Mass Nouns and Plurals[*]

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0. Introduction

0.1. Parallels between plural and mass expressions

Mass and plural expressions show some interesting similarities, suggesting they should be analyzed in a similar way. For example, both exhibit *cumulative reference*, as noted by Quine (1960: 91); that is, they license inferences like those in (1):

(1)   a.   A is water and B is water; therefore A and B together are water.
         b.   A are apples and B are apples; therefore A and B together are apples.

Singular count nouns do not license the same kind of inference; (2) is invalid:
(2) A is an apple and B is an apple; therefore A and B together are an apple.

Singular count nouns instead exhibit *divided reference*; as Quine puts it, "To learn 'apple' it is not sufficient to learn how much of what goes on counts as apple; we must learn how much counts as *an* apple, and how much as another."

In addition, mass and plural nouns may appear (in English) with no overt determiner, while a determiner is normally required for singular count nouns:

(3)   a.   I see water.
         b.   I see horses.
         c.   * I see horse.

To the extent that (3)c. is acceptable, it involves either a conversion of *horse* from a count noun into a mass noun, or a special "telegraphic" style of speech in which determiners are omitted generally.

Determinerless (or "bare") mass and plural noun phrases also show a parallel alternation in interpretation, depending on the predicate with which they combine. If the predicate is *stage-level* (in the terminology of Carlson 1977a,b), the noun phrase is understood as existentially quantified, as in (4)a. and b., which are roughly equivalent to ***Some** water leaked into the floor* and ***Some** raccoons were stealing my corn*, respectively:

(4)   a.   Water leaked into the floor.
         b.   Raccoons were stealing my corn.

If the predicate is *individual-level*, the sentence is understood as drawing a generalization about objects of the kind picked out by the mass or plural noun, as in (5)a. and b.:

(5)   a.   Water is wet.
        b.   Raccoons are sneaky.

If the predicate is *kind-level*, the mass or plural noun is understood as referring to a "kind" of object, and the predicate is applied to this kind collectively, as a whole:

(6)   a.   Water is common.
            b.   Raccoons are extinct.

Parallels such as these have led many semanticists to treat plural and mass expressions together as "non-singular," or even to identify mass nouns with lexical plurals (Chierchia 1998a, 1998b). But it is obvious that mass nouns also show some differences from overtly plural nouns, notably in their inability to combine directly with numerals, and in their selection of other determiners:

(7)   a.   two horses   * two water
        b.   many horses   * many water
        c.   * much horses   much water
        d.   few horses   * few water
        e.   * little horses   little water

An adequate analysis of plural and mass nouns must capture these similarities and differences, while assigning intuitively correct truth conditions to sentences containing plural and mass expressions.

0.2. Issues in what is meant by mass *and* count

The use of the term *mass* in its technical sense in semantics originates with Jespersen (1913, 1924). *Count* is considerably more recent than *mass*; the earliest occurrence I know of is in *Structural Notes and Corpus*, published without indication of authorship by the American Council of Learned Societies (1952); the term seems to have been popularized by Gleason (1955). However, earlier authors did employ comparable terms such as *thing-words* (Jespersen 1913), *bounded nouns* (Bloomfield 1933), or *individual nouns* (Whorf 1941).

Jespersen characterized "mass-words" as "words which represent 'uncountables', that is, which do not call up the idea of any definite thing, having a certain shape or precise limits" (1913: 114), in contrast to thing-words, which represent countable objects. He went on to note various syntactic differences between mass-words and thing-words; but reference to countable or uncountable objects seems to have been the defining distinction.

Jespersen was careful to note that the mass-word/thing-word distinction cross-cuts the distinction between "material" and "immaterial" words, and cited this feature of his terminology as providing an advantage over Sweet's (1892) earlier classification into "class nouns" and

"material nouns." Abstract nouns such as *progress*, *knowledge*, *admiration*, or *safety* were categorized as mass-words.

Bloomfield (1933: 205) partially continued Jespersen's terminology, but distinguished "mass nouns" from "abstract nouns," placing both categories under a more general heading of "unbounded nouns," in opposition to "bounded nouns." Abstract nouns, such as *life*, denote things which "exist only as the demeanor (quality, action, relation) of other objects," while mass nouns, such as *milk*, denote things which "exist independently."

The use of the term *mass* was imported from linguistics into philosophy by Quine (1960), and although Quine cited Jespersen and was careful to stress that the distinction between count and mass terms was not in the "stuff" they denote, but only in whether they show cumulative or divided reference, much of the subsequent philosophical literature has construed *mass term* so narrowly as to include only those words which serve as names for physical substances, and not abstract nouns like *progress* or *admiration*. But many authors, both in linguistics and philosophy, use *mass* in Jespersen's broader sense which includes some abstract nouns. This variation in what is meant by *mass* leads some writers to eschew the term entirely, preferring *non-count* as more clearly including abstract examples (e.g. Payne & Huddleston 2002, Laycock 2006).

A related issue is whether the term *mass* should be understood broadly enough to include some morphologically plural examples. Jespersen argued that a wide range of plural nouns were actually mass, including examples such as *victuals*, *oats*, *brains* (in the sense exemplified in *blow out somebody's brains*), *dregs*, *lees*, *proceeds*, *measles*, *mumps*, *hysterics*, *blues*, *creeps*, and others. We may note that these impose plural agreement on the verb, but (under the relevant reading) combine with *much* rather than *many*:

(8)   a.   In this kind of work, brains **are** less important than guts.
         b.   It doesn't take **much** brains to figure this out.

Here again Bloomfield (1933) introduced a shift in terminology, stipulating that mass nouns "have no plural," without providing discussion of Jespersen's examples; the idea that mass nouns are always singular has been part of conventional wisdom ever since. Plural mass nouns have been periodically rediscovered (McCawley 1975, Gillon 1992), and are treated in detail in Ojeda (2005). Some authors (e.g. Gleason 1965: 135) consider such examples to be neither count nor mass, but a third category.

Even if we recognize some morphologically plural examples as mass nouns, it should be noted that they, like morphologically singular mass nouns, lack a number distinction; in these examples it is simply the singular which is "missing" rather than the plural.

A separate issue is whether *count* and *mass* are categories of linguistic expressions, or rather of occurrences of linguistic expressions, or of senses of linguistic expressions, etc. The choice among these will not matter much for our purposes here; see Pelletier & Schubert (2002) for discussion. But we should explicitly recognize that a single form may sometimes be used as a mass noun, and sometimes as a count noun. *Beer*, for example, is ordinarily mass, but may be

used as a count noun to refer to individual servings of beer, or to kinds of beer; many other mass nouns show a similar alternation. Conversely, any more-or-less concrete count noun may also be used as a mass noun if one imagines the objects it denotes being put through a "universal grinder," as suggested by Pelletier (1975); after putting a steak (count) through the grinder, "there is steak all over the floor" (mass).

A final issue in what is meant by the terms *mass* and *count* is whether they apply to nouns and noun phrases (or DPs) only, or also to verbs, adjectives and other predicates as well. Some analogues to the mass-count distinction have been noticed in these other categories, and will be discussed in Section 4.

1. Issues in the denotation of mass and plural NPs

By an "NP" we here mean a phrase consisting of a common noun, possibly with complements or modifiers, but excluding any determiner; for example *water*, *horse*, *books written by Mark Twain*, etc., but not *that water*, *a horse*, or *all books written by Mark Twain*. We turn to phrases including the determiner in Section 2. For the sake of discussion, we assume in this section that NPs are predicates, and hold or fail to hold of groups and/or individuals; we turn to the idea that NPs may sometimes serve as something like the name of a kind in Section 2.1.

1.1. Approaches to plural denotation

Most analyses assume that plural nouns (and other plural predicates) hold true of collective objects of some sort, which I will here call "groups." (Readers are cautioned that *group* has a more specific technical sense in some work, especially that derived from Link 1984, Landman 1989a, 1989b, 2000.) Thus, a plural noun such as *horses* will hold true of groups of horses just as a singular noun like *horse* holds true of individual horses. Assuming the denotation of a predicate is the set of things of which it holds true, a plural noun will then denote a set containing groups.

Under this assumption, the issue arises of what, exactly, a "group" is. One option is to identify groups with *sets*. However, some authors object to this identification on the grounds that sets are abstract mathematical objects, while the denotata of plural nouns may be concrete (Burge 1977, Blau 1981, Link 1983, 1984). As Link (1984: 247) puts it, "If my kids turn the living room into a mess I find it hard to believe that a set has been at work, and my reaction to it is not likely to be that of a singleton set…" However, Black (1971) has argued that regarding the referents of plural terms as sets actually clarifies, rather than distorts, the notion of a set; and in any case not everyone shares the intuition that sets of concrete objects are themselves abstract (Cresswell 1985, Landman 1989a).

If groups are not identified with sets, they are usually taken to be concrete particulars of some sort — what are often called "plural individuals," though this is quite a departure from the meaning of the word *individual* in ordinary, non-technical usage. The group of John and Mary, for example, would be identified with a complex, spatially scattered individual with John and Mary as parts; or, as it is usually termed, the *sum* of John and Mary, which we may notate 'j+m'.

Exactly how the parts of a sum relate to the sum itself depends on the details of one's theory of mereology; but typically, it is assumed that the sum operation is associative, so that $(a+(b+c)) = ((a+b)+c)$. The sum operation differs in this respect from set-theoretic pairing, since $\{a,\{b,c\}\} \neq \{\{a,b\},c\}$ (where a, b, and c are distinct). This allows us a way of distinguishing the two approaches to the representation of groups completely independently from issues of abstractness and concreteness. This difference will play a role particularly in the analysis of distributivity (Section 3).

Another line of analysis denies that plural NPs (and other plural predicates) hold true of groups at all. Reference to groups is avoided by locating the plurality in the denotation relation itself, rather than in the denoted object. This idea can be worked out in various ways; major references include Boolos (1984, 1985a, 1985b), Schein (1993), Oliver & Smiley (2001, 2006), Rayo (2002), Yi (2005, 2006), McKay (2006), Linnebo (2008), Linnebo & Nicolas (2008).

The exact semantics of plural NPs is not uniform across these proposals (and not always made explicit), but an illustrative treatment of plural predication in this general approach may be given by considering a revision to the standard notion of *satisfaction*. In the usual semantics for a language with variables, interpretation is relative to an assignment function, which assigns exactly one value to each variable. In developing a system with plural variables, rather than assigning each plural variable exactly one "group" as its value, we might instead allow assignments to be relations rather than functions, so that an assignment might match a given variable with more than one value. Then a formula containing a plural variable might be satisfied by an assignment which gives multiple values $a_1,\ldots,a_n,\ldots$ to this variable, without being satisfied by assignments which give the set of all these values $\{a_1,\ldots,a_n,\ldots\}$ as the (sole) value for the same variable, or by assignments which give any one of those values a_i as the (sole) value for the same variable. The plurality is located in the assignment relation itself, rather than in the assigned value. Predication in general can be treated as satisfaction; adopting this technique in effect allows an argument place to be saturated simultaneously by more than one individual, rather than by the group containing those individuals.

The primary advantage of such a technique is that it allows an analysis of phrases like *the sets which do not contain themselves* which does not give rise to Russell's paradox; see the references above for details.

Regardless of whether one analyzes plural NPs as satisfied by sets, or sums, or simultaneously by multiple individuals, certain more purely descriptive, theory-neutral issues must be addressed. In what follows I will, for convenience, continue to phrase these issues in terms of the "groups" denoted by a plural NP, but essentially the same questions arise in a groups-free approach; readers who prefer such an approach are invited to rephrase the discussion accordingly.

Prominent among these issues is the question of how the denotation of a plural noun relates to the denotation of the corresponding singular. A natural assumption to make is that the plural noun holds true of all and only the groups of objects of which the corresponding singular noun holds true; so that *horses*, for example, will hold true of all and only the groups whose members are individual horses. Note that this directly predicts that plural nouns will have cumulative

reference, on the plausible assumption that for any groups A and B, there is a group whose members include all and only the members of A and the members of B.

However, if we take seriously the idea that a group must contain more than one member, this idea runs into immediate problems with quantificational examples using the determiner *no* (Schwarzschild 1996: 5). Intuitively, a sentence of the form *No A B* is true iff there is nothing of which both *A* and *B* are true. For example (9) should be true only if there is nothing of which *horses* and *in the corral* both hold true.

(9)   No horses are in the corral.

But suppose there is only one horse. Then there are no groups containing more than one horse, so by our assumption that plural nouns hold only of groups, *horses* does not hold true of anything. This renders (9) automatically true, even if the one horse is in the corral — obviously the wrong result.

This problem is easily solved if we allow plural NPs to hold of individuals, and not just groups. In particular, a plural NP should hold of all the same individuals as the corresponding singular, as well as all groups of such individuals. Then in the case where there is only one horse, the plural noun *horses* will hold true of it, and (9) is correctly predicted to be false if the horse is in the corral.[1]

Adopting such a principle raises the issue of what the "corresponding singular" is for a plural NP, and it must be admitted that there need not always be a corresponding singular, either because of a lexical gap, as in cases like *cattle* or *police*, or because the NP is built up compositionally from a constituent plural noun and its modifiers or complements, rather than pluralized directly from a singular NP, as in *people who owned this car*. We cannot treat this as holding of exactly those individuals who owned the car, and all groups of such individuals, since the car may have been owned collectively by a group. Rather, we take *people* to hold of all individual people and groups of people, and *who owned this car* to hold of all groups and individuals who owned the car, and let the whole phrase hold of those groups and individuals who meet both conditions.

1.2. Approaches to mass denotation

A mass noun like *water* is frequently assumed to hold true of all and only the individual portions of water — with no assumption that an individual "portion" must be physically separated in any way. Thus, *water* will hold of the water in the top half of my glass, as well as the water in the bottom half, and the water in the top three quarters, and the water occupying the glass as a whole. Nor need portions be physically contiguous; the water in two separate glasses

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[1] Chierchia (1998b) defends the idea that plural nouns hold only of groups by assigning a more complex denotation to *no*: Rather than taking *no*(A,B) as true iff A and B do not overlap, he takes it as true iff $\pi(A)$ and B do not overlap, where $\pi(A)$ is the set of all subsets and members of the union of all groups in A (and singletons of members of A). But in the case just described, the plural noun denotation A is empty, so this more complex procedure gains us nothing; incorrect truth conditions are still assigned.

may be considered together as a portion of water, of which the noun *water* holds true. Assuming, then, that for any two portions A and B, there is a portion A+B consisting of them, we may stipulate that mass nouns are cumulative, holding of A+B whenever they hold of A and of B.

Since plurals also show the cumulative reference property, this will not distinguish mass nouns from plurals, or explain the differences between them, such as the ability of plurals but not mass nouns to combine with numerals. It is therefore sometimes assumed that mass nouns, but not plurals, show *distributive reference*, also sometimes known as *divisive reference* (not to be confused with Quine's *divided reference*) or *Cheng's condition* (after Cheng 1973): If a mass noun holds of A, and B is a part of A, then the mass noun holds of B as well.

Some analyses go further, and require that mass nouns be *non-atomic*; that is, that for each A of which the mass noun holds, there is some B which is a proper part of A, of which the mass noun also holds. This implies that mass noun denotations have no minimal parts; one may "divide" them without limit.

If a noun's denotation is cumulative, distributive, and non-atomic, we may call it *continuous*. Much of the attraction of analyzing mass nouns as denoting continuously is that it offers an explanation for why mass nouns do not combine with numerals: One may divide their denotations in any arbitrary fashion into any number of parts, so there is no basis for counting.

Unfortunately, a condition requiring continuous denotation does not achieve even initial plausibility in the case of complex mass NPs like *water covering the floor*, since some water could easily cover the floor without all its parts covering the floor. Yet such complex mass NPs fail combine with numerals and other count determiners, just as simple mass nouns do.

Moreover, it is quite debatable whether even lexical mass noun denotations are really non-atomic; the individual hydrogen and oxygen atoms constituting an H_2O molecule would not seem to be water, for example. (It should be cautioned that the issue here is not whether they would be water if separated from each other and released as gas, but whether they are water when still part of the H_2O molecule — perhaps a trickier issue.) One may claim that even if mass noun denotations are not actually continuous, the language portrays them as if they were (see especially Bunt 1985); but this would seem to imply that much of our ordinary talk using mass nouns is literally false, a consequence many semanticists would want to avoid.[2]

A different approach to semantically distinguishing count and mass nouns is to regard the mass nouns as holding of portions of material, while count nouns hold of more abstract objects constituted of that material. Link 1983 is a particularly influential proponent of this approach.

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[2]It may also be objected that certain highly general count nouns like *thing* or *event* would also seem to allow arbitrary divisions of their denotations; but the ease with which these nouns combine with numerals suggests that the pragmatic context may provide some more specific division on any occasion of use, so that their denotations in context are not actually continuous.

This way of drawing the distinction allows an easy solution to the "gold ring" paradox: It may be that a ring is gold, and that the ring is new, but that the gold is old. If we distinguish between the ring and the gold which constitutes it, there is nothing to prevent one from being new and the other from being old.

The philosophical merits of claiming that physical objects like rings are distinct from the portions of material of which they are constituted may be debated. But in addition, the proposal makes sense only under the very narrowest construal of the term *mass noun*, under which it refers only to those nouns which can function as names of physical substances. Even though *chair* is a count noun and *furniture* is, by most definitions, a mass noun, one hesitates to say that chairs are constituted of furniture in the way that rings are constituted of gold, or that a chair can be new while the furniture it is constituted of may be old.

A third approach to the semantics of the mass-count distinction, advanced especially by Chierchia (1998a, 1998b), is to claim that mass nouns are essentially just lexical plurals, so that the part/whole relation on the denotata of mass nouns coincides with the subgroup relation on the denotata of plurals. Under Chierchia's approach, a mass noun like *change* is (nearly) identical in denotation to the plural noun *coins*; the mass noun *footwear* is (nearly) identical in denotation to *shoes*, etc.

An analysis which drew no distinction at all between mass nouns and lexical plurals would face several problems: First, there are clear examples of lexical plurals which are not mass, such as *police* and *cattle*. Second, mass nouns and plurals do not combine with the same determiners, and may not give equivalent truth conditions even when they do. (*Most change is copper*, for example, may be understood as claiming that the copper coins exceed the other coins in some measure such as weight or volume, while *Most coins are copper* requires more specifically that the total number of copper coins exceeds the number of other coins.)

Chierchia's proposal addresses challenges like these by allowing that mass nouns are not in fact completely indistinguishable in denotation from plurals: plural nouns hold only of groups and never of individuals, while mass nouns may hold of both. But as pointed out in Section 1.1 above, claiming that plural nouns cannot hold of individuals makes the semantics of determiners like *no* highly problematic; until an adequate solution to this problem is offered, this general strategy for representing the mass-count distinction must be regarded as questionable.

A fourth approach to the semantics of mass NPs treats them not as predicates at all, but as singular terms denoting sums. *Water*, for example, would not be treated as a predicate holding true of all individual portions of water, but instead as something like a name, denoting the sum or fusion of all such portions. The inability of mass NPs to combine with numerals can then be explained in the same way as the inability of proper names to combine with numerals: it makes no sense to count a single object, as opposed to a set.

The analogy to proper names must not be pushed too far, since proper names have little or no ability to combine with quantifiers, while mass NPs combine with a wide variety of quantifiers, including some which are dedicated just to this purpose. But as stressed by Roeper (1983), Lønning (1987), Higginbotham (1994), this approach can explain a number of otherwise

puzzling facts about mass quantification, if we assume that the domain of possible mass NP denotations forms a Boolean algebra; this is discussed in Section 2.2 below.

2. Issues in the denotation of mass and plural DPs

By a "DP" we mean a phrase consisting of an overt or covert determiner, together with an NP, such as *that water*, *a horse*, or *all books written by Mark Twain*.[3] In this section we also discuss the semantics of plural and mass NPs when these are analyzed as serving directly as arguments to a verb or other predicate.

2.1. Bare plurals and mass nouns

As already mentioned in Section 0.1, plural and mass nouns are distinguished from singular count nouns in English by their ability to appear "bare," with no overt determiner; and show a parallel alternation in interpretation among existential, generalizing, and kind-level readings, depending on the type of predicate with which they combine (illustrated in (4) to (6) above).

The starting point for most modern literature on this pattern is Carlson (1977a,b), which argued that bare plurals and mass nouns are interpreted unambiguously as something like proper names of kinds.

In this analysis, the existential interpretation exhibited in examples like (4) is not due to a different reading of the bare NP, but is built into the semantics of the predicate with which it combines: We relate each kind to the "stages" which realize it via a relation R, then represent *were stealing my corn*, for example, as $\lambda x \exists y[\text{R}(x,y)\ \&\ \textit{stealing-my-corn}(y)]$. This predicate can then apply to the kind "raccoons" collectively, to yield truth conditions to the effect that there is at least one realization of this kind that was stealing my corn.

Likewise, individual-level predicates like *are sneaky* are analyzed as containing a hidden generic operator, allowing them to take kinds as arguments while generalizing about the individuals realizing those kinds, as in (5). (Carlson 1989 replaces this operator with one taking scope over entire sentences.) Kind-level readings like those in (6) result from a straightforward application of the predicate to its argument, with no hidden quantification.

A major argument for this approach is that it correctly predicts that the existential quantifier associated with bare plurals and mass nouns always takes the narrowest possible scope. Thus (10)a. has only the reading which allows everyone to have read different books about caterpillars, while (10)b. is ambiguous, and admits a reading which requires everyone to have read the same book about caterpillars — an unexpected difference if the bare plural *caterpillars* expressed existential quantification as part of its internal semantics:

(10)   a.   Everyone read books about caterpillars.
       b.   Everyone read a book about caterpillars.

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[3]The term 'DP' is usually understood as implying that the determiner is the head of the phrase, but this assumption will not play a significant role in our discussion.

A second argument comes from the fact that kind-level, individual-level and stage-level predicates can be conjoined to take a single bare plural or mass argument:

(11)   Raccoons are widespread, sneaky, and have been stealing my corn.

If bare plurals were treated as ambiguous between existential, generalizing and collective readings, examples like this would seem to impose conflicting requirements on how to interpret the bare plural subject; but if bare plurals are unambiguously kind-denoting, such examples are expected.

A popular alternative analysis, developed in Wilkinson (1991), Krifka & Gerstner-Link (1993), and Diesing (1992), claims that bare plurals and mass nouns are interpreted as plural indefinites when they combine with stage- or individual-level predicates as in (4) or (5). Indefinites are interpreted as contributing free variables to the semantic representation, with no quantificational force as part of their internal semantics, as in Discourse Representation Theory (Kamp 1981) or File Change Semantics (Heim 1982). The variable contributed by an indefinite may be "accidentally" bound by a quantifier in the surrounding context, such as the adverb *usually* in (12)a., to yield truth conditions represented roughly as in (12)b.:

(12)   a.   Bears usually have blue eyes.
        b.   usually x (bear(x), x has blue eyes)

Or, the variable may be bound by a general operation of existential closure, as in (4). To obtain a generic reading for examples like (5), it is assumed that the variable is bound by a "generic operator" analogous to an adverb of quantification:

(13)   GEN x (raccoon(x), x is sneaky)

In Diesing's version of this proposal, it is claimed that existential closure takes place at the level of VP; bare plural or mass subjects of stage-level predicates are VP-internal (perhaps because the external argument of a stage-level predicate is a Davidsonian event variable, as argued by Kratzer 1995), hence existentially bound. Subjects of individual-level predicates are VP-external, hence available for binding by the generic operator or other quantifiers. On the assumption that quantificational determiners must take scope higher than the existential closure operation on VP, this correctly predicts Carlson's generalization that the existential quantification associated with bare plurals in examples like (10)a. always takes narrow scope.

This approach has an advantage over Carlson's in that it predicts that bare plurals are available for binding by adverbs of quantification, as in (12); such sentences require some extra stipulation if bare plurals are unambiguously kind-denoting. On the other hand, Carlson's analysis has an advantage in predicting the conjoinability of kind-level with stage-level and individual-level predicates, as in (11); if bare plurals combining with stage- and individual-level predicates are indefinite rather than kind-denoting, some extra stipulation must be given for these examples.[4]

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[4]Chierchia (1998a) gives additional arguments defending a Carlsonian analysis over this kind of alternative.

A syntactic issue regarding bare plurals and mass nouns is whether they are DPs with an implicit determiner, or simply NPs serving directly as arguments to the verb, with no determiner at all, implicit or explicit. If the latter, it may be necessary to allow that NPs may serve as something like names of kinds. This would force a revision to much of our discussion in Section 1, where it was assumed that NPs were predicates.

Chierchia (1998a,b) suggests that this is a point of parametric variation among languages: In languages like Chinese or Japanese, NPs are unambiguously kind-denoting, so that all NPs may appear bare. To combine such NPs with a determiner requires application of a predicate-forming operation, whose output, Chierchia suggests, is mass; this predicts that in such languages, NPs in general cannot be combined directly with numerals, but require classifiers. In contrast, NPs in languages like French are unambiguously predicates, and never function as names of kinds; the prediction is that French NPs may not appear without a determiner. Languages like English allow NPs to function both as predicates and as names of kinds, according to whether they are count or mass. Mass nouns may thus appear bare, while (singular) count nouns may not. Plural marking on a count noun serves to form the name of a kind from a predicate, allowing plurals to appear bare as well.

2.2. Quantified plurals and mass nouns

Plural DPs with quantificational determiners such as *many*, *few*, *most*, *all*, etc. differ from singular DPs in allowing quantification over groups. But there appear to be several different kinds of quantification over groups involved, and trying to give a unified account of all of them is a significant theoretical challenge.

First, many plural quantifiers allow a reading which involves existential quantification over groups of a size given by the determiner. With certain quantifiers, this reading is most natural when the determiner heads a partitive construction:

(14)   a.   Most of the students gathered in the hallway.
        b.   Many of the students gathered in the hallway.
        c.   All of the students gathered in the hallway.

Sentence (14)a., for example, may be paraphrased as "A group consisting of most of the students gathered in the hallway"; analogous paraphrases are available for the other examples.

Similar readings are available for non-partitive constructions, but at least with some determiners, many speakers find these slightly degraded in comparison to partitives:

(15)   a.   ? Most students gathered in the hallway.
        b.   ? Many students gathered in the hallway.
        c.   ? All students gathered in the hallway.

Other determiners allow this reading naturally even in non-partitives:

(16)   a.   Fifty students gathered in the hallway.

b.   The students gathered in the hallway.

Existential quantification over groups of the size given by the determiner gives the wrong results for determiners like *few*, *exactly fifty*, and other non-monotone-increasing quantifiers. Sentence (17), for example, does not mean that at least one group consisting of few students gathered in the hallway, but rather that the total number of students who gathered in the hallway is few; (17)b. does not mean that at least one group of exactly fifty students gathered in the hallway, but rather that the total number of students that gathered in the hallway was exactly fifty:

(17)   a.   Few of the students gathered in the hallway.
        b.   Exactly fifty students gathered in the hallway.

To obtain correct results in examples like these, the determiner should be analyzed as placing a cardinality restriction on the maximal group satisfying both the NP and the predicate, so that *exactly fifty*, for example, denotes $\lambda X \lambda Y[|\cup(X \cap Y)| = 50]$, where X and Y range over sets of groups.

An interesting observation due to Dowty (1986), made originally with respect to *all* but equally applicable to many other plural quantificational determiners, is that they do not combine naturally with predicates expressing pure cardinality:

(18)   a.   ?? Most of the students are numerous.
        b.   ?? Many of the students are numerous.
        c.   ?? All of the students are numerous.

Dowty suggests that although predicates like *gather* hold only of groups and not individuals, they have "distributive subentailments" concerning the individual members of those groups. If a group gathers in the hall, for example, individual members of the group must come into the hall and remain there long enough that they are all present at a common time. In contrast, a predicate like *be numerous* carries no (non-trivial) entailments about the individual members of the groups of which it holds. The determiner *all* in examples like (14)c. serves to indicate that the subentailments of the predicate hold of each individual member of the group; thus *All of the students gathered in the hallway* requires that each individual student come into the hallway, while *The students gathered in the hallway* permits exceptions. Because *be numerous* does not carry any distributive subentailments for *all* to operate on, (18)c. is anomalous. An analogous explanation could presumably be given for the contrasts between (14)a. and (18)a., and (14)b. and (18)b.

A different kind of quantification over groups is noted by Link (1987). Sentence (19), for example, seems to involve universal quantification over groups of competing companies:

(19) All competing companies have common interests.

In this sort of example, the correct results may be obtained straightforwardly by assigning the determiner its usual semantics in Generalized Quantifier Theory, and letting plural NPs and VPS denote sets containing groups. We let a group be in the denotation of *competing companies* iff its members are companies in competition with each other, and a group be in the denotation of

have common interests iff its members have common interests with each other; the determiner *every* indicates that the former set is a subset of the latter.

However, it should be noted that this kind of reading is generally only available when the NP contains a modifier such as *competing* which forces the NP to hold only of groups. Indeed, if neither the NP nor the VP forces a collective reading, most quantifiers, even if morphologically plural, are most naturally interpreted as quantifying simply over individuals:

(20)   a.   Most students wrote a good paper.
        b.   Few students wrote a good paper.

Sentence (20)a., for example, means that the majority of individual students wrote a good paper and (20)b. that few individual students did so.

The definite determiner allows a collective reading even without such modification, as do numerals:

(21)   a.   The students wrote a good paper.
        b.   Three of our students wrote a good paper.

One natural interpretation of (21)a. is that the students collaborated in writing a good paper, for example.

If the predicate holds only of groups but the NP does not, the result is slightly anomalous with determiners like *most*, *many*, etc., but allowed with *the* or numerals, as pointed out above in connection with (15) and (16).

As noted by Scha (1981), if more than one plural quantifier is present in a clause, a reading is available involving "cumulative quantification" (not to be confused with the "cumulative reference" property discussed in Section 0, above). Sentence (22), for example, has a reading which claims that the total number of Dutch firms that have an American computer is 600, and the total number of American computers owned by a Dutch firm is 5000:

(22)   600 Dutch firms have 5000 American computers.

Roberts (1987: 148ff.), following unpublished work by Partee, suggests that the cumulative reading is just a special case of an ordinary collective reading in which the predicate takes two groups as arguments, so that (22) means simply a group consisting of 600 Dutch firms stands in the "have" relation to a group of 5000 American computers. But as van der Does (1993:545) points out, this approach does not extend properly to sentences containing certain determiners.[5] There seems no way, for example, to obtain the relevant truth conditions for (23) if we interpret the quantifiers according to their usual semantics and assign them scope in the usual way:

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[5] The problematic cases appear to be the non-monotone-increasing quantifiers, as noted by van der Does and also by Schein (1993: 167). However, the precise identification of the problematic class depends in part on whether we regard the cumulative interpretation strictly as a separate reading, or as a special case of some more general reading.

(23)   Fewer than 600 firms own fewer than 5000 computers

Scha's semantics for this sort of example requires an unusual syntactic analysis in which the two determiners combine to form a "compound numerical": in (22), for example, *600* and *5000* combine to form an expression denoting $\lambda R[|proj_1(R)|=600 \ \& \ |proj_2(R)|=5000]$, where $proj_n$ maps a relation onto the projection of its nth argument place.   The two NPs also combine to form a "compound noun," denoting the Cartesian product of the denotations of the NPs which combine: DF×AC. The compound numerical combines with the compound noun to form a complex DP or "noun phrase sequence" denoting $\lambda R[|proj_1(\{<x,y>\in DF\times AC|R(x,y)\})|=600 \ \&$ $|proj_2(\{<x,y>\in DF\times AC|R(x,y)\})|=5000]$. This may then combine with the 2-place predicate *own* to give the desired truth conditions.

Although the need for compound determiners roughly analogous to what Scha suggested has been independently argued in Higginbotham & May (1981) and related work, many semanticists have viewed this proposal as non-compositional, and a variety of subsequent proposals have been made to interpret such sentences while retaining a more intuitive constituency.

One family of analysis uses special mechanisms to pass information up the tree which would be lost in ordinary semantic composition: Van der Does (1992) employs product types to allow access to NP denotations above the level of the DP, together with several type-shifting operations. Landman (2000) proposes a complex system in which multiple semantic representations are derived in parallel, then combined to form the asserted content of the sentence as a whole. A different family of solutions treats this as an example of branching quantification (Westerståhl 1987, Sher 1990); this requires extending the definition of branching quantification beyond the standard semantics given in Barwise (1979). Schein (1993) appeals to a neo-Davidsonian theory of thematic relations: each argument of the verb corresponds to a separate clause in logical form, over which the corresponding quantifier may take scope; the subject and object quantifiers thus remain scopally independent of one another. The choice among these analyses is a major unresolved issue in the semantics of plurality.

Quantified mass DPs generally fall into two patterns: In the first, a bare mass DP combines with a measure phrase or classifier to form a complex count NP, which may then combine with an ordinary count determiner, as in *two liters of water*, *every loaf of bread*, etc. In the second, the mass NP combines directly with a determiner without a measure phrase or classifier, in which case a mass determiner is required: *much water*, *all bread*.

Measure expressions such as *liter* or *loaf* are most often analyzed in terms of *measure functions*, that is, functions from individuals to real numbers. As stressed by Lønning (1987), Krifka (1989), Schwarzschild (2002), this kind of quantification requires *additive* measure functions, meeting the condition that whenever x and y do not overlap, $f(x+y) = f(x)+f(y)$. (Hence **fifty degrees Celsius of water*.)

Where **liter** is the function mapping portions of material onto their volume in liters and R relates kinds to their realizations as in Section 2.1 above, we may analyze the measure word *liter*, for example, as denoting $\lambda k\lambda n\lambda x[R(k,x) \ \& \ \textbf{liter}(x) = n]$. T*wo liters of water* will therefore denote $\lambda x[R(water,x) \ \& \ \textbf{liter}(x) = 2]$, the set of individuals realizing the kind "water" and

measuring two liters. Note that in this analysis, the numeral *two* is not analyzed as a quantificational determiner, but as something more like a proper name denoting the number 2, and serving as an argument of *liter*.

Alternatively, we might treat *liter* as denoting $\lambda k\lambda x[R(k,x) \ \& \ \mathbf{liter}(x) = 1]$, so that *liters of water* simply denotes the set of 1-liter volumes of water. (This option must probably be available anyway, to handles examples like *every liter of water*.) We might then allow this to combine with the ordinary determiner *two*; but since every 2-liter volume of water contains many more than two 1-liter volumes of water, this will not give the right results unless we adopt some sort of non-overlap condition, either by revising the semantics or as part of the pragmatic background.

This use of measure functions is extended to noun classifiers of the kind exemplified in Chinese, Japanese and other East Asian languages in Krifka (1995). Sometimes it is claimed that in these languages, all nouns are mass nouns, since they all must combine with classifiers before they may combine with numerals (Chierchia 1998a, 1998b; Krifka 1999). However, even in classifier languages, some sort of mass/count distinction is often detectable (Hundius & Kölver 1983, Cheng & Sybesma 1999).[6]

Direct quantification of a mass NP, with no measure phrase or classifier, is possible in English using quantifiers such as *much*, *little*, *most*, *all*, etc. As noted by Roeper (1983), Lønning (1987), Higginbotham (1994) and others, we do not obtain correct results by treating mass NPs as predicates holding of individual portions of "stuff" as in Section 1.2 above, and treating these quantifiers as binding variables ranging over these portions. Sentence (24), for example, does not mean that for every x, if x is a portion of phosphorus, then either x is red or x is black, since (24) may be true in the case where some portions are only partly red and partly black.

(24)   All phosphorus is either red or black.

A related observation, first made by Bunt (1979), is that direct mass quantification normally requires not only the NP, but also the scope of the DP to show cumulative and distributive reference:

(25)   a.   Most water is wet.
         b.   * Most water is heavy.

Exceptions to this generalization have been noted and discussed e.g. by Higginbotham (1994); but these may perhaps be regarded as special cases.[7]

Assuming such a restriction, we may define a sum operation on the extensions of cumulative, distributive predicates: let $\sigma xP(x)$ denote the sum of all those objects x of which P holds true, providing P refers cumulatively and distributively; and let $\sigma xP(x)$ be undefined otherwise. We

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[6]The opposite sort of claim, that all nouns are count, is made for Hopi in Whorf (1941).

[7]Of course, the validity of this observation will also depend on the legitimacy of the claim that mass nouns are generally distributive; see Section 1.2 above.

apply this sum operation to both the NP and the verbal predicate before combining them with the mass determiner; in effect this treats the determiner as a relation between sums.

Assuming a Boolean part-whole structure on portions, we may now reconstruct the theory of quantification in this Boolean algebra, rather than the power set algebra of the universe of discourse (Roeper 1983, Lønning 1987, Higginbotham 1994). *All*, for example, may be analyzed as holding between two portions x and y iff x is a material part of y, so that (25)a. is true iff the sum of all water is a part of the sum of all wet material. *Most* may be treated as holding between x and y iff $\mu(x \wedge y) > \frac{1}{2}\mu(x)$, where μ is some pragmatically salient measure function[8] and $\wedge$ is the Boolean meet operation.

2.3. Plural and mass definites and conjunction

A related use of sum operations may be made in the analysis of plural and mass definite DPs and in the analysis of conjoined DPs.

An obvious limitation of Russell's (1905) theory of definite descriptions in terms of unique existential quantification is that it does not apply to plural or mass definites: *The horses are in the corral* does not mean that there is exactly one horse, and *The coffee is in the room* does not mean that there is exactly one portion of coffee (since the coffee in the room may be composed of many smaller portions of coffee). Yet the fact that the same word *the* is used both with singular count NPs and with mass and plural NPs seems no accident; one would hope for a unified semantics.

An idea suggested by Sharvy (1980) and popularized in the linguistics literature by Link (1983), is to replace the Russellian representation of 'The A is/are B' in (26)a. with the adapted representation in (26)b., where '≤' indicates the part-whole relation:

(26) a. $\exists x[A(x) \& \forall y[A(y) \rightarrow x=y] \& B(x)]$
      b. $\exists x[A(x) \& \forall y[A(y) \rightarrow x \leq y] \& B(x)]$

In this analysis, *The coffee is in the room* will be true iff there is a maximal portion of coffee, of which all other portions are part, which is in the room. Assuming that the maximal group of horses has its smaller subgroups and members as parts, *The horses are in the corral* will require this maximal group of horses to be in the corral. But on the assumption that no king of France may contain another as part, *The king of France is bald* will continue to require the existence of a unique king of France: the Russellian truth conditions fall out as a special case.

The maximality condition imposed in this analysis has the effect that the definite description picks out the sum of the extension of the NP, on the assumption that the NP refers cumulatively. If one prefers a presuppositional analysis, the definite determiner may be treated as directly expressing the sum operation, so that 'The A is/are B' is represented as in (27):[9]

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[8]Note that sentences such as *Most of this vodka is alcohol* may vary in truth value depending on whether one measures by weight or by volume.

[9]The sum operation here should not be construed as requiring that A have the distributive reference property, unlike that used at the end of Section 2.2.

(27) $B(\sigma x(A(x)))$

Then *the A* will be undefined when A is not cumulative; for example if it is a singular count noun with more than one element in its extension.[10]

A related idea is frequently invoked in analysis of conjoined DPs, as in (28):

(28)   John and Mary are a happy couple.

The conjunction in this sort of example cannot be reduced in any direct and obvious way to sentential conjunction; (28) does not mean "John is a happy couple and Mary is a happy couple." Instead, most analyses treat the coordinate subject *John and Mary* as referring to the group of John and Mary, and let the predicate *are a happy couple* apply to this group collectively.

Perhaps the simplest way to obtain this result is to treat *and* as ambiguous, between the ordinary truth-functional *and* (or some generalization of truth-functional *and* across a type hierarchy) and a "group-forming" *and* which maps any two individuals to the group consisting of them. This idea dates to ancient times and is represented in the modern literature by Partee & Rooth (1983) and many others; see Lasersohn (1995) for a historical overview.

A number of complications arise in such an analysis. First, "group forming" readings of conjunction are not limited to proper names and other individual-denoting DPs, but also occur with indefinites and other quantificational DPs:

(29)   a.   A man and a woman own this house.
        b.   Every student and every professor met to discuss their plans.

Hoeksema (1983, 1988) discusses ways to adapt a group-forming conjunction operation into Generalized Quantifier Theory and Discourse Representation Theory to deal with such examples.

Another complication is that group-forming *and* must sometimes be done "in the argument places" of NPs or other predicates, as in (30):

(30)   This man and woman are in love.

This can be accomplished by a suitable type-theoretical generalization of the group-forming conjunction operation (Lasersohn 1995, Heycock & Zamparelli 2005).

But perhaps the most unsatisfying feature of an analysis which claims that conjunction is ambiguous between truth-functional and group-forming *and* is the claim that *and* is ambiguous at

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[10] Treating definite DPs as referring to sums (whether in a presuppositional analysis or in a quantificational analysis, as in Sharvy's original proposal) will obviously not be appropriate in a theory which locates plurality in the denotation relation rather than the denoted object, such as that of Boolos (1984, 1985a, 1985b), discussed in Section 1.1 above; but Brogaard (2007) shows how to adapt a Sharvy-style analysis of definiteness to this framework.

all. The putative ambiguity is too systematic and too common cross-linguistically to be accidental; an analysis should at least make clear what these readings have in common which leads them naturally to be expressed by the same lexical item, and ideally should unify their semantics completely.

Lasersohn (1992, 1995) argues that examples like (31) require that the conjunction be analyzed in terms of a group-forming operation on events, and from here that verbal and sentential conjunction in general can be assimilated to group-forming conjunction:

(31)   This refrigerator runs alternately too hot and too cold.

Winter (2001) argues for an assimilation in the opposite direction, noting that if one treats proper names as generalized quantifiers in type <<e,t>,t> and allows them to conjoin using the cross-categorial generalization of ordinary truth-functional conjunction in the style of Partee & Rooth (1983), then *John and Mary* denotes the set of sets containing John as a member and Mary as a member; the group of John and Mary is recoverable from this set through a simple type-shifting operation. Conjunction itself is therefore treated as unambiguous; the collective reading is obtained by applying this type-shifting operation to the ordinary conjunction of *John* and *Mary*.

3. Collective and distributive readings.

An important observation about sentences containing plural or conjoined DPs is that they may be understood either *collectively*, as in (32)a. and (33)a., or *distributively*, as in (32)b. and (33)b.:

(32)   a.   Our problems are numerous.
        b.   The children are asleep.

(33)   a.   John and Mary are a happy couple.
        b.   John and Mary are asleep.

Sentence (32)a. means that our problems, taken together as a group, are numerous — no individual problem is numerous — and (33)a. means that John and Mary together form a happy couple, not that they each do. In contrast, (32)b. entails that the individual children are asleep, not that the group is somehow asleep without its members being asleep, and (33)b. is interpreted in the same way.

The availability of these collective and distributive interpretations depends in large part on the predicate. Certain predicates, such as *be asleep*, cannot hold of a group without holding of the individual members of the group; others, such as *be numerous*, cannot sensibly apply to an individual.

A third class of predicates may apply both to groups (without necessarily applying to their members) and to individuals: *draw a picture*. Sentences containing this third class of predicates may be understood either collectively or distributively. Hence (34) can mean either that each individual child drew a picture, or that the children collaborated in drawing a picture together:

(34)   The children drew a picture.

In examples with conjoined plural subjects, a distributive interpretation is possible even with predicates which do not sensibly apply to individuals:

(35)   The students and the professors met to discuss the issue.

Sentence (35) may be understood as meaning either that the students met to discuss the issue, and so did the professors; or that the students met with the professors to discuss the issue.

Examples like (35) suggest that distributive interpretations do not necessarily involve application of a predicate to individuals as opposed to groups; but rather, application to the members of the group denoted by the DP, whether these members are themselves groups or individuals. Returning to an issue raised in Section 1.1 above, this supports the idea that group-formation is not associative, since an associative operation does not permit the representation of higher-order groups: Where a and b are the students, and c and d are the professors, ((a+b)+(c+d)) = (a+b+c+d) if + is associative.

The idea that group-formation is associative has been defended in the face of such examples by Schwarzschild (1992, 1996), who argues that the denotations of plural DPs may be analyzed as always having a "flat" structure if interpretation is relativized to a pragmatically established cover of the group denoted by the DP, following Gillon (1987). (A *cover* of a set *S* is a set of subsets of *S* whose union equals *S*.) In this style of analysis, a predicate applies to each cell in a pragmatically salient cover of the group denoted by its plural argument. For example, shoes conventionally come in pairs, so we naturally interpret (36) relative to a cover which divides the set of shoes into matching pairs, yielding a reading that each pair of shoes costs $50, rather than each individual shoe or the group of shoes as a whole:

(36)   The shoes cost $50.

Describing the group whose members are the individual students and the individual professors using a coordinate DP like *the students and the professors* makes salient a cover of this group which divides it into the group of the students and the group of the professors, so that (35) may be interpreted as meaning that the students met, and so did the professors.

It should be noticed that even though a covers-based analysis allows the use of an associative group-formation operation for the denotations of plural DPs, covers themselves have a non-associative structure: {{a}, {b,c}} and {{a, b}, {c}} are both covers of {a, b, c}, but must be distinguished from one another. The need for some technique for representing non-associative groupings seems beyond dispute.

Moreover, a covers-based analysis generates non-existent readings in some cases (Lasersohn 1989). If John, Mary and Bill are the teaching assistants, and earned exactly $7000 each last year, (37) is false, even though each cell in the cover {{John, Mary}, {John, Bill}} earned exactly $14,000:

(37)   The teaching assistants earned exactly $14,000 last year.

Whether distributive interpretations make reference to covers, or simply involve applying a predicate to each member of the group denoted by its plural argument, the issue arises whether the collective/distributive alternation represents authentic ambiguity, or rather a single reading which is general enough to cover both possibilities. Lasersohn (1995) argues for an ambiguity, based on examples like (38):

(38)   a.   John and Mary earned exactly $10,000.
         b.   John and Mary earned exactly $5000.

Suppose John and Mary each earned exactly $5000; then both (38)a. and (38)b. are true. This is easy to explain if there is an ambiguity, since then (38)a. might be true relative to one reading, while (38)b. is true relative to the other. But if there is no ambiguity, we face the paradox that there are two distinct amounts, both of which are *the* exact amount which John and Mary earned — without claiming that in one sense, the exact amount was $5000, and in another sense, it was $10,000, since this appeal to different senses amounts to a claim of ambiguity.

As Roberts (1987) points out, an ambiguity is also helpful in explaining patterns of anaphora. Sentence (39)a. may be interpreted as meaning that John and Mary collectively a piano, that they each lifted the same piano, or that they each lifted a potentially different piano. Only the first two readings may be continued as in (39)b., where *it* is anaphoric to *a piano*:

(39)   a.   John and Mary lifted a piano.
         b.   It was heavy.

If there is no formal difference between collective and distributive readings — in particular if the third reading of (39)a. is not semantically differentiated from the first two readings — it is difficult to see how rules governing the distribution of discourse anaphors could be coherently stated. Gillon (1987) provides additional arguments for an ambiguity.[11]

Given that an authentic ambiguity exists, the issue arises of where in the sentence it is located. Early analyses often took for granted that DPs were ambiguous between collective and

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[11]Moltmann (1997: 52) argues against an ambiguity, based on examples like (i):

(i)   The men lifted the piano individually and together.

The claim is that *lifted a piano* must have a single meaning, compatible with both collective and distributive action, or else it would conflict with one of the adverbs. But this argument only shows that the predicate must have a reading which encodes which individuals and which groups lifted the piano; it does not show that it has a single meaning under which it holds of a group iff that group lifted the piano collectively or each of its members lifted the piano.

distributive readings, but many analyses now attribute the ambiguity to the predicate. A standard argument for this approach, first published in Dowty (1986)[12] comes from examples like (40):

(40)   John and Mary met in a bar and had a beer.

The natural interpretation is that John and Mary met collectively in the bar, but each had a separate beer; if we locate the collective/distributive alternation in the subject DP, this example would seem to impose conflicting requirements on the interpretation of *John and Mary*. But the correct interpretation may be obtained by locating it in the predicates: under its distributive reading, *had a beer* holds of a group iff each of its members had a beer; this predicate may be sensibly conjoined with *met in a bar* to yield a complex predicate applying to the group of John and Mary.

Frequently, distributive readings are attributed to a hidden operator attached to the predicate, following Link (1991), Roberts (1987); predicates may be ambiguous because this operator may be present or absent. Notated '^{D}', this operator may be defined as in (41), where 'yΠx' means that y is a member of group x:

(41) $^DP = \lambda x \forall y[y\Pi x \rightarrow P(y)]$

See Schwarzschild (1996) for an analogous operator making reference to covers. Lasersohn (1998a) generalizes a similar operator type-theoretically to account for distributivity in non-subject argument places.

A collective reading may be forced by modifying a predicate with an adverbial expression such as *together* or *as a group*. As pointed out by Lasersohn (1990, 1995, 1998b), this presents a problem for analyses in which the extensions of distributive predicates are not distinguishable in principle from the extensions of collective predicates. For example, if John and Mary lifted the piano distributively but not collectively, (42) is false; if they each lifted the piano individually and also lifted it collectively, (42) is true. But in either case, the extension of *lifted the piano* would seem to be the set containing John, Mary, and the group of John and Mary — and if the extensions are identical, there is no way for *together* to operate on them differently to provide distinct truth values in the two cases:

(42)   John and Mary lifted the piano together.

Lasersohn suggests that collective and distributive readings may be extensionally distinguished using a hidden event argument, as in Davidson (1967). An event of John and Mary lifting the piano distributively will be composed of smaller events of John lifting the piano and Mary lifting the piano; an event of John and Mary collectively lifting the piano will not. This allows a

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[12]See Lasersohn (1995: 125) for details concerning the origin of this argument. Example (40) is from Lasersohn (1989).

definition of *together* as $\lambda P \lambda g \lambda e[P(g)(e) \ \& \sim \exists e' \exists x[e' \leq e \ \& \ x \neq g \ \& \ P(x)(e')]$.[13] For alternative analyses, see Schwarzschild (1994), Moltmann (1997, 2004).

4. Count and mass in the verbal domain.

   Before concluding, it should be pointed out that various parallels to the count/mass distinction and to the singular plural distinction have been pointed out in the semantics of categories other than NPs and DPs, particularly verbs and adjectives. Bunt (1979) suggests a distinction between count and mass adjectives based on cumulative and distributive reference, and points out that mass nouns are generally constrained to appear with mass adjectives, as discussed in Section 2.2, above. Bach (1986) draws an analogy between the mass/count distinction and the aspectual distinction between telic and atelic event types, a parallel which is exploited in Krifka (1989) to explain the effect of mass or plural arguments of a verb on the aspectual category of a larger verb phrase or sentence in which it appears. Parallels have long been noted between plurality in the nominal system and "pluractional" markers in the verbal system, which attach to a predicate to indicate a multiplicity of events; see Cusic (1981), Lasersohn (1995).

References

Anonymous 1952. *Structural Notes and Corpus: A Basis for the Preparation of Materials to Teach English as a Foreign Language.* Washington, D.C.: American Council of Learned Societies Devoted to Humanistic Studies, Committee on Language Programs.

Bach, Emmon 1986. The algebra of events. *Linguistics and Philosophy* 9: 5-16.

Barwise, Jon 1979. On branching quantifiers in English. *Journal of Philosophical Logic* 8: 47-80.

Black, Max 1971. The elusiveness of sets. *Review of Metaphysics* 24: 614-636.

Blau, Ulrich 1981. Collective objects. *Theoretical Linguistics* 8: 101-130.

Bloomfield, Leonard 1933. *Language*. New York: Holt, Rinehart and Winston.

Boolos, George 1984. To be is to be the value of a variable (or to be some values of some variables). *Journal of Philosophy* 81: 430-449. Reprinted in: G. Boolos, *Logic, Logic, and Logic*. Cambridge, Massachusetts: Harvard University Press, 1998, 54-72.

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[13]The definition given here suffices for the reading of *together* which simply enforces collective predication; it differs slightly from the definitions given in Lasersohn (1990, 1995, 1998b), where a major concern is to give a unified semantics for several different readings of *together*, including spatial and "social accompaniment" readings as in *John and Mary sat together* and *John and Mary went to the movies together*.

Boolos, George 1985a. Nominalist Platonism. *Philosophical Review* 94: 327-344. Reprinted in: G. Boolos, *Logic, Logic, and Logic*. Cambridge, Massachusetts: Harvard University Press, 1998, 73-87.

Boolos, George 1985b. Reading the *Begriffschrift*. *Mind* 94: 331-344. Reprinted in: G. Boolos, *Logic, Logic, and Logic*. Cambridge, Massachusetts: Harvard University Press, 1998, 155-170.

Brogaard, Berit 2007. Sharvy's theory of definite descriptions revisited. *Pacific Philosophical Quarterly* 88: 160-180.

Bunt, Harry C. 1979. Ensembles and the formal semantic properties of mass terms. In: F.J. Pelletier (ed.), *Mass Terms: Some Philosophical Problems*. Dordrecht: D. Reidel Publishing Co., 249-277.

Bunt, Harry C. 1985. *Mass Terms and Model-Theoretic Semantics*. Cambridge: Cambridge University Press.

Burge, Tyler 1977. A theory of aggregates. *Noûs* 11: 97-117.

Carlson, Greg 1977a. *Reference to Kinds in English.* Ph.D. dissertation, University of Massachusetts, Amherst. Reprinted: New York: Garland Publishing, 1980.

Carlson, Greg 1977b. A unified analysis of the English bare plural. *Linguistics and Philosophy* 1: 413-457.

Carlson, Greg 1989. On the semantic composition of English generic sentences. In: G. Chierchia, B.H. Partee & R. Turner (eds.), *Properties, Types and Meaning, Volume II: Semantic Issues*. Dordrecht: Kluwer Academic Publishers.

Cheng, Chung-Ying 1973. Comments on Moravcsik's paper. In: K.J.J. Hintikka, J.M.E. Moravcsik & P. Suppes (eds.), *Approaches to Natural Language: Proceedings of the 1970 Stanford Workshop on Grammar and Semantics*. Dordrecht: D. Reidel Publishing Co., 215-220.

Cheng, Lisa Lai-Shen & Rint Sybesma 1999. Bare nouns and not-so-bare nouns and the structure of NP. *Linguistic Inquiry* 30: 509-542.

Chierchia, Gennaro 1998a. Reference to kinds across languages. *Natural Language Semantics* 6: 339–405.

Chierchia, Gennaro 1998b. Plurality of mass nouns and the notion of "semantic parameter". In: S. Rothstein (ed.), *Events and Grammar.* Dordrecht, Boston, London: Kluwer Academic Publishers, 53–103.

Cresswell, Max 1985. Review of Landman and Veltman (eds.), *Varieties of Formal Semantics*. *Linguistics* 23: 626-634.

Cusic, David 1981. *Verbal Plurality and Aspect*. Ph.D. dissertation, Stanford University.

Davidson, Donald 1967. The Logical Form of Action Sentences. In N. Resher (ed.), *The Logic of Decision and Action*. Pittsburgh: University of Pittsburgh Press, 81–95. Reprinted in D. Davidson (ed.), *Essays on Actions and Events*. Oxford: Clarendon Press, 1980, 105–148.

Diesing, Molly 1992. *Indefinites*. Cambridge, Massachusetts: MIT Press.

Does, Jaap van der 1992. *Applied Quantifier Logics: Collectives, Naked Infinitives*. Ph.D. dissertation, University of Amsterdam.

Does, Jaap van der 1993. Sums and quantifiers. *Linguistics and Philosophy* 16: 509-550.

Dowty, David 1986. Collective predicates, distributive predicates, and *all*. In: F. Marshall (ed.), *Proceedings of the Third Eastern States Conference in Linguistics* (= *ESCOL '86*). Columbus: Ohio State University, 97-115.

Gillon, Brendan 1987. The readings of plural noun phrases in English. *Linguistics and Philosophy* 10: 199-219.

Gillon, Brendan 1992. Towards a common semantics for English count and mass nouns. *Linguistics and Philosophy* 15: 597-639.

Gleason, H.A. 1955. *An Introduction to Descriptive Linguistics*. New York: Henry Holt and Company.

Gleason, H.A. 1965. *Linguistics and English Grammar*. New York: Holt, Rinehart and Winston.

Heim, Irene 1982. *The Semantics of Definite and Indefinite Noun Phrases*. Ph.D. dissertation, University of Massachusetts, Amherst. Reprinted: New York: Garland Publishing, 1988.
Heycock, Caroline & Roberto Zamparelli 2005. Friends and colleagues: plurality, coordination, and the structure of DP. *Natural Language Semantics* 13: 201-270.

Higginbotham, James 1994. Mass and count quantifiers. *Linguistics and Philosophy* 17:447-480.

Higginbotham, James & Robert May 1981. Questions, quantifiers and crossing. *Linguistic Review* 1: 41-79.

Hoeksema, Jack 1983. Plurality and conjunction. In: A. ter Meulen (ed.) *Studies in Modeltheoretic Semantics*. Dordrecht: Foris Publications, 63-84.

Hoeksema, Jack 1988. The semantics of non-Boolean 'and'. *Journal of Semantics* 6: 19-40.

Hundius, Harald & Ulrike Kölver 1983. Syntax and semantics of numeral classifiers in Thai. *Studies in Language* 7: 165-214.

Jespersen, Otto 1913. *A Modern English Grammar on Historical Principles, Part II: Syntax (First Volume).* London: George Allen & Unwin, Ltd., and Copenhagen: Ejnar Munksgaard.

Jespersen, Otto 1924. *The Philosophy of Grammar.* New York, London: W.W. Norton & Co.

Kamp, Hans 1981. A theory of truth and semantic representation. In: J. Groenendijk, T. Janssen & M. Stokhof (eds.), *Formal Methods in the Study of Language*, vol. 1. Amsterdam: Mathematisch Centrum, 277-322. Reprinted in J. Groenendijk, T. Janssen & M. Stokhof (eds.), *Truth, Interpretation and Information*. Dordrecht: Foris Publications, 1-42.

Kratzer, Angelika 1995. Stage-level and individual-level predicates. In: G. Carlson & F. Pelletier (eds.), *The Generic Book*. Chicago: University of Chicago Press, 125-175.

Krifka, Manfred 1989. Nominal reference, temporal constitution, and quantification in event semantics. In: R. Bartsch, J. van Benthem and P van Emde Boas (eds.), *Semantics and Contextual Expression*. Dordrecht: Foris Publications.

Krifka, Manfred 1995. Common nouns: A contrastive analysis of Chinese and English. In: G. Carlson & F. Pelletier (eds.), *The Generic Book*. Chicago: University of Chicago Press, 398-411.

Krifka, Manfred 1999. Mass expressions. In: K. Brown & J. Miller (eds.), *Concise Encyclopedia of Grammatical Categories*. Amsterdam: Elsevier, 221-223.

Krifka, Manfred & Claudia Gerstner-Link 1993. Genericity. In: J. Jacobs, A. von Stechow, W. Sternefeld & T. Vennemann (eds.), *Syntax: An International Handbook of Contemporary Research*. Berlin: De Gruyter, 966-978.

Landman, Fred 1989a. Groups, I. *Linguistics and Philosophy* 12: 559-605.

Landman, Fred 1989b. Groups, II. *Linguistics and Philosophy* 12: 723-744.

Landman, Fred 2000. *Events and Plurality: The Jerusalem Lectures.* Dordrecht: Kluwer Academic Publishers.

Lasersohn, Peter 1989. On the readings of plural noun phrases. *Linguistic Inquiry* 20: 130-134.

Lasersohn, Peter 1990. Group action and spatio-temporal proximity. *Linguistics and Philosophy* 13: 179-206.

Lasersohn, Peter 1992. Generalized conjunction and temporal modification. *Linguistics and Philosophy* 13: 381-410.

Lasersohn, Peter 1995. *Plurality, Conjunction and Events*. Dordrecht: Kluwer Academic Publishers.

Lasersohn, Peter 1998a. Generalized distributivity operators. *Linguistics and Philosophy* 21: 83-93.

Lasersohn, Peter 1998b. Events in the semantics of collectivizing adverbials. In: S. Rothstein (ed.), *Events and Grammar.* Dordrecht, Boston, London: Kluwer Academic Publishers, 273-292.

Laycock, Henry 2006. *Words without Objects: Semantics, Ontology, and Logic for Non-Singularity.* Oxford: Clarendon Press.

Link, Godehard 1983. The logical analysis of plural and mass terms: a lattice-theoretical approach. In: R. Bäuerle, C. Schwarze & A. von Stechow (eds.), *Meaning, Use and Interpretation of Language*. Berlin: de Gruyter, 302-323. Reprinted in: G. Link, *Algebraic Semantics in Language and Philosophy*. Stanford, Calif.: CSLI Publications, 1998, 1-34.

Link, Godehard 1984. Hydras: on the logic of relative constructions with multiple heads. In: F. Landman & F. Veltman (eds.), *Varieties of Formal Semantics: Proceedings of the Fourth Amsterdam Colloquium*. Dordrecht: Foris Publications, 245-257. Reprinted in: G. Link, *Algebraic Semantics in Language and Philosophy*. Stanford, Calif.: CSLI Publications, 1998, 77-88.

Link, Godehard 1987. Generalized quantifiers and plurals. In: P. Gärdenfors (ed.), *Generalized Quantifiers: Linguistic and Logical Approaches*. Dordrecht: D. Reidel Publishing Company, 151-180. Reprinted in: G. Link, *Algebraic Semantics in Language and Philosophy*. Stanford, Calif.: CSLI Publications, 1998, 89-116.

Link, Godehard 1991. Plural. In: D. Wunderlich & A. von Stechow (eds.), *Semantics: An International Handbook of Contemporary Research*. Berlin: DeGruyter, 418-440. Reprinted in: G. Link, *Algebraic Semantics in Language and Philosophy*. Stanford, Calif.: CSLI Publications, 1998, 35-75.

Linnebo, Øystein 2008. Plural Quantification. In: Edward N. Zalta (ed.), *Stanford Encyclopedia of Philosophy*, http://plato.stanford.edu/entries/plural-quant/

Linnebo, Øystein & David Nicolas 2008. Superplurals in English. *Analysis* 68: 186-197.

Lønning, Jan Tore 1987. Mass terms and quantification. *Linguistics and Philosophy* 10: 1-52.

McCawley, James 1975. Lexicography and the count-mass distinction. In: Proceedings of the annual meeting of the Berkeley Linguistics Society (=BLS) 1. Berkeley, California: Berkeley Linguistics Society, 314-321. Reprinted in: J. McCawley, *Adverbs, Vowels and Other Objects of Wonder*. Chicago: University of Chicago Press, 1979, 165-173.

McKay, Thomas J. 2006. *Plural Predication*. Oxford: Clarendon Press.

Moltmann, Friederike 1997. *Parts and Wholes in Semantics*. New York, Oxford: Oxford University Press.

Moltmann, Friederike 2004. The semantics of *together*. *Natural Language Semantics* 12: 289-318.

Ojeda, Almerindo 2005. The paradox of mass plurals. In: S.S. Mufwene, E.J. Francis & R.S. Wheeler (eds.), *Polymorphous Linguistics: Jim McCawley's Legacy*. Cambridge, Massachusetts: The MIT Press, 389-410.

Oliver, Alex & Timothy Smiley 2001. Strategies for a logic of plurals. *The Philosophical Quarterly* 51: 289-306.

Oliver, Alex & Timothy Smiley 2006. A modest logic of plurals. *Journal of Philosophical Logic* 35: 317-348.

Partee, Barbara & Mats Rooth 1983. Generalized conjunction and type ambiguity. In: R. Bäuerle, C. Schwarze & A. von Stechow (eds.), *Meaning, Use and Interpretation of Language*. Berlin: de Gruyter, 361-383.

Payne, John & Rodney Huddleston 2002. Nouns and noun phrases. In: R. Huddleston & G. Pullum (eds.), *The Cambridge Grammar of the English Language*, Cambridge: Cambridge University Press, 323-523.

Pelletier, Francis Jeffry 1975. Non-singular reference: some preliminaries. *Philosophia* 5: 451-465. Reprinted in: F.J. Pelletier (ed.), *Mass Terms: Some Philosophical Problems*. Dordrecht: D. Reidel, 1979, 1-14.

Pelletier, Francis Jeffry & Leonard K. Schubert 2002. Mass expressions. In: D. Gabbay and F. Guenther (eds.), *Handbook of Philosophical Logic*, vol. 10. Dordrecht: Kluwer Academic Publishers, 1-87.

Quine, Willard Van Orman 1960. *Word and Object.* Cambridge, Massachusetts: The MIT Press.

Rayo, Agustín 2002. Words and Objects. *Noûs* 36: 436-464.

Roeper, Peter 1983. Semantics for mass terms with quantifiers. *Noûs* 17: 251-265.

Russell, Bertrand 1905. On denoting. *Mind* 14: 479-493.

Scha, Remko 1981. Distributive, collective and cumulative quantification. In: J. Groenendijk, T. Janssen & M. Stokhof (eds.), *Formal Methods in the Study of Language*, vol. 2. Amsterdam: Mathematisch Centrum, 483-512. Reprinted is: J. Groenendijk, T. Janssen & M. Stokhof (eds.), *Truth, Interpretation and Information*. Dordrecht: Foris Publications, 131-158.

Schein, Barry 1993. *Plurals and Events.* Cambridge, Massachusetts: The MIT Press.

Schwarzschild, Roger 1992. Types of plural individuals. *Linguistics and Philosophy* 15: 641-675.

Schwarzschild, Roger 1994. Plurals, presuppositions and the sources of distributivity. *Natural Language Semantics* 2: 201-248.

Schwarzschild, Roger 1996. *Pluralities*. Dordrecht: Kluwer Academic Publishers.

Schwarzschild, Roger 2002. The grammar of measurement. In: B. Jackson (ed.), *Proceedings from Semantics and Linguistic Theory XII* (= SALT 12). Ithaca, New York: Cornell University, 225-245.

Sharvy, Richard 1980. A more general theory of definite descriptions. *Philosophical Review* 89: 607-624.

Sher, Gila 1990. Ways of branching quantifiers. *Linguistics and Philosophy* 13: 393-422.

Sweet, Henry 1892. *A New English Grammar, Logical and Historical*. Oxford: Clarendon Press.

Westerståhl, Dag 1987. Branching generalized quantifiers and natural language. In: P. Gärdenfors (ed.), *Generalized Quantifiers: Linguistic and Logical Approaches*. Dordrecht: Kluwer Academic Publishers, 269-298.

Whorf, Benjamin Lee 1941. The relation of habitual thought and behavior to language. In: L. Spier (ed.), *Language, Culture and Personality: Essays in Memory of Edward Sapir*. Menasha, Wisconsin: Sapir Memorial Publication Fund, 75-93. Reprinted in: J.B. Carroll (ed.), *Language, Thought and Reality: Selected Writings of Benjamin Lee Whorf*. Cambridge, Massachusetts: The MIT Press, 1956, 134-159.

Wilkinson, Karina 1991. *Studies in the Semantics of Generic Noun Phrases*. Ph.D. dissertation, University of Massachusetts, Amherst.

Yi, Byeong-Uk 2005. The logic and meaning of plurals, part I. *Journal of Philosophical Logic* 34: 459-506.

Yi, Byeong-Uk 2006. The logic and meaning of plurals, part II. *Journal of Philosophical Logic* 35: 239-288.