N', where the dots are filled in by an appropriate reference-dividing relation. The noun N, in the new paraphrase, is now still playing the role of a name, referring to the totality in question. For example, (20), on this view, would become (24),

(24) Most (x) [Ψ(x,s); Is-white(x)]

where 'Ψ' is to be filled in by some appropriate reference-dividing relation, and 's' is a name for the totality of the world's snow.

It is precisely this reference-dividing relation that is, in my view, the most worrisome feature of the name view. Consider the expression 'Ψ(x,s)', which occurs in (24) above. It is meant to relate individual instances of the totality of the world's snow to the totality itself. But when is it true of something that it is an instance of the totality of the world's snow? The trouble is that replacements of the reference-dividing Ψ-relation, such as 'is a bit of' or 'is a batch of', cannot simply be understood in familiar mereological terms. For not all parts of the totality of the world's snow are themselves snow. Single hydrogen or oxygen atoms, for example, are parts of the world's snow, but are not themselves snow. What seems to be required for something to be a bit of the totality of the world's snow, and not just a part, is that it be itself snow. But now we have explained the meaning of the Ψ-relation by appeal to mass-predication, precisely what the

Ψ-relation was meant to explain away. To tell whether something is a bit of snow, we must know whether it is snow, i.e. whether the predicate 'is snow' is true of it. Thus, giving the meaning of the Ψ-relation requires a grasp of the predicative use of nouns in their mass-occurrences. But the name view makes no room for genuine (unreduced) mass-predicates; for 'is snow', on this view, is taken to mean 'is a .... of snow'.[21]

III.1.3 The Mixed View: The mixed view has an easy time dealing with the sentences in both groups mentioned above. It analyzes the mass-occurrences in the first group as playing the role of a name, the ones in the second group as predicates. It thereby shares all the strengths of the name view, while avoiding its weaknesses. Because the mixed view makes room for predicative mass-occurrences of nouns, it does not stand in need of a reference-dividing relation. And because it assigns the same simple and elegant subject/predicate structure to the generic sentences in (17)-(19), it preserves the parallel between (17)-(19) and (23) equally well.

The difficulty with the mixed view is that it has a tendency to overemphasize the difference between the predicative and non-predicative role of nouns in their mass-occurrences to a point where it becomes unrecognizeable that we are in fact dealing with two occurrences of one and the same expression. This objection was famously made by Burge (1972), against the mixed view advanced in Quine (1960), by means of the following inference:

(25.a) Snow is white.
(25.b) This stuff is snow.

(25.c) This stuff is white.[22]

According to the mixed view, 'snow' performs two different functions in (25.a) and (25.b): in (25.a), it plays the role of a name; in (25.b), that of a predicate. But there is evidently some common semantic core shared by these two occurrences of 'snow', which allows us to make the inference in the first place. Unless the mixed view introduces some additional measure to capture this common semantic core, it cannot properly account for the inferences we commonly make. Since nothing hangs on the particular features of the example in (25), the mixed view will have the same difficulty with all inferences which ask us to move from totalities to individual instances, or vice versa.[23]

III.2 Mass-Predicates and Count-predicates: Given the weaknesses of both the name view and the mixed view, the most attractive one from among the available options is to analyze nouns in their mass-occurrences as predicates. Consider the following simple sentence:

(27) This is hair.

The noun 'hair', in (27), has a mass-occurrence. (27) is not a generic sentence: in its most straightforward readings, it does not talk about the totality of the world's hair in general, but a particular instance of it.[24] Since the name view had to be discarded, 'hair', in its occurrence in (27), must now be analyzed as functioning semantically as a predicate.

Now consider sentence (28):

(28) This is a hair.

'Hair', in its occurrence in (28), is also traditionally thought of as playing the semantic role of a predicate. (28) is true just in case the predicate 'is a hair' is true of the referent of the demonstrative pronoun 'this'. Yet the semantic contribution of 'hair' to the whole of (28) must be different from its contribution to the semantic value of (27). Neither one can be reduced to the other, otherwise the intuitive contrast between (27) and (28) will be lost. What, then, is the difference between (27) and (28), given that 'hair' is functioning as a predicate in both sentences?

Let's look at these two sentences more closely. Sentence (28) has four syntactic components: the demonstrative pronoun 'this', the copula 'is', the indefinite article 'a' and the noun 'hair'. Semantically, (28) has two components: the subject 'this' and the predicate 'is a hair'.

(27) differs from (28) only very slightly. It has three syntactic components: the demonstrative pronoun 'this', the copula 'is' and the noun 'hair'. Only the indefinite article is missing. Semantically, (27) also has two components, just like (28): the subject 'this' and the predicate 'is hair'.

More generally, replace 'hair' in (28) by any noun which can sensibly occur next to the indefinite article, e.g. 'man', 'desk', 'computer', 'cigarette', etc., the result is still the same. (28) will still have the following two semantic components: the subject 'this' and the predicate 'is a man/desk/computer/cigarette/...'. The result of substituting any noun N, which can sensibly occur next to the indefinite article, into the schema 'is a _____', will be a predicate of the form 'is an N'.

Similarly, in the case of (27). Replacing 'hair' in (27) by any noun which can sensibly occur in this position will not change the overall semantic structure of the sentence. The result of substituting any noun N, which makes sense in this position, into the schema 'is .....', will be a predicate of the form 'is N'. It works for 'water', 'gold', 'mud', 'snow', and the like. Replacing 'hair' in (27) by any such noun will still leave us with the following two semantic components: the subject 'this' and the predicate 'is water/gold/mud/snow/...'.

So, for appropriate nouns N, substituting N for the blank in both 'is a _____' as well as 'is .....' results in a predicate. But, if predicates of the form 'is an N' are to be different from predicates of the form 'is N', there must then be two different groups of predicates. The kinds of nouns which can sensibly be substituted into

the schema 'is .....' are just those which standardly have mass-occurrences. The kinds of nouns which can be substituted into the schema 'is a _____', on the other hand, are just those which standardly have count-occurrences. Let's therefore call predicates of the form 'is N' *mass-predicates* and predicates of the form 'is an N' *singular count-predicates*.

Many nouns, 'hair' among them, standardly also have plural occurrences, such as that in (29):

(29) These are hairs.

What is the semantic role of these noun-occurrences? According to the rules of classification outlined in Section II, plural occurrences of nouns are classified as count-occurrences. As will become evident shortly in Sections III.3ff, plural count-occurrences are, in certain respects, semantically quite similar to mass-occurrences; at the same time, there are also enough differences between them to warrant keeping their semantic roles distinct from one another. Since the correct analysis of plural noun-phrases is still a hotly debated issue in current semantic theory, I assume in what follows only, for reasons of symmetry, that plural noun-occurrences can also be properly analyzed as playing the sematic role of a predicate; on all other questions specific to the semantics of plurals, I remain, for present purposes, uncommitted.[25]

Supposing, then, that plural noun-occurrences can be so analyzed, (29) has the same structure as (27) and (28): it also has two semantic components, the plural demonstrative pronoun 'these' and the predicate 'are hairs'. More generally, replacing 'hairs' in (29) by any noun which can sensibly have plural occurrences (i.e. almost any noun which standardly has count-occurrences), will result in a *plural count-predicate* of the form 'are Ns', for appropriate nouns N.

The view I am proposing can thus be stated in the following way:

Anti-Reductionist Predicate View:

(i) When a noun N has a mass-occurrence, it functions semantically as a *mass-predicate*, of the form 'is N'.

(ii) When a noun N has a singular count-occurrence, it functions semantically as a *singular count-predicate*, of the form 'is an N'.

(iii) When a noun N has a plural count-occurrence, it functions semantically as a *plural count-predicate*, of the form 'are Ns'.

(iv) Predicates of the form 'is N' are *not reducible* to predicates of the form 'is an N' or 'are Ns'.[26,27]

The logical form of (27)-(29) can now be made more explicit. (27) will be true just in case the mass-predicate 'is hair' correctly applies to the referent of the demonstrative pronoun 'this', in a context c; correspondingly for (28) and (29). Since the semantic value of a demonstrative pronoun depends on the particular

context of utterance, it will be necessary to relativize the truth-predicate as follows:[28]

(30) 'This is hair' is true in a context c iff 'is hair' is true of the referent of 'this' in c.
(31) 'This is a hair' is true in a context c iff 'is a hair' is true of the referent of 'this' in c.
(32) 'These are hairs' is true in a context c iff 'are hairs' is true of the referent of 'these' in c.

where the variable denotes the referent determined by the respective demonstrative pronouns in context c.[29] (For more on the truth-conditional differences between the different kinds of predicates, see Sections III.3ff below.)

The central assumption underlying this view is that, as competent speakers of English, we have an equal grasp of mass-predicates and count-predicates; there is nothing especially mysterious about mass-predicates (if anything, as we will see in Section III.4, the mystery lies in the interconnections between mass- and count-predicates). If the notion of a mass-predicate makes us feel somewhat anxious, this is only because historically there has been a presumption in favor of the singular count-predicate. Until fairly recently, plural and mass-occurrences of expressions were all but ignored in logic textbooks and most treatments of natural language; if they were mentioned at all, it was only to point out that these are surely, in some way, analyzeable in terms of singular count-predicates. That this presumption can no longer be upheld in the case of the plural is now widely recognized.[30] Mass-occurrences afford us with another way of speaking, which is similarly irreducible to singular count-occurrences. For, as became evident earlier in Section III.1, attempts to reduce mass-predicates like 'is hair' to singular count-predicates of the form 'is a quantity of hair' lead nowhere, due to the question-begging nature of the reference-dividing relation.

Our customary presumption in favor of the singular count-predicate is prominently displayed in the works of Quine. For Quine, general terms have a "built-in mode of dividing their reference" (Quine (1960), p.91). In Quine's view, a competent speaker, who has mastered the machinery of general terms, will be able to tell not only "how much of what goes on counts as apple", but also "how much counts as an apple, and how much as another" (Quine (1960), ibid.). Such a speaker will have grasped what Quine calls "the scheme of enduring and recurrent physical objects" (Quine (1960), p.92): he can successfully individuate, identify and contrast particular apples, as exemplified in the use of expressions like 'an apple', 'another apple' and 'apples'. In contrast, singular terms require no such mastery: singular terms simply refer.

Quine's is fundamentally a count-way of thinking about predication. For once we can tell "how much counts as an apple, and how much as another", the step from there to counting the individual apples is small. The assumption that predication is tied up so intimately with countability is no doubt one that is often taken

for granted, at least for the substantival case.[31] But it is not obvious why this should be the case. The anti-reductionist predicate view, for one, rejects this conception of predication. It holds that nouns in their mass-occurrences are equally good at dividing their reference as their count-relatives; they do not need the help of reference-dividers to do so. But mass-predicates divide their reference differently; they are not simply count-predicates in disguise.[32] The next section takes a closer look at these different kinds of predicates, in particular the differences and connections between them.

III.3 Homogeneity and Atomicity: I now turn to the contrast between mass-predicates, i.e. predicates of the form 'is N' (for appropriate nouns N), and count-predicates, i.e. predicates of the form 'is an N' or 'are Ns' (for appropriate nouns N). When is a singular count-predicate true of something? The singular count-predicate 'is a hair', for instance, is true of something x just in case x is a hair. Or, equivalently, 'is a hair' is true of x just in case x is *one* hair: something is *a* hair just in case it is *one* hair. The plural count-predicate 'are hairs' is true of the x's just in case the x's are several such hairs. In contrast, the mass-predicate 'is hair' is true of something x just in case x is hair. For 'is hair' to be true of x, x does not need to be *a* hair (though it could be). Thus, the truth-conditional difference between count-predicates and mass-predicates can be stated as follows:

> *Singular Count-Predicate:* 'Is a hair' is true of x (in context c) iff x is a (one) hair.
> *Plural Count-Predicates:* 'Are hairs' is true of the x's (in context c) iff the x's are hairs.
> *Mass-Predicate:* 'Is hair' is true of x (in context c) iff x is hair.

The same holds for appropriate nouns N in general.

There is thus a truth-conditional difference between these three kinds of predicates. But how can the semantic differences between them be characterized more informatively, beyond pointing to their bare truth-conditional skeleton? Quine (1960) proposes the following semantic property:

> "So-called *mass* terms like 'water', 'footwear', and 'red' have the semantical property of referring cumulatively: any sum of parts which are water is water." (Quine (1960), p.91; his emphasis)

Thus, cumulativity is the following property:

> *Cumulativity:* A predicate Φ is cumulative iff Φ is true of any (mereological) sum of things of which it is true.

Cumulativity is still widely accepted as a semantic property of mass-predicates.[33] But it is a property mass-predicates share with plural count-predicates. Adding hairs to hairs results in more hairs, just as adding hair to hair results in more hair.

Both mass-predicates like 'is hair' and plural count-predicates like 'are hairs' are therefore cumulative.[34] This indicates that cumulativity cannot be all there is to the semantic contrast underlying the mass/count distinction; for plural count-predicates, despite their similarities with mass-predicates, are still a species of count-predicates.

What other semantic properties are available to us? To some, it has seemed that there is a significant contrast not only with respect to sum-formation, but also going in the other direction, that of parthood. Not only does adding hair to hair result in more hair, we can also divide up a quantity of hair in a variety of ways and still get hair back. A hairdresser can cut off half an inch, an inch, two inches, and so forth, and both what is left on his customer's head (if anything), as well as what is now lying on the floor, is still hair. Only a scientist (e.g. a forensic analyst), using special devices, could extract something from the quantity of hair which is not itself hair, e.g. individual strands of DNA. In this respect, there is undoubtedly a striking contrast between (at least some) mass-predicates and count-predicates.

It is often thought that the intuition concerning division into parts to which I have just appealed is properly captured by means of the following property:[35]

> *Distributivity:* A predicate Φ is distributive iff Φ is true of any part of something of which it is true.

The conjunction of distributivity and cumulativity is known as 'homogeneity':

> *Homogeneity*: A predicate Φ is homogeneous iff it is both cumulative and distributive.[36]

Singular count-predicates are not distributive: for example, half a hair is not itself a hair.[37, 38] Plural count-predicates are also not distributive: not every part of some hairs is itself still hairs; a single hair (arguably) is not hairs, nor are the parts of a single hair. Both singular and plural count-predicates therefore fail to be distributive.[39] This characteristic gives expression to our intuition that count-predicates ultimately apply to indivisible 'units' ('indivisible' not in an absolute sense, but in the relativized sense of 'not further divisible into parts to which the predicate in question still applies'); it is these 'units' which are singled out when we count the entities in question.

Are mass-predicates distributive? Distributivity requires that the predicate in question applies to *any*, i.e. *all*, parts of something to which it applies. This is a very strong requirement. For 'is hair' to be distributive, a quantity of hair, it seems, would need to be hair all the way through. As we have seen above, it is certainly true, up to a certain point at least, that parts of hair are themselves hair: some parts of a quantity of hair are themselves hair, perhaps even many or most. In this respect, the mass-predicate 'is hair' already contrasts with the count-predicates 'is a hair' and 'are hairs'.

However, we also know that, as a matter of fact, hair is not hair all the way through. There may be no precise cut-off point, as to when parts of hair cease to count as hair. Still, individual strands of DNA, for example, are parts of hair, according to an intuitively straightforward reading of the part/whole relation, but they are not themselves hair.[40] Moreover, 'is hair' is by no means a special case. To satisfy distributivity, it appears that a predicate would need to apply to something that is truly continuous and has no compositional substructure to speak of. With the possible exception of 'is space' and 'is time' (and only according to certain conceptions of space and time), not very many things of which we are aware seem to be of this kind.

But what is the status of parts that are too small to count as hair? What relevance, if any, do they bear to the semantic analysis of the mass/count distinction? Does the property of distributivity properly apply to mass-predicates, despite the presence of these parts that are too small? These questions, which are commonly referred to as "the Problem of Minimal Parts", were first explicitly brought to our attention by Quine, who notes that "...there are parts of water, sugar and furniture too small to count as water, sugar and furniture" (Quine (1960), p.99). To Quine, the observation that there are such parts that are too small was reason enough to conclude that mass-predicates are not distributive (ibid. n.4). However, since Quine, there has been widespread disagreement and confusion in the literature as to how the Problem of Minimal Parts ought to be resolved.[41]

Let's introduce the following property to bring out more clearly what is at issue:

> *Relativized Atomicity:* x is a minimal part or atom with respect to the predicate Φ iff (i) Φ is true of x; and (ii) x has no proper parts of which Φ is true.

It is often thought to be, in some sense, part of the meaning of count-predicates that what they apply to consists of minimal parts, in the relativized sense just defined. For example, the minimal parts in the case of 'is a hair' or 'are hairs' are the individual hairs; an individual hair cannot be divided further into individual hairs. These minimal parts, again, are the 'units' that are counted, when we count hairs. A competent speaker of English, according to this view, is aware of the fact that 'is a hair' or 'are hairs' apply to such minimal parts, merely by having mastered the use of the noun 'hair' in its count-occurrences; no further expertise (e.g. concerning the molecular structure of hair) seems to be required to become aware of the atomicity of count-predicates.

Mass-predicates appear to be different. For example, while it also is true that water, in some sense, consists of minimal parts (viz. the individual H_2O-molecules), this feature is not considered part of the meaning of 'is water', in the same way in which the atomicity of 'is a hair' or 'are hairs' is part of the meaning of these latter predicates. The atomicity of 'is water' is thought to be an empirical, not a semantic, matter. We only discovered the fact that water consists of H_2O-molecules fairly recently, and we did so, not through enhanced

mastery of language or conceptual analysis, but by conducting empirical research on the chemical composition of water. It therefore seems reasonable to conclude, at least at first sight, that the atomicity of a mass-predicate like 'is water' ought to be viewed in a different light from that of count-predicates like 'is a hair' or 'are hairs'. This conclusion seems to be further strengthened by the observation that some mass-predicates do not even apply to minimal parts, even in this empirical sense, either because what they apply to, as a matter of fact, does not consist of minimal parts at all (e.g. 'is time' or 'is space', if time and space are continuous), or because no obvious candidate comes to mind (e.g. 'is mud', 'is stew', 'is dirt', etc.). Given this contrast, it is often proposed that the mass-system ought to be represented semantically in terms of a non-atomic Boolean algebra, or similiar non-atomic structures (i.e. algebraic structures which make no explicit commitment concerning the existence of minimal parts), while the count-system is best thought of along the lines of an atomic structure (i.e. an algebraic structure which does make an explicit commitment to the existence of minimal parts).[42]

If this is right, then the different kinds of predicates can be classified according to the following attractive tripartite division:

Singular Count-Predicates: Neither distributive nor cumulative; atomic.
Plural Count-Predicates: Cumulative but not distributive; atomic.
Mass-Occurrences: Both cumulative and distributive; non-atomic.

Whether this classification is acceptable depends on how the Problem of Minimal Parts is resolved.

My own view is that Quine was essentially right. The 'real world' presence of parts that are too small *is* relevant to the semantics of the mass/count distinction. What it shows is, quite straightforwardly, that the predicate in question is not distributive. It cannot be part of the meaning of 'is water' that what it applies to is water all the way through, when we know that water as a matter of fact consists of H_2O-molecules, parts of which are not themselves water. If there are any claims at all which are true by virtue of meaning, then surely such claims cannot be as a matter of fact false. Yet this would seem to be exactly the embarrassing situation in which we find ourselves, if we agree that distributivity is a semantic property of mass-predicates.

Moreover, and perhaps more surprisingly, even the thesis that count-predicates are atomic strikes me as questionable. For it is quite conceivable that a count-predicate, as a matter of empirical fact, turns out to apply to something which is infinitely divisible into the same kind of thing. 'Is a particle', for example, could easily turn out to be just such a case. This indicates that if our semantic theory should not commit itself to the existence of minimal parts in the case of mass-predicates, there may be good reason to leave this question open for count-predicates as well. In other words, if mass-predicates are viewed as non-atomic, so should count-predicates. If this is correct, then atomicity cannot be what accounts for the semantic contrast between mass- and count-predicates.[43]

I therefore conclude that, as it stands, the properties of homogeneity and atomicity are unsuccessful in capturing the semantic differences between mass-predicates and count-predicates. Despite widespread agreement in the literature to the contrary, this result should furthermore not come as a suprise. The grammatical distinction between mass- and count-occurrences of nouns is extremely broad and includes specimens from all kinds of metaphysical corners. It would therefore be far more suprising if the opposite were the case and a handful of mereological generalizations had produced an exact match with the grammatical distinction between mass and count. This suggests that a more fruitful approach would aim at isolating smaller subdivisions within the original linguistic classification, as guided by metaphysical considerations.

To illustrate, we might expect a suitably weakened version of distributivity to apply to predicates denoting stuff-like entities, such as 'is water', 'is stew' and 'is mud'. For, intuitively, even though water, stew and mud are not the same absolutely all the way through, they are the same, as it were, almost all the way through. While they are not entirely continuous and without compositional substructure, the requirements they impose on how their parts can be combined and rearranged to result in stuff of the same kind are much less stringent than, say, those imposed by furniture, silverware, and jewelry (which are also represented in English in the form of nouns that standardly have mass-occurrences). A weakened version of distributivity, which takes these observations into consideration, might take roughly the following shape:

> *Weakened Distributivity:* A predicate Φ is weakly distributive iff Φ permits a myriad of unprincipled divisions of what it applies to into parts.

This property is meant to capture the intuition that certain mass-predicates (viz. in general those that apply to stuff-like entities) apply to very many parts, though perhaps not absolutely all of them, of something to which they apply. Moreover, these many parts can be picked quite randomly, without any particular care or plan in mind. The first characteristic ("a myriad") speaks to the mere number of possible divisions into parts, while the second ("unprincipled") speaks to the way in which these divisions may be effected. Of course, unless something is infinitely divisible into the same kind of thing, there will be some, among the many randomly picked proper parts, to which the predicate in question no longer applies. (The lone carrot, for example, which may be removed from a bowl of stew is overshadowed by the many randomly picked spoonfuls which do themselves count as more of the same.) The force behind weakened distributivity is that these divisions are insignificant as compared to the myriad of parts to which the predicate in question does apply.

It might be prudent to offer a similarly weakened version of cumulativity, even though this latter property is less obviously open to apparent counterexamples. However, it seems at least conceivable that there exists a kind of stuff, quantities of which, when combined with other quantities of the same stuff, only remain

quantities of the same stuff up to a certain point and not indefinitely. This feature might, for instance, be due to a certain chemical volatility of the stuff in question. Or, perhaps, dust is of just this kind: dust seems to be the kind of stuff which usually comes in relatively thin layers. Would a huge heap of it still count as dust? If not, then the mass-predicate 'is dust' satisfies the following weakened version of cumulativity, but not the strong version mentioned earlier:

> *Weakened Cumulativity:* A predicate Φ is weakly cumulative iff Φ applies to a myriad of mereological sums of things to which it applies and these sums may by formed in unprincipled ways.

The idea is, again, that a predicate like 'is dust' applies to very many mereological sums of things to which it applies, though perhaps not absolutely all of them, and that, furthermore, such mereological sums may be formed quite randomly, without any particular care or plan in mind. In the overwhelming majority of cases, mereological sums of quantities of dust do result in further quantities of dust. If this is not the case across the board, because there is an upper limit to sum-formation (as in the case of the huge heap of dust imagined earlier), then such 'sums that are too big' are insignificant in the face of the myriad of sums, formed in unprincipled ways, to which the predicate still applies.[44]

The weakened versions of distributivity and cumulativity were specifically tailored to predicates that apply to stuff-like entities. This illustrates how one might go about formulating more finegrained mereological principles that are aimed at smaller subdivisions within the broad initial classification into mass and count. The subdivision, in this case, is based on metaphysical considerations, viz. the stuff-like nature of the entities in question. However, there is no a priori guarantee that all stuff-like entities are reflected in language in the form of mass-predicates. For example, clouds are quite stuff-like, but the noun 'cloud', in English, standardly only has count-occurrences. For this reason, more fine-grained mereological generalizations, in addition to their more restricted scope, can also sometimes be expected to cut across linguistic lines. However, such generalizations may nevertheless be quite useful in characterizing the paradigm cases of what we count and what we do not count. For unless they are very clearly delineated, clouds may be just the sort of thing we have trouble counting.

We have seen, in Section III.2, that the different kinds of predicates differ in truth-conditional content: the singular count-predicate 'is a hair' is true of something x just in case x is a hair; the plural count-predicate 'are hairs' is true of the x's just in case they are hairs; and, finally, the mass-predicate 'is hair' is true of something x just in case x is hair. As discussed in Section III.3, these differences in truth-conditional content also yield interesting asymmetries concerning sum-formation and division into parts. The next section now turns from the differences between the three kinds of predicates to their interrelations.

III.4 Entailment Relations: As was pointed out in Section III.2, for the mass-predicate 'is hair' to be true of something, it could be a single hair or several such

hairs as well as parts or sums thereof. Everything that is *a* hair (or hairs) is also hair. However, not everything that is hair is also *a* hair (or hairs). I have suggested in the previous section that the mass-predicate 'is hair' is weakly distributive: that is, a myriad of unprincipled divisions of hair yields parts that are themselves hair. 'Is hair' is also strongly cumulative: any sum of things that are hair is itself hair. Most parts and all sums of something that is hair are therefore themselves hair, but these parts and sums are not themselves *a* hair (or hairs). The mass-predicate 'is hair' is therefore true of everything of which the singular and plural count-predicates are true, but the reverse does not hold. The example 'is hair', then, suggests the following relation between mass-predicates and count-predicates:

One-Way Entailment, Count to Mass:
(i) For any x, if the singular count-predicate 'is an N' is true of x, then the mass-predicate 'is N' is also true of x.
(ii) For any x's, if the plural count-predicate 'are Ns' is true of the x's, then the mass-predicate 'is N' is also true of the x's.

Does this entailment relation hold across the board? As in the case of homogeneity above, we must proceed in a piece-meal fashion. Intuitively, the entailment holds in the case of hair, because the mass-predicate denotes the stuff or substance of which the entities denoted by the singular and plural count-predicates consist.[45] A single hair or several such hairs represent different ways in which the substance, hair, can be carved up, as do parts and sums of hair. Because all of these partitionings themselves still consist of the same substance, hair, the mass-predicate 'is hair' applies to all of them. The count-predicates 'is a hair' and 'are hairs', on the other hand, are more difficult to satisfy, because they only apply to certain among the many possible ways of carving up the substance, hair. This explains why the mass-predicate applies to everything they apply to, including parts and sums of what they apply to, while the reverse is not the case.

We would expect the above one-way entailment from count to mass to extend to all cases in which the entities involved are related in a similar fashion, viz. via the relation of *constitution*.[46] This includes cases in which the substance or entity in question, as in the case of 'hair', comes naturally carved up into individual 'units', e.g. 'rock', 'carrot', 'apple', etc. But it also includes a large number of cases in which the carving up is done by us, e.g. 'beer'. The relation between a beer and beer is (usually) that of a conventional 'unit' of serving. There is a whole host of other cases which function much like 'beer', e.g. 'soup', 'coffee', 'soda', etc. In general, the things we order in restaurants or buy in stores are packaged and served in certain ways; frequently, we have come to refer to these conventional 'units' as 'a beer', 'a soup', 'a coffee', 'a soda', and the like. But the conventional-'unit' relation can also apply, more generally, to relatively abstract things, such as e-mail: an e-mail is a conventional 'unit' of e-mail; in this case, the conventional 'unit' is typically a single message. In all these cases, the above

entailment goes through, because the conventional 'units' are still 'units' *of* the substance or entity in question; the mass-predicate applies to any (suitably sized) instance of the substance or entity, regardless of how it is carved up.

There are, then, at least two kinds of cases in which the entailment from count to mass holds seems to work quite straightforwardly. In both cases, the relation between the entities to which the mass-predicate applies and those to which the count-predicates apply is that of constitution. The difference between the two cases is that, in the first, the substance in question comes naturally carved up into 'units', while, in the second, the 'units' are due to conventional ways of packaging, serving or otherwise carving up the substance in question.[47]

Let's now consider some possible counter-examples to the inference from count to mass. There are several different kinds of cases. First, consider a case like 'iron'. While it used to be the case that everything that is an iron is also iron, this is no longer true. Perhaps, 'paper' is similar. Although it is still true, in this case, that everything that is a paper is also paper, this is, as it were, accidental. Even if papers were no longer made of paper, we might nevertheless go on calling them papers. The connection between the entity (or institution), the paper, and the material of which it is made has thus become rather loose.

These cases, however, do not seem to present genuine counter-examples to the inference above from count to mass. For, in cases like 'iron' and 'paper', we are plausibly dealing with two different nouns, which, for historical reasons, look the same.[48] 'Iron' and 'paper' began their linguistic life in the same vein as 'beer' and 'soup' above, but the conventional 'unit' has taken on a life of its own and can now be separated from the material of which it was once (or is still) made.

The second group of potential counter-examples are nouns like 'truck', 'house', 'tool', 'dishwasher', etc., which do not standardly have mass-occurrences. As was suggested above in Section II, many nouns which at this point standardly have only one kind of occurrence could easily acquire the other kind, if the right circumstances are imagined or obtained. Does the entailment from count to mass hold with respect to nouns like 'truck'? That is, is everything that is a truck also truck?[49]

In general, it is difficult to evaluate whether the inference goes through with respect to nouns whose use (in one or the other kind of occurrence) has not yet become standard. Since a large number of cases seem to conform to the pattern of 'hair' or 'beer' above, it is likely that 'truck', in its mass-occurrences, would also be used in such a way as to indicate the 'substance' of which individual trucks consist. However, as we shall discover below, not all cases exhibit this pattern, and until the use of 'truck' becomes standard (if it ever does), it is best left open whether it permits the inference or not. The same applies to all other nouns which standardly have only one kind of occurrence, whether that occurrence be count (e.g. 'house', 'tool', 'dishwasher', etc.) or mass (e.g. 'water', 'snow', 'mud', 'blood', etc.).[50]

Thirdly, a particularly interesting and tricky group of possible counter-examples consists of nouns denoting things that are alive and, in some cases, the substance

we derive from them, e.g. 'chicken', 'fish', 'turkey', 'turtle', 'alligator', 'quail', 'shrimp', 'rabbit', and the like. We might expect these nouns to function much like the paradigm of 'hair' above, as the relation between the entities involved seems quite close to that between individual hairs and the hair of which they consist. However, the fact that we are dealing with things that are at one point alive, complicates matters considerably. Does the one-way entailment from count to mass go through, in these cases? That is, is everything that is a chicken also chicken?

At the very least, the entailment sounds somewhat awkward. We would not normally call chickens that are still alive chicken, perhaps because we are reluctant to think of living chickens as the meat we are going to eat. (Think, however, of the signs saying 'Live Poultry' that can sometimes be seen outside of stores or restaurants, which pride themselves on the freshness of the meat they serve.) There are two possible responses. First, we could regard the inference as valid, though pragmatically odd. It is pragmatically odd perhaps due to our practices of self-deception, which lead us to pretend that the live animal has nothing to do with the meat we are going to eat. Alternatively, we could complicate the entailment relation and make explicit allowances for the transition from live animal to dead meat, along roughly the following lines: anything to which the count-predicates 'is a chicken' or 'are chickens' applies, while alive, is also such that the mass-predicate 'is chicken' applies to it, once slaughtered. (This will have to be refined even further, because beaks, claws, feathers, etc. may not count as chicken.) I will leave it open for now which strategy will ultimately prove more promising.

The case of 'chicken' raises an interesting question. There are many cases in which the entities referred to stand in much the same relation as the live chicken and the meat it is going to become, but they are not referred to by the very same phonetic shape, as illustrated by 'calf' and 'veal', 'cow' ('bull', 'steer', etc.) and 'beef', 'deer' and 'venison', 'pig' and 'pork', etc. The relation between 'calf' and 'veal' is surely much the same as that between the two uses of 'chicken'. But the entailment relation is currently formulated explicitly in terms of different uses of the very same noun.

The success of the entailment relation depends, not so much on the way in which we refer to the entities in question, but on the way in which the entities referred to are related to each other. If calves and veal are related to each other in much the same way as the live chicken and the meat it is going to become, we should expect the entailment relation to apply as much in the former case as in the latter. This suggests a more general formulation of the entailment relation, which is not restricted to two occurrences of the very same noun, but allows different phonetic shapes to take over the two roles. To illustrate, a more general formulation of the modified entailment relation above could take roughly the following shape: anything to which a count-predicate of the form 'is an N_1' or 'are N_1s' applies, while alive, is also such that a related mass-predicate of the form 'is N_2' applies to it, once slaughtered, where 'N_1' and 'N_2' could be different nouns. A

more general formulation of this kind may be desirable in any event, in view of such pairs of nouns as 'chair' and 'furniture', 'ring' and 'jewelry', 'poem' and 'poetry', and the like.

We have so far considered six different kinds of cases; the paradigms, for each case, were (i) 'hair', (ii) 'beer', (iii) 'iron', (iv) 'truck', (v) 'chicken', and (vi) 'calf'/'veal'. The one-way entailment from count to mass works very straightforwardly for cases (i) and (ii). Cases (iii)-(vi) present some prima facie difficulties, but can be acommodated, in one way or another, at least with some relatively minor qualifications. I now turn to a group of examples which seems to point in a completely different direction.

Consider the nouns 'justification', 'proof', 'truth' and 'virtue'. These are different, not only because the entities to which they apply are not concrete, but because their mass- and count-occurrences are related to each other in a different way from the previous six cases. In this case, the entities to which the count-predicates apply do not seem to represent different ways of carving up the entities to which the mass-predicate applies. Rather, it seems that the mass-predicate marks a kind of success, the accumulated endresult achieved by the individual 'units' referred to by the count-predicates. Consider, for example, the following pair:

(33) The district attorney has presented *a justification* for his indictment.
(34) The district attorney has presented *justification* for his indictment.

(33)-(34) seem to permit a reading in which the second sentence is stronger than the first. On this reading, (34) implies something like complete or total justification, while (33) is compatible with only partial justification. If the district attorney has presented a justification for his indictment, it may not follow that his indictment is justified, i.e. that there is justification for his indictment, since the justification he has presented may have serious holes in it. This suggests that justification is not so much the 'stuff' of which individual justifications are made, but rather what individual justifications, when successful, add up to. (A single justification, I suppose, would be enough to achieve justification, if it was a very good one.)

In a similar vein, consider the following pair:

(35) There are many *proofs* of the existence of God.
(36) There is *proof* of the existence of God.

As with (33)-(34), (35)-(36) admit of at least a reading in which the second member of the pair is stronger than the first. There is a sense in which there still is no proof for the existence of God, even though many proofs have been proposed. Or consider the occurrence of 'virtue' in (37):

(37) Mother Teresa's *virtue* is expected to lead to her canonization.

'Virtue', in (37), can be read as either having a mass- or a count-occurrence. When read in the first way, it is most naturally understood as applying to Mother Teresa's overall virtue (the accumulated effect of her individual virtues, e.g. her humbleness, her life-long devotion to the poor, her piety, etc.); when read in the second way, it suggests that Mother Teresa had only one virtue, and it is this one virtue on the basis of which she will be made a saint.[51]

If this is right, then we are dealing with a group of examples in which the constitution-relation is precisely reversed, as compared to our previous paradigm: individual justifications, if successful, achieve justification; individual truths may lead to truth; proof is given in the form of individual proofs; and virtue is the overall effect of individual virtues taken together. More generally, then, these are cases in which the entities denoted by the count-predicate 'is an N' or 'are Ns' constitute what is denoted by the corresponding mass-predicate of the form 'is N'. But the mass-predicate 'is N', if understood as 'is total, complete or overall N', does not apply to everything to which the corresponding count-predicates apply; for individual Ns may fail to achieve total, complete or overall N. These are cases, then, in which our previous entailment from count to mass does not generally go through, unless the individual 'units' denoted by the count-predicate are particularly successful examples of their kind. The entailment relation in the other direction, on the other hand, from mass to count, does work, since the overall effect can be achieved only by way of individual 'units' of the kind in question. If the DA's indictment is justified, this can only be because (one or more) individual justifications are available. There is no direct route to truth, proof and virtue, it seems, that does not lead through individual truths, proofs and virtues.

I conclude, then, that, unlike some of the earlier cases we have considered, the present group of examples does finally present us with a genuine counterexample to the above entailment from count to mass, which cannot be patched up through relativily minor modifications. The reason is that the entities in question are related in precisely the opposite way from our previous paradigm. But the fact that the constitution-relation is exactly reversed in this case also provides us with a satisfying explanation for why the one-way entailment relation from count to mass fails. We are thus led to believe that the above entailment from count to mass applies only to cases in which the entities denoted by the mass-predicate *constitute* the entities denoted by the corresponding count-predicates; and that the entailment relation furthermore applies to these cases *because* the entities in question are related in just this way. Our current group of examples also suggests that when the constitution-relation goes the other way, the entailment similarly follows course, so that the constitution relation counts as an explanation for why the entailment holds, in both directions.

We have now come across a group of examples which do not satisfy the above entailment relation from count to mass, but do satisfy an entailment relation going in the opposite direction, from mass to count:

One-Way Entailment, Mass to Count:

(i) For any x, if the mass-predicate 'is N' is true of x, then the singular count-predicate 'is an N' is also true of x.

(ii) For any x's, if the mass-predicate 'is N' is true of the x's, then the plural count-predicate 'are Ns' is also true of the x's.

Do our previous examples ('hair', 'beer', etc.) satisfy this entailment relation? It would certainly be desirable to have an entailment relation going in the direction from mass to count. After all, the systematic relation between mass-predicates and count-predicates was offered as an argument against the lexical ambiguity approach and in favor of the occurrences approach, according to which it is one and the same noun 'hair' occurring in both (1) and (2) (cf. Sections I and II). The lexical ambiguity theorist might at this point object that a mere one-way entailment between mass-predicates and count-predicates is too weak to maintain that we are in fact dealing with one and the same expression.

We have already seen that not everything of which the mass-predicate 'is hair' is true is also such that the count-predicate 'is a hair' is true of it: (suitably sized) parts and sums of hair are themselves hair, but not necessarily a hair or hairs. Thus, for the above entailment from mass to count to have any chance at all, it would have to be modified. Nevertheless, one might feel that the relation between hair and individual hairs can still be expected to license *some* kind of entailment relation, even if only of a weakened form. After all, in order for there to be something of which the mass-predicate 'is hair' is true (and of which the count-predicate is not true), there must at some point have been something of which the count-predicate 'is a hair' was true. For parts and sums of hair do not come into existence out of nowhere. At some point, there must have been whole individual hairs, in order for there to be parts and sums of hair. Consider also the relation between 'is chicken' and 'is a chicken'. In order for there to be something of which the mass-predicate 'is chicken' is true (and of which the singular count-predicate 'is a chicken' is not true), e.g. chicken breast, there must at some point have been something of which the singular count-predicate 'is a chicken' was true. Again, chicken breast comes into existence from individual chickens, which we can then proceed to slaughter and turn into chicken breast and other types of chicken.

Thus, there does seem to be some relation going in the other direction between mass-predicates and count-predicates, at least in certain cases. However, there is also something quite 'unsemantic' about the relation between whole individual chickens and chicken breast. An entailment relation going from mass to count would have to rely crucially on the natural processes by which chicken breast comes into existence from once-alive individual whole chickens. But this is clearly a contingent fact, as becomes apparent if we switch to a different example, e.g. 'beer'. In order for there to be something of which 'is beer' is true, it is not necessary that there must at some point have been something of which 'is a beer' is true. For there is beer before there are beers; and there could be beer without there ever being any beers.

The examples 'hair', 'chicken' and 'beer' indicate that, while *some* entailment relation from mass to count holds between the entities in question, no one general entailment relation will work across the board. As before, however, there is some hope that a piece-meal approach will in the end be successful in capturing the multiplicity of relations underlying the linguistic distinction between mass- and count-occurrences of nouns.[52]

III.5 How-Many Questions: Finally, I would like to consider the different roles played by mass- and count-predicates in our practices of counting and measuring. There is a reason for calling 'is a hair' and 'are hairs' *count*-predicates. The reason is that, just as one would expect, there is some connection between count-predicates and our practices of counting.

If someone asks,

(42) How many hairs are there in your soup?

then the natural thing to do would be to count the individual hairs in one's soup. Each of the things we count in response to (42) is *a* or *one* hair, i.e. something of which the singular count-predicate 'is a hair' is true.

If, on the other hand, someone asks

(43) How much hair is there in your soup?

we might answer 'a lot' or 'more than last time we ate here' or ' very little'. 'Hair', in (43), has a mass-occurrence and functions semantically as the mass-predicate 'is hair'.

(42) could be posed in exactly the same circumstance as (43); that is, (42) and (43) need not reflect any difference in what is in our soup (although they could). But they are still two different questions and they demand different answers. (43) does not ask for the *number* of individual hairs in one's soup; rather, it asks for the *amount* of hair. Two individual hairs cut into little shreds is the same amount of hair as two individual hairs not cut into shreds. When faced with a question like (43), we do not care what state the hair in our soup is in, we only care how much of it there is.

As (42) illustrates, one way of initiating, or at least issuing a request for, an act of counting is by posing a question beginning with the words 'how many'. Following Richard Cartwright, I take the category of how-many questions to be delineated syntactically: a how-many question is simply a question beginning with the words 'how many' (cf. Cartwright (1994), p.72). As it turns out, there are different kinds of how-many questions and not all of them can be taken to issue a request to count something or other. Cartwright distinguishes, among other things, the following two kinds: (i) *cardinality questions*; and (ii) *how-much questions*. I briefly consider both of these in turn.

Cardinality questions overlap with how-many questions: that is, some but not all cardinality questions are how-many questions (i.e. begin with the words 'how

many'); and some but not all how-many questions are cardinality questions. An example of a cardinality question that is not a how-many question is one beginning with the words 'what is the number of'. An example of how-many questions that are not cardinality question are the how-much questions, considered below.

Cardinality questions are roughly what Frege must have had in mind when he says, in §44 of the *Grundlagen*, "[w]hat answers the question How many? is number, ..." (Frege (1980), p.57).[53] (42) was an example of a cardinality question; so is Frege's example (44) and even (45),

(44) How many moons of Jupiter are there?
(45) How many moons of Venus are there?

despite the fact that the answer to (45) is 'zero'.

What is being asked in these questions? Cardinality questions are so-called, because they ask for a cardinal number as their answer: they ask how many things of a certain kind there are (e.g. hairs, moons of Jupiter, moons of Venus, etc.). In Fregean terms, (42), (44) and (45) ask what the number belonging to a certain concept is, i.e. how many objects fall under it. In our terms, cardinality questions ask how many things there are, such that the corresponding count-predicate is true of them. Without entering too far into the semantics of questions, let's represent the cardinality question in (44) more formally as follows:

(46) (What k) n[the x's: Are-moons-of-Jupiter(the x's)] = k?

where 'what' is a quantifier, 'k' is a variable ranging over numbers (of some appropriate sort), and 'n[the x's: ...(the x's)...]' denotes a function which yields the number of things to which the predicate substituted in for the ellipsis applies. (46) can be read as 'What k is such that the number of x's that are moons of Jupiter is identical to k?'. The how-many question in (44) issues the request to fill in the correct numerical value for 'k' in (46); this numerical value is supplied in the answer, as in (47):

(47) n[the x's: Are-moons-of-Jupiter(the x's)] = 4

(47) reads 'The number of x's, such that the x's are moons of Jupiter, is four'.

Since cardinal numbers can be extremely large, not all how-many questions of the first kind can be answered by actually counting the things in question (in our ordinary ways), as was possible in (42), (44) and (45). For example, the correct answer to (48) is 'infinitely many':

(48) How many natural numbers are there?

This is one place where singular count-predicates and our ordinary practice of counting part ways. However, there are other ways of determining how many

things of a certain kind there are, and the size of the set of natural numbers can only be determined by some such alternative method. It therefore makes sense to group (48) with (42), (44) and (45), because they all ask for a cardinal number as their answer.[54]

Let's now turn to Cartwright's second kind, how-much questions. How-much questions also overlap with how-many questions; that is, some how-many questions, as it turns out, are really how-much questions and not cardinality questions, when paraphrased into their 'true' form. These are questions of the following kind:

(52) How many spoons of sugar did you put in your coffee?
(53) How many cups of sugar are in that bowl?

(52) and (53) can be paraphrased roughly as

(54) How *much* sugar, as measured in spoonfuls, did you put in your coffee?
(55) How *much* sugar, as measured in cupfuls, is in that bowl?

Of course, a question like (52)

(52) How many apples did you eat today?

could also be paraphrased into a question beginning with the words 'how much':[55]

(56) How *much* apple, as measured in individual apples, did you eat today?

But the paraphrase in (56) clearly sounds more awkward than the sentence it is intended to paraphrase, whereas the paraphrases in (54) and (55) do not.

The difference, as Cartwright points out, is that cardinality questions and how-much questions call for two very different kinds of answers. Cardinality questions call for cardinal numbers as their answers; these answers in turn indicate how many individual things of a certain kind there are. For example, the cardinality question in (44) asks for the number of moons revolving around Jupiter; its answer in (46) indicates that this number is four, meaning that *there are* four individual things of the kind, moon of Jupiter.

The answer to (52) could of course also be 'four'. But, in this case, the answer 'four' cannot be understood as a cardinal number indicating how many individual things fall under a certain kind (e.g. sugar that was put in the coffee). (52) and (53) ask for an *amount* of sugar, as measured in a certain way, not a number of particular quantities. We might represent this difference (in very simplified form) as follows:

(60) (What k) $p_{\text{spoonfuls}}$[x: Is-sugar(x) & Was-put-in-your-coffee(x)] = k?
(61) (What k) p_{cupfuls}[x: Is-sugar(x) & Is-in-that-bowl(x)] = k?

where'what' is again a quantifier, as before, 'k' is a variable ranging over numbers, and 'p_m[x: ...(x)...]' denotes a partitioning function, mapping quantities to numbers, whose subscript indicates the unit of measurement determined by the context at hand. (60), for example, can be paraphrased as 'what k is such that the number of spoonful-partitionings of x, where x is sugar that was put in your coffee, is identical to k?'. The partitioning function 'p_m[x: ...(x)...]', when applied to the extension of a given predicate, yields a number (not necessarily a whole number) indicating the *amount* of the substance in question (in this case, sugar), as measured in a certain way (in this case, spoonfuls or cupfuls). To ask for an amount, on the analysis just given, is to ask into how many non-overlapping subdivisions of a certain size the quantity in question can be partitioned; the size of these subdivisions is determined by the unit of measurement supplied by the context. Thus, while the partitioning function also yield a numerical value when applied to the extension of the predicate in question, the resulting number k is to be interpreted differently from before: the number k does not indicate how many individual quantities of a certain kind there are; it indicates the number of subdivisions resulting from a certain way of partitioning the quantity in question.

To illustrate, (60) and (61), on this analysis, ask into how many spoonful- or cupful-sized subdivisions the quantity of sugar in question can be partitioned. But the quantity of sugar consisting of the four spoonfuls that were put in the coffee can be partitioned into individual quantities in many different ways: there is the maximal quantity, comprising all the sugar that was put in the coffee; there are the four little heapfuls that appeared on the spoon successively; there are many other constellations consisting of four non-overlapping quantities each of which is of the same amount as one spoonful of sugar; and so on, indefinitely. One of these partitionings may very well be the most 'natural' or contextually most salient; but the others are nevertheless available as well. The number four, as an answer to (60) or (61), hence does not translate into a number of individual sugar-quantities. This comes out quite clearly, when we note that (62)—our supposed answer to the how-much question in (60)—is equivalent, for example, to (63) and (64):

(62) $p_{\text{spoonfuls}}$[x: Is-sugar(x) & Was-put-in-your-coffee(x)] = 4.
(63) p_{grams}[x: Is-sugar(x) & Was-put-in-your-coffee(x)] = 14.16.
(64) p_{ounces}[x: Is-sugar(x) & Was-put-in-your-coffee(x)] = 0.48.

Of course, if asked about spoonfuls, we would not normally phrase our answer in terms of grams or ounces; (63) and (64) would thus be pragmatically odd if they were given as answers to (60). However, they do serve to bring out that the number which appears on the right-hand-side of the identity sign is not to be read as indicating how many individual quantities of sugar there are; rather, it indicates the number of non-overlapping spoonful-sized, gram-sized and ounce-sized partitionings into which this particular quantity of sugar can be subdivided.

As in the case of the moons of Venus earlier, the correct, though perhaps unexpected, answer to a how-much question may also be 'zero', as in (65),

(65) $p_{\text{spoonfuls}}$[x: Is-sugar(x) & Was-put-in-your-coffee(x)] = 0.

if no sugar at all was put in the coffee. For where there is no quantity of anything, there is also no amount to be measured. Thus, judging from the appropriateness of 'none' or 'zero' as the correct numerical value to be filled in for 'k', how-much questions and cardinality questions alike do not seem to carry an existential presupposition, to the effect that *there are* individual things of the kind mentioned in the question. Their answers commit us the existence of things to be counted or measured, only where the correct numerical value filled in for 'k' is greater than zero.

Not all questions beginning with the words 'how much' are genuine how-much questions. (56), repeated here, is an example:

(56) How much apple, as measured in individual apples, did you eat today?

For, in contrast to (52) and (53), (56) still asks how many individual things of a certain kind there are, even though this might be obscured by the awkward paraphrase. This just goes to show that 'individual apple' is not a genuine measure of an amount in the way in which 'spoonfuls of sugar' is. 'How much apple, as measured in individual apples...?' is just another—more awkward—way of asking 'How many apples...?'. For one thing, individual apples would be much too diverse to qualify as a practical unit of measurement. But even if, in addition to the standard meter, there were such a thing as 'the standard apple' (whatever exactly that might be), this could only act as a standardization for certain measurable characteristics of individual apples, such as their weight, shape, etc. A question like 'How much apple, as measured with reference to 'the standard apple', did you eat today?' would correspondingly be just another way of inquiring about one or more of these measurable features (i.e. 'How does the apple you ate compare with respect to the relevant measurable characteristics to 'the standard apple'?'). 'How much sugar, as measured in spoonfuls...?', on the other hand, does genuinely ask for an amount and is not just another way of asking 'How many individual quantities of sugar...?'; for the answer to this latter question would have to be a very large number, the same on every occasion.

This tells us roughly what the difference is between the two kinds of how-many questions with which we began: cardinality questions and how-much questions.[56] Cardinality questions ask how many individual things of a certain kind there are; their answers fill in the numerical value requested by the question, indicating that so-and-so many individual things of a certain kind exist. How-much questions, on the other hand, ask for an amount of something, as measured in a certain way; any particular quantity will do, as long as it is in the right amount.[57]

In a cardinality question, the nouns or noun-phrases occurring after the words 'how many' have count-occurrences and function semantically as a count-predicate of the form 'are Ns'. In a how-much question, on the other hand, the nouns or noun-phrases occurring after the words 'how much' have mass-occurrences and function semantically as a mass-predicate of the form 'is N'. In other words, if we want to associate the world's hair in some way or other with *number*, we need to

speak of it (them) in terms of individual hairs, i.e. the things of which the count-predicates 'is a hair' or 'are hairs' are true. If, on the other hand, we are interested in *amounts* of hair, we need to speak of the world's hair through the guise of the mass-predicate 'is hair' which applies to individual hairs, hair-parts and hair-sums. But how we use the noun 'hair'—in its mass- or count-occurrences—need not reflect a difference in what is talked about.

Number, then, as Frege would put it, is not a "property of external things".[58] The distinction between what we count and what we do not count is drawn by our concepts; in language, it is reflected in the form of the mass/count distinction. As in the case of 'hair', different modes of speaking about the very same "external phenomenon" are often available to us: a mass-way and a count-way. One way of speaking is conducive to association with number; the other invokes amounts, as measured in a certain way. Count-predicates of the form 'is an N' or 'are Ns' divide their extension into individual Ns. These individual Ns are the 'units' we count when asked a genuine cardinality question. Insofar as count-predicates divide their extensions into countable 'units', they draw a kind of invisible conceptual line around each of the things in their extension. This is the sense in which we tend to think of the things to be counted along the lines of neatly separated parcels.[59]

The Fregean picture, according to which the distinction between these different ways of talking lies purely in our concepts and not in the objects referred to, is reflected in this analysis in the following way. When we say of one and the same "external phenomenon", first, that it is hair and, then, that it is a hair or that they are hairs, the reference of the 'it' or 'they' has not shifted; it is the very same thing or things to which this conceptual distinction is applied. This means that, at the level of logical form, the object or objects talked about is represented by the same variable or constant, as has already emerged in our discussion of entailment relations in Section III.4.

IV. Conclusion

In conclusion, let me review the main points I have covered and give some indication of where this leaves us. I began with the observation that there is an intuitive distinction between the role of 'hair' in (1) and (2):

(1) There is hair in my soup.
(2) There is a hair in my soup.

According to the view taken here, (1) and (2) contain one and the same noun, in two different occurrences: in (1), 'hair' has a mass-occurrence; in (2), a (singular) count-occurrence. In Section II, I briefly sketched how these different noun-occurrences can be marked off from each other, at least in part on the basis of such features as pluralization and quantification.

The remainder of this paper, and its primary focus, dealt with the semantic differences between the two kinds of noun-occurrences, in particular the following two questions: what is the logical form of sentences containing mass-occurrences of nouns? And how is it different from that of sentences containing nouns in their count-occurrences? The proposals available in the literature generally fall under these three broad headings: the name view, the predicate view and the mixed view. Both the name view and the mixed view give rise to serious difficulties, which were the subject of Section III.1: the former, due to the reference-dividing relation(s) to which it must inevitably appeal; the latter, because it has trouble accounting for certain kinds of inferences involving both name-like and predicative occurrences of one and the same noun.

In the light of these difficulties with the two rival views, I adopt a version of the predicate view. Any version of this view must reject the common Quinean assumption according to which substantival predication is intimately tied up with countability. The anti-reductionist predicate view proposed here suggests instead that there is another kind of predicate, the mass-predicate, which is suitable to association not with number, but with amounts and measurement. To uphold the intuitive difference between the two, I distinguish between (irreducibly) different kinds of predicates: mass-predicates of the form 'is N' and count-predicates of the form 'is an N' or 'are Ns'. Section III explores the differences and interrelations between these different kinds of predicates: their truth-conditional and mereological differences; their different roles in our practices of counting and measuring; as well as the entailment relations that yield systematic connections between mass- and count-predicates.

The essence of the view presented here is that mass-predicates of the form 'is N' are in no way defective, mysterious or in need of such relations as 'is a quantity of', 'is a bundle of', 'is a tuft of', 'is a puddle of'. Of course, it is always possible to paraphrase sentences containing mass-occurrences in this way. However, in doing so, the paraphrase will convey more information than the original sentence. To illustrate, while 'This is a tuft of hair' may be an appropriate paraphrase for 'This is hair' in a certain context, the paraphrase tells us not only what kind of entity we are dealing with (hair, as opposed to, say, dust or yarn), but also roughly how much of it there is and how it is organized. Although some paraphrase of the form 'This is a mound of hair', 'This is a tuft of hair', and so on, can always be found whenever we utter 'This is hair', we have seen that, as attempts to explain away mass-predication, such paraphrases are both uncalled for and ineffective. The sentence 'This is hair' by itself is perfectly intelligible and semantically complete. As Helen Cartwright has observed a long time ago in response to Strawson, there is no need to "[...] wait until we know whether we are talking of veins, pieces or quantities of gold or of falls, drifts or expanses of snow" (cf. Strawson (1953/54, p.242)).[60] Even more so, talk of snow *simpliciter* accomplishes something that talk of drifts and expanses cannot: talk of snow *simpliciter* captures what stays the same when some snow reorganizes, as it might be, from a heap, into a drift or expanse. Talk of drifts and expanses only tells us how the snow

happens to be organized as a particular moment. Far from capturing the 'real' logical form of sentences containing nouns in their mass-occurrences, such paraphrases therefore immortalize what appear to be rather superficial properties.[61]

Notes

*This paper grew out of my doctoral dissertation, *Talk about Stuffs and Things: The Logic of Mass and Count Nouns*. I would like to acknowledge the help of my thesis supervisor, Judith Jarvis Thomson, as well as the rest of my committee, Richard Cartwright, Robert Stalnaker and the late George Boolos; I have profited greatly from their many wonderful comments both during and after the completion of my dissertation in May of 1995. Along the way, I have also received numerous helpful suggestions from, among others, Sylvain Bromberger, Irene Heim, Harry Howard, Georgette Ioup, Edward Johnson, Richard Larson, Mitzi Lee, Barry Schein, Jason Stanley, and Jim Stone. This paper was much improved by the extensive and insightful comments of my two anonymous referees, which prompted substantial revisions. I thank them for the time and effort they put into preparing their comments. Graeme Forbes deserves my special gratitude for his untiring support; I have benefited greatly from the many fruitful discussions we have had over lunch during the past three years. Finally, I am deeply indebted to Helen Morris Cartwright, whose groundbreaking work on the mass/count distinction, more than anyone's, has influenced my own thinking on this subject.

1. Of course, even the nouns in this group can always have count-occurrences read as 'kind of ...' or 'kinds of ...', as in 'Some believe that the best wines in the world now come from California'.

2. In some cases, it may not be immediately obvious to which category (if any) a noun belongs, e.g. 'groceries', 'cattle', 'spaghetti', 'mashed potatoes' and 'weather' (cf. Ware (1975)). One may take examples such as these to indicate that the mass/count distinction is not an exhaustive classification of nouns (but see also n.7, for another possible take).

3. There is a large body of literature on the mass/count distinction, beginning with the first serious attempt at systematic treatment in Quine (1960). A good bibliography of works written up until the mid-seventies can be found in Pelletier (1979), pp.295-8. For more recent references, see e.g. Bunt (1985), Lønning (1987), Pelletier & Schubert (1989), Gillon (1992), Zimmerman (1995). Particularly illuminating is Helen Morris Cartwright's work on the subject, cf. Cartwright (1963), (1965), (1970), (1975a), (1975b).

Attempts have been made (e.g. Quine (1960), Moravcsik (1973), Evans (1975), Hoepelman (1976), Mourelatos (1978), ter Meulen (1980)) to extend the mass/count distinction to syntactic categories other than nouns and noun-phrases. However, in what follows, I shall restrict myself to nouns and noun-phrases.

4. There are many different frameworks currently in use in semantic theory. For example, according to the neo-Davidsonian program, semantic theory is a theory of the speaker's knowledge of meaning; knowledge of meaning, on this approach, amounts to knowledge of a truth-theory, defined recursively from a set of logical forms (cf. especially Davidson (1965), (1967a), (1967b); Higginbotham (1985), (1989), (1991); Harman (1972), (1974); Larson & Segal (1995); et al.). The relevant logical forms are typically assumed to be those specified by some version of the Extended Standard Theory (cf. Chomsky (1981), (1986), (1993)). Another approach, which also enjoys a good deal of popularity currently, is to conceive of semantic theory as concerned primarily with the way in which an expression affects the context in which it occurs, i.e. its context-change potential (cf. Stalnaker (1978); Heim (1983); et al.). For the purposes of this paper, I help myself to the vocabulary of the neo-Davidsonian framework. For reasons of space, I must refer the reader to the works cited above, for a justification of this approach. However, for the most part, I rely on very general and basic semantic distinctions, such as that between names and predicates, which are common to different approaches to semantic theory. The results of this study should therefore translate straightforwardly into different frameworks.

5. A few remarks are in order to justify at least some of these classifications, since not all of them are uncontroversial. First, Quine (1960) appears not only as a representative of the mixed view, which

is standard, but also under the name view. According to the more well-known reading, Quine suggests that nouns in their mass-occurrences play a dual role, depending on their position and semantic function in the sentence: when they precede the copula, they play the role of a singular term, denoting a scattered object; when they follow the copula, they play the role of a general term. But a version of the name view is at least suggested in Quine, when he addresses the question of what these predicative mass-occurrences denote (Quine (1960), p.98). For he seems to propose that predicative mass-occurrences are in fact *elliptical* for more complex expressions involving certain appropriate reference-dividing relations, such 'is a bit of', 'is a batch of', etc., where the noun following the reference-dividing relation refers to the scattered object again, just like its counterpart in subject-position. This seems to suggest that the name-like role of nouns in their mass-occurrences is in fact basic. To justify this second, more controversial, reading of Quine would lead us too far afield in the present context (for more detail, see Koslicki (1995), ch.2).

Secondly, as far as I know, H.M. Cartwright nowhere explicitly states that she regards nouns in their mass-occurrences as playing the semantic role of a predicate. She does speak of nouns in their mass-occurrences as being just as good at dividing their reference or individuating what they apply to as their count-relatives (though they do so differently). I translate this to mean that she would put nouns in their mass-occurrences into the semantic category of a predicate, rather than a name. On the other hand, Cartwright also introduces a reference-dividing relation, 'is a quantity of', which makes her view more akin to the name view, for reasons which will become apparent below.

Finally, Higginbotham (1994) is also somewhat difficult to place. He initally assimilates nouns in their mass-occurrences to singular terms, but then asserts that "there should be a sense in which" they can function both as singular terms and as predicates (p.456, top) and that they in fact "begin their semantic lives as predicates" (ibid.).

6. For a helpful and extensive discussion of different approaches to classification, see Pelletier & Schubert (1989), especially pp.333-349.

7. There are several potential objections to (R2). First, one may feel that some plural noun-occurrences really should be classified as mass-occurrences, e.g. the occurrence of 'potatoes' in 'Please hand me the (mashed) potatoes!'. Secondly, it has often been pointed out that there are interesting similarities, both of a syntactic and a semantic nature, between plural and mass-occurrences of nouns. For example, the bare plural occurrence of 'chair' in 'Chairs are a useful piece of furniture' is perfectly acceptable, in contrast to its bare singular occurrence in (4). (R2) threatens to do away with these interesting connections between plural and mass-occurrences.

I have sympathy with both objections. Nevertheless, I still believe that (R2) is a useful rule of classification. In particular, the fact that the plural occurrence of 'wine' in (5) is classified as a count-occurrence, in my view, speaks in favor of (R2). For 'wine', in (5), intuitively means something like 'kind of wine'; and we can count kinds of wine (e.g. Zinfandel is one kind, Merlot another, and so on). There is thus good reason for wanting to keep apart the occurrence of 'wine' in (5) from its standard mass-occurrences, as in 'Could you please pour me more wine?'. For example, in response to (5), it would be perfectly legitimate to ask 'Which ones?' or 'How many?' (as in 'Which ones do you think come from California, as opposed to France, Italy, etc.?' or 'How many do you think come from California, as opposed to France, Italy, etc.?'); not so in response to 'Could you please pour me more wine?' (unless, perhaps, there are many different salient bottles of wine of different kinds to choose from, as may be the case at a wine tasting; otherwise, it would be more natural to follow up with 'How much?').

We can accomodate the first objection by allowing that some noun-occurrences, which on the surface appear to be plural count-occurrences, are nevertheless construed as mass-occurrences. The occurrence of 'potatoes' mentioned above is not an isolated case; terms like 'groceries' and 'beans' suggest that there may be other examples for which a similar strategy appears plausible. Moreover, it is also sometimes suggested in the literature that the converse phenomenon is to be found in terms like 'cattle', 'furniture', 'jewelry', 'china', etc. (possibly, 'police' fits into this group as well). These terms standardly have what look like mass-occurrences, but are perhaps best viewed as 'implicitly' plural. If this is right, then we may want to classify these occurrences accordingly (i.e. as plural count-occurrences), despite the fact that our sample rules, as they stand, would count them as mass-occurrences.

But the examples just mentioned are the exception, rather than the rule. 'Cattle', 'furniture', 'jewelry', and 'china' clearly belong to a special group of nouns, sometimes referred to as "collective"; they are perhaps more similar to 'people' and 'tools' than to 'wine' and 'snow'. Rather than abandoning (R2) altogether, then, in the face of these apparent counter-examples, I suggest that we meet the first objection by essentially weakening (R2), to allow for cases in which the overt presence or absence of the plural suffix is overruled by other consideration.

As for the second objection, I agree that it is of great importance to capture the similarities between plural and mass-occurrences. However, there are better ways to do so than in the context of rules of classification. Despite their similarities, plural count-occurrences and mass-occurences still constitute two different kinds of noun-occurrences and it is surely advantageous to classify them accordingly, even if, at another level, we aim to capture the similarities between them. I discuss some of the semantic similarities between these two kinds of noun-occurrences below, in Section III.

8. Cf. e.g. Higginbotham (1994), for more discussion and a formal treatment of mass and count quantifiers.

9. Cf. H. Cartwright (1975b), Parsons (1970) and Section III.5 below, for more discussion of measures of amount phrases.

10. The two structures are (i) 'Mary had [[a little] lamb]' and (ii) 'Mary had [a [little lamb]]'. There is ample linguistic evidence for this ambiguity. First, the two different readings give rise to different questions, e.g. 'How much/how little lamb did Mary have?' and 'What/which (little) lamb did Mary have?'. The different WH-phrases suggest that the different structures associated with (6) have different determiniers/quantifiers: the whole phrase 'a little', in (i); the indefinite article, in (ii). Secondly, the two readings allow for different comparative forms. Consider, for example, the contrast between '*Mary had more little lamb than Bill had' and 'Mary had more little lambs than Bill had'. The fact that the first of these is unacceptable suggests that 'little', in (i), is not playing the role of an adjective, since adjectives, notoriously, admit of degrees. Thirdly, adjectives can stack recursively, while quantifiers cannot. This predicts correctly that the presence of another adjective makes the ambiguity disappear and forces a count-occurrence of 'lamb': 'Mary had a fuzzy little lamb', 'Mary had a cute fuzzy little lamb', etc. Fourthly, adjectives can be used as predicates, while quantifiers cannot; hence the contrast between '*That lamb is a little' and 'That lamb is little'. Furthermore, sentences of the form 'X had a (adjective) (noun)' typically have a synonymous counterpart of the form 'X's (noun) was (adjective)'. This predicts, again correctly, that when (6) is recast using the possessive (as in 'Mary's lamb was little'), the mass-quantifier reading disappears. Finally, consider 'Mary had a little lamb and Alice did too': the fact that the two readings cannot be 'crossed' is a familiar test for ambiguity; that is, if the first conjunct is read with 'lamb' having a mass-occurrence, the second must be as well.

11. Pelletier (1975) uses his famous "Universal Grinder" to illustrate a similar point (ibid. pp.456ff). We are to imagine a device which can grind anything, no matter how big or small, hard or soft. Now imagine putting any entity denoted by a noun that has a count-occurrence into the grinder. Using the same noun to apply to what comes out the other end, this noun would now have a mass-occurrence, even if it had not been standardly used in this way before. Thus, the Universal Grinder is a thought experiment that enables any noun which has so far only had count-occurrences to acquire mass-occurrences. To go the other way, imagine a complimentary device, the "Universal Objectifier", which has the effect of delineating the entities denoted by nouns in their mass-occurrences into neat parcels.

12. In the sense that new usages of this kind can be coined by individual speakers, our object of analysis can be said to be created by the speaker. However, there are general rules governing the truth-conditional differences between nouns in their mass-occurrences and those in their count-occurrences (see also n.13 and Sect.III). To this extent, the mass/count distinction is part of the common knowledge shared by the competent speakers of a given linguistic community.

13. It is an interesting question whether 'hair' has some kind of basic (i.e. 'pre-mass or count') lexical meaning, and, if so, what it would be. Judging from the experience of non-native speakers, it is sometimes possible to acquire a kind of partial (and rather vague) grasp of what a word means or what it applies to, even before one knows whether it standardly has mass- or count-occurrences or

both. For example, one might know that hair is what naturally grows on a body, without knowing how this is standardly parceled up by speakers of English or whether indeed it is parceled up at all. Of course, as an occurrence theorist, I believe that a full grasp of the meaning of 'hair' is only possible relative to particular occurrences within a linguistic context. The noun 'hair' has, as it were, two 'entries' attached to it, one of which gives the meaning for its mass-occurrences and the other for its count-occurrences (cf. Section III). Particular linguistic contexts (supposing they are not ambiguous) then select one or the other of these 'entries'. The speaker imagined in the main text, who has mastered only the use of 'hair' in its count-occurrences, has a full grasp of one of these entries, and also understands the general truth-conditional difference between the two kinds of noun-occurrences (cf. Section III). For him, it is thus only a small stretch to add the other entry to his repertoire. The non-native speaker imagined above, on the other hand, vaguely knows what 'hair' applies to, but does not know how to apply it.

14. For example, the systematic relation between (15) and (16) could be captured by means of entailment relations (a topic which will concern us further in Section III), e.g. along the lines of a Davidsonian analysis of action sentences in terms of quantification over events. According this approach, some verbs have, in addition to their explicit argument positions, an extra position for events. Certain kinds of thematic roles (e.g. AGENT, PATIENT, THEME, GOAL, etc.) express how the participants are related to the event introduced by the verb. This approach was first suggested in Davidson (1967b); see also Higginbotham (1985), (1989), Schein (1986), (1993), Parsons (1990), and ch.12 of Larson & Segal (1995).

15. Although they sound slightly odd, we do sometimes find occurrences of proper names in quantificational contexts, as in 'Several Johns came to the party'. Perhaps, these occurrences can ultimately be analyzed away, along the lines of 'Several people named 'John' came to the party'. Another option would be to say that expressions like 'John' can sometimes play the role of a predicate, although they usually function as singular terms. For an analysis of proper names as predicates, cf. Burge (1973).

16. It is this semantic double life which first prompted Quine to propose his famous version of the mixed view, in *Word and Object*. He says:

> "...[T]he mass term is found to enter predication sometimes after 'is', like a general term in adjectival form, and sometimes before 'is', like a singular term. The simplest plan seems to be to treat it accordingly: as a general term in its occurrence after 'is', and as a singular term in its occurrences before 'is'." (Quine (1960), p.97)

17. There are various candidates available here. For example, it is very common to construe these objects as mereological fusions (cf. Quine (1960), Burge (1972), Moravcsik (1973), Simons (1987), Zimmerman (1995), et al.), or, more generally, along algebraic lines (cf. H. Cartwright (1963), Bunt (1979), (1985), Link (1983), Roeper (1983), Lønning (1987), Landman (1991), Higginbotham (1994), et al.). Parsons (1970) and ter Meulen (1981) conceive of them as intensional objects, which they call "substances". A set-theoretic conception seems to be at work in Laycock (1972). In what follows, I will simply speak of "the totality of the world's ...", leaving it open which of these conceptions is chosen, since this does not affect my general point. (The phrase, "the totality of the world's ...", is of course Quine's, who also uses "scattered object", for the same purpose.)

18. Actually, generic sentences are commonly divided into two groups, I-generics and D-generics ('I' stands for 'indefinite', because indefinite noun-phrases can occur very happily in the first group; 'D' stands for 'definite'). The characterization of genericity given in the main text only captures the first group, I-generics. The second group, D-generics, consists of sentences such as 'Dinosaurs are extinct', 'Potatoes were first introduced into Ireland in the 17th century', 'Gold is no longer mined in Arizona', etc. Intuitively, this second group of sentences seems to assert a (possibly quite non-characteristic) property of a kind of thing directly. An I-generic sentence, on the other hand, is true just in case individual instances of the kind in question generally have a certain characteristic property. For more on the topic of genericity, cf. Carlson (1977a), (1977b), (1979), (1982), (1989), Carlson & Pelletier (1995), Chierchia (1982), Farkas & Sugioka (1983), Gerstner (1979), Gerstner-Link (1988),

Gerstner & Krifka (1993), Koslicki (1997a), Krifka (1987), (1988), Lewis (1975), Schubert & Pelletier (1987), (1989), Wilkinson (1991).

19. Even for generic sentences, nouns that have mass-occurrences need not be analyzed as playing the semantic role of a name. For an alternative treatment, see Koslicki (1997a).

20. Again, there are different candidates available. Quine (1960) leaves it up to the context to select an appropriate reference-divider. H. Cartwright (cf. (1963), (1965), (1970)), Parsons (1970) and ter Meulen (1981) have a technical relation 'is a quantity of', which does not seem to be context-sensitive, at least not overtly. Often, we find simply the part/whole relation (or more general algebraic relations) used in this context (cf. n.17, for references); but the objection I am about to raise will make clear why this cannot be adequate, as it stands.

21. See also Burge (1972), p.270. Burge raises what I believe amounts to the same objection against the Q-relation, 'is-a-quantity-of', introduced in Parsons (1970). Parsons' Q-relation is also intended as a reference-divider, relating totalities, such as the substance snow, with their particular instances.

22. Of course, 'Snow is white', in (25.a) (=(17)), does not strictly speaking mean that *all* quantities of snow are white. (25.a) is a generic statement, to the effect that quantities of snow are *generally* white. Given the fact that it is merely a generic truth about snow that it is white, we might become doubtful of the validity of (25). It does not follow from the fact that quantities of snow are generally white that this particular bit of snow is white. Generic statements differ from universal quantifications precisely in that the former allow for exceptions, while the latter do not. (25) also has another reading:

(26.a) Snow is white.
(26.b) This stuff = the totality of the world's snow

(26.c) This stuff is white.

(26) is valid, but is not the reading Parsons, Burge and others have in mind in their discussion of (25).

23. One option that is open to the mixed view, in response to this objection, is to connect the name and the predicate determined by two occurrences of one and the same noun via a meaning postulate or some similar mechanism. However, in this case, the mixed view threatenes to collapse into one or the other of its rival views; for the temptation will then be to take one of the two semantic roles as basic and derive the other from it.

24. References to totalities such as the one just made in the main text are quite harmless, even for the advocate of the predicate view. The predicate view does not entail that all talk of totalities must be banned from our discourse, only that such talk must be analyzeable in terms of mass-predicates, rather than names. For example, the predicate view may legitimately describe the generic sentence 'Snow is white' as attributing the property of being white to the totality of the world's snow, but it must ultimately spell out what this comes to in terms of particular instances of snow, i.e. the things to which the mass-predicate 'is snow' applies. The reference to totalities in the main text is really only meant as a way of contrasting generic with non-generic sentences; as long as this contrast can be described in terms of instances of the kind of thing in question, as I believe it can, it is available to the predicate view, along with everybody else (for a defence of the view that genericity can be so described, see Koslicki (1997a)).

25. This view is, for example, defended in Higginbotham and Schein (1989) and further elaborated in Schein (1993). Higginbotham and Schein are inspired by the work of George Boolos on plurals and second-order logic (cf. Boolos (1975), (1984), (1985a), (1985b)) and by Bennett (1972). According to the Higginbotham and Schein analysis, plurals function semantically as predicates: their semantic values are concepts, in Frege's sense of the term. For example, the plural noun-occurrence 'the rocks' denotes a concept satisfied by the rocks and nothing else. This is represented by means of the second-order expression '$(\iota X)(\forall y)[X(y) \leftrightarrow \text{Is-a-rock}(y)]$', according to which 'the rocks' denotes the concept X, such that something y is in its extension just in case y is a rock. Following the nominalist interpretation of second-order logic developed by George Boolos (cf. Boolos (1975), (1984), (1985a), (1985b)), higher-order expressions of this sort do not commit us ontologically to anything over and above the individual rocks that satisfy it. By saying that 'the rocks'

denotes the concept stated above, we are saying nothing more than that 'the rocks' denotes the rocks. For alternative (objectual) analyses of plurals, which date back at least to Russell (1903), see Higginbotham (1980), Scha (1981), Gillon (1984), Link (1983), (1987) and Lønning (1987). Although I myself favor the Higginbotham and Schein analysis of plurals, it is important to note that nothing in the present context hangs on accepting any particular position on this issue. Even those subscribing to some version of the objectual view will agree that nouns in their mass-occurrences should be assigned a different semantic role from that of plural noun-occurrences, though they may choose a different way of expressing this point.

26. A few remarks on clause (iv). As it stands, (iv) only speaks to the possible reduction of mass-predicates to count-predicates; it does not make any claim concerning any other reductions one might attempt in this context (i.e. that of count-predicates to mass-predicates, or the two kinds of count-predicates to each other). While I in fact believe that none of the three kinds of predicates is reducible to any of the others, i.e. that there are at least these three irreducible kinds of predicates, I have only given arguments (viz. the question-begging nature of the reference-dividing relation) for one of these claims, the irreducibility of mass-predicates to count-predicates. Given the general trend in the literature, it seems most important to combat this particular reductionist tendency. The only proposal I am aware of which urges us to reduce count-predicates to mass-predicates is Sharvy (1978). All other reductionist proposals in the literature take count-predicates (in particular, singular count-predicates) as better-understood and basic. Whether plural count-predicates can be reduced to singular count-predicates is tangential to the main concerns of this paper.

27. It might be objected that introducing irreducible predicate-kinds is not the only method available to uphold the intuitive contrast between mass- and count-occurrences of nouns. For example, instead of straightforwardly identifying mass-predicates with count-predicates, the reductivist might propose, in a more subtle vein, that the meaning of the mass-predicate is a *function* of the meaning of the count-predicate. While this strategy is no doubt in principle open to the reductivist and would admittedly make for a much more attractive kind of reductivism than a straightforward identification, I suspect that any such view would utlimately need to avail itself of the kinds of reference-dividing relations discussed earlier (viz. to single out the *right* ones among the many parts of a hair). Moreover, when I suggest above that a reductivist predicate view threatens to do away with the intuitive contrast, I specifically have in mind Burge's version, in part because Burge most explicitly addresses the issues under discussion. Burge seems to operate under the Quinean assumption that there is only one way for expressions to divide their reference, the count-way (what I mean by this will become clearer in the next few paragraphs). If our usual ways of speaking lead us to believe differently, according to Burge, this is only for *pragmatic* reasons: we typically find the things to which nouns in their mass-occurrences apply difficult or inconvenient to count (cf. Burge (1972), pp.273-6); but this could easily be remedied with the help of science, among other things. I interpret this (perhaps uncharitably) to mean that mass-occurrences of nouns are, at bottom, simply count-occurrences in disguise. A reduction of this latter kind does seem to assign our initial intuitive contrast between mass- and count-occurrences, when all is said and done, to the realm of mere appearances.

28. (27)-(29) can be used either as an assertion, predicating the property of being hair, being a hair or being hairs of the referent determined by 'this' in context c, or as a demonstration, presenting the referent. This second use is perhaps comparable to the use of 'Here is your dinner' (meaning not much more than simply 'Here you go') as uttered by a waitress who is about to put the plate of food in front of you. She typically does not mean to inform you that your dinner occupies a certain region of space. (This would normally be too obvious to be worth saying, and is in any case put more naturally as 'Your dinner is here (i.e. right in front of you, as opposed to, say, over there)'.) The logical forms given in (30)-(32) are meant to capture the use of these sentences as an assertion, since, presumably, only assertions have truth-values. How other illocutionary acts are to be treated is a difficult question and not one that I can do justice here.

29. The classical treatment of demonstratives is of course that given in Kaplan (1989). According to Kaplan, demonstratives are, like proper names, directly referential rigid designators; however, unlike proper names, their content is variable from context to context (though their character remains constant).

30. The literature on plurals distinguishes between distributive and collective readings; in the latter, the predicates in question do not distribute over *each* of the objects involved and therefore cannot be analyzed straightforwardly in terms of singular count-predicates (e.g. consider the different readings of 'The boys ate a cake').

31. See, for example, Wiggins (1980, pp.71ff), who considers countability a 'near-miss' as a necessary condition for sortal concepts; not so, however, Geach (1962) and Lowe (1989).

32. For more on the rejection of the Quinean picture, see also Koslicki (1997b).

33. Cf. Burge (1972), p.264; Laycock (1972), p.35; Roeper (1983), p.256; ter Meulen (1981), p.111; Zimmerman (1995), p.65; et al.

34. Perhaps, the cumulativity of plural count-predicates cannot be expressed in terms of mereological sums. For, at least according to the traditional conception of mereological sums, developed in Leonard & Goodman (1940), sums are themselves individuals. It is not immediately obvious how an individual could have a plural property, such as 'are hairs'. However, the important point for now is simply the similarity between mass-predicates and plural count-predicates.

35. Cf. Bunt (1979), (1985), Cheng (1973), Higginbotham (1994), Lønning (1987), Roeper (1983), ter Meulen (1981), et al.

36. These properties are mentioned by practically everyone writing on the mass/count distinction. Quine (1960) attributes them to Goodman (1951) (cf. Quine (1960), p.91, n.3; p.99, n.4), who has 'dissective' instead of 'distributive' and 'collective' instead of 'cumulative' (cf. Goodman (1951), pp.38-9). In the literature, distributivity is often attributed to Cheng (1973). While it is true that Cheng explicitly states distributivity as a property characterizing mass-predicates (actually, he speaks in terms of the objects to which they refer, which he calls "mass objects"), the property as such is surely much older. Ultimately, distributivity and cumulativity have been recognized by philosophers at least since the Presocratics (see also Aristotle's homoiomerous substances, e.g. flesh, blood, marrow, etc.).

37. Is it in fact true that a hair has no proper parts that are themselves a hair? What about proper parts that differ from the original hair only very minutely, e.g. in the form of a single molecule or several such molecules? Surely, a hair can survive losing a single molecule or several such molecules. Can we infer from this that these minus-one-molecule or minus-several-molecules proper parts are themselves to count as hairs? If they do, we land in what is known as "the Problem of the Many": there are then too many hairs occupying the same place at the same time (cf. Unger (1981)). We are therefore well-advised to maintain that no proper part of a hair is itself a hair, even those which differ from the original only very minutely.

38. Even if, in practice, we may have trouble telling the difference between mere parts of a hair and whole hairs, I assume that there nevertheless is such a difference, as marked by the root and the end, and that this difference could be detected, for example, under the microscope.

39. Some count-predicates, such as 'is a pattern' or 'is a line', are 'almost' counter-examples to this claim. While very many parts of a pattern or a line may themselves still constitute a pattern or a line, it is not clear that *all* of them do, as full-fledged distributivity requires. However, as we shall see below, this seems to be true of most mass-predicates as well. It is precisely for this reason that I ultimately reject distributivity (at least in the unqualified version stated above) as a semantic contrast between mass- and count-predicates (more on this below).

40. There are possible interpretations of the part/whole relation according to which individual strands of DNA would not count as parts of hair, e.g. Burge (1977) and Fine (1994). However, these are of no help in the present context. According to Burge's theory of aggregates, "membership" in an aggregate is determined is similar fashion as set-membership, viz. via the satisfaction of a certain predicate. Thus, something is a "member" of the aggregate of all hair if it satisfies the predicate 'is hair', just as something is a member of the set of red things if it satisfies the predicate 'is red'. But if this is how "membership" in an aggregate is determined, it is no wonder that parts of hair that are not themselves hair fail to make it into the aggregate. Distributivity thus follows trivially from the definition of an aggregate. Fine's notion of a "c-part" ('c' stands for 'compound') is similarly defined by reference to the whole.

41. For example, Bunt (1979) and (1985) suggest that nouns that standardly have mass-occurrences allow us to speak of the things they apply to *as if* these were infinitely divisible, even if, as a matter

of empirical fact, they are not. (Lønning (1987), though with some reservations, leans in this direction as well; see also ter Meulen (1981) and Roeper (1983), for similar remarks.) But this approach requires two levels of semantic theory: one level is, as Bunt would put it, "purely linguistic" and has nothing to do with the real-world referents of our words. The other incorporates facts concerning the actual referents, such as the fact that water actually consists of H_2O-molecules. A radically different view is offered in Laycock (1972), who argues that nouns in their mass-occurrences are, as a matter of *a priori* fact, equivalent to plural sortal terms (e.g. 'water' analyzes into roughly 'minimal water-parts').

42. To my knowledge, the first such proposal is given in Cartwright (1963). For subsequent analyses which employ atomic and non-atomic structures, see Bunt (1979), (1985), Higginbotham (1994), Landman (1991), Lønning (1987), et al. Non-atomicity is not to be confused with another property commonly known as atomlessness. For example, while there appear to be no clear candidates for minimal parts in the case of 'is stew', stew is nevertheless not infinitely divisible into more of the same. 'Is stew' is therefore non-atomic, but not atomless.

43. The issues raised here are of great interest and complexity, and to do them justice requires a separate full-length treatment. For reasons of space, I can only present here the conclusions I have reached elsewhere. For more detailed discussion and a defense of my view concerning homogeneity and atomicity, the reader is referred to Koslicki (1997c).

The reader may have noticed that I have implicitly appealed to a reading of the part/whole relation, according to which an object, A, is a part of an object, B, if A occupies a subregion of the region of space occupied by B. It is quite plausible that spatial overlap counts at least as a necessary condition for parthood (restricting ourselves to material objects, for the moment). However, it may well be the case that parthood cannot be spelled out *merely* in terms of space-occupancy. For example, in the literature on the problem of constitution, it is frequently said that the clay and the statue share all of their parts. By mereological extensionality, this would therefore lead one to believe that they must be identical. Of course, there may be independent reasons to reject mereological extensionality. However, regardless of how that question is resolved, the assumption that the statue and the clay share all of their parts all by itself seems to me to be highly questionable (cf. Simons (1987), for a defense of a similar view). For example, the statue is an (improper) part of itself; but is it also a part of the lump of clay? If this is correct, however, such an interpretation of the part/whole relation which requires more than mere spatial overlap also would be of no help in the present context, for much the same reason to which I appealed earlier with respect to Burge (1977) and Fine (1994) (cf. n.40). Such a notion of parthood would need to be defined with reference to the characteristic properties of the respective whole, in which case distributivity again falls out trivially.

44. There is, however, still an interesting asymmetry between weakened distributivity and weakened cumulativity: while most, or almost all, mass-predicates fail distributivity in its strong form, those that fail to satisfy cumulativity in its strong form (e.g. 'is dust') seem to be the exception.

45. As will become clear in the next section, however, I consider this to be a conceptual difference, not a difference in what is referred to. The reference of the variables in (i) and (ii), on my view, therefore remains the same. The mass-predicate 'is hair' and the count-predicates 'is a hair' and 'are hairs', according to this conception, apply to "the very same external phenomenon", as Gottlob Frege would put it, but they do so in different ways. The difference, however, lies purely in our concepts, not in the actual objects referred to. More on this in Section III.5.

46. The precise nature of this relation is one of the most difficult and exciting issues in metaphysics; for a recent anthology of essays on the topic of constitution, see Rea (1997), which also contains a helpful bibliography.

47. As I remarked in Section I, almost all nouns that standardly have mass-occurrences can have count-occurrences that are read as 'a kind of ...' or 'kinds of ...'. This constitutes another possible group of cases to which the entailment from count to mass applies. 'Some believe that the best *wines* in the world now come from California' entails 'Some believe that the best *wine* in the world now comes from California'; intuitively, kinds of wine are, again, just another way of carving up the substance, wine.

48. This comes out more explicitly in other languages. For example, in German, the word for the entity or institution, the paper, is 'Zeitung', while the word for the material, paper, is 'Papier'. 'Zeitung' is etymologically related to 'Zeit' ('time'), not 'Papier' ('paper').

49. I take it that this is really the kind of case in view of which Pelletier's Universal Grinder was first introduced. As mentioned earlier (cf. n.11), the Universal Grinder is a thought experiment that enables any noun which has so far had only count-occurrences to acquire a mass-occurrence, by imagining the entity in question ground up, no matter how small, hard, etc. Pelletier's device not only illustrates the ease with which nouns can acquire new occurrences, when the right circumstances are imagined. It also suggests a one-way entailment relation from count to mass, of much the same kind as the one stated above, along with an explanation for why the entailment relation holds. The suggested explanation is that the mass-predicate always applies to the stuff of which the entity denoted by the count-predicate is made. As will become apparent in what follows, I agree with Pelletier to some extent. However, as examples like 'justification', 'truth', 'proof' and 'virtue' (discussed below) indicate, the entities in question are not always related in the way implied by the Universal Grinder. While very suggestive and applicable in a large number of important cases, I believe that Pelletier's Universal Grinder offers a too restrictive picture of the multi-faceted relations that can underlie the single linguistic distinction between mass and count.

50. There are some nouns and noun-phrases for which it is difficult to imagine how they could ever acquire the kind of occurrence they now lack, e.g. 'number' and 'pair of pants', both of which standardly have only count-occurrences. If we stick pairs of pants into Pelletier's Universal Grinder, what is it that comes out the other end? Since what comes out the other end is now scattered all over the floor and no longer arranged in pairs, a mass-occurrence of 'pair of pants' seems somewhat of a stretch. As for 'number', our only hope is perhaps to move to tokens. After a cup of tokens of the number three is poured into the Universal Grinder, someone might say 'who is going to clean up all this mess of number on the floor?'. If this is at least marginally acceptable, then 'number' becomes more like 'car' above. If a noun or noun-phrase cannot be made to acquire the kind of occurrence it currently lacks (and 'number' and 'pair of pants' seem as good of an example as any), I am reluctant to regard this as a genuine counter-example to the inference above, since the inference is intended to apply only to nouns which have (or at least could be imagined to have) both kinds of occurrences.

51. There are also other contexts, in which justification is not total justification, but rather something each individual justification already brings with it, at least to some degree (similarly, for 'proof', 'truth' and 'virtue'):

(38) There is virtue in his character.
(39) There is truth in what he said.
(40) There is proof for his theory.
(41) There is justification for the DA's indictment.

(38)-(41) seem to be most naturally read as implying only that there is *some* of the good thing in question. However, there are still important differences between these cases and those of 'hair' and 'beer', in that we would not expect sums and parts of something that is virtue/truth/proof/justification to count as more of the same. Thus, even if used in this latter way, the mass-predicate indicates the success achieved by the individual 'unit' denoted by the count-predicate; there is no reason to expect this success to be preserved when the individual 'unit' is further divided into parts or combined with other 'units' of the same kind.

52. For more discussion of these and related issues, see Laycock (1972), Pelletier (1975), Pelletier & Schubert (1989), Pelletier (1991), et al.

53. For a more detailed discussion of Frege's proposal, in §54 of the *Grundlagen*, on how to distinguish concepts that can be associated with number (e.g. 'moons of Jupiter') from those that cannot (e.g. 'red'), see Koslicki (1997b).

54. Some how-many questions seem to admit of rational numbers as their answers, as in (49) and (50):

(49) How many apples did you eat today?
(50) I ate three and a half apples today.

But (49) is still importantly similar to our previous examples. This similarity can, for instance, be brought out by means of the following (admittedly crude) paraphrase of its answer in (51):

(51) {n[the x's: Are-apples(the x's) & Eat(I, the x's, today)]=3} & {n[the y's: Are-detached-apple-halves(the y's) & Eat (I, the y's, today)]=1}.

Given the paraphrase in (51), (50) says that I ate three things of the kind, apple, and one thing of the kind, apple-half. The three things of one kind and the one thing of another kind do not add up to four things, unless we introduce some covering kind which includes all four of them under it. But such a kind would either be extremely general, such as 'thing', or extremely unnatural, such as 'whole-apple-or-detached-apple-half'. Neither option does justice to our usual practices of counting.

55. The same is true in the case of (42), which can be paraphrased as (57):

(57) How much hair, as measured in individual hairs, is there in your soup?

(44) and (48), on the other hand, cannot be paraphrased as (58) and (59):

(58) How much moon of Jupiter, as measured in individual moons, is there?
(59) How much natural number, as measured in individual numbers, is there?

This difference is presumably due to the fact that the nouns 'moon' and 'number' do not standardly have mass-occurrences, while 'apple' and 'hair' do.

56. For more discussion on measures of amount, see Helen Cartwright (1975) and Parsons (1970), Sect.VII, pp.378-81.

57. I do not mean to rule out a nominalistic analysis of amounts in terms of quantities. Such a reduction could conceivably utilize the notion of a partition of the maximal quantity in question into so-and-so many arbitrary non-overlapping quantities. For instance, the maximal quantity of sugar in the bowl is that quantity which comprises all the sugar in the bowl. If there are four cupfuls of sugar in my bowl, then one of the ways of partitioning the sugar in the bowl is to divide it into (any) four non-overlapping quantities (each of which is of the same amount as one cupful of sugar) which together add up to the maximal quantity. Whatever the merits of such an approach, it is quite compatible with the distinction between cardinality questions and how-much question, as drawn in terms of quantification over particular things of a certain kind. I am quite confident that there would still be a noticable contrast between the four moons of Jupiter and the four cupfuls of sugar in the bowl.

58. Frege (1980), §22, p.28; §25, p.33; §46, p.59.

59. For more on these issues, see Koslicki (1997b).

60. See Cartwright (1970) and subsequent work.

61. An extremely interesting, difficult and important issue on which I have not commented, and which I must leave for another occasion, is that of rigidity. Since the early work on this topic by Kripke and Putnam (cf. Kripke (1971), (1972), Putnam (1975) etc.), it is widely held that, in addition to proper names and indexicals, there is another category of terms that are rigid designators, viz. natural kind terms ('NKTs'). Biological species aside, many of the standard examples for natural kind terms are nouns that have mostly mass-occurrences ('heat', 'light', 'arthritis', 'water', 'gold', etc.). The reader might therefore wonder how the present analysis accounts for the property of rigid designation.

According to the present analysis, nouns in their mass-occurrences function semantically as predicates, as do those in their count-occurrences. Throughout the paper, I characterize the truth-conditions and semantic properties of these predicates in purely extensional terms: a mass-predicate of the form 'is N' is true of something x just in case x is N, and so on. This will do for the kinds of contexts discussed in this paper. To capture the property of rigidity, however, we need to be able to express what it is about the meaning of the NKT that remains *constant* as we we move from world to world. Surely, it is not the extension that remains constant. 'Water', for example, does not denote the very

same spatiotemporal expanse in every possible world in which there is water as it does in the actual world: there could have been more or less water; different water; or no water at all. This seems to require that we extend our semantic vocabulary to something more than the individual things that fall in the extension of a predicate. But what other candidates are there? As indicated in Forbes (1981) (following a suggestion by Donnellan), the kind of proposal that first comes to mind—an abstract property of some sort (e.g. the property of being water)—may not be without its problems. However, the difficulty of how to account for the rigidity of general terms is not peculiar to nouns in their mass-occurrences, but arises across the board. In (i) 'Humans descend from apes', for example, both 'human' and 'ape' have a count-occurrence. If (i) expresses an essentialist claim about humans (and apes), what is it that stays the same from world to world? As in the case of 'water' and 'gold', it cannot be the extension, as there could have been more or fewer humans, different ones, or none at all. Thus, we run into the same problem with nouns in their count-occurrences: a first-order language apparently does not suffice to capture the rigidity of general terms. This, however, is a topic I must leave for another occasion.

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