Plural Reference and Reference to a Plurality. A Reassessment of the Linguistic Facts

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There are two fundamentally different views of the semantics of definite plural NPs. I will call them 'Reference to a Plurality' and 'Plural Reference'. Reference to a Plurality is the view that definite plurals stand for a particular sort of entity, a plurality, more precisely a plurality 'as one'.[1] There are different formal conceptions of pluralities as 'one': as sums within extensional mereology or as sets or classes. On the extensional mereological view, which is the dominant one in current linguistic semantics, the semantics of a definite plural NP will look as in (1a), where s is the relevant situation containing a restricted domain of entities:[2]

(1) a. $[\textit{the children}]^s = \text{sum}([\textit{children}]^s)$

Plural Reference is the view that definite plural NPs stand for several individuals at once. [3] On that view, *the children* refers to each child in the relevant situation at once. Moreover, a (one-place) predicate with a definite plural will have to be true of each individual that the plural term stands for at once, to give a true sentence:

(1) b. *The children are happy* is true iff *are happy* is true at once of all the xx of which *children* is true at once.

Plural Reference goes along with plural logic, a logic that contains besides singular variables and singular terms plural variables of the sort 'xx', 'yy', …, variables that are assigned

[1] Representatives of that view are Link (1984), Ojeda (1993), Gillon (1984), Schwarzschild (1996), and Moltmann (1997).

[2] See in particular Sharvy (1984).

[3] Representatives of that view are Boolos (1984, 1985), Li (2005, 2006), McKay (2006), Oliver/Smiley (2006), Linnebo (2012).

several individuals at once, and plural terms, terms that stand for several individuals at once. Finally, plural logic will contain plural predicates, predicates that are true only of several individuals at once (for a particular argument position).

Reference to a Plurality is clearly the dominant view in linguistic semantics. Plural Reference, by contrast, has been pursued primarily by philosophical logicians and received little attention by linguists working in semantics.[4] In this paper, I will review the two views from the point of view of natural language, in particular some lesser known empirical generalizations. I will argue in favor of Plural Reference, though I will argue that there are two ways of developing that view that each face particular difficulties.

The popularity of Reference to a Plurality in linguistic semantics can be traced to a range of semantic parallels between singular count, plural, and mass NPs which suggest that definite NPs of all three categories stand for single entities: individuals, pluralities, or quantities. One construction particularly suggestive of that parallel is the partitive construction below:

(2) a. all of the house
b. all of the children
c. all of the wood

All in (1) appears to range of whatever counts as the parts of referent of the definite NP, the house 'the children', or 'the wood'. Thus individuals, pluralities, and quantities appear to be treated on a par, as entities that come with a part-whole structure.

Also adjectival modifiers in some languages may function that way. Thus, German *ganz* 'whole' can apply to definite singular count, plural, and mass noun phrases, with the same part-quantificational effect as *all* in the partitive construction:

(3) a. das ganze Haus
'the whole house'
b. die ganzen Leute
'the whole people'
c. das ganze Holz
'the whole wood'

[4] Exceptions are McKay (2006) and Schein (1995). Schein follows Boolos (1984) for the treatment of plural NPs, but makes use of extensional mereology for events.

Finally, adverbial part-related modifiers such as *partly* or *to some extent* may treat singular count, plural, and mass NPs in exactly parallel ways:

(4) a. The house is partly / to some extent white.
b. The people are partly / to some extent French.
c. The wood is partly / to some extent dry.

Again the semantic effect of *partly* and *to some extent* consists in existential quantification over parts of individuals, pluralities, or quantities.

Furthermore, in Moltmann (1997, 1998, 2005), I argued that the same conditions that drive the individuation of objects drive the 'contextual individuation' of pluralities and quantities into subgroups and subquantities (for the purpose of part quantification and the application of distributivity and part-structure-sensitive predicates). Furthermore, there are particular plural or mass modifiers that impose conditions on the structure of a plurality (or quantity). For example, *individual* imposes the condition that the plurality in question does not have subgroups as parts, but only individuals (in the relevant situation).

Yet natural language also poses serious challenges for the view that pluralities are on a par with individuals. Pluralities are simply never treated as 'single' entities or as particular types of entities. They are always treated as 'multitudes' or 'classes as many', rather than 'classes as one', to use Russell's terminology.

The approach of Plural Reference treats plurality primarily as an issue of reference, not of ontology. Pluralities are what a plural term plurally refers to. They are not entities in any sense. Yet in a given context they may be structured and divided into lower-level pluralities. This paper will explore two approaches regarding phenomena of higher-level pluralities in English, one that involves situated structured pluralities and one that involves multigrade predicates and an enrichment of the content and complexity of plural descriptions. The upshot will be somewhat inconclusive: both approaches face significant difficulties.

1. Reference to a Plurality: The extensional mereological version

I will start by presenting two versions of the Reference to a Plurality approach: the extensional mereological version and s my earlier theory, which I will call the 'information-based' version.

The extensional mereological version of Reference to a Plurality makes use of a part relation that, most importantly, is transitive and closed under sum formation.[5] Plural nouns will have as their extension sets of sums of individuals – elements of the extension of the corresponding singular count noun. Thus, *students* will have as its extension the set of sums of individual students. A definite plural NP such as *the students* will stand for the sum of all the contextually relevant entities in the extension of the corresponding singular count noun.

A central, but highly problematic feature of the extensional mereological version of Reference to a Plurality is a distinction among different part relations. In order to not have parts of individuals count as pluralities, different part relations need to be associated with different syntactic categories. Thus, one part relation applies to individuals in the extension of singular count nouns; but a different part relation applies to pluralities, entities in the extension of plural nouns. This means, for example, that an individual student is an atom with respect to the part relation associated with plural nouns, but is not an atom with respect to the part relation associated with individuals. The notion of an atom, as a notion associated with singular count and plural nouns, plays a central role in the extensional mereological account of the semantics of plurals.

2. Constraints on distributivity and part-structure-sensitive predicates: The Accessibility Requirement

There is an important semantic feature of plurals that any semantic theory at some point has to deal with, namely the Accessibility Requirement (Moltmann 1997, 2005). This is a constraint both on the availability of a distributive interpretation and on the applicability of certain predicates that involve the part structure of their argument.

Plurals, and only plurals, allow for a distributive interpretation of predicates. This concerns predicates that allow for both a collective and a distributive interpretation such as *heavy*:[6]

(5) a. The boxes are heavy.

[5] For the extensional mereological account see Link (1983) and Ojeda (1993).
[6] Such predicates need to be distinguished from predicates displaying only a distributive interpretation:

(i) The children slept.

Such predicates license the inference below in virtue of their lexical meaning:

(ii) For a plurality x,if [P](x) = 1, then [P](y) = 1 for all y < x.

Distributivity may also involve distribution over subgroups of a plurality. (5b) has a reading distributing over individuals ('John weighed the individual stones') and a reading distributing over subgroups ('John weighed particular contextually relevant subgroup of stones'):

(5) b. John weighed the stones

Also collective predicates may display distributive readings, distributing over subgroups. Thus, (5c) can mean that particular contextually relevant subgroups of students gathered:

(5) c. The students gathered.

One rather common account of the distributive interpretation of predicates allowing both collective and distributive readings is to posit an implicit distributive operator in the logical form of a sentence with a distributive reading of the predicate. Such an operator will act as a quantifier ranging over the contextually relevant parts of the plurality, as below:[7]

(5) d. For a situation s, [D VP]([NP], s) = 1 iff for all d, $d <_s$ [NP], [VP](d) = 1.

The distributive interpretation of predicates is available only with plurals and not with collective NPs, that is, singular count NPs referring to collections of some sort (Moltmann 1997, 2003). For example, it is available in the a-examples below, but not in the b-examples:

(6) a. The things are heavy.
b. The collection of things is heavy.
(7) a. John has evaluated the students.
b. John has evaluated the class.
(8) a. The paintings are expensive.

[7] One good argument in favor of that account is that the speaker must have either a distributive or collective reading in mind, which requires the distributive interpretation to be explicitly represented in the logical form of the sentence.

This differs from the account given in Moltmann (1997), which proposes disjunctive lexical meanings of predicates, with one disjunct representing 'the ordinary' collective reading and the other disjunct the distributive reading. One motivation for that was to account for disjunctions of collective and distributive modifiers as in *They lifted the piano together and alone*. I will leave a discussion of this conflict in intuitions for another occasion.

b. The collection of paintings is expensive.

(9) a. The team members lifted the piano.

b. The team lifted the piano.

The very same constraint holds for the application of part-structure-sensitive predicates. More precisely, the same constraint holds for any predicate making reference to the parts, but not the whole of an argument (Moltmann 1997, 2005):

(10) a. John compared the students.

b. # John compared the class.

(11) a. The students like each other.

b. # The class likes each other.

(12) a. John cannot distinguish the students.

b. # John cannot distinguish the class.

(13) a. The students are similar.

b. # The class is similar.

(14) a. John counted the students.

b. John counted the group of students. (means: he counted one)

(15) a. The students are numerous.

b. # The class is numerous.

Predicates that make reference not only to the parts of an argument, but also to the whole (its organization or overall structure) are not subject to the constraint (Moltmann 1997). These are predicates such as *organize, rank, dissolve,* and *re-arrange*:

(16) John organized / rearranged the collection of things on his desk.

Like distributivity, part-structure-sensitive predicates may take into account relevant subgroups as the parts of the plurality to which they apply and not its individual members. This is the case with relevant readings of the examples below:

(17) a. John compared the men and the women.

b. John compared the students (in the different classes).

Certain modifiers may influence what could count as the contextually relevant parts, both for the purpose of distributivity and for the purpose of the application of part-structure-sensitive predicates. In particular, *individual* has the effect of disabling proper groups from counting as relevant parts, thus preventing higher-level plurality readings (Moltmann 1997, 2005).

3. Two problems for the extensional mereological version of Reference to a Plurality

3.1. Distributivity and part-structure-sensitive predicates

The extensional mereological version of Reference to a Plurality appears to provide a straightforward way of dealing with higher-level plurality, namely by mapping pluralities (that is, sums) onto atoms. This is in fact the strategy used by Link (1984).[8] There are both empirical and conceptual problems, though, for such a strategy.

First, the notion of an atom used is a problematic one. The notion of an atom was previously used as a notion that is relativized to the category of singular and plural count nouns: singular count nouns set up 'their own' part relation by establishing what counts as an atom. But if pluralities can be mapped onto corresponding atoms without being in the extension of a particular singular count noun, the notion of an atom loses its ground.

A further difficulty for the extensional mereological account concerns the status of the constraint on distributivity and part-structure-sensitive predicates. The extensional mereological acccount will have to consider the Accessibility Requirement a restriction to 'nonatoms'. Since atoms in general are the entities in the extension of singular count nouns, this means that the account will predict that distributivity and the relevant part-structure-sensitive predicates are impossible with all singular count NPs. However, the connection to the singular-count distinction is not strict. There are two exceptions.

First, the addition of the adjectival modifier *whole* enables a singular count NP to allow for a distributive interpretation of the predicate and to accept the relevant part-structure-sensitive predicates:

(18) a. The whole collection is expensive.

[8] See also Barker (1992).

b. John has evaluated the whole class.

(19) John has counted / enumerated the whole class.

Second, quantifiers such as *something* and pronouns such as *what* are expressions that may replace plural NPs, allowing for distributive interpretation and part-structure-sensitive predicates:

(20) a. What did John evaluate? – the paintings.
b. Even John has evaluated something; namely the paintings.
c. What can't John distinguish? – the cups.

The plural *several things* below makes clear that *something* may be categorized as a singular count quantifier (rather than a mass quantifier):

(21) a. John has evaluated several things, the paintings, the sculptures, and the drawing
b. There are things John cannot distinguish, the cups, the glasses, and the plates.

Thus, the syntactic category 'singular count' is not what is primarily at stake in the constraint on distributivity and part-structure-sensitive predicates.

3.2. Attributive readings of plural descriptions

Another general problem for the extensional mereological account is the possibility of using definite plurals attributively. On such a use, a definite plural stands for whatever the maximal plurality is in the circumstance of evaluation. It thus can take narrow scope with respect to other quantifiers, as below:

(22) a. Every year, John needs to evaluate the students.

The crucial observation is that on an attributive use, readings involving a contextual partition are equally available. Thus, (22a) can naturally have a reading on which John needs to evaluate the groups of students belonging to particular classes, and similarly for the comparison John has to do according to (22b):

(22) b. Every year, John needs to compare the students (in the various classes, whoever they may be).

According to such readings, the utterance of *the students* in (22a) and (22b) may involve the same way of dividing the students into subgroups in a circumstance in which there are other students than there actually are.

The possibility of attributively used definite plurals involving a contextual partition presents a serious, but so far unnoticed problem for approaches using covers of actual pluralities for the analysis of distributivity (Schwarzschild 1996, Gillon 1987).[9]

4. The information-based version of Reference to a Plurality

Two main features characterize the information-based version of Reference to a Plurality developed in Moltmann (1997, 2005):

[1] The role of integrity conditions

The view is that part-whole structure of entities does not just consist in an ordering relation subject to general conditions such as transitivity, closure, and extensionality. Rather it is driven to an extent by conditions of integrity, conditions on the basis of which entities count as integrated wholes.

Integrity conditions may block the transitivity of the part relation. That is, if x is part y and y of z and y is an integrated whole, then x need not be part of z. Individuals, the elements in the extension of singular count nouns, generally are integrated whole or so the assumption. Thus, their parts will not generally count as the parts of proper sums of individuals. By giving up transitivity, one and the same part relation can be used for pluralities and individuals and no part relation needs to be posited that is relativized to the category of singular count nouns as on the extensional mereological account.

Integrity conditions also block sum formation. A sum of integrated wholes exists only if the potential sum is itself an integrated whole. Integrity conditions will also be the basis for a division of a plurality into subgroups. If subgroups count as integrated wholes, only they, not their members, may count as the parts of the entire plurality.

[9] The possibility of attributively used plural descriptions with incomplete specifications of relevant subgroups parallels the possibility of using incomplete singular definite descriptions attributively. The latter have been discussed as a problem for the use of resource situations in situation semantics by Soames (1990).

Two sorts of integrity conditions may define pluralities (and thus subgroups) as integrated wholes: the condition of being a maximal plurality of entities standing in a particular relation to each other and nothing else, and the condition of being a maximal plurality falling under a property. The latter can be reduced to the former by defining a relation on the basis of a property, as in (23b):[10]

(23) a. For a symmetric (non-formal) relation R, x is an R-integrated whole iff for all y and z, if $y < x$, $z < x$, then Ryz, and for no w, $- w < x$, Rwy.

b. For a property F, for any x, y, FFxy iff Fx and Fy.

If definite plural descriptions stand for the maximal sum of individuals all of which fall under a particular count noun, then definite plural descriptions stand for integrated wholes. This means that as long as the noun has a nonempty extension, the definite plural will have a referent (since it will be an integrated whole). Thus, *the students* will count as an integrated whole since it will be the maximal plurality of individuals that have the property of being a student.

The integrity-based conditions on part structure also allows that in (17a) the maximal plurality of men and the maximal plurality of women may count as the only parts of the plurality of men and women, and that in (17b) the maximal pluralities of students belonging to particular classes may account as the only parts of the plurality of the students.[11]

[2] The relativization of part structures to situations

On the information-based account, what matters for the part relation that is relevant in natural language semantics is not whether entities are integrated wholes as such, but rather whether they are integrated wholes in the relevant context of information or *reference situation*. Thus, the maximal group of relevant students forms an integrated whole in the reference situation that the speaker had in mind by uttering *the students* because that situation contains no other entities that are students. A reference situation may be conceived as a partial possible world that comes with its own domain of entities. Its information content is to a great extent driven by the information given by the NP used, but it is ultimately up to the speaker's intentions

[10] These conditions are taken from Simons (1987).

[11] Note that entities may be integrated wholes either essentially or accidentally. This allows collective NPs to denote the same plurality as is denoted by a plural NP, namely if the collective NP specifies only accidental integrity conditions. Thus, *the pile of papers on the desk* and *the papers on the desk* may denote the very same plurality, namely a plurality that accidentally comes in the shape of a pile.

what it may consist in. The same information permits different readings, higher-level plurality readings and others. For example, both (24a) and (24b) do not display a single reading, but permit a variety of different readings:

(24) a. John compared the students of the different classes.
b. John compared the male and female students.

(24a) and (24a) allow for the higher-level plurality reading based on properties of being maximal plurality of individuals in a given class or a maximal plurality of females. But (24a) and (24b) also allow for individual-student comparison readings. Both sorts of readings are available on the basis of the very same descriptive content of the NP. It can therefore not be the case that the descriptive content of the NP itself determines the part structure of the plural referent. Rather it is the reference situation as part of the speaker's intentions, whose information content determines the part structure of the plurality. Or rather it will be the information content of a reference situation organized in a certain way that drives the individuation of the plurality. Thus descriptive content of (24b) corresponds to two sorts of complex properties, (25a) and (25b):

(25) a. $\lambda xx[\exists x(x < xx \rightarrow Mx \vee Wx)]$
b. $\lambda xx[\exists yy\ (yy < xx \ \&\ yy = \max z[Mz]) \ \&\ \exists yy\ (yy < xx \ \&\ yy = \max z[Wz]))]$

(25a) is a description of the plurality based on the description of the individual members; (25b) is a description of a plurality on the basis of the description of two subpluralities. Only the latter gives rise to higher-level plurality readings.

The information-based account provides a solution to both problems for the extensional mereological approach. First, the account makes use of a language-independent notion of part, and does not tie singular count nouns to a notion of atom. Instead it assumes that singular count nouns always express conditions of integrity. This means that in general the referent of a definite singular count NP is an integrated whole, but not always. It is not so, for example, in the presence of the modifier *whole*. *Whole* is an expression whose semantic function as an adjectival modifiers is to map an integrated whole to the mere sum of its parts (Moltmann 1997, 2005). Moreover, special quantifiers even if they classify as singular count can be exempt from the condition (see Section 5).

Given the information-based account, the Accessibility Requirement will naturally be considered a condition on predicates not applying to integrated wholes. However, this requires several qualifications. First of all, definite plurals in fact refer to integrated wholes (FF-integrated wholes). The information-based account has to make a distinction between weak integrated wholes and strong integrated wholes. FF-integrated whole count as weak integrated wholes, and the Accessibility Requirement will require only that the arguments of part-structure sensitive predicates and readings of predicates not be strong integrated wholes.

Furthermore, a plurality may in actual fact be a strong integrated whole, but this will not matter if it has not been described as such. To capture such information-dependence, the information-based account needs to assume that a predicate does not apply to an object as such, but only to a pair consisting of an object and a situation. This yields the following formulation of the Accessibility Requirement:

(26) The Accessibility Requirement (Moltmann 1997, 2005)

A predicate or reading of a predicate making reference to the parts, but not the whole of an argument can apply to an object d in a situation s only if d is not a strong integrated whole in s.

The relativization to a situation with its partial information-content allows ontological conditions to apply to pluralities as they do to individuals. There are serious difficulties for the account, however.

First, there is a problem concerning the use of the notion of integrity. The account crucially has to assume that pluralities could at best be weak integrated wholes, whereas individuals as referents of (unmodified) singular count NPs would always be strong integrated wholes. But this is just not plausible. It would mean that entities described as ‘sums’, ‘pluralities’, ‘collections’ would always have a greater degree of integrity than pluralities as referents of definite plurals; but this is just wrong, unless a notion of merely ‘conceived integrity’ is invoked, which is obviously problematic. The difference between pluralities as semantic values of definite plurals and individuals as semantic values of definite singular count NPs does not reside in a degree of integrity that individuals exhibit as opposed to pluralities, but rather in that the former count as ‘one’, whereas the latter count as ‘many’.

A second difficulty concerns the unusual role of situations that the account has to make use of. In semantics, situations have been used to help identify the domain of incomplete

quantifier restrictions and descriptions.[12] But they were never needed as part of the argument of the predicate. Situations are invoked for that role only by the information-based account, to deal with part-structure-sensitive predicates and distributivity.[13]

A third difficulty concerns the availability of readings involving higher-level plurality. Such readings are in fact more construction-driven than predicted by the information-based account. The account predicts that exactly the same readings are available in (27a) and (27b):

(27) a. John compared the men and women.
b. John compared the men and the women.

But in fact there is a significant difference in the availability of higher-level plurality readings. First, higher-level plurality readings involving the maximal plurality of men and the maximal plurality of women are significantly more easily available in (27b) than in (27a). Second, (27b) allows for the reading on which John compared the young men and women to the old men and women, but this is not a reading available for (27a).

The following examples from Nicholas/Linnebo (2008) make the point even clearer:

(28) a. The things that are square, blue, or wooden overlap.
b. The square things, the blue things, and the wooden things overlap.

(28b) allows for a higher-level plurality reading on which the overlap regards shared parts of pluralities, but such a reading is not available in (28a).

On the information-based account, such sentences should share exactly the same readings, since the descriptive content of the NPs is exactly the same.

4. The information-based account and attributively used NPs

[12] See Barwise / Perry (1983) and Cooper (1993).

[13] One possible other application of a situations being part of the arguments of a predicate is the lexical restriction of a predicate like *high* to entities in vertical position (Moltmann 1998):

(i) The flag pole is high.

Attributively used definite plural NPs pose an obviously problem for an account that makes use of reference situations, such as the information-based account. Its use of reference situations was to make sure that only the integrity conditions provided by the descriptive content of the NP determines the part structure of a plurality. But by relativizing the interpretation of an NP to a particular situation and making that situation part of the argument of the predicate, the account is inapplicable to attributively used definite plurals, whose semantic value is independent of any particular circumstance of evaluation.

To deal with attributively used plural definites requires not making a particular situation part of the speaker's intention when uttering the NP, but rather a possibly enriched plural description. The part structure of an entity in a circumstance of evaluation will then have to be strictly driven by the description used, and not any other properties that the members of the plurality may happen to have in those circumstance. The part structure of the plurality in a circumstance of evaluation will be strictly driven by the complex description that will be part of the speaker's intention. This requires a notion of reference situation for a circumstance of evaluation that carries nothing but the information given by the description used:

(29) For a circumstance of evaluation c for an attributively used description D, the reference situation of D in c is the smallest part of c in which D is true of its referent in c.

With this modification, three difficulties for the information-based account remain: first, the problem of the degrees of integrity and the association of integrity conditions with singular count nouns; second, the construction-relatedness of readings with higher-level pluralities; and third, the peculiar and unusual use of situations that the account involves.

5. Problems for Reference to a Plurality

5.1. Number-related predicates

One general problem for Reference to a Plurality is that it treats pluralities as entities on a par with individuals. This also holds for the pluralities that make up the relevant parts of higher-level pluralities. The extensional mereological approach in particular does not distinguish between pluralities whose 'atomic parts' are individuals from pluralities whose 'atomic parts' are themselves pluralities. Both sorts of pluralities are entities with atomic parts. The

information-based account might distinguish the two sorts of parts in terms of degrees of integrity (a subgroup has a lesser degree of integrity than a part that is an individual). But still a part of a plurality that is a subgroup will count as 'one' just like a part that is an individual.

In natural language, two different kinds of part-structure-sensitive predicates must be distinguished: those that can take into account subgroups as parts of a plurality and those that can take into account only individuals as parts of a plurality. Predicates that can take into account only individuals as part of pluralities include *enumerate*, *name*, *count*, and number predicates:

(30) a. John counted the people.
b. The stones are numerous.
c. The students are twenty in number.
(31) a. John enumerated the students.
b. John named the students.

Let me call those predicates *number-related plural predicates*.[14]

Predicates that can take into account subgroups as parts of pluralities include *compare, distinguish, divide* and also corresponding adjectival predicates such *similar* and *different*. Let me call those *part-related plural predicates.*

The most serious problem for Reference to a Plurality is the question of why number-related predicates cannot take into account subgroups, but only individuals. Given Reference to a Plurality, a contextually relevant subgroup has the very same ontological status as an individual; it counts as 'one' rather than as 'many'. [15]

The very same problem also applies to the plurality as a whole that is the semantic value of a plural term. Why can't number-related predicates count the entire plurality as 'one'. That is, why is (32a) impossible, as opposed to (32b):

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[14] Note that the modifier *individual* has the effect of having predicates apply like number-related predicates.

[15] The information-based account might attempt an alternative account by appealing to a distinction between essential integrated wholes on the one hand and accidental or information-driven integrated wholes on the other hand. Referents of definite plurals always count as accidental wholes or information-driven wholes (albeit weak integrated wholes). If the parts of a plurality are individuals, these will generally be essential integrated whole, but if subgroups count as parts, they will generally count as accidental integrated wholes (or information-driven wholes). Predicates like *count* on this view could apply only to pluralities whose relevant parts are essential integrated wholes, whereas predicates like *compare* could apply to pluralities whose relevant parts are accidental integrated wholes. The problem is that even accidental integrated wholes are single entities and thus count as 'one'. Moreover, it is not obvious that certain pluralities could not be essential integrated wholes, let's say by being maximal pluralities of essential integrated wholes.

(32) a. John counted the ten children – he counted one.

b. John counted Mary – he counted one.

The problem is a central one for Reference to a Plurality, which treats pluralities as single entities. The solution to the problem, I think, can only be to conceive of pluralities not as single entities, but as multitudes, that is, as 'many'. The difference between number-related predicates and plural-part-related predicates simply shows that some predicates are sensitive to the fundamental distinction between 'one' and 'many', whereas others are not.

One might pursue another strategy to account for the problem and that is by insisting on distinguishing between the conception of the semantic value assigned to definite plurals in the semantic theory and the use of plural terms and predicates in the metalanguage.[16] Suppose in the semantic theory, plural terms are all assigned sets so that those sets combine with the predicate denotations in a way to give the right truth conditions of the sentence. The inference from *John counted the children correctly* to *John counted one* then will be blocked by making sure that *one* is not true of the semantic value of *the children*. The semantic theory will specify that *one* is true only of singleton sets. A predicate like *count* will select only sets of singleton sets, whereas a predicate like *compare* will be applicable also sets of non-singleton sets. Of course, the semantic value of *the children* is in fact 'one' and not 'many', and if John counted what *the students* stands for correctly, he should have counted one. But that is by using *one*, *many*, and *count* as part of the metalanguage, which the strategy would say is illegitimate.

However, this argument goes against what is generally considered an important condition on a semantic theory, namely that the object language be included in the metalanguage. This is reflected in the disquotational axioms of Davidson's (1984) theory of meaning as a Tarski-style truth theory, as well as Horwich's deflationist account of meaning (Horwich (1990, 1998), which posits (33) as a condition on the application of predicates:

(33) $(\forall y)$(*F* is true of $y \leftrightarrow$ Fy)

There is an alternative interpretation of that strategy, though, and that is that it treats definite plurals not as referential NPs, but as non-referential terms, terms whose function is

[16] I would like to thank Oystein Linnebo for suggesting that option to me.

not to provide the arguments of predicates but to combine compositionally with the denotation of the predicate to give the overall truth conditions of the sentence. (33) would then not be applicable. It is fairly obvious, however, that whatever criteria one adopts for referential terms (their behavior with respect to identity predicates or quantifiers, let's say), if definite singular NPs in argument position are referential terms, then so are definite plurals.[17]

5.2. The Accessibility Requirement

Another general problem for Reference to a Plurality is the status of the Accessibility Requirement. Given Reference to a Plurality, the requirement has to be considered a sortal restriction of particular predicates (predicate argument positions) to certain types of entities or to entities with certain types of properties in situations. However, it appears that the Accessibility Requirement does not behave like a sortal restriction. Standard cases of sortal restrictions (or semantic selection) characteristically allow for coercion or type shift, the mapping of an object of reference not meeting the restriction to one meeting it. The examples below, for example, involve type shift of an object (which is not what the predicate selects) to a suitable event involving the object (which is what the predicate selects):

(34) a. John started reading the book.
b. John started the book.
(35) a. John proposed a movie.
b. John proposed watching a movie.

With predicates subject to the Accessibility Requirement, by contrast, coercion is completely impossible:

(36) a. The collection is expensive. (no collective reading)
b. The class is similar. (no collective reading)

Coercion in those would simply involve mapping, say, a collection, to the plurality of entities constituting it, but this is impossible. The relation between a plurality and a corresponding

[17] See Hale (1988) for a discussion of philosophers' criteria for referential terms.

collection is certainly ontologically closer than that between an individual and an event involving it. Yet, coercion is entirely unavailable.

The complete unavailability of coercion is strong evidence that the Accessibility Requirement is simply not a sortal restriction or semantic selectional requirement, as Reference to a Plurality would have it.

6. Plural Reference

6.1. Plural Reference and the Accessibility Requirement

Given Plural Reference, definite plural NPs and definite singular count NPs differ not in what they refer to, but in how they refer. Singular definites refer to a single entity, whereas plural definites refer to several entities at once. Given Plural Reference, the Accessibility Requirement need not be treated as a semantic selectional requirement positing conditions on the argument to which certain predicates can apply. Rather the requirement will simply be a condition on which argument places of predicates of a certain sort will be plural argument places:

(37) The Accessibility Requirement as a Condition on Plural Argument Places
A predicate or semantic operation making reference to the parts, but not the whole of an argument in a particular argument position is a plural predicate with respect to that argument position.

Recall that 'plural argument position' means that the predicate has to hold of several individuals at once for that argument position to allow for the sentence to be true.

Clearly, given (36), coercion would be inapplicable to sentences violating the Accessibility Requirement.

NPs modified by *whole* will be exempt from the Accessibility Requirement if *whole* is considered an expression whose semantic function is to turn an expression referring to a single entity into a term plurally referring to the proper parts of that entity. Special quantifiers like *something* or *two things* will be exempt from the requirement because they are at once plural quantifiers and singular quantifiers, as will be discussed later (Section 5).

6.2. Plural Reference and higher-level plurality

Semantic phenomena involving higher-level pluralities present a well-known challenge to plural reference. Whether Plural Reference should allow for higher-level pluralities is a controversial issue.[18] If plural reference is just a matter of reference, that is, of a term referring to several entities at once, there is no reason to posit higher-level pluralities, unless there are referential structures reflecting them. If pluralities by nature are pluralities of single entities, then there could not be such as a thing as pluralities of pluralities. Higher-level pluralities could only mean pluralities of pluralities-as-many. To what extent natural language really allows for reference to higher-level pluralities is an issue as well.[19] In the present context it should suffice to just focus on higher-level pluralities as they are reflected in the application of distributivity and part-structure sensitive predicates discussed earlier.

For the purpose of the semantics of natural language, there are two options for dealing with higher-level plurality. One of them is to allow for structured pluralities as arguments of predicates. Another is to reduce apparent higher-level pluralities to the use of multigrade predicates and (implicit) complex plural descriptions. In this paper, I will restrict myself to presenting the two options with their advantages and disadvantages, leaving a more thorough discussion to another occasion.

6.2.1. Situated structured pluralities

Given Plural Reference, a slight modification of the information-based account permits an analysis of higher-level pluralities as *situated structured pluralities*. The modification would simply consist in considering a plurality as 'many' rather than as 'one'. Conditions of integrity will be applicable to pluralities in situations in the very same way as before. The notion of an integrated whole will simply be considered both a plural concept and a concept applying to individuals.

As before, it will depend on the information content of the situation what the structure of the plurality will be, and the situation itself will be part of the speaker's intention, being only partly determined by the description used. As before, a plurality cannot as such provide the arguments of a part-structure-sensitve predicate, but only together with a situation. The

[18] See the discussion of Simons (this volume).

[19] See McKay (2006) for the view that natural language does not involve higher-level pluralities.

arguments of part-structure-sensitive predicates will now be of the form <dd, s> for a plurality dd and a reference situation s. The situation s has the purpose of specifying which lower-level pluralities are integrated wholes, which is what part-structure-sensitive predicates will care about. For example, suppose the application of the two-place plural predicate *compare* to a plurality consists in applying the three-place predicate *compare to* to the lower-level pluralities or whatever counts as the relevant parts. Then two-place compare will be subject to the following condition:

(38) For an individual d, a plurality xx, and a situation s, [*compare*](d, <xx, s>) = 1 iff [*compare to*](d, yy, zz) = 1 for any integrated wholes yy and zz in s.

Recall that higher-level-plurality readings are equally available with attributively used definite descriptions as with referentially used definite descriptions. On the information-based version of Reference to a Plurality, the enriched plural description serves to help individuate the part-whole structure of the plurality in a given circumstance of evaluation. This can straightforwardly be carried over to situated pluralities. An enriched plural description will be the basis of the individuation of a structured plurality in a minimal situation in a circumstance of evaluation.

The account of higher-level plurality in terms of situated structured pluralities still faces challenges, not only in regard to its peculiar use of situations, but also given the observation that higher-level plurality readings are sensitive to the structure and not just the content of a complex plural description.

6.2.2. Complex plural descriptions and multigrade predicates

An alternative to structured situated part structures is to regard the predicate itself as multigrade and to enrich in relevant cases the description used so that it will form a suitable list. This would be a way of avoiding higher-level pluralities entirely. The appearance of higher-level plurality on this account is reduced to the use of plurally referring descriptions of lower-level pluralities. Let us consider the simple case below:

(27) b. John compared the men and the women.

Rather than taking *compare* to apply to a situated structured plurality, it will be considered a multigrade predicate in one of its places, namely its second place, linked to the object position. That is, the second place of *compare* will be a position that in principle takes an unlimited number of arguments. This goes along with the analysis of the complement *the men and the women* as a list of two pluralities, the plurality of men and the plurality of women.

A few words are needed concerning the distinction between plural predicates and multigrade predicates.[20] Whereas a plural predicate (for a particular argument place) is a predicates that applies to several individuals at once (with respect to that place) to give truth, a multigrade predicate (or rather argument place) takes an (unlimited) number of arguments, in a particular order. The arguments in a multigrade argument place can be repeated, which is not the case for a plural predicate. A clear example of a multigrade predicate in English is *add*:

(39) a. John added two and two and two.

Clearly, English does have multigrade predicates and their arguments can be provided by a conjunction of referential NPs.[21]

It is significant that *add* also has a two-place relational variant taking a PP-complement:

(39) b. John added two to two.

In general, it seems, in natural language certain types of relational predicates systematically come with a multigrade variant. Further examples are given below:

(40) a. John is similar to Mary.
b. John and Mary are similar.
(41) a. John cannot distinguish the students from the teachers.
b. John cannot distinguish the students and the teachers.

The arguments for the multigrade position can in general be given either by a conjunction of NPs or by a simple plural definite NP:

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[20] For the notion of a multigrade predicate see in particular Oliver/Smiley (2004).

[21] Note that each position in a multigrade place can itself be plural or multigrade.

(39) c. John added the numbers.

(40) c. The people are similar.

(41) c. John cannot distinguish the people.

Compare also has a corresponding relational variant, which gives plausibility to the view that it is a multigrade predicate:

(42) John compared the men to the women.

But if *compare* is multigrade even when taking a definite plural as complement, then there is no further need for positing second-level pluralities as arguments. Instead, both conjunctions and definite plurals as complements will provide arguments for the multigrade relation. In the case of the simple plural, this requires a mapping from the plurality onto a sequence of objects to fill in the positions of the multigrade argument place:

(43) For a multigrade (one-place) predicate P, [P *the N*] = 1 iff for some multivalued function f mapping [*the* N] onto a sequence s consisting of exactly the entities among [*the* N], [P](proj$_1$(s), proj$_2$(s), …) = 1.

A simple definite plural NP will have to be considered an incomplete description if it should provide lower-level pluralities as arguments of a multigrade argument place. The completed description will have to consist in descriptions of lower-level pluralities that are implicitly coordinated.[22] Thus, even if the description used is *the students*, the complex description to be evaluated may be of the sort *the students in class 1 and the students in class 2 and the students in class 3* etc. There is a major debate in philosophy of language about whether such implicit linguistic material needs to be silently present in the syntactic structure or whether it may be obtained by 'free enrichment'.[23] Note that in the present case, the implicit syntactic structure may be of the appropriate sort if *and* is give wide scope over the

[22] Implicit coordination is coordination lacking an overt coordinator. Implicit coordination might be treated by positing a silent coordinator. Alternatively, on a view on which coordination involves a three-dimensional syntactic structure, it just means that the conjuncts, belonging to different planes, are dominated by a single category node. See Moltmann (1992) for such a view of coordination.

[23] See the discussion in Stanley/Szabo (2000).

definite determiner and the head noun. But this would give the wrong result for singular NPs such as *the student in class 1 and in class 2*. Without going into a more thorough discussion of the syntactic issues involved, let us just assume that the plural description used may be only partial and that a complete description providing the arguments of the multigrade predicate needs to be part of the speaker's intentions.[24]

Since the account makes no use of particular situations of reference, it has no problem applying to attributively used definite descriptions. Yet, it faces challenges of its own.

First of all, it commits itself to treating all predicates displaying higher-level plurality as multigrade predicates. This is a strong hypothesis that requires at least independent motivations and perhaps justification from a general lexical theory of argument structure.

Second, there are cases of third-level pluralities that the account does not easily accommodate:

(44) The daughters and the mothers and the sons and the fathers have similar problems with each other.

On the relevant reading, (44) states similarity between mother-daughter problems and father-son problems.[25]

Third, the account faces challenges from phenomena that appear to involve the part-whole structure of pluralities. Partitives and the modifier *whole* do not present the most serious challenge. 'Is / are among' as a relation between individuals/pluralities and pluralities and 'is part of' as a relation between individuals are certainly analogous notions, allowing a treatment of partitives and *whole* at least as systematically polysemous. More difficult, however, is the analysis of modifiers like *individual*. *Individual* could no longer express a condition on the structure of a plurality in a situation, but would have to express a peculiar syntactic condition on (implicit) complex plural descriptions (to the effect that the complex plural description that the speaker has in mind not consist in descriptions of lower-level pluralities of at least two).[26]

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[24] There is also a more general philosophical debate to what extent implicit linguistic material can be fully part of the speaker's intention.

[25] Note that for such a reading, the structure of the plural description again matters. A third-level plurality reading is not available in (i), which lacks the right structure:

(i) The daughters, mothers, sons and fathers have similar problems with each other.

[26] Note that such a condition would not be applicable to the adverbial *individually*, which certainly could not impose a formal condition on the implicit structure of NP.

The account furthermore has a difficulty with the treatment of distributivity. It will have to deal with distribution over individuals differently from distribution over sub-pluralities. In the former case, distributivity will relate to a simple plural; in the latter case, it will relate to a conjunction (possibly an implicit one). Plural-related distributivity can be dealt with in the usual way, namely semantically as quantification over the individuals that are members of the plurality denoted by the plural, as in (44b) for (44a):

(45) a. The children are heavy.

b. D([*are heavy*]) ([*the children*]) = 1 iff ∀d (d < [*the children*] → [*are heavy*](d) = 1)

Conjunction-related distributivity, by contrast, will have to be treated syntactically, involving the distribution of the predicate over the conjuncts, as roughly below:

(45) c. [NP_1, …, and NP_n D *are heavy*] = 1 iff [*are heavy*]([NP_1]) = 1, …,
[*are heavy*]([NP_n]) =1

Thus, treating higher-level plurality just as a phenomenon of reference, rather than of ontology or situated structure, faces some serious disadvantages.

7. Restrictions on collective predication

Plural Reference receives further support from certain restrictions on collective predication. Certain predicates simply cannot have collective readings with plurals, even though such readings would be perfectly conceivable on a view of pluralities as entities on a par with individuals. Plural Reference provides an explanation of the absence of such collective readings.

The restriction concerns predicates that express properties of size, shape or 'gestalt', as well as spatial or temporal extension, as below (Moltmann 2004):[27]

(46) a. The children are big.

b. The pearls are long.

c. The grains are round.

[27] See Schwarzschild (2009) for similar observations.

d. The fields are extended.

e. The speeches were long.

The puzzle is that it is perfectly clear what those predicates would mean on a collective reading if they were applicable to pluralities in the way they apply to individuals. Thus, *big* in (46a) should mean that the collection of children is big; *long* in (46b) should mean that the entity constituted by the pearls, let's say the necklace, is long; *round* in (46c) should be able to mean, let's say, that the pile made up by the grains is round. Finally, (46d) should be able to mean that the collection of fields is extended, and (46e) that the sequence made up of the speeches was long.

The impossibility of collective predicates is hard to explain given Reference to a Plurality. Reference to a Plurality treats pluralities on a par with other objects of reference and thus, without further constraints being imposed, collective readings of the predicates in (46) are expected to be available.

Plural Reference, by contrast, does not predict that predicates with the meaning they have with individuals should be applicable with pluralities. A plural predicate functions fundamentally differently from a predicate applying to individuals, and it is not obvious how a predicate when acting as a collective plural predicate can carry over the meaning it has when applying to individuals. Plural Reference in fact requires an account of why a predicate can apply both to individuals and, with a collective reading, to pluralities, if this is to be based on the same meaning. Given Plural Reference, what requires an explanation is predicates displaying both a distributive and a collective reading, not predicates displaying only a distributive reading.

The restriction on collective readings displayed by (46) means that that collective readings of predicates in general are derivative and that the way of deriving them is simply not applicable to the predicates in (46). It suggests that collective readings of predicates applying to pluralities are obtained from properties or relations involving individuals in one way or another.

Three kinds of plural predicates can be distinguished according to their possible conceptual origin in relations involving individuals and not pluralities:

[1] Predicates that have a relational alternative such as *neighbors, similar, equal, compare (with), similar (to), overlap (with), add (to)*

Such predicates arguably are multigrade even with plural argument, as we have seen. Their lexical meaning involves the very same relation as is expressed by the explicit relational variant.

[2] Event-related predicates such as *gather* and *lift the piano*

Such predicates arguably are plural predicates on the basis of relations of participation of individuals in a collective event. The suggestion would be that eventive plural predicates have their conceptual origin in individual relations, relating individual agents to a collective event. As plural predicates, they do not start out as predicates relating the entire plurality as a participant to the described collective event.

[3] Measure-related predicates such as *heavy*

Let us assume, as is common, that measure predicates express relations between pluralities and measurements (degrees). Like event-related predicates, measure-related predicates with plurals can be considered plural predicates on the basis of individual contributions to the collective measurement of the entire plurality. Measure predicates as plural predicates are cumulative, that is, for a measure predicate P, if $P(x_1, d_1)$ and $P(x_1, d_2)$, then $P(xx, d_1+d_2)$, for the plurality xx consisting of x_1 and x_2 and degrees d_1 and d_2. Thus, the suggestion is that measure predicates have their conceptual origin in the relations of individual contributions to the collective measurement.

It needs to be emphasized that this is only a proposal about the lexical-conceptual origin of plural predicates. It is not in any way a claim about the logical form of sentences with plural predicates. The proposal is not that a reanalysis takes place at logical form. Rather establishing relations involving individuals would be part of the lexical conditions on introducing plural predicates.

5. Reification of pluralities

This paper has treated higher-level plurality as a matter of reference or situated structured 'multitudes' rather than ontology. But there is one phenomenon in English that involves counting pluralities and thus treating pluralities as entities of their own, that is as 'one' rather as 'many'. These are quantifiers like *something*, or better the more obvious count quantifiers of the sort *two things* or *several things*, which were mentioned earlier. In the examples below, those quantifiers take the place of definite plural NPs:

(47) a. John has tasted two things, the peas and the beans.
b. There are several things John cannot distinguish, the cups, the glasses, and the plates.

Recall that (47b), which contains a part-structure-sensitive predicate, shows that such quantifiers do not interfere with the Accessibility Requirement.

Quantifiers like *two things* or *several things* thus are in a way both of the category 'count' and of the category 'plural / mass'. This double nature matches the semantic role of such quantifiers as nominalizing quantifiers (Moltmann 2003). The status of quantifiers like *something* and *two things* as nominalizing quantifiers is apparent in their ability to replace nonreferential complements, yet accept first-order predicates as restrictions and to be able to count:

(48) a. John is wise.
b. John is something admirable.
(49) a. John needs a car and a house.
b. John needs two things.

As nominalizing quantifiers, *something* and *two things* introduce objects that act as arguments of first-order predicates and can be counted, as in (48b) and (49b) respectively. At the same time, they involve quantification over possible semantic values of the sorts of expressions whose place they take, such as concepts as expressed by predicates in (49a) and intensional quantifiers as the denotations of complements of intensional verbs as in (49b).

The nominalizing function of the quantifiers *two things* and *several things* can explain straightforwardly their particular behaviour when taking the place of definite plurals, as in (47a, b). The quantifiers will involve quantification over pluralities as arguments of the predicate, and at the same time introduce objects that correlate with those pluralities, namely 'reified' pluralities, pluralities which count as 'one' rather than 'many'.

Conclusion

Plural Reference is an approach that has been explored only little in the context of natural language semantics. The main aim of this paper was to show that there are a range of strong arguments from natural language in favour of Plural Reference. But the development of that approach in order to deal with higher-level plurality requires rather special assumptions either about multigrade predicates and incomplete plural descriptions or about situated structured pluralities. These issues await a more thorough discussion in the future.

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