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Structured Plurality Reconsidered

Berta Grimau
Institute of Information Theory and Automation, Czech Academy of Sciences, Prague, Czech Republic
E-mail: grimau@utia.cas.cz

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Abstract

In this article, I address the question of the semantic analysis of structured plurals, that is, expressions like *these children and those children*, which seem to refer to pluralities of individuals divided into groups. In the first half of the article, I describe a variety of structured plural expressions and predicates they can combine with and I point out the difficulties faced by two extant approaches to the semantics of plurals: inflationary and cover-based semantics. In the second half of the article, I propose an alternative account which combines elements from both of them. The main novelty of my proposal is that, by capitalising on the background operation of certain pragmatic principles, it correctly formalises the fact that some interpretations of ambiguous sentences involving structured plurality are more accessible than others.

1 INTRODUCTION

Prima facie, some expressions refer to objects organised in groups. For example, *these children and those children* seems to refer to a plurality of children divided into two groups. Moreover, these expressions are sometimes accompanied by predicates which appear to take the relevant grouping into account.

(1) These children and those children do not get along.

For instance, there is a natural reading of (1) according to which some children (i.e. these) do not get along with some other children (i.e. those), rather than each of the children not getting along with one another (or some other configuration). In this article, I will call referring expressions like the subject of (1) 'structured plurals' and the general linguistic phenomenon they instantiate, 'structured plurality'. By contrast, I will refer to ordinary plurals such as *these children*, *Serena and Venus*, *the red shoes* and *the Outer Hebrides* as 'basic plurals' and to the corresponding linguistic phenomenon as 'basic plurality'.

In the literature, structured plurals have received the attention of both philosophers and formal semanticists. From a philosophical perspective, structured plurals have been addressed within the literature on Plural Logic, an extension of First-Order Logic which

has as well as singular quantifiers, their plural counterparts.[1] The reason why structured plurals come up in this debate is that they have a prima facie good claim to being what would result from iterating the semantic operation of pluralisation: the plural of the plural. Roughly speaking, the idea is that just as, for instance, *the pig and the cow* is a basic plural expression, *the pigs and the cows* should be a plurally plural expression. This has come to the attention of philosophers who are interested in extensions of Plural Logic which have quantifiers of higher-levels: plural, plurally plural, plurally plurally plural, and so on. These logics, if available, would be valuable tools within various philosophical programmes, such as different variants of ontological eliminativism and strengthened forms of mathematical logicism.[2] Although this approach will not be at the center of my proposal, it will inspire some aspects of it. For instance, the fact that I take structured plurality as an iteration of basic plurality, semantically speaking, and thus as displaying analogous features to those of the latter. This view receives a prima facie rationale from the idea that *and*, as a singular NP (type *e*) coordinator, is a plural NP (type *et*) formant.[3] By iteration, one could expect *and* to give rise to a type (*et*)*t* expression when coordinating two or more plural NPs. My analysis will adhere to this intuition. Moreover, one of the ideas discussed in this debate is relevant for us and I will go back to it at the end of the article. It is the metaphysical claim that structured plural reference can be interpreted as not introducing any new objects over and above basic individuals into the ontology of our theories, but rather as involving a new kind of reference to basic individuals.

From a linguistic perspective, structured plurals are interesting, precisely because, despite what some philosophers argue, they suggest that the ontology of our semantic framework should be expanded. At first sight, a term like *these children and those children* picks out not a mere plurality of children, but a plurality of pluralities of children. Thus it seems that in order to interpret the fragment of the language including structured plurals, we would need a domain containing as well as individuals and pluralities of individuals, pluralities of pluralities of individuals. By contrast, in a basic plural linguistic fragment, we could make do with individuals and basic pluralities of individuals. I call theories that endorse this expansion 'inflationary semantics', borrowing a term often used in philosophy to refer to theories that make additional (in some sense) ontological assumptions.[4] Some linguists, however, claim that the meaning of structured plurals can be described in ways that do not demand such an expansion and assign context and pragmatics a more prominent role in the theory of plurality. These theories hold that all we need to interpret sentences with structured plural subjects is that their predicates be interpreted relative to a 'cover' (a special kind of set) of the basic plurality denoted by their subject. Which cover is relevant in each case is determined by the context. These semantics are called 'cover-based theories'.[5]

In this article I propose a semantics of plurality that incorporates elements from both the inflationary and the cover-based theories. In particular, while adopting inflationary domains for my models, I will give contextual dependance a central role, following the

1 See Linnebo (2017) for an overview of this topic.

2 See Rayo (2006), Oliver & Smiley (2016, ch. 15) and Grimau (forthcoming) for discussion and formalisations of Higher-Level Plural Logic.

3 See Hoeksema (1988, p. 20).

4 See Hoeksema (1983, 1988), Landman (1989a,b, 2000), Link (1984) and Winter (2001) for different versions of this view.

5 See Schwarzschild (1989, 1996) and Gillon (1987, 1990a,b) for developments of cover-based semantics.

insights of cover-based theories. My claim is that, by combining the two, we will be able to derive from our formalism the preference relation holding between different readings of one and the same sentence with regards to how accessible they are (and, in fact, some of the observations cover-based theorists make regarding the salience of certain covers for a given sentence). In order to do this, however, we crucially need another element, which, as far as I am aware, neither of these theories considers: the background operation of certain pragmatic principles, namely, the Gricean Maxim of Conciseness and the Interpretive Economy Principle, which I will define shortly.

With this article, I hope to make both a theoretical and an empirical contribution. On the one hand, the theoretical contribution of the paper is, as explained, a theory of plurality which combines two extant theories as well as a background pragmatic story. As with any semantic theory, the scope of my proposal is limited. In particular, my focus is on the interpretation of non-quantificational NPs[6] such as *the students*, *Serena and Venus* or *the cats and their owners*. More specifically, I am interested in the semantic contribution of overt structured morphosyntax (such as the one of *these children and those children*) and in how structured readings can arise for basic plural expressions. My hope is, of course, that the proposal developed here can eventually be extrapolated to wider linguistic fragments. On the other hand, the empirical contribution consists in bringing the focus to the empirical data on structured plurality and presenting a variety of overtly structured plural expressions and predicates they can combine with richer than has been considered so far in the literature, including some cross-linguistic evidence of so-called 'doubly plural' expressions.

The plan is as follows. In Sect. 2, after presenting the account of basic plurals which will be at the basis of my own proposal, I introduce the topic of structured plurality and describe the main data I aim to account for. In particular, I describe the main classes of predications that rely on structured plurality and the main morphosyntactic kinds of overtly structured plurals. In Sect. 3, I briefly describe inflationary semantics and cover-based semantics and I argue, partly following other authors, that they suffer from important limitations. My main contribution in this section is the argument (in Sect. 3.2.1) against one particular aspect of cover-based semantics: the idea that structured plurality is a matter of pragmatic implicature, rather than of semantic contribution. In Sect. 4, I finally turn to my own view. First (Sect. 4.1-Sect. 4.2), I develop a formal semantic analysis of sentences involving structured plurality. Second (Sect. 4.3), I argue that this account overcomes the limitations faced by inflationary and cover-based theories by means of the interaction of my formal analysis with the two independently motivated pragmatic principles mentioned above. Finally (Sect. 4.4), I defend my proposal from a potential objection regarding its meta-theoretical features. In Sect. 5, I take stock of what has been achieved. Finally, in the Appendix present a more detailed compositional analysis of the various types of NPs investigated in the article.

2 BASIC AND STRUCTURED PLURALS

Plural terms, expressions which can point to many individuals at once, have received a good deal of attention in formal semantics. Some accounts treat them as generalised quantifiers and take the formation of plural denotations out of singular ones as consisting of the

6 In the sense of Winter (2001, Ch. 4).

Boolean join operation (Hoeksema, 1983; Winter, 2001). While others take plurals to denote plural individuals, which can be more precisely characterised as sums (Link, 1983) or as sets of individuals, and take pluralisation to be either the Boolean join operation (Landman, 1989a; Link, 1983) or an operation of set formation (Hoeksema, 1988).

My own view will take plural definite NPs to be referring expressions rather than quantifiers. Moreover, the ontology of my models will be purely set-theoretic and pluralisation will consist of set formation. According to this view, a bare singular noun like *cat* would denote the set of all relevant cats, the bare plural noun formed from it (*cats*) would denote all the non-singleton sets of the relevant cats and, finally, a derived definite plural NP (*the cats*) would refer to the set of all relevant cats. Hereafter, I adopt this semantics as the general framework for my discussion unless indicated otherwise. I will occasionally have to adapt the authors' original formulations, but this will not interfere with any of the points being discussed.

A big part of the attention structured plurals have received has been focused on what we can call 'covert structured plurals', that is, basic plurals such as *the cats*, which nevertheless receive a structured interpretation, because they interact with a predicate and/or a context which triggers it. For instance, this would be the case of (2) if it were uttered in a context in which the speaker were describing the relationship between the neighbour's and their own cats.

(2) The cats do not get along.

However, here I will be primarily interested in overtly structured plurals, such as *the cats and their owners*, where the form of the NP indicates a certain structure, division or grouping affecting the objects being denoted. Hereafter, whenever I speak of 'structured plurals' simpliciter I will be referring to overtly structured plurals.

In the next subsection, I show that structured plurals, when combined with certain types of predicates, give rise to propositions that cannot be described without positing some sort of structure. These will constitute the main data I aim to account for with my analysis. For my examples in this section, I will focus on coordinate NPs for simplicity, but in the following section I will describe a wider variety of structured plurals NPs.

2.1 *Varieties of predication*

When we move from the singular to the plural, there is a genuine expressive gain, since not everything one can say by means of plural expressions can be paraphrased away in favour of merely singular expressions.[7] One of the reasons why plurals bring about an expressive expansion is that they can give rise to a kind of predication which singulars cannot: collective predication, in which the predicate is seen to hold of various individuals taken together. (Hereafter, I will speak of 'predications' or 'uses of predicates', since one and the same predicate may be used in different ways, giving rise to different sorts of predications.)

In what follows, I describe a classification of predications based on the basic distinction between collective and distributive interpretations. The question of how to categorise predicates that can combine with plural subjects has been treated at length and various

7 The question of the expressive power of plural language versus that of singular language has been discussed at length in the philosophical literature. See Boolos (1984), Oliver & Smiley (2001), Oliver & Smiley (2016, Chs. 3-4), Yi (2005) and Florio (2014) for arguments to this conclusion.

typologies have been endorsed by different authors. My own taxonomy is based on the one considered traditional (Champollion, 2017, pp. 71-74). The way in which my proposal modifies the traditional one is by distinguishing between different types of collective and distributive predications. In fact, one of the main claims of this article is that these distinctions must be drawn at the semantic level of our theory, as we will see. Importantly, the traditional view is adopted by all the main works I will be discussing in the article; for instance, it is adopted by Link (1983), Hoeksema (1983, 1988), Gillon (1987), Dowty (1987), Landman (1989a, 2000), Schwarzschild (1996) and, as far as I know, by all the philosophical works on the topic. However, the traditional typology has been criticised and rejected by some. For example, by Winter (2001) and Champollion (2017).

Hereafter, I call collective predications understood in the sense informally described above '**individual-collective**' predications ('i-coll' for short) in order to distinguish them from other sorts of collective predications. To define i-coll predication more precisely, it is useful to look at its dual notion: **individual-distributive** predication (i-dist). In an i-dist predication, the predicate holds of some objects if, and only if, it holds of each of them separately. For instance, *run a marathon* or *smile* can both be used in an i-dist way. These readings are illustrated in (3) and (4):

(3) Serena and Venus ran a marathon.
(4) The participants smiled.

We can now define i-coll predications more precisely as the uses of a predicate for which this biconditional fails, because the predicate may hold of some objects without necessarily holding of each of them. For instance, *meet for a drink* and *are siblings* both give rise to i-coll predications when combined with plural subjects.

(5) Serena and Venus are siblings.
(6) The participants met for a drink.

Distributivity is one of the most debated topics in the literature on plurality. One of the questions that has occupied researchers is the distinction between lexical and phrasal distributivity. That there are these two distinct sources of distributivity was first pointed out by Winter (2001) (see Champollion, forthcoming, Sect. 2.6, for an overview of this topic). Lexical distributivity involves predicates that, due to their lexical meaning, give rise to distributive readings (e.g. *smile*, *die*). By contrast, phrasal distributivity occurs with complex VPs that have an object (e.g. *run a marathon*, *bake a cake*). More precisely, it arises whenever the subject is interpreted as a quantifier taking scope over a constituent of the VP, such as an indefinite singular object or a pronoun. For instance, (7) has a distributive reading according to which each of the children baked a different cake. This can be explained by interpreting its subject as taking scope over the existential quantifier denoted by the indefinite singular object.

(7) The children baked a cake.

Analogously, collective readings can have their source in the lexical meaning of a simple predicate or in the scopal relation between two objects, whenever the predicate is a complex VP. In fact, this would be the case of (7) if the subject were assigned narrow scope (meaning, in this case, that the children baked a single cake altogether). Hereafter, the terms 'distributivity' and 'collectivity' encompass both their lexical and phrasal variants. As we shall see, my semantic analysis will be designed so as to account for both forms.

So much for basic plural readings. In what follows, I turn to what really matters for our purposes: those combinations of subject and predicate which demand some sort of structure for their correct interpretation.

Firstly, note that as well as predicates which can distribute down to individual level, there are predicates which can distribute down to plural level.

(8) Serena and Venus, and Marc (Gasol) and Pau (Gasol) are siblings.

This sentence can be naturally interpreted as saying that Serena and Venus are siblings and so are Marc and Pau. This seems to be both due to the form of the subject and the meaning of the predicate. I call this kind of predication '**plurality-distributive**' (p-dist). A p-dist predication is a predication in which the predicate holds of some pluralities if, and only if, it holds of each of them.

In fact, the predicates which can give rise to i-coll predications are exactly those which can give rise to p-dist predications. For instance, *are siblings* can give rise to both readings, depending, among others, on the form of the subject. To see this, note that

(9) Serena, Venus, Marc and Pau are siblings.

is more easily interpreted as an i-coll predication, according to which the four athletes have the same parents.

Next, there are predicates which can hold collectively of various pluralities at once. I call these uses '**plurality-collective**' (p-coll). For instance, consider:

(10) The students and their lecturers met in adjacent rooms.

This sentence has, among others, a reading according to which the students met in one room, the teachers met in another room and the rooms were adjacent. Under this interpretation, the predicate is used in a p-coll way, since it holds of two pluralities taken together, rather than of each of them separately.[8]

Importantly, predicates which admit i-coll/p-dist and p-coll readings can give rise to apparent failures of substitutivity between arguments which pick out the same individuals but do so under different structures.[9] [10] This is because these predicates are sensitive to the structures conveyed by their subjects. For instance, there are readings of (8) and (9) according to which the substitution of their subjects brings about a shift of interpretation, namely, the readings I suggested above. The shift occurs because *are siblings* distributes down to plurality level in the first place, but does not distribute at all in the second. We observe a similar shift when substituting the subject of (10) with that of (11):

(11) The students, their art lecturers and their science lecturers met in adjacent rooms.

Suppose that *the lecturers* in (10) refers to the art and the science lecturers in (11) and no-one else. Now, under the reading of (10) described above and the reading of (11) according to

8 I am not the first one to point out the availability of these interpretations. See, for example, Linnebo & Nicolas (2008).

9 This kind of failures have been pointed out by Ben-Yami (2013).

10 Throughout this article, I will talk of structured plurals as terms that 'refer to objects under a certain structure'. Moreover, I will talk of 'the structure conveyed by a term' in order to focus on the structural aspect of the term rather than on the basic objects it picks out. This terminology is intended as pre-theoretical and compatible with any semantic analysis of these expressions.

which there were meetings in three different (and adjacent) rooms, there is an interpretation shift. In this case, the shift seems to occur because even though both sentences are p-coll predications, the structure conveyed by the two subjects is different.

Finally, I believe there are **structured-plurality-distributive** predications (sp-dist), that is, interpretations where the predicate distributes down to structured plurality level. Analogously to the case of i-coll and p-dist predications, the predicates which give rise to sp-dist predications are exactly those which give rise to p-coll predications, since they are simply predicates capable of holding collectively of various pluralities whenever they are applied to a subject with two levels of structure (i.e. denoting a plurality of structured pluralities). This type of predications seem rare, but possible.

(12) The philosophy students and their lecturers, and the linguistics students and their lecturers met in adjacent rooms.

For example, (12) can receive the following sp-dist reading: the philosophy students met in a room adjacent to the room where the philosophy lecturers met and the linguistics students met in another room, which is also adjacent to the room where the linguistics lecturers met.

As far as I know, it is an open question whether we can go up this hierarchy and find instances of **structured-plurality-collective** (sp-coll) predications. Perhaps predicates such as *have equally strong bonds* can give rise to such readings:

(13) This musher and her dogs, and that musher and her dogs have equally strong bonds.

It seems to me that (13) can be interpreted as saying that the bond that the first musher has with her dogs is as strong as the bond that the second musher has with her dogs. If this is correct, (13) would be an example of a structured-plurality-collective predication, that is, a sentence in which the predicate holds collectively of more than one structured plurality (in this case, the structured pluralities are mixed: they consist of an individual, on the one hand, and a basic plurality, on the other). Even if this were an acceptable sentence of English, one would expect higher levels of this hierarchy not to be realised in natural languages, due to performance limitations. The next step would consist of a predicate distributing down to super-structured-plurality level, but this must be a very rare if not impossible construction in ordinary discourse. I will proceed on the basis that sp-coll predication is the most complex kind of predication present in natural language.

Note that the subjects of both (12) and (13) involve three levels of structurality. For instance, in the case of (13), at the most basic level, we have the terms that denote each of the mushers and the terms that denote each group of dogs. At the next level, we have the two coordinate NPs *this musher and her dogs* and *that musher and her dogs*. And at the most complex level, we have the coordination of these two coordinations. Interestingly, that definite referring expressions with two levels of nestedness are possible (even if rare) receives support from an experiment reported in Wagner (2005) according to which speakers were able to prosodically produce NPs with double nesting (see also Wagner, 2010, p. 194).

In any case, these expressions (and, a fortiori, terms with a higher level of complexity, if possible) do not bring about any difficulties not already present at the p-dist and p-coll level. Hence, even though I will include them in my formalism, I will not discuss them separately. Everything I say about p-dist and p-coll predications applies analogously to them.

Note that some of the predicates that trigger collective readings are reciprocal predicates. Reciprocal predicates take one of two forms. Either they involve an overt reciprocal construction – as in *hate each other* or *listened to one another* – or else they have a

lexical meaning which intuitively involve a reciprocal interpretation – as in *disagree*, *meet* or *competed*. Even though reciprocals are the subject matter of distinctive debates, they are also affected by many of the questions that concern plurality in general. In this article, I only address questions that do not distinguish between reciprocal and non-reciprocal collective predications; thus all the claims made here with respect to predicates that admit collective readings apply to the reciprocal sub-class just as well. Note that I will operate on a very simplified view of reciprocals as being on a par with collective monadic predicates that admit basic and structured plurals as subjects. This means that my account does not include a proper compositional analysis of reciprocals and that it does not address the question of the range of reciprocal readings in terms of strength (in the sense of Dalrymple *et al.*, 1998). My focus will be instead, as with all other predicates, on the interaction of reciprocal predicates with structured plurality. Nevertheless, despite falling outside the scope of this article, I cannot foresee any difficulties in further modifying and extending my analysis so as to include a more detailed treatment of reciprocals along the lines of the double anaphora approach of Heim *et al.* (1991), Schwarzschild (1996) and Beck (2001).[11]

At this point, I hope to have made a case that, as well as basic distributive and collective predications, natural language contains their structured counterparts. The latter will be the main subject matter of this article.

For future reference, let me list all the types of plural predication described so far (and which will be the main concern of this article) together with an example (the examples' relevant interpretations are the ones described above):

i-dist	*The participants smiled.*
i-coll	*The participants met for a drink.*
p-dist	*Serena and Venus, and Marc and Pau are siblings.*
p-coll	*The students and their lecturers met in adjacent rooms.*
	The phi-students and their lecturers, and the ling-students and their lecturers met in
sp-dist	*adjacent rooms.*
sp-coll	*This musher and her dogs, and that musher and her dogs have equally strong bonds.*

Finally, on top of distributive and collective readings of various levels, there are **cumulative predications**.[12] Cumulative readings arise with sentences that have two plural NPs, such as Beck & Sauerland (2000):

(14) The soldiers hit the targets.

They occur whenever the truth conditions of these sentences are weaker than those of a doubly distributive paraphrase. For example, (14) would be true even if it were not the case that every soldier had hit every target. More specifically, suppose a cumulative sentence says that objects *A* stand in relation *R* to objects *B*. Then, under a cumulative reading, that

11 See Dotlačil (2010, 4. 2) for an overview of different theories of reciprocals.

12 In fact, authors such as Beck & Sauerland (2000) have treated phrasal collectivity and cumulativity as a single phenomenon, while others have distinguished them (Landman, 2000). This debate falls beyond the scope of this article (see Champollion, forthcoming, Sect. 4.3, for a discussion thereof). My only aim regarding cumulativity is to describe a possible implementation in my framework for the sake of providing a more complete theory.

sentence would be true if, and only if, each of *A* were in the relation *R* to at least one of *B* and each of *B* were in the inverse relation to at least one of *A*.

Relevantly for us, cumulative sentences can be of the various levels illustrated in this section.

(15) The cows, the pigs and the sheep ate the four bales of hay.

For instance, (15) would be true if the cows had eaten one bale, the pigs another one and the sheep, the two remaining ones.

2.2 *The morphosyntax of structured plurals*

Let us briefly describe a wider range of different sorts of NPs capable of conveying structure (naturally, this will not be an exhaustive list). So far we have seen **coordinate plural NPs**, like *these children and those children* or *the Potters, the Weasleys and the Grangers*, and **nested coordinates of singular noun phrases**, such as *Serena and Venus, and Marc and Pau*. The latter are what Winter (2007) calls 'repeated coordinator coordinations' (RC-coordinations). In that article, he notes the structuring effects that these NPs have, as opposed to multiple coordinations of singular NPs such as *Serena, Venus, Marc and Pau*, which tend to trigger basic plural readings. As observed by him and investigated in detail by Wagner (2010), the structuring effects of RC-coordinations are often brought up in speech by an articulated prosody (in which the boundaries between the different coordinates have different relative strength). In order to capture this prosodic articulation, I use commas (possibly followed by a conjunction), slightly artificially. By analogy, nested coordinates of plural NPs can be seen as structured plurals of higher level (e.g. *the cat lovers and their cats, and the dog lovers and their dogs*), which I will refer to as 'super-structured plurals'.

Note that coordinate plural NPs seem able to denote mixed structured pluralities. For example, this is the case of *Rafa Nadal and the Williams sisters*, which would denote a single person, on the one hand, and a group of two people, on the other. My account will cover these mixed cases as well.

As well as coordinate plural NPs, plural definite descriptions can contribute structure to a predication. This is the case of **plural definite descriptions formed with basic collective predicates**. The presence of these predicates facilitates a reading of the resulting phrase according to which it does not simply refer to some objects fulfilling a certain condition, but to all the pluralities of objects which do so separately.[13] For example, *the numbers whose product is larger than 25* and *the authors of multi-volume classics in logic* fall into this category.[14] To see this, note that *the numbers whose product is larger than 25* can be taken to denote all the pluralities of numbers which jointly satisfy the property of having a product larger than 25, in which case it would denote numbers organised in different groups.

A related class of expressions is that of **plural definite descriptions formed with a verb phrase with a quantificational object**. What seems to facilitate the structured interpretation

13 The fact that this kind of expressions give rise to structured plural readings has been pointed out by Oliver & Smiley (2016, Ch. 8), who call them 'plurally exhaustive descriptions'.

14 The second example is from Oliver & Smiley (2005, p. 1062). Its relevance comes from the fact that Hilbert and Bernays co-authored what is considered a classic logic book and so did Russell and Whitehead.

in this case is a certain scopal relation between the quantificational object and the main NP. For example, *the people forming two lines* can be interpreted as denoting two groups of people each of which is such that there is a line that they are collectively forming. A similar example would be *the specialists competing for each job*. Note that once we have got such an embedded quantificational phrase, the predicate doing the restriction need not be collective. For instance, *the cars parked in each lane* can be interpreted as denoting various groups of cars each of which is such that its members (individual cars) are parked in the same relevant lane.

Note that plural definite descriptions of either of these two forms are always ambiguous between two readings. The first one is the one described here and which Oliver & Smiley (2016) call 'exhaustive'. The other one is what they call 'unique' and it does not convey any structure, but a mere basic plurality. Exhaustive descriptions pick out all the pluralities that satisfy a certain condition, whereas unique descriptions denote a unique plurality that satisfies the condition in question. For example, *the students who met for a drink* can refer either to a single group of students who met for a drink or else to a plurality of such groups. In the first case, the interpretation is unique (and thus basic), in the second it is exhaustive (and thus structured).

Moreover, a few languages have structured plurals of yet another form: terms with **a double plural inflection**.[15] For instance, we find expressions of this sort in Icelandic, in the form of plural numeral phrases.[16] More specifically, Icelandic's first four cardinal numbers have both a singular and a plural form and they can be combined with nouns in both of these forms:

Value	Singular	Plural
1	*einn*	*einir*
2	*tveir*	*tvennir*
3	*þrír*	*þrennir*
4	*fjórir*	*fernir*

When the plural form is combined with a plural common noun, we obtain expressions which pick out pluralities of the objects being referred to by the head noun – as many as the original singular numeral. However, they do not pick out any old kind of pluralities, but a specific kind: pairs of objects. For example, whereas *einn skór* translates to 'one shoe', *einir skór* means 'one pair of shoes'. Analogously, *tveir skór* means 'two shoes' (not necessarily forming a pair) and *tvennir skór* means 'two pairs of shoes'. And so on.

15 See Corbett (2000, pp. 36-8) for an overview. Apart from the languages mentioned in this article, it has been claimed that Breton also contains this sort of expressions (see Jespersen, 1924, p. 197, and Corbett, 2000, pp. 36-7). However, Acquaviva (2008, pp. 234-265) argues that cases of double pluralisation in Breton are not really cases of double plural inflection, since the plural suffixes involved play two different roles: lexical/derivational and grammatical/inflectional. It follows that Breton is akin to English in this respect: it simply contains the plural of lexicalised terms such as *pair* or *group*.

16 This is reported in Jespersen (1924, p. 189) and Linnebo (2017).

Like Icelandic, Finnish contains plural numeral phrases. However, unlike Icelandic, it contains plural forms of all cardinals, not only the first four.[17] These are a few examples:

Value	Singular	Plural
1	*yksi*	*yhdet*
2	*kaksi*	*kahdet*
3	*kolme*	*kolmet*
10	*kymmenen*	*kymmenet*
50	*viisikymmentä*	*viidetkymmenet*
100	*sata*	*sadat*
1000	*tuhat*	*tuhannet*

When the plural numerals of Finnish precede plural nouns, the resulting NPs usually mean something like '*n* pluralities of...', where *n* corresponds to the original singular numeral determiner. The most uncontroversial cases involve things that come naturally in certain groupings, such as pairs – i.e. hands, socks, eyes. However, things which do not typically come in any specific groupings can also be denoted by these phrases. For example, *kahdet paperit* means 'two pluralities of papers'.

Just as it occurred with Icelandic, there is no way to denote pluralities of objects in the plural simpliciter, but a specific number thereof must always be specified. This is not the case with Khamtanga, a Cushitic language which admits an iterated application of the plural suffix, where the singular ends in *-a*, the basic plural ends in Ø and the third term varies (Appleyard, 1987, p. 252, reports forms ending in *-t* and others in *-le*):

ieferā́	*iefír*	*iefírt*
child_{S}	child_{PL}	$\text{child}_{\text{2PL}}$
'child'	'children'	'crowds of children'

lálā	*lal*	*lálle*
bee_{S}	bee_{PL}	bee_{2PL}
'bee'	'bees'	'swarms of bees'

A word of caution. While the following examples were reported by Appleyard in 1987, they were originally recorded a whole century before, in Reinisch (1884). Appleyard reports that even though in his study he found similar forms, they had evolved into alternative plural forms. Thus it would not be surprising if the distinction had been lost today.

As mentioned in the Introduction, the expressions falling into this category are especially relevant for our purposes, since they suggest that structured plurals can be analysed, in a sense, as pluralised plurals, in line with the account being proposed in this article.

Finally and more controversially, we find terms in the form of **definite descriptions which have a group noun as their head noun**. For instance, *the ugliest pairs of shoes in the shop* or *my favorite teams*. Group nouns (e.g. *pair*, *team*, *couple*, *committee*) have been considered to be semantically plural expressions by some. In particular, this view has been defended in Oliver & Smiley (2016, pp. 305-6) on the basis that group nouns behave in a grammatically hybrid way in many languages. For example, in English, Spanish, Catalan, French and Latvian, they admit plural override: while they are usually accompanied with

17 According to Hurford (2003), Estonian is 'to a large extent' similar to Finnish in this respect.

singular determiners, they admit a plural verb and/or plural anaphoric reference back to them. Since these terms are syntactically singular, they can be syntactically pluralised in a straightforward way, thereby allegedly giving rise to an expression which seems to denote a plurality of pluralities. For instance, *my favorite teams* would, according to this, refer to a plurality of pluralities (i.e. teams) of people. Nevertheless the relevance of these expressions for the present topic is not straightforward, since many semanticists have argued that group nouns refer singularly. For example, Vries (2017) argues that these expressions denote single individuals, because certain distributivity patterns fail for them, demonstrating that the compositional semantics of the sentence does not have access to the members of the relevant group.[18]

3 TWO SEMANTIC THEORIES AND THEIR LIMITATIONS

Structured plurality has been addressed in the linguistics literature mainly because of its relevance for the topic of distributivity. Distributivity, it has been observed, can be non-atomic. That is, predicates can distribute down to various pluralities of individuals, rather than to the individuals themselves. Various semantic theories have been developed with the aim of accounting for these readings. Two important such theories are inflationary semantics and cover-based semantics. The former introduces new entities in the models in order to account for the structurality apparently involved in non-atomic distributive readings, while the latter tries to make do without them and assigns, instead, a crucial role to context. Let me briefly present each of these views and point to some of their limitations.[19]

3.1 *Inflationary semantics*

Works such as Hoeksema (1983), Link (1984), Landman (1989a,b, 2000) and Winter (2001) introduce what we can generically call 'structured pluralities' as possible denotations of NPs.

This ontological inflation can be done in various ways (which are equivalent for many purposes). I describe the one we shall base our proposal on, which is similar to Hoeksema (1988)'s. Suppose we start off with a model for plural NPs as described in Sect. 2, in which singular NPs are assigned individuals and basic plural NPs, sets of individuals. In order to obtain denotations for overtly structured plural NPs, inflationary semantics expands the domain by closing it under set formation. Thus, assuming that our basic individuals are a, b, c and d, the newly expanded domain includes now sets of sets such as $\{\{a, b\}, \{c, d\}\}$, $\{\{a, b\}, \{b, c\}\}$ and $\{a, \{b, c\}\}$. These sets can be mixed, as is the last one in this list. With these new entities in our models, we ensure that the members of the members of structured sets are not directly available for distribution and thus open the door to non-atomic distributivity. For instance, under this analysis an overtly structured plural such as *the red cards and the*

18 For arguments in favour of the atomicity of the reference of group nouns see also Barker (1992), Link (1984), Landman (1989a), Schwarzschild (1996) and Winter (2002).

19 Note that another important branch of theories are those that combine semantics for plurals with event-based semantics, à la Davidson. For instance, Landman (2000) develops one such theory. In this paper, I will not consider these kind of theories. I leave the potential incorporation of my own event-less approach into an event-based framework for future research.

black cards would denote the set {⟦*the red cards*⟧, ⟦*the black cards*⟧}. Hereafter I refer to sets of individuals as 'basic sets' and to sets of sets as 'nested sets'.

Under this framework, predicates are interpreted as one would expect: as sets of objects from the domain (thus possibly as nested sets). Moreover, these proposals typically make use of an operator which attaches to predicates whenever they receive a distributive reading, and turns them into plural predicates:[20]

(16) Definition (Star operator) For any set P, $^*P$ is the smallest set s.t. $P \subseteq {}^*P$ and if $a \in {}^*P$ and $b \in {}^*P$, then $\{a, b\} \in {}^*P$.

Suppose (17) is interpreted as saying that the red cards are shuffled and so are the black cards, but the two piles are shuffled separately:

(17) The red cards and the black cards are shuffled.

We would formalise (17) as $^*S$(*the red cards and the black cards*), which would be satisfied if, and only if, ⟦*the red cards*⟧ ∈ ⟦$^*S$⟧ and ⟦*the black cards*⟧ ∈ ⟦$^*S$⟧.

Limitations Inflationary semantics has some important limitations. Firstly, it struggles with the compositional analysis of certain plural expressions. And, secondly, it can easily give rise to an over-generation of readings for sentences involving plurality. I discuss these one at a time.

In the first place, inflationary semantics seems to make some mistaken predictions. On the one hand, if nested sets can only work as denotations of NPs which are overtly structured (such as those involving the NP coordinator *and*), then this semantics does not allow for structured readings of sentences with basic plural subjects, but, as demonstrated by examples like (18), they often seem to be available.

(18) Hammerstein, Rodgers and Hart wrote musicals together.[21]

This sentence, under its truthful reading, says that Hammerstein and Rodgers wrote musicals together and so did Rodgers and Hart. This reading would demand that we assign to its basic plural subject, the nested set {{Hammerstein, Rodgers}, {Rodgers, Hart}}.

The possibility of p-dist readings for sentences with basic plural subjects is a controversial topic, with some authors arguing that it is less easily accessible than distributivity at the individual level. For instance, this idea is defended in Lasersohn (1989) and Link (1998). In particular, there is substantial controversy regarding the possibility that phrasal distributivity give rise to p-dist readings. However, the view that p-dist readings involving a basic plural subject are available in certain contexts (even in the phrasal case) is defended, among others, by Gillon (1987, 1990b) and Schwarzschild (1996), and it receives support from the experimental data recently collected in Wohlmuth (2019, pp. 95-107). I proceed on the assumption that they are indeed available.

On the other hand, the opposite also occurs: overtly structured plural subjects sometimes must be interpreted as basic plurals. One reason for this is that they can be combined with

20 This operator is adopted (in its sum-based form), among others, by Link (1983) and Sternefeld (1998).

21 This example is a variation of one from Gillon (1987).

predicates which make their structure irrelevant, such as predicates which can only receive i-dist interpretations:

(19) These children and those children smiled.

In this case, even though the subject is a structured plural, the predicate *smiled* can only apply to individuals and thus must be understood as i-dist.

Landman (1989a) provides a partial solution for these issues. He suggests that in order to tackle cases like (19), we use a type-shifting operator which turns any set of sets into the union of its members.[22] He denotes this operator $\downarrow^2$ and analyses (19) as

(20) Smiled($\downarrow^2$ {⟦these children⟧, ⟦those children⟧}).

Moreover, Landman makes use of an operator that lifts the type of expressions (namely, *LIFT*). However, it is of no use to us, since its only effect is to transform an i-dist predication into an i-coll one (it turns any x into $\{x\}$) – thus it is not capable of introducing structure and cannot deal with cases like (18). Nevertheless, for the sake of the argument, let us suppose that we had such an operator (it can certainly be defined, as we will see) and suppose that, more generally, we were to make basic and structured plurals ambiguous between basic and structured readings in order to account for this kind of cases. This would lead to a new problem: the problem of overgeneration of interpretations, which has been pointed out by Lasersohn (1989, 1995). He argues, by means of the following example, that allowing for such an ambiguity can make true sentences that are intuitively false.

(21) The T.A.s earned exactly $14,000.

Suppose that John, Mary, Anna and Bill are the relevant T.A.s, and that each of them earned $7,000. In this case, the predicate *earned exactly $14,000* holds of each element of the set {{John, Mary}, {Anna, Bill}}, but (21) is not intuitively true in this situation. Lasersohn concludes that this assignment should not be available for the subject of (21).[23]

However, as a reply to this objection, Gillon (1990b) describes an alternative context of utterance in which this sentence would be naturally true relative to this assignment, thereby showing, in my view convincingly, that this assignment and the reading it gives rise to cannot be ruled out outright. Here is the scenario. Suppose that a philosophy department had two T.A.s for each of the two courses it offered and suppose that for one of the courses the T.A.s were John and Mary and for the other, they were Anna and Bill. Moreover, suppose that the department payed $14,000 per course, leaving it to each pair of T.A.s to decide how to divide the wages between them. In this context, the set above would be clearly adequate as a cover for the subject of (21). More generally, I think we must agree with Gillon that we will always be able to find strange enough contexts in which any cover may be correctly chosen as the relevant one for a given sentence.

I think the moral of the exchange between Lasersohn and Gillon is that, although we cannot rule it out altogether, the reading of (21) just described is less likely than others.

22 His formulation is slightly different, because he takes the domain of the model to include sums as well as sets, but nothing is lost in my adaptation to the present purely set-theoretic framework.

23 I have slightly changed Lasersohn's example so as to avoid overlap between the two pluralities of T.A.s (his original example involved only three T.A.s, each of them earning $7,000). I believe that overlap brings about issues of its own, whose discussion falls outside the scope of this paper.

For instance, it is less easily accessible than the reading according to which each T.A. earned \$14,000 or that the T.A.s made \$14,000 in total. However, as far as I know, Gillon has no way to account for this preference relation.

Moreover, we can construct more pressing cases to back Lasersohn's point. For instance, consider (22):

(22) 2 and 8, and 3 and 9 are co-prime.[24]

Prima facie, (22) seems false. However, if basic and structured plurals are really ambiguous between basic and structured interpretations, (22) could be true, after all. For instance, it would be true if its subject were assigned a basic plural denotation (since 2, 3, 8 and 9 are co-prime). Moreover, what stops us from assigning it a structured denotation different from the one conveyed by the syntactic form of its subject? Note that (22) would also be true if its subject were interpreted as denoting $\{\{2, 3\}, \{8, 9\}\}$ and its predicate, as distributing down to each member of this set. Even though they are difficult to imagine, there must be some contexts which make this interpretation available. Perhaps it would be available in a situation in which 2 and 8 were presented together – say, on one side of a blackboard – and 3 and 9 also appeared together – on the other side – but the sentence were uttered with a prosody and were accompanied by gestures indicating that 2 and 3 are to be thought of as forming a group and 3 and 9 as forming another one. However, this context seems very rare and specific. In the vast majority of contexts, this will not be the relevant interpretation; rather it will be the one that assigns the subject the set $\{\{2, 8\}, \{3, 9\}\}$. I submit that any adequate theory of plurality should render (22) false by convention in most contexts of utterance.

3.2 *Cover-based semantics*

Structured plurality has been considered to be highly context-dependent in the sense that its analysis crucially involves a free variable pointing to an element provided by the context of utterance. In particular, this view has been developed in the form of cover-based semantics, in which the meaning of sentences involving structured plurals is relativised to a contextually-determined set of objects: a cover. As we will see, making the interpretation of basic and structured plurals context-dependent helps address some of the difficulties considered above.

Cover-based semantics has been proposed in Gillon (1987, 1990a) and Schwarzschild (1996). Under a cover reading, a predicate needs not apply collectively to all the objects denoted by the subject (i-coll) nor distribute down to the individual level (i-dist), but may stay in between, distributing down to some sub-pluralities of the plurality picked out by the subject (p-dist). According to Schwarzschild, moreover, the contribution that covers make is not semantic, but pragmatic. In other words, semantically speaking, there are only singular and plural expressions: the salience of an intermediate cover for the interpretation of a sentence does not have any semantic consequences. Whenever an intermediate cover is salient, all that happens is that a series of pragmatic implicatures are validated. Another way to express this view is to say that there are no predicates in natural language which are semantically capable of drawing distinctions between subjects that convey different types of structure. From the point of view of the predicates' interpretation, every plural

24 Two or more integers are co-prime if, and only if, the only positive integer that divides all of them is 1.

and structured plural subject makes the same kind of contribution: it denotes a plurality of individuals. I will criticise the arguments put forth by Schwarzschild for this view in Sect. 3.2.1, but first I focus on the other aspects of cover-based semantics.

The proposal, roughly speaking, is that the interpretation of any sentence involving a plural term depends on a contextually-determined choice of cover, where covers are characterised as follows:[25]

(23) Definition (Cover) Given a set x, C is a cover of x iff
- (i) C is a set that can have as members both members of x and non-empty non-singleton subsets of x.
- (ii) Every member of x belongs to C or to some member of C.

More precisely, the reading of any plural sentence makes use of a distributive operator, $Part_{Cov}$, which attaches to a predicate and forces it to apply to the elements of the relevant cover, picked out by *Cov*. Suppose that t is a basic plural term (i.e. it denotes a basic set). This is the semantic rule for the $Part_{Cov}$-operator:

(24) Definition ($Part_{Cov}$) $Part_{Cov}P(t)$ iff *Cov* is a cover of t and $\forall y(y \in Cov \rightarrow P(y))$.

In this framework, i-dist predication is the limiting case where *Cov* is the set of individuals which t denotes ($Cov = [\![t]\!]$) and i-coll predication is the limiting case where *Cov* picks out the singleton set of the set of individuals denoted by t ($Cov = \{[\![t]\!]\}$). The rest of covers are intermediate and are used to account for p-dist predications.

The notion of cover allows for overlap between its elements. This is necessary to account for the meaning of sentences like (18), repeated as (25):

(25) Hammerstein, Rodgers and Hart wrote musicals together.

Recall that (25) is true relative to the cover {{Hammerstein, Rodgers}, {Rodgers, Hart}}, where its elements overlap.

Under this semantics, sentences with an overtly structured plural subject can be analysed relative to intermediate covers. But, as made clear by (25), sometimes basic plurals also demand an intermediate cover reading. This is not a problem for the cover-based analysis, since the variable *Cov* can obtain its value from elements of the sentential context other than the morphosyntactic form of the subject as well as from the non-sentential context.

Importantly for the advocate of cover-based semantics, both basic and structured plural terms refer to basic pluralities. There is no need to expand our domain, as described in Sect. 2, with additional entities. However, structured plurals typically make salient certain sub-pluralities thereof (i.e. the elements of the cover) with respect to which the predication may be evaluated. Thus it is not that structured plurals refer to covers, but rather that by referring to basic pluralities in the way they do, predications can be seen to be done on the elements of the covers thereof instead of on their referents.

Limitations Cover-based semantics also faces some difficulties. First, it does not suffice to analyse all the varieties of predication described in the previous section – in particular, p-coll, sp-dist and sp-coll predications. Secondly, similarly to inflationary semantics, it faces

25 I adapt the notion of a cover to the Hoeksema-style models I described above, where pluralisation is set-formation rather than union.

the problem of over-generation to some extent. This leads, in turn, to an unsatisfactory treatment of certain anaphora. Let us have a look at each of these.

As described so far, cover-based semantics can only account for i-dist, i-coll and p-dist predications. However, as shown above, English also displays p-coll/sp-dist predication (and possibly even sp-coll predication). To give a couple more examples, predicates like *be equally well coordinated* (applied, for instance, to two tennis doubles' teams) or *be equally loud* (applied to a herd of pigs and a herd of cows) would give rise to p-coll interpretations. The reason why cover-based semantics, as it stands, does not leave room for these cases is that it only allows for distributivity over covers which have basic sets as elements. Hence, according to it, any predicate will only ever be taken to apply to individuals or basic sets of individuals. However, in a p-coll interpretation we need the predicate to apply to various sets of individuals taken together, in other words, to a set of sets.

Nevertheless, prima facie, cover-based semantics can be easily modified so as to account for p-coll predications simply by not forcing cover readings to be accompanied by the *Part* operator. For example, we can make this explicit by introducing a collective operator defined as follows:

(26) Definition ($Coll_{Cov}$-operator) $Coll_{Cov}P(t)$ iff Cov is a cover of t and $P(Cov)$.

Alternatively, one could keep only the $Part_{Cov}$-operator, but generalise the definition of 'cover' thereby allowing for covers that are sets of sets of sets of individuals. This would in fact make it easier to climb up the hierarchy of interpretations and have as well as basic and structured plurals also super-structured plurals. Either way, this revision of cover-based semantics would go against the spirit of the cover-based approach, one of whose aims was not to populate the domain of interpretation with extra entities. This is because, according to the modification I am suggesting, one would need to accept that nested sets can figure in the extensions of predicates. Once this expansion is accepted, the claim that we need only appeal to basic sets (as selected by a cover) in our semantics of plurals is indefensible. Nested sets not only serve to determine which basic plural predications are relevant, but they actually are sometimes the objects of which predications are made.

Schwarzschild (1996, Ch. 6) has proposed a different approach to this issue, which allegedly circumvents the issue just pointed out. His solution makes use of relations holding between the pluralities picked out by the relevant cover.

(27) The cows and the pigs are equally loud.

According to Schwarzschild, (27) should be analysed as saying that any sub-plurality of the plurality of pigs and cows singled out by a contextually given cover is such that it is as loud as any other such sub-plurality. In this case, the cover could be determined by the syntax of the subject: {⟦*the pigs*⟧, ⟦*the cows*⟧}. As far as I can see, the advantage of this approach over a full-fledged inflationary account is that we avoid saying that a predicate holds of a set of sets and we say, instead, that some basic sets bear a certain relation to one another. In other words, we place the basic plurals denoting the sub-pluralities selected by the cover in different argument positions, thereby circumventing the need for argument positions admitting cover-denoting terms. I will go back to this issue in Sect. 4.4, where I will argue that Schwarzschild's proposal does not really carry an advantage in this sense, since even though it does not involve an expansion of the domain of interpretation, it still comes with a certain meta-theoretical cost, since it introduces new conceptual machinery.

The second difficulty faced by cover-based analyses has to do with the issue of the overgeneration of interpretations discussed above with respect to inflationary accounts. As we saw, there appears to be a certain preference order between the various interpretations of sentences with basic and structured plural subjects. Schwarzschild acknowledges that certain linguistic factors are relevant for the availability of interpretations.

First of all, according to him, i-dist and i-coll readings take preference over the rest. This is because they are the limiting cases of a wide range of possible readings. This makes them cognitively salient for speakers, who thus tend to choose them as intended as a means to achieve successful communication. Interestingly for us, Champollion (2016, p. 20) notes that this can be explained by means of the Interpretive Economy Principle, which is the idea that whenever possible, speakers should maximise precision in their utterances, thereby leaving as little as possible of their meaning for the context to decide. Although I will also invoke this principle as being operative in the analysis of plurality (Sect. 4.3), as we will see, its operation will have different consequences due to the specific features of my semantic analysis. This is important, since, in my view, the observation that i-dist and i-coll readings are more prominent than the rest is mistaken. I will go back to this in Sect. 4.3, once I have presented more data to back up this claim.

Secondly, non-atomic readings may arise, but only when an intermediate cover is made salient by the context. What is crucial for such a cover to be available is that the properties associated with each of their elements be made explicit. This can occur in various ways. Most importantly, according to Schwarzschild (1996, p. 71 and p. 94), covers become salient when they are mentioned in the subject. For instance, the cover {⟦*the cows*⟧, ⟦*the pigs*⟧} is explicitly mentioned as the subject of (27), as we saw.

Moreover, Schwarzschild also takes embedded quantified clauses as well as adverbial modifiers as capable of determining the relevant intermediate cover:[26]

(28) The pigs from the two communities were separated.
(29) The cows were separated by age.

These are interesting observations, but as Schwarzschild himself acknowledges, he does not have a theory of how they contribute to the semantics of plurality (Schwarzschild, 1996, p. 98; Schwarzschild, 1989, p. 387). One of the aims of this paper is, precisely, to provide one such theory.

As a special kind of linguistic context in which the problem of overgeneration can arise, let us consider cases of anaphora in which the various predicates involved take different structures into account. For example, consider the following sentence, involving an anaphoric use of *they*:

(30) These players and those players are arch-rivals, but outside the field they all get along with one another.

Suppose that the sentences in (30) are interpreted as saying that two teams are arch-rivals and that each individual player gets along with any other player, irrespective of their team (the interpretation of the second sentence is enforced by the presence of *all* and *one another*). In the second sentence, *they* is linked to *these players and those players*. However, while in the first sentence the subject appears to function as a structured plural, the subject of the second one appears to function as a basic plural. This is because whereas *be arch-rivals*

26 See Schwarzschild (1989, Part II).

must take into account the fact that the players are referred to as belonging to two different groups (it is used as p-coll), *all get along with one another* does not take that fact into account (it receives an i-coll reading). Prima facie, anaphoric reference could be a problem for cover-based semantics, because according to a naive understanding of anaphora, the anaphoric pronoun would stand for the exact same noun phrase, which would be associated with a single cover. Hence, in the case of (30), the interpretation of the two sentences would be relativised to the exact same cover, resulting in one of them being incorrectly interpreted.

However, the cover-based approach has been developed by Gillon (1990a) in a way which appears to account correctly for anaphoric reference of this sort. He proposes that all that is preserved via anaphora is the set of individuals generating whatever cover is at play in the analysis of the preceding sentence. In other words, the structure conveyed by the first NP is not preserved. This solves the issue pointed out, but it introduces a new problem, namely, that of overgeneration. This is because it seems that in many cases anaphora does preserve structure:

(31) The students and their lecturers met in adjacent rooms. They do not agree at all.

A natural reading of (31) is that the students met in a room which was adjacent to the room where their lecturers met and that the students (as a group) do not agree at all with the lecturers (as group). Under this reading, the two predications are p-coll and the pronoun *they* must denote the students and the lecturers structured exactly in the same way as picked out by the subject of the first sentence. This reading seems to be very easily accessible and in many contexts it will be the salient one. Of course, it would be surprising if the fact that the predicate *do not agree at all* holds of the exact same groups of individuals (in many contexts) did not depend on the form of the first sentence. Even though Gillon is right that there must be a mechanism by which the analysis of anaphora can give rise to, for instance, our reading of (30), we cannot completely disentangle anaphoric reference from preservation of structure, since doing so would give rise to too liberal predictions, as (31) illustrates. The advocate of cover-based semantics might say at this point that the syntax of the subject of the first sentence may trigger an intermediate cover-reading of not only the first, but also the second sentence. My account will try to go beyond this and formalise this mechanism.

3.2.1 *Pragmatic sub-entailments*

As mentioned in the beginning of Sect. 3.2, structured plurality has also been taken to belong to the pragmatics of language in a different sense: in the sense that its linguistic contribution does not belong to the truth-conditional meaning of sentences, but rather it manifests itself in the form of certain pragmatic implicatures. More specifically, structured plurals have been seen as basic plurals which give rise to certain pragmatic sub-entailments, where the pragmatic sub-entailments of a sentence are implicatures which indicate how the individuals making up a plurality participate in the action predicated of the whole plurality (e.g. in the case of p-dist predications, the implicature from the predication of a plurality to the predications of parts of that plurality) (Schwarzschild, 1989, Ch. 4; Link, 1998). Cover-based semantics is compatible with this view. The result of the combination of the two views is that the mechanism that determines which pragmatic sub-entailments a proposition has relies crucially on the action of the context of utterance to determine the relevant cover. Schwarzschild seems to endorse this combined view (Schwarzschild, 1996, p. 103).

The general idea is that a sentence like (32) can be understood as stating that the animals were separated into the two groups consisting of the young animals, on the one hand, and

the old ones, on the other. However, the subject of (32) does not refer to these two groups, but rather to a basic plurality of animals. The fact that the sentence be understood as just indicated is a matter of pragmatics, not of semantics. More precisely, it is a pragmatic implicature and as such it can be cancelled without contradiction.

(32) The young animals and the old animals were separated.[27]

The main argument for this conclusion is based on the alleged validity of the principles of Set Generalisation and Upwards Closure. In their description, I follow Schwarzschild (1989) and Schwarzschild (1996, Ch. 4), but note that he presents them in a sum-based framework (in fact, Set Generalisation is originally called Sum Generalisation). I state them in their set-theoretic version.

According to the former principle, even though we normally express certain propositions by using structured plurals, this is only so because using basic plurals would result in a pragmatically misleading way of describing a certain situation, but not in a false statement:

(33) Principle (Set Generalisation) Whenever P is true of a nested set a', P is true of the basic set a which has as elements the individuals that generate a'.

According to this principle if (32) is true, then so is

(34) The animals were separated.

This is supposed to show that *the young animals and the old animals* is substitutable with *the animals* (provided they pick out the same individuals). He proposes two other examples to illustrate this point (I indicate the alleged truth-preservation by an arrow):

(35) The cows and the pigs talked to each other. ⇒ The animals talked to each other.
(36) The cows and the pigs were given different foods. ⇒ The animals were given different foods.

Moreover, Schwarzschild thinks that this works in the opposite direction as well: although it may be pragmatically preferable to express a certain proposition by employing a basic plural term, if we substitute the latter by a structured plural, truth-value will not vary. This idea is captured by the following principle:

(37) Principle (Upwards Closure) Whenever P is true of a basic set a, P is true of any nested set a' generated by the elements of a.

For instance, the inference from (38) to (39) is truth-preserving if the pigs and the cows are all and only the relevant animals:

(38) The animals are mammals.
(39) The cows and the pigs are mammals.

A consequence of the acceptance of these two principles is the validity of the following inference, by a single application of each principle:

(40) The young animals and the old animals were separated. ⇒ The cows and the pigs were separated.

27 Most of the examples in this section, including this one, are from Schwarzschild (1989).

The second statement would be predicted to be true in the situation where the animals were separated by age, even though it would be, admittedly, a misleading way of describing the situation. In favour of this result, the second statement may be argued to be made more natural in the scenario where the young animals were separated from the old ones by adding a clause to it cancelling the implicature concerning the structure conveyed by its subject:

(41) The cows and the pigs were separated, but not in this way.

Limitations In my view, Schwarzschild's arguments for the validity of Set Generalisation and Upwards Closure are not convincing. First, all the examples that Schwarzschild gives to illustrate the validity of Upwards Closure involve collective predications, but once we consider sentences with distributive readings, its validity loses plausibility.

For instance, the predicates of (42)-(43)[28] and (44)-(45) can all hold of some individuals collectively and which, as such, can give rise to i-coll and p-dist readings:

(42) 2, 3, 8 and 9 are co-prime.
(43) 2 and 8, and 3 and 9 are co-prime.
(44) These people went to the same school.
(45) The people who are talking to each other went to the same school.

In these cases it is more difficult to argue that there is no shift in meaning from the first to the second sentence of each pair. At least in some contexts there would appear to be one such shift: whenever the predicate is applied to a structured plural subject, like in the second sentence of each pair, it can naturally receive a p-dist reading, in which case there is a shift in interpretation (in order to see this effect in (44)-(45), think of a context in which there are various groups of people who are talking to each other and not to people in other groups). To see that these inferences do not generally go through, note that adding clauses to cancel the alleged pragmatic sub-entailments of the second sentences is awkward:[29]

(46) ?2 and 8, and 3 and 9 are co-prime, that is, when considered altogether.
(47) ?The people who are talking to each other went to the same school, that is, all of them did.

If I am right that the truth-conditions of these pairs of sentences are different, then they must also work as counterexamples to Set Generalisation. This receives support from the observation that the alleged implicatures of the first sentences of each pair are also difficult to cancel. (To illustrate the case of the first pair, I slightly modify the example so that we start off with an apparently incorrect implicature which is thus cancelled.)

(48) ?2, 3, 8 and 9 are not co-prime, that is, 2 and 8 are not co-prime and neither are 3 and 9.
(49) ?These people went to the same school, that is, those who are talking to each other did.

When we consider the result of applying both principles, cancellation clauses are even more awkward. Suppose that the young animals hate the old animals and

28 (43) is the same as (22).

29 See Winter (2001, p. 41) for an analogous counterexample.

vice-versa. It seems to me that the following would not be considered true in such a scenario:

(50) ?The cows and the pigs hate each other, but not in this way/but not grouped in this way/according to their age.

The same occurs for:

(51) ?2 and 8, and 3 and 9 are co-prime, that is, 2 and 3 are co-prime and 8 and 9 are.
(52) ?The children who are wearing the same t-shirt went to the same school, that is, those who are talking to each other did.

Judgments concerning the contrast between semantic and pragmatic anomaly are often vague and controversial. However, I hope to have provided some evidence that Upwards Closure and Set Generalisation are not valid.[30] If correct, the arguments laid out in this section undermine to some extent the claim, essential for cover-based approaches, that we need not distinguish between different types of plural predications at the semantic level. It seems that there are predicates in natural language that are sensitive to structure and that this sensitivity has not mere pragmatic consequences, but consequences at the truth-conditional level. Schwarzschild takes structured readings as pragmatic phenomena, while taking their atomic counterparts as falling on the side of semantics. The claim I defended in this subsection is that the division of labour between semantics and pragmatics lies elsewhere: not only is basic plurality part of semantics, but so is structured plurality.

3.3 *Recap*

In the rest of the article, I will lay out my own proposal. As I said above, I will adopt inflationary models of interpretation, but I will also recognize that contextual dependance must be ascribed a central role in determining the interpretation of plural expressions. Moreover, I will reject the idea that structured plurality is only a matter of pragmatic implicature and instead take it as an element that is present in the truth-conditions of statements.

The main problem suffered by the two theories surveyed is that of overgeneration. Even though cover-based theories provide a basis to tackle it, since they in fact do not allow for absolute freedom of interpretation for the free variable over covers, but restrict it to salient covers, they leave the treatment of this salience out of the theory, in the form of a few informal remarks. My aim is to bring to life within the semantic formalism the observations regarding the influence of context made by cover-based theorists. By incorporating such remarks into the formalism I hope to provide support for them and to develop a theory that makes more precise predictions. The main novelty of my account is that it allows us to 'regulate' the influence of context into the computation of the final interpretations of sentences involving structured plurals by invoking two pragmatic principles: the Gricean Maxim of Conciseness and the Interpretive Economy Principle. I believe these two principles to be crucial for our understanding of sentences involving structured plurals. As we will see, their effect will be to deem certain interpretations less likely than others without ruling them out altogether.

30 Importantly, the semantics to be developed in the next section will be able to account for the inferences which Schwarzschild judges as valid (in my view, in general, correctly) without making use of these principles.

4 RECONTEXTUALISING STRUCTURED PLURALITY: A PROPOSAL

In my proposal, I will be concerned with the emergence of the six kinds of predications described in Sect. 2.1: i-dist, i-coll, p-dist, p-coll, sp-dist and sp-coll. My focus will be on the influence of the following three factors responsible for these readings: (i) the type of the subject phrase, (ii) the type of the predicate and (iii) the context of utterance, broadly understood.

Note that there are other relevant factors involved. For example, regarding phrasal distributivity, the specific form of the object of a transitive VP appears to have a certain effect on the availability of p-dist readings. For instance, it has been observed that bare plural objects (as in (53)) give rise to p-dist readings more easily than do indefinite singular objects (as in (7), repeated as (54)) (Link, 1998; Winter, 2001, Sect. 6.2; Champollion, 2016; see also Wohlmuth, 2019, for experimental data supporting this claim):

(53) The children baked cakes.
(54) The children baked a cake.

Moreover, certain overt distributive markers (such as *each*), trigger i-dist readings (as opposed to p-dist ones) whenever these are available (Champollion, 2017, Sect. 10.7):

(55) The children each have ten coins.

However, the treatment of these phenomena lies beyond the scope of this article.

4.1 *The formal framework*

In what follows I present the formal language that I will use to regiment my semantic analysis.

Basic syntax Our language is a many-sorted first-order language with a symbol of set-theoretic membership ($\in$), a negation symbol ($\neg$) and an arrow ($\rightarrow$) as the only logical connectives. Terms are constants (c^k, d^k, etc) and variables (x^k, y^k, etc). I also use placeholders for variables and constants (t^k, u^k, etc). I use indices to indicate their type: terms of the form t^0 are singulars, terms of the form t^1 are basic plurals, terms of the form t^2 are structured plurals and terms of the form t^3 are super-structured plurals.

Moreover, I use a notation to compositionally represent the internal structure of basic and structured plurals: $t^{k_1}\&t^{k_2}\&...\&t^{k_n}$ is a term of type k_i+1 (where $k_i = max(k_1, ..., k_n)$), which has n components of possibly different types (recall our need for mixed pluralities). In the Appendix, I give a more detailed analysis of the different kinds of structured NPs presented in Sect. 2.2, but for the purposes of my discussion, constants, variables and these complex terms will suffice.

Turning to predicate symbols, I indicate the type of predicates with indices as well: P^0 are singular predicates, P^1 are plural predicates, P^2 are structured plural predicates and P^3 are super-structured plural predicates, notions which I will clarify shortly.

Predicates with a certain index can only hold of terms with that same index. Thus with the vocabulary introduced so far, only formulas of the form $P^k(t^k)$, $t^k \in t^{k+1}$, $\neg\phi$ and $\phi \rightarrow \psi$ (for ϕ and ψ well-formed) are well-formed. Formulas of the form $P^k(t^k)$ represent collective predications (of level k). Distributive predications (of level k) are recovered by means of a bullet operator ($\bullet$), which, as we will see, is a type-shifting operator that is compulsory whenever there is a type mismatch of the form $P^k(t^{k+1})$ which is not resolved via another type-shifter. Distributive predications are represented as $\bullet P^k(t^{k+1})$.

Equipped with this formalism we can represent the main kinds of predications considered in this article as follows:[31]

	-dist	-coll
i	$^{\bullet}P^0(t^1)$	$P^1(t^1)$
p	$^{\bullet}P^1(t^2)$	$P^2(t^2)$
sp	$^{\bullet}P^2(t^3)$	$P^3(t^3)$

As we have seen, as well as distributive and collective predications, there are cumulative ones. They can be easily incorporated in this framework via the double star operator of Beck & Sauerland (2000): **. This operator applies to binary relations, rather than monadic predicates, thus we need to introduce those. We use superscripts indicating the type of each of their positions (note that relations can admit arguments of different types in their positions). Formulas of the following form are well formed: $^{**}R^{(j,k)}(t^{j+1}, u^{k+1})$.

Note that, following Dowty (1987), Lasersohn (1995) and Winter (2000) among others, I locate the collective/distributive/cumulative ambiguity in the predicate, rather than the subject. As is well-known from the literature, this is useful to deal with certain forms of anaphora and sentences with conjoined VPs. I will come back to this.

Interpretation I take a model M to be a tuple $\langle D^0, [\![]\!]\rangle$, where D^0 is a set of individuals and $[\![]\!]$, an interpretation function.

Semantic pluralization is interpreted as set-formation, rather than union. Importantly for us, set-formation is not a Boolean operation and hence gives us the means to distinguish between pluralities formed from the exact same individuals but conveying different structures (due to the failure of associativity), such as $(a,(b,c))$ and $((a,b),c)$.[32],[33]

More precisely, the collection of entities that will be possible referents of NPs is analogous to that of Hoeksema (1988, p. 23). However, there are two substantial differences. Firstly, it includes a further level of pluralization, since we, unlike Hoeksema, are interested not only in i-coll and p-dist readings, but also in p-coll and sp-dist ones. And, secondly, D^0 is reserved for individuals; basic and structured pluralities are built from them and assigned different types. Thus, D^0 is a simple set of non-set-theoretic objects

31 One may wonder at this point why are not more general forms, such as $P^k(t^j)$ for $j < k$, permitted. The reason why we do not need these is that the cases in which syntactic constructions of this form seem to occur will be analysed by means of the type-shifters 'flattening' and 'structuring' that I will introduce shortly.

32 To be fair, Landman (a proponent of the union theory) also manages to distinguish between these, but he needs to take as basic entities singletons of individuals (Landman, 1989a, pp. 582-3). This has some undesired consequences. For example, Landman's semantics distinguishes between {a}, {{a}}, {{{a}}}, and so on. This, as pointed out by Hoeksema (1988, pp. 26-27) is a spurious structure which is not needed at any other point in his semantics. If possible, it is preferable to dispense with it. See Hoeksema's article (pp. 26-30) for further criticism of Landman's models.

33 Note that this includes, as a particular case, the interpretation of *and* as a NP coordinator and thus sides my proposal with the collective views of *and*, as opposed to the intersective ones (for details on the debate around the semantics of the NP-coordinator *and*, see Champollion, 2016). However, as far as I can see, my overall proposal is compatible with both views and thus provides support for neither.

(type *e*), without any further internal structure, and the referents of basic and structured plurals as well as the extensions of predicates are built via set-formation from them.

Let me describe the different types of objects in some detail. We start of with a set of individuals D^0. From D^0 we build D^1 as the power set of D^0 minus the empty set and the singletons. Next we construct D^2. At this point the fact that, as I argued above, we need mixed structured pluralities (that is, pluralities that have as members, for example, an individual and a basic plurality) demands that D^2 be constructed both from D^0 and D^1. Thus, we define D^2 as the power-set of $D \cup D^1$ minus, once again, the empty set and the singleton sets. We also take away D^1, which has been generated again from applying the power-set operation to D^0. Finally, we iterate this operation to obtain D^3. Note that D^1, D^2 and D^3 are not explicit elements of the tuples that constitute our models; that is because they are mechanically built from D^0 and thus there is no need to specify them.

Put formally, assuming that $Sing(X)$ is the set of all the singletons in X, we have:

(i) D^0 is a set of individuals.
(ii) $D^1 = PW(D^0) - \emptyset - Sing(PW(D^0))$
(iii) $D^2 = PW(D^0 \cup D^1) - \emptyset - Sing(PW(D^0 \cup D^1)) - D^1$
(iv) $D^3 = PW(D^0 \cup D^2) - \emptyset - Sing(PW(D^0 \cup D^2)) - D^1 - D^2$

To illustrate, suppose that our domain of individuals contains only *a* and *b*. Then the following objects of types 1, 2 and 3 can be formed:

D^0	a, b
D^1	$\{a, b\}$
D^2	$\{a, \{a, b\}\}$, $\{b, \{a, b\}\}$
D^3	$\{a, \{a, \{a, b\}\}\}$, $\{b, \{a, \{a, b\}\}\}$, $\{a, \{b, \{a, b\}\}\}$, $\{b, \{b, \{a, b\}\}\}$, $\{\{a, b\}, \{a, \{a, b\}\}\}$, $\{\{a, b\}, \{b, \{a, b\}\}\}$, $\{a, \{a, b\}, \{a, \{a, b\}\}\}$,...

Typically, D^2 and D^3 contain what we can call 'pure' and 'impure' objects (precisely, the mixed entities). Pure objects are individuals or sets that have only pure members that belong to a single type. Impure objects are objects that are not pure. (However, in the example provided this is not the case, due to the small size of D^0: all the objects in D^2 and D^3 are impure.) Importantly, it follows from our definitions that objects of any type greater than 0 have at least one object of the immediately lower type as a member. Otherwise they would collapse into entities of lower types.

The interpretation function $[\![\,]\!]$ maps non-logical symbols to objects in the domain. And, as usual, we have variable assignment functions g, g', etc.

Here is how terms are interpreted. Singular terms t^0 refer to objects of type 0, plural terms t^1 refer to objects of type 1, structured plural terms t^2 refer to objects of type 2 and, finally, super-structured plural terms t^3 refer to objects of type 3. Moreover, as one would expect, $[\![t^{k_1}\&...\&t^{k_n}]\!] = \bigcup_{1 \leq i \leq n}\{[\![t^{k_i}]\!]\}$, that is, $t^{k_1}\&...\&t^{k_n}$ denotes the set that has as elements each of the individuals or sets denoted by each t^{k_i} $(1 \leq i \leq n)$.

Turning to the interpretation of predicates, a singular predicate P^0 has in its extension objects of type 0, a plural predicate P^1 has in its extension objects of type 1, a structured plural predicate P^2 has in its extension objects of type 2 and a super-structured plural predicate P^3 has in its extension objects of type 3.

Moreover, we mentioned two type shifting operators: $\bullet$ and **. The former lifts the type of predicates in the exact same way the star operator defined in (16). The latter does it as follows:

(56) Definition (**-operator) For any set of ordered pairs R, $^{**}R$ is the smallest set s.t. $R \subseteq {}^{**}R$ and if $\langle a, x\rangle \in {}^{**}R$ and $\langle b, y\rangle \in {}^{**}R$, then $\langle \{a, b\}, \{x, y\}\rangle \in {}^{**}R$.

Finally, we define 'satisfaction' implicitly. Firstly, collective and distributive predications have the following truth conditions:

$P^k(t^k)$ is satisfied by M and g iff $[\![t^k]\!]$ is a member of $[\![P^k]\!]$.

$\bullet P^k(t^{k+1})$ is satisfied by M and g iff for every g' which is an x^k-variant of g, M and g' satisfy $x^k \in t^{k+1} \rightarrow P^k(x^k)$.[34]

Thus the bullet operator plays a twofold role in our framework: like Link's star operator, it lifts the type of the predicate, but, unlike it, it enforces a distributive truth-conditional analysis. As we shall see, the latter will be needed in order to distinguish distributive from collective readings whenever the predicate involved is mixed, that is, it can hold of objects of various types.

Note that the operator applies to full VPs in this framework, rather than just verbs. The reason for this choice is that, as pointed out in Sect. 2.1, the phenomenon of distributivity can have two different sources: lexical and phrasal. Phrasal distributivity arises because the subject is interpreted as a quantifier taking scope over another element in the sentence. Thus we need distributivity to affect whole VPs, since this has the effect of fixing the scope of the subject as wide (Champollion, 2019, p. 302).

The third kind of predication considered is cumulative predication. The cumulative operator is similar to the bullet operator in that it works both as a type-shifting operator and as enforcing certain truth-conditions on the formulas it gives rise to. As in the case of the bullet operator, the latter is needed due to the ambiguity inherent to mixed predicates.

And these are the truth-conditions it enforces:

$^{**}R^{(j,k)}(t^{j+1}, u^{k+1})$is satisfied by M and g iff

(i) for every g' which is a x^j-variant of g, there is a g'' which is a x^k-variant of g' s.t. M and g'' satisfy $((x^j \in t^{j+1} \wedge x^k \in u^{k+1}) \rightarrow R(x^j, x^k))$,

(ii) and for every g' which is a x^k-variant of g, there is a g'' which is a x^j-variant of g' s.t. M and g'' satisfy $((x^j \in t^{j+1} \wedge x^k \in u^{k+1}) \rightarrow R(x^j, x^k))$.

Finally, the negation and the arrow are interpreted as usual:

$\neg\phi$ is satisfied by M and g iff they do not satisfy ϕ.
$\phi \rightarrow \psi$ is satisfied by M and g iff they do not satisfy ϕ or they satisfy ψ.

Mixed predicates In order to correctly analyse the variety of phenomena considered in this article, we need a few more devices. First, we need to consider mixed predicates, that is, predicates which can hold of more than one type of object, i.e. have a mixture of kinds of objects in their extensions. Only three sorts of mixed predicates are relevant for us. First, predicates whose extensions include type-0 and type-1 objects. I represent

34 An x^k-variant of g is an assignment that only differs from g at most in what it assigns to x^k.

these predicates with a superscripted 0/1, as $P^{0/1}$. That some predicates admit such extensions follows from the fact that they can hold of single individuals separately (giving rise to i-dist predications) and of various individuals taken together (giving rise to i-coll or p-dist predications). For instance, the predicate *carry a box upstairs* is of this sort.

(57) My cousins carried a box upstairs.

(57) can mean, among others, that each cousin carried a different box upstairs (i-dist), that all the cousins carried, collectively, a single box upstairs (i-coll) or can receive a p-dist reading. For instance, (57) could mean that some of my cousins carried one box altogether and the rest carried another box altogether.

Secondly, there are predicates which admit in their extension both type-1 objects and type-2 objects. Analogously to the previous case, this follows from the fact that they can hold of various individuals taken together (i-coll/p-dist) and of various pluralities taken together (p-coll). Moreover, they can even give rise to sp-dist readings. I represent these predicates with a superscripted 1/2, as $P^{1/2}$. This is the case of *be equally loud*, as illustrated by (27), repeated as (58):

(58) The cows and the pigs are equally loud.

(58) can receive, among others, an i-coll reading according to which each individual animal is as loud as any other and a p-coll reading according to which the herd of cows is, as a group, as loud as the herd of pigs, as a group.

Note that the predicates involved in Schwarzschild's examples to illustrate the alleged validity of Set Generalisation were all of this sort (see Sect. 3.2.1). I think that a plausible explanation of the apparent validity of the inferences from (32) to (34), and in (35) and (36) is that their mixed predicates are interpreted in the first sentences as p-coll and in the second ones as i-coll. Given that the first sentences are thus seen to describe a more specific situation than the second ones, they are judged to imply them. Thus they are valid, but not because of the validity of Set Generalisation.

Finally, we can also find mixed predicates of the sort $P^{2/3}$. One way to construct them is by forming equative constructions from predicates that are of the form $P^{1/2}$, such as *are well-coordinated*. For instance, *are equally well-coordinated* seems capable of holding of various pluralities of individuals, but also of various pluralities of pluralities of individuals. To see this, suppose that there are four groups of people (the blues, the reds, the greens and the yellows). (59) can be read as saying that the blues are well-coordinated between them and they are as well coordinated as are the reds, between them. This would be a p-coll predication.

(59) The blues and the reds are equally well-coordinated.

Moreover, (60) can mean that the blues, as a group, are well-coordinated with the reds, as a group, and they are as well coordinated as are the greens with the yellows. This would be an sp-coll predication.

(60) The blues and the reds, and the greens and the yellows are equally well-coordinated.

It is highly doubtful whether there are mixed predicates of other sorts, for instance, predicates which can hold of individuals separately and of various pluralities taken together. I leave this possibility aside.

Interestingly, mixed predicates seem capable of giving rise to mixed distributive readings, in the sense that they can distribute down to different kinds of entities. For instance, (57) can receive a mixed distributive reading according to which one of my cousins carried a box on her own and the rest of my cousins carried a box collectively.

Syntactically, these predicates can combine with a larger variety of subjects than their non-mixed counterparts. In particular, any sentence of the following two forms is well-formed: $P^{k/k+1}(t^{k})$ and $P^{k/k+1}(t^{k+1})$. Also, just as in the non-mixed case, formulas of the form $^{\bullet}P^{k/k+1}(t^{k+1})$ and $^{\bullet}P^{k/k+1}(t^{k+2})$ are well-formed. Analogous constraints apply to cumulative predicates: $^{**}R^{(j_1/j_2,k_1/k_2)}(t^{j_1+1}, u^{k_1+1})$, $^{**}R^{(j_1/j_2,k_1/k_2)}(t^{j_1+1}, u^{k_2+1})$, $^{**}R^{(j_1/j_2,k_1/k_2)}(t^{j_2+1}, u^{k_1+1})$and $^{**}R^{(j_1/j_2,k_1/k_2)}(t^{j_2+1}, u^{k_2+1})$are all well-formed.

The truth conditions of sentences with mixed predicates are mostly analogous to those with non-mixed predicates. First, their collective truth conditions are exactly like those of their non-mixed counterparts:

$P^{k/k+1}(t^{k})$ is satisfied by M and g iff $[\![t^{k}]\!]$ is a member of $[\![P^{k/k+1}]\!]$.
$P^{k/k+1}(t^{k+1})$ is satisfied by M and g iff $[\![t^{k+1}]\!]$ is a member of $[\![P^{k/k+1}]\!]$.

However, there is a disanalogy when we look at the distributive reading of mixed predicates. This is because, as mentioned, mixed predicates can give rise to mixed distributions. These mixed distributive readings can be of two different kinds. Firstly, they can be mixed in the sense that, despite the fact that the members of the set denoted by the subject are all of the same type, the predicate can apply collectively or distributively to them. For example, this is what would occur in (61), supposing that the context made it clear that the children carried a box altogether and that the adults each carried a different box:

(61) The children and the adults carried a box upstairs.

In order to account for these cases, we need to allow for the possibility of iterated distributivity. In other words, as we will see shortly, we must define the truth conditions of mixed sentences with a disjunctive clause covering the simple and the iterative case (see condition (ii.b) below).

A different case of mixed distributivity occurs whenever the subject denotes a mixed structured plurality and the predicate is capable of holding of its members, despite being of different types. For instance, suppose that (62) is interpreted as saying that the children carried a box altogether and my sister carried a box on her own:

(62) The children and my sister carried a box upstairs.

In order to cover these cases, we need to universally quantify over variables of all the lower types in describing the truth-conditions of mixed sentences, not only of the immediately lower type (see condition (ii) below). For instance, in this case the sentence would be true if, and only if, the set of the children (type 1) and my sister (type 0) both belonged to the mixed extension of *carried a box upstairs*.

The resulting truth-conditions for distributive readings of mixed predicates are as follows. There are two possible cases, depending on the type of the subject:

(i) $^{\bullet}P^{k/k+1}(t^{k+1})$ is satisfied by M and g iff for every assignment g' which is an x^{k}-variant of g, M and g' satisfy $(x^{k} \in t^{k+1} \rightarrow (P^{k/k+1}(x^{k})))$.
(ii) $^{\bullet}P^{k/k+1}(t^{k+2})$is satisfied by M and g iff

(a) for every assignment g' which is an x^k-variant of g, M and g' satisfy ($x^k \in t^{k+2} \rightarrow (P^{k/k+1}(x^k))$), and
(b) for every assignment g' which is an x^{k+1}-variant of g, M and g' satisfy ($x^{k+1} \in t^{k+2} \rightarrow (P^{k/k+1}(x^{k+1})$ or $^{\bullet}P^{k/k+1}(x^{k+1}))$).

A couple of clarifications. First, in cases like (i), we need only consider one type of members of the set denoted by the subject (the one immediately lower than that of the subject), because the predicate is not capable of holding of any lower types. Second, (ii.a) does not include the disjunctive clause mentioned above, because this clause describes the case in which the predicate distributes down to the lowest type of subject it can apply to, hence we need not consider the possibility of iterated distributivity.

Having looked closely at mixed predicates, we can now better appreciate why we need to specify truth-conditionally that distributive predications hold of all the members of the denotation of their subject. For example, as we saw, *carry a box upstairs* can hold of individuals, but also of groups of individuals. Thus whenever it is combined with a plural subject, such as *the children*, it can give rise to an i-dist reading or an i-coll one, among others. Now, suppose that $[\![$*the children*$]\!]$ is a member of $[\![^{\bullet}$*carried a box upstairs*$]\!]$. This can either be because the children, altogether, carried a box upstairs or because each of them did, and by the interpretation of the $^{\bullet}$-operator their set is included in the extension of the predicate. In order to distinguish between these two possibilities, we need to make sure that distributive predications apply to the members of the set picked out by the subject.

Flattening and structuring I have mentioned in passing the idea that some predicates are sensitive to the structure conveyed by structured plural subjects and that others always ignore structure whenever it is provided. Let me clarify these and some related notions and introduce the two final pieces of our formalism.

First of all, there are predicates which always ignore structure, namely, P^0 predicates. This is because they can only give rise to i-dist predications, where the predicate simply holds of single individuals separately. These predicates cannot take structure into account and they will ignore it whenever it is provided either by the subject term itself or by context.

In the second place, there are predicates which always take structure into account, they require it. This is the case of P^2 and P^3 predicates, which apply collectively to various pluralities (possibly structured), as made available by a certain structure. Hence, these predicates demand that either the subject term convey a structure or else that this be provided by the context.

Finally, there are predicates which fall into neither category, namely, P^1 predicates. These predicates can give rise to p-coll predications, in which case the predicate is applied collectively to a single plurality of objects, thereby ignoring structure if the latter is provided. But they can also give rise to p-dist predications, which require a certain structure in order to make the right distribution.

Sometimes predicates which ignore structure are combined with an overtly structured plural. This was the case of (39), repeated as (63):

(63) The cows and the pigs are mammals.

To address these cases, we need a mechanism in our formalism to indicate that whatever structure is conveyed by a term is being ignored by the predicate. To this end, I introduce

the function *flat* ('flattening'), which turns any term of type k into a term of type $k-1$ as follows:

(64) Definition (Flattening) $[\![flat(t^k)]\!] = \{x : \{x\} \in [\![t^k]\!] \vee (x \in [\![t^k]\!] \wedge \forall y(y \notin x))\}$[35]

This function is defined only for $2 \leq k$ and it is a type-shifter: it transforms any term of type k into one of an immediately lower type. In particular, it flattens the reference of structured plural terms, transforming them into basic plurals. Thus formulas of the following sort are well-formed: $P^k(flat(t^{k+1}))$ and $^\bullet P^k(flat(t^{k+2}))$(similarly for cumulative formulas).

Conversely, predicates which require structure can be combined with terms which do not convey it, as long as the structure is introduced by the context. This is the case of (18), repeated as (65), under its truthful reading:

(65) Hammerstein, Rodgers and Hart wrote musicals together.

In order to account for this possibility, I define the function *str* ('structuring'), which maps any set onto a contextually given intermediate cover thereof. Note that this operation is defined only for $1 \leq k$:

(66) Definition (Structuring) $[\![str(t^k)]\!] = IntCov_{t^k}$

$IntCov_{t^k}$ denotes an intermediate cover of $[\![t^k]\!]$. Covers were defined in Sect. 3.2, but here we make use only of the intermediate ones, namely, those that are neither just the set $[\![t^k]\!]$ itself nor its singleton.

The function *str* is contextually dependent in the sense that which specific cover it assigns to t^k will have to be decided by the context of utterance. Note that $flat(str(t^k)) = t^k$, but $str(flat(t^k)) \neq t^k$. This follows from the fact that *str* can return different intermediate covers for one and the same set, depending on the context.

Since the function *str* introduces structure into the denotation of any term, it is a type shifting operator, mapping expressions of type k to expressions of type $k+1$. In particular, it takes basic plural NPs and delivers structured plural NPs 'in disguise'. Thus formulas of the following sort are well-formed: $P^{k+1}(str(t^k))$ and $^\bullet P^k(str(t^k))$(similarly for cumulative formulas).

Hence, the operators *flat* and *str*, just as $^\bullet$ and **, work not only as semantic shifters, changing the denotation of the expressions they apply to, but, at the same time, and precisely because of the kind of semantic shift they enforce, as type-shifting operators.

Everything said in this section so far also applies to mixed predicates, with the complication that the latter give rise to a wider range of readings than non-mixed ones. Moreover, as we saw, mixed predicates can give rise to mixed distributive predications. We saw some simple examples above, but there are more complex cases: those in which the predicate distributes to elements which either convey too much structure or else not enough. With the apparatus introduced in this subsection, we can also address these. For example, consider once again (27), repeated as (67):

(67) The cows and the pigs are equally loud.

Suppose the context made it clear that (67) means that the cows are each as loud as each other, while two groups of pigs are as loud as each other (as groups). Since *the pigs* does

35 Note that Landman (1989a)'s $\downarrow^2$-operator is exactly analogous to our *flat*.

not convey the structure needed (a set of two sets of pigs), we need to apply *str* to it. Thus we need to make use of the complex term notation introduced above: $c^1\&str(p^1)$. When combined with the mixed predicate *are equally loud*, represented as $P^{1/2}$, we obtain the correct truth conditions (see clause (ii.b) in previous subsection).

To finish this section, note that whenever *flat* and *str* are not necessarily brought up by the combination of types of the subject and the predicate (that is, in cases where the predicate is mixed), they can still be brought up by the context. One of the ways in which this can happen is by the presence of certain adverbial modifiers and floating quantifiers. These elements can be seen as object language counterparts of *flat* and *str*. For example, *altogether*, *jointly* and *as a single team* typically act as counterparts of the former:

(68) The kids and the adults baked a cake altogether/jointly/as a single team.

But also the floating quantifier *all*:

(69) The writers and the editors all exchanged ideas.
(70) The cows and the pigs are all as loud as each other.

On the other hand, *str* is triggered by adverbial modifiers like *divided into teams*, *organised in groups* or *in pairs*:

(71) The kids baked a cake divided into teams.
(72) The writers met in groups of three.

In order to further demonstrate how the tools presented so far are used and why exactly they are needed, in the following subsection I describe the range of the possible interpretations of the sentences relevant for us and I show how they are represented with this formalism. As I will point out, some sentence-interpretations are less likely than others. Later, I will explain how the pragmatic maxims mentioned above together with our formalism can correctly predict this fact.

4.2 *The range of possible sentence-interpretations*

I start by considering sentences with non-mixed predicates. Among these I consider, first, the readings that arise from their combination with overtly structured plural subjects. These are all cases in which the subject NP conveys enough structure for the predicate it combines with. In fact, in some cases, it conveys too much, as we will see. After that I will consider which readings arise when the predicates combine with basic plural subjects. These are cases in which the subject NP does not convey enough structure for the predicate it combines with. After this, we will look at mixed predicates.

As said in Sect. 2.1, cases involving overtly super-structured plural subjects and sp-dist and sp-coll predications do not bring about any difficulties not already present at the level of type-2 expressions and thus I will not consider them separately. Nevertheless, I will consider a case involving a type-2 subject which is raised via the function *str* and thus is ultimately interpreted as being covertly super-structured, i.e. of type 3.

4.2.1 ***Structured plural subject: (more than) enough structure***

Combined with a P^0 predicate If the predicate is of the form P^0, then it has only an i-dist interpretation, so the fact that the subject term is structured is necessarily ignored by the predicate. Consider and (19), repeated here as (73):

(73) These children and those children smiled.

The only available reading of (73) is that each one of the children smiled. This is analysed as $^{\bullet}P^0(flat(a^2))$. Another example of this sort is (39).

Note that this provides an explanation of the apparent validity of the inference from (38) to (39), which was used by Schwarzschild to argue for the validity of Upwards Closure (see Sect. 3.2.1). Their predicate can only ever be true of basic individuals, hence when combined with structured subjects, it always ignores their structure. The inference can be taken to be valid, but not because of the general validity of Upwards Closure.

Combined with a P^1 predicate If the predicate is of the form P^1, its combination with a structured plural subject can give rise to three different readings: first, it can hold collectively of the individuals generating the set of sets referred to by the term (i-coll); second, it can distribute down to basic plurality according to the structure conveyed by the term (p-dist); and, third, it can distribute down to basic plurality according to another structure, provided by context (p-dist). To see this, consider (74):

(74) The children who are wearing the same colour are siblings.

The i-coll reading of (74) says that all the children share the same parents, regardless of what they are wearing, represented as $P^1(flat(a^2))$. The first p-dist reading says that any two children who wear the same colour as one another share the same parents. It is captured by $^{\bullet}P^1(a^2)$. It seems that this reading is more accessible than the i-coll one (whenever the children are dressed in at least two different colours). The second p-dist reading would take the predicate to distribute over a structure, but not the one conveyed by the subject. This is clearly the most far-fetched reading of the three. Suppose (74) was meant to say that the shorter children are siblings and so are the taller children. In this case, the sentence would be analysed as $^{\bullet}P^1(str(flat(a^2)))$, since we would need to ignore the structure provided by the subject and obtain another one via context.

This kind of reading also corresponds to what I judged to be the most unlikely interpretation of (22).

Combined with a P^2 predicate If the predicate is of the form P^2, then it is typically taken to apply collectively to the pluralities denoted by the structure of the subject. For instance, consider:

(75) The students and their lecturers are equally homogeneous.

(75) is most naturally interpreted as a p-coll predication, according to which the students (as a group) are as homogeneous as the lecturers are (as a group). In our notation: $P^2(a^2)$.

However, the predicate of (75) could also be taken to distribute down to structured plurality level, thus giving rise to an sp-dist reading. For example, it could express the proposition that some of the students are as homogeneous as some other students and that some of the lecturers are as homogeneous as some other lecturers, in which case the corresponding covers would need to be contextually provided for the set of students and for the set of lecturers. In order to formalise this, we must regiment the subject by means of the complex term $s^1 \& l^1$ and use *str* on each component of this structured plural to get the extra structure that the sp-dist reading demands: $str(s^1) \& str(l^1)$. The resulting term is a super-structured plural, hence when combined with our P^2 predicate, it gives rise to an

sp-dist reading: $^{\bullet}P^2(str(s^1)\&str(l^1))$. Despite being available, this interpretation is certainly less likely than the simple p-coll one described above.

Moreover, the predicate could be given a p-coll reading applying to a structured plurality different from the one conveyed by the syntax of its subject, for instance to the people from the linguistics department (be it students or lecturers) and to the people from the philosophy department (again, regardless of whether they are students or lecturers). This reading would be captured by $P^2(str(flat(a^2)))$. However, this interpretation seems very far fetched.

4.2.2 *Basic plural subjects: not enough structure*

So much for sentences with structured plural subjects. Let us turn to the cases in which the subject does not provide the structural information that the predicate demands. This will occur whenever the term is a basic plural (a^1), but the predicate is of the form P^2 or P^3. In these cases we will always have to rely on the context to supply an adequate structure:

(76) The students are equally homogeneous.

This sentence must be interpreted as saying that some groups of students (determined by a contextually-provided cover) are such that each of them is as homogeneous as any other group. This reading is captured by $P^2(str(a^1))$.

Moreover, this can also occur in cases in which either the context or the lexical meaning of the expressions involved together with world knowledge forces a plural predicate (P^1) to distribute to basic plurality level despite the subject term being a basic plural (a^1). This is the case of

(77) These eight people are married to each other.

This reading is formalised as $^{\bullet}P^1(str(a^1))$, where the contextually provided cover in this case will have to be a set of four sets of two people each.

4.2.3 *Mixed predicates*

Finally, let us turn to mixed predicates. There are many possible combinations of the various types of mixed predicates considered and the various types of NPs considered. I discuss only two examples.

The first one is the one discussed by Lasersohn and Gillon ((21), repeated as (78)), which involves a mixed predicate of the form $P^{0/1}$ and a basic plural subject.

(78) The T.A.s earned exactly $14,000.

There are three different readings for (78): i-dist, i-coll and p-dist. The i-dist one says that each T.A. earned $14,000 and is represented as $^{\bullet}P^{0/1}(a^1)$. The i-coll one says that the T.A.s earned $14,000 collectively and is represented as $P^{0/1}(a^1)$. Finally, the p-dist reading is the one over which the quarrel between Lasersohn and Gillon takes place. According to it, the predicate holds of a contextually provided intermediate cover of the T.A.s, and is thus represented here as $^{\bullet}P^{0/1}(str(a^1))$. This is indeed the least accessible reading of the three, but as demonstrated by Gillon, it may be the right one in certain contexts. Our formalism predicts its existence, but, together with the pragmatic story to be developed shortly, it also predicts its unlikelihood.

The other example, a variation of (69), involves a mixed predicate of the form $P^{1/2}$ and a structured plural term, a^2:

(79) The writers and the editors exchanged ideas.

There are many possible readings for (79). The first three exploit the ability of the predicate of applying to sets of individuals. The first one is a p-dist reading and it says that each of the writers exchanged ideas with every other writer and each of the editors exchanged ideas with every other editor. It is regimented as $^{\bullet}P^{1/2}(a^2)$. The second one is an i-coll one and it says that each person exchanged ideas with every other person, regardless of their job. We represent it as $P^{1/2}(flat(a^2))$. The third one is a p-dist predication which makes use of an alternative structure to the one conveyed by the subject; it is represented as $^{\bullet}P^{1/2}(str(flat(a^2)))$. This would be a reading according to which, for instance, the older people all exchanged ideas and so did the younger people, regardless of their job. Amongst these three readings, the first one seems to be the most easily accessible, followed by the second one and, finally, the third one.

The next three readings work on the restriction of the predicate that applies only to sets of sets of individuals. The fourth reading is a p-coll predication and it says that the writers (as a group) exchanged ideas with the editors (as a group). This would be represented as $P^{1/2}(a^2)$. The fifth reading is also a p-coll predication, but it is based on a structure not conveyed by the subject term. It is represented as $P^{1/2}(str(flat(a^2)))$. For instance, this would be the case if the sentence was meant to say that the older people exchanged ideas with the younger people (and vice versa), regardless of their job. And the last one is an sp-dist reading, according to which some of the writers exchanged ideas with the rest of writers and some of the editors exchanged ideas with the rest of editors. It would be represented as $^{\bullet}P^{1/2}(str(w^1)\&str(e^1))$. For instance, it could mean that the older writers exchanged ideas with the younger ones and that the male editors exchanged ideas with the non-male editors. It seems clear that these last two readings are less accessible than the fourth one.

Finally, there are mixed distributive readings available. For example, the reading according to which each of the writers exchanged ideas with any other writer and some of the editors (as a group) exchanged ideas with the rest of the editors (as a group). This would be captured by $^{\bullet}P^{1/2}(w^1\&str(e^1))$. They are, it seems, the most far fetched of all.

4.3 *The pragmatics behind the availability of sentence-interpretations*

As the exchange between Lasersohn and Gillon teaches us and as was further demonstrated in the last section, there are more and less accessible interpretations of sentences involving structured plurality. I believe that the semantic framework proposed so far, together with the pragmatic apparatus that I will present in this section, adequately predicts and explains this preference relation. Moreover, it implements some of the informal remarks made by Schwarzschild with respect to the influence of various linguistic and non-linguistic factors in the emergence of this preference relation (Sect. 3.2).

Although not all cases are as easily assessed as others, judging from the observations in the previous section, we can extract the following general pattern: other things being equal, readings which make use of *flat* or *str* are less accessible than the rest. But why?

That ambiguous sentences can have more and less available interpretations has been observed in other debates; for instance, by Dalrymple *et al.* (1998) in their analysis of reciprocals and by Cobreros *et al.* (2012) in their account of vagueness. Their strategy, in both cases, is to observe that there is an independently motivated pragmatic principle operating in the background which defines a preference order between various interpretations. The

culprit in both of these cases is judged to be the Stronger Reading Principle, which says that, for any ambiguous sentence, speakers should go for its logically strongest interpretation. I propose that we follow the same strategy, but appeal to two other principles.

These two principles are two of the sub-maxims contained in the multifaceted Gricean Maxim of Manner. This maxim has four sub-clauses: (i) avoid obscurity, (ii) avoid ambiguity, (iii) be succinct and (iv) be orderly.

The first principle I will make use of corresponds with the third sub-clause of the Maxim of Manner, which I will refer to as the Maxim of Conciseness (MC). This principle has been recently interpreted as demanding that speakers use unmarked expressions whenever possible, as markedness can be seen as a clear realisation of complexity in natural language (Rett, 2020). Clearly, structured plurality is marked relative to basic plurality: it has a narrower language-internal distribution (i.e. many more predicates admit basic plurality than they do structured plurality) and it is processed more slowly (Wagner, 2010). Moreover, while I am not aware of evidence regarding the other forms, the doubly plural realisation of structured plurality clearly shows a narrower cross-linguistic distribution than basic plurality and it is diachronically outlasted by it (as showed in Sect. 2.2). Hence, MC dictates that speakers opt for basic (unmarked) rather than structured (marked) plurality, whenever possible (namely, whenever the latter is semantically superfluous and thus will be ignored). In other words, MC deems as less likely the readings that make use of *flat*. Recall that these are the cases in which a sentence has an unnecessarily structured subject; *flat* is then used to capture the fact that the predicate does not take into account the superfluous structural information. The fact that part of the contribution made by the subject ends up being ignored in the compositional meaning of the sentence renders this kind of reading unlikely, since according to MC, speakers assume that their interlocutors do not use unnecessarily complex expressions. Thus, for instance, MC together with our semantic analysis, explains why (74)'s (repeated here as (80)) flattened, i-coll, interpretation is less accessible than its p-dist interpretation, when uttered in a minimal context (where the children are dressed in at least two different colours):

(80) The children who are wearing the same colour are siblings.

Compare it with (81), whose main interpretation is the i-coll one according to which all of the children share the same parents:

(81) The children are siblings.

The other relevant principle is the Interpretive Economy Principle (IEP). This principle is described in Kennedy (2007), where it is used in an analysis of graded predication. According to it, speakers should maximise the contribution of the conventional meaning of the elements of a sentence to the computation of its truth-conditions thereby avoiding indeterminacy, whenever doing so does not carry too high a cost. This principle can be seen as a more precise version of the second sub-maxim of the Maxim of Manner, which demands that we avoid ambiguity.

In Sect. 3.2, I mentioned that Champollion appeals to this principle as possibly being operative in Schwarzschild's analysis. In that framework, the main consequence of IEP is that speakers tend to go for i-dist and i-coll readings, rather than p-dist ones. This is because i-dist and i-coll readings arise whenever the relevant cover is one of the two limiting cases available and since limiting cases are salient, speakers tend to converge on them. In our analysis, i-dist and i-coll readings are not more salient than p-dist ones, since atomic

distributivity and basic collectivity do not correspond with objects that stand at the two ends of the same scale. So what job does IEP do for us? It predicts our preference for disambiguations which do not use *str*. This is because the function *str* assigns pluralities a contextually determined cover and hence its use always introduces a semantic indeterminacy that can only be resolved by the context. According to IEP, if this indeterminacy is easy to avoid by the speaker, she should do so; in this case, by making the relevant structure salient in her choice of subject NP.

By invoking this principle, we can address the two cases discussed in Sect. 3.1. First, regarding the case discussed by Lasersohn and Gillon (sentence (21), repeated in (78)), our account renders the reading that Lasersohn finds unacceptable less natural than the rest. Even though it is available, in most contexts speakers will not go for it, since its analysis would be of the form $^{\bullet}P^{0/1}(str(a^1))$. Only in very specific contexts in which the relevant intermediate cover were clearly made available, speakers would go for it. Normally, speakers will go for readings that do not make use of *str*, such as $P^{0/1}(a^1)$ or $^{\bullet}P^{0/1}(a^1)$, that is, its i-coll and i-dist readings. This diagnosis seems correct: it matches Lasersohn's intuitions while agreeing with Gillon that such a reading cannot be ruled out altogether.

By contrast, according to my proposal, Gillon's reading would be readily available in most contexts for (82), analysed as $^{\bullet}P^{0/1}(a^2)$:

(82) John and Mary, and Anna and Bill earned exactly $14,000.

Similarly, we can explain why the reading of (75) where we applied *str* to each of the components of the subject is not easily accessible. Moreover, we can explain why (22)'s (repeated as (83)) unlikely reading seems even more far-fetched than that of (21):

(83) 2 and 8, and 3 and 9 are co-prime.

This is analysed as $^{\bullet}P^{1}(str(flat(a^2)))$. Hence, according to our account, not only does it rely on the context to saturate the variable $IntCov_{flat(a^2)}$ introduced by *str*, against IEP, but it also requires an application of *flat*, against MC. In other words, it requires that we ignore a structure already conveyed by the subject and that we introduce a different one via context. The same goes for the analogous reading of (74), according to which the shorter children are siblings and so are the taller ones, and the last reading described for (75), according to which the philosophers are as homogeneous as the linguists.

Finally, these two principles explain the preference relation between the interpretations of (79) (repeated as (84)) in an analogous way. Let me go in a bit more detail concerning this for further illustration.

(84) The writers and the editors exchanged ideas.

As we saw, this sentence has many interpretations available. Suppose it is uttered in a minimal context in which not much contextual information is provided. Let us summarise the range of readings for (84), as described above:

According to MC and IEP, in a context where no alternative value for the free variable over intermediate covers introduced by *str* is provided, (a) and (d) are equally likely and more likely than the rest. Next comes (b), which makes use of *flat* a single time. This accords with the assessment made above regarding these readings' degree of availability.

Things get a bit more murky when we move on to (c), (e), (f) and (g), both in the sense that my account does not make concrete predictions and that intuitions seem to become less clear. In the absence of proper empirical evidence, it is difficult to answer the question

	Analysis	Predication	Reading
(a)	$^{\bullet}P^{1/2}(a^2)$	p-dist	Each writer exchanged ideas with every other writer and each editor exchanged ideas with every other editor.
(b)	$P^{1/2}(flat(a^2))$	i-coll	Each person exchanged ideas with every other person, regardless of their job.
(c)	$^{\bullet}P^{1/2}(str(flat(a^2)))$	p-dist	Some people exchanged ideas and so did the rest between them, but in a grouping different from the one conveyed.
(d)	$P^{1/2}(a^2)$	p-coll	The writers, as a group, exchanged ideas with the editors, as a group.
(e)	$P^{1/2}(str(flat(a^2)))$	p-coll	Some people, as a group, exchanged ideas with the rest, as a group, but in a grouping different from the one conveyed.
(f)	$^{\bullet}P^{1/2}(str(w^1)\&str(e^1))$	sp-dist	Some writers, as a group, exchanged ideas with the rest of writers, as a group, and some editors, as a group, exchanged ideas with the rest of editors, as a group.
(g)	$^{\bullet}P^{1/2}(w^1\&str(e^1))$	mixed-dist	The predicate distributes differently to each of the pluralities denoted by the subject. For instance, each writer exchanged ideas with every other writer and one group of editors exchanged ideas with another group of editors.

which readings are more accessible than which ones. One thing is clear, (c), (e) and (f) are less easily accessible than (a), (b) and (d) and this is indeed what this accounts predicts, since they make use of the structuring/flattening functions twice, thereby violating MC and/or IEP more times.

However, I think it is unclear how (c) and (e) compare to (f). The former seem to be equally available, and this is explained by the fact that they involve a single violation of MC and IEP. However, (f) is different in that it makes use only of *str*, but twice, demanding thus a double violation of IEP. Moreover, it is not clear how (c), (e) and (f) compare to (g). My working hypothesis is that mixed distributive readings like that of (g) are extremely far-fetched, since they demand that speakers apply MC and/or IEP differently to different constituents of the subject phrase. However, I have no data confirming this and indeed my account, as it is, does not predict it. In the future I hope to gather empirical data concerning these more complex cases as well as elaborate further on my formalism so as to properly account for them. Leaving the case of (g) aside, in general, I take the fact that my account is silent about the comparison between some of the readings of (84) as a welcome result, since it matches the fact that intuitions are not clear at all with respect to the relative accessibility of these readings.

Unsurprisingly, the preference relations imposed by MC and IEP can be overruled. This is in fact why the less natural readings mentioned in this work are sometimes adequate and thus must be made available by any adequate semantics. First, the effect that MC has on expressions involving structured plurals can be overruled due to the fact that structured plurality interacts with other aspects of meaning. For example, there is a lexical fact that can make readings involving *flat* perfectly natural: whenever we have a structured plural in the form of a coordinate which is not easily reduced to a basic plural form, the flattened reading becomes much more likely. This occurs, for instance, when the predicates involved in each

component of the coordinate are not easily subsumable under a single predicate, e.g. *the children and their pets*. By contrast, examples like *the older children and the younger children*, where we have a good candidate basic plural to replace it (namely, *the children*), make flattened readings less likely, since they would have been more easily conveyed by means of the basic plural term in the first place. Thus, one concludes, they must be there for a reason, namely, distinguishing some of the children from the others with respect to how they participate in whatever is predicated of them. Moreover, IEP is overruled whenever making structural information explicit is more costly than it is to leave it for the context to provide. This will occur, for instance, in cases in which the relevant structure is made explicit in the context and is perfectly known by all speakers involved. For example, suppose two farmers are comparing features of their pigs with features of their cows. In such a context, it would be perfectly unproblematic to interpret (85) as saying that the pigs are as loud as the cows:

(85) The animals are equally loud.

In this context, this interpretation would not be less likely than the one according to which each animal is as loud as each other, where we do not need to use *str*. This fact predicts and explains the data gathered by Wohlmuth (2019) and mentioned above, according to which, in contexts where structure is clearly made salient, basic NPs can receive a structured interpretations as easily as overtly structured NPs.

Moreover, these principles can be violated thereby giving rise to certain conversational implicatures. I leave a deeper investigation of these effects for future work, but following Rett (2020) my working hypothesis is that the result of flouting MC and choosing a structured over a basic plural NP is a conversational implicature of atypicality – that is, by violating MC, the speaker intends to describe a somewhat atypical picture. For example, the speaker may implicate that the fact that one of the groupings made salient by the conveyed structure satisfies the predicate is unexpected (this is most obvious in the case of structured plurals in the form of coordinate NPs). Importantly, the implicatures resulting from violating MC are not the structured readings themselves (as discussed in Sect. 3.2.1), since under our account, these are part of the semantics. On the other hand, the flouting of IEP can lead to the so-called 'non-committal' implicature, whereby one tries to avoid commitment to one particular reading so as to be able to deny any specific disambiguation.

Note that this approach is not directly available for cover-based semantics as developed by Schwarzschild. Admittedly, that theory leaves both room for structured interpretations of basic plural NPs and for basic plural interpretations of overtly structured terms. The problem, however, is that for cover-based semantics all covers of the plural denotation of a term are on a par pragmatically and semantically speaking. Since you always need to carry out a cover assignment whenever a plural term is present, the price to pay for readings that add structure, ignore structure or leave things as they are is always the same.

I can think of two ways in which cover-based semantics could try to derive a preference relation between interpretations. Firstly, they can, as suggested by Champollion, adopt IEP thereby favouring the limiting cases in which the predication is i-dist or i-coll. However, there are two problems with this strategy. Firstly, it contradicts the data discussed in this article, as it is not the case that i-dist and i-coll readings are always preferred over non-atomic predications (p-dist). Recall, for instance, that sentence (22), repeated as (86), clearly has a preferred p-dist interpretation according to which 2 and 8 are co-prime and so are 3 and 9 (which is false).

(86) 2 and 8, and 3 and 9 are co-prime.

Secondly, this strategy would not extend to the cases of p-coll, sp-dist and sp-coll readings (recall that in Sect. 3.2 I suggested a way in which cover-based semantics could allow for those). One could take, analogously to the basic case, p-coll readings to be a limiting case together with p-dist readings of a scale in which the intermediate cases are sp-dist readings. One can see this scale as ordering covers of any set of sets from the one that is just the set itself to the one that is its singleton, passing through all the intermediate covers of the set. Similarly, sp-coll readings would be a limiting case of yet another scale: a scale of covers of sets of sets of sets (but recall that natural language does not seem to display super-structured-plural distributive predications, as pointed out in Sect. 2.1):

Kind of denotation	**Scale**
Basic set	i-dist<p-dist<i-coll
Set of sets	p-dist<sp-dist<p-coll
Set of sets of sets	sp-dist<(ssp-dist?)<sp-coll

However, this would demand that we take structured and super-structured plural reference for granted in the first place, that is, that we take NPs as capable of denoting nested sets of objects. This goes against the core of cover-based semantics. Moreover, that would still not give us the means to make comparisons between readings belonging to two different scales. Thus, IEP would still not give us the means to decide, for example, between the i-coll and the p-coll reading of (27), repeated as (87):

(87) The cows and the pigs are equally loud.

A second way in which cover-based semantics could be amended so as to internally account for the preference between interpretations would be to incorporate some explicit principles stating that, for example, readings which arise from saturating the cover variable according to the morphosyntax of the argument NP are to be preferred over any others (as Schwarzschild informally does). However, there are two problems with this move. First, as we observed, the morphosyntax of the subject term does not give us everything we need; the type of the predicate is crucial to determine the final interpretation of the sentences: some predicates demand structure, others demand basic plural subjects, while yet others are less particular in their demands. However, Schwarzschild (1996, p. 48) denies the existence of predicates which demand structure. This fact, combined with the simple maxim that the morphosyntax of the NPs determines the reading of the sentence, would give the wrong results in cases like that of (76) (repeated as (88)), when uttered in a context that does not make salient an intermediate cover:

(88) The students are equally homogeneous.

In this case, Schwarzschild's theory (with our modification) would predict that this is an i-coll predication, but this is wrong: *are equally homogeneous* can only hold of various pluralities of objects collectively.

But there is a more fundamental problem with this strategy: it would be ad hoc. Simply stating that the form of the subject has preference over other factors (or similar claims) would leave us in the dark with respect to the reasons behind the adoption of such principles. Unless we can argue that they are independently motivated, simply making them part of our theory does not help much.

4.3.1 *Constraining anaphora*

Let us go back to the issue of anaphora and show that we can analyse it satisfactorily in this framework. As we will see, what allows us to tackle anaphora successfully is the same apparatus behind our treatment of the preference relations between sentence-interpretations: MC and IEP.

First of all, one of the advantages of our account is that it makes room for cases in which structure is not preserved, like that of (30), which we repeat as (89):

(89) These players and those players are arch-rivals, but outside the field they all get along with one another.

The two sentences in (89) are analysed in our framework as $P^{1/2}(a_i^2)$ and $Q^1(flat(a_i^2))$, respectively (I use indices to link anaphoric elements with their antecedents). The first sentence is a p-coll predication, while the second one is an i-coll one, thereby ignoring the structure of its subject. This reading is predicted by our account to be perfectly natural, because, on the one hand, the first sentence requires neither flattening nor structuring for its interpretation and, on the other, even though the second one makes use of the flattening function, this is the only way in which it can be understood, since the predicate has only an i-coll reading (enforced by the presence of *all* and *one another*).

Furthermore, despite allowing for these cases, our account correctly predicts that in many cases, structure is indeed preserved, as it occurred in (31), repeated as (90):

(90) The students and their lecturers met in adjacent rooms. They do not agree at all.

As before, the first sentence is analysed as a p-coll predication ($P^{1/2}(a_i^2)$). The second one is analysed either as a p-coll predication ($Q^{1/2}(a_i^2)$) or as a p-dist one ($^{\bullet}Q^{1/2}(a_i^2)$), since our theory does not predict an order of preference between the collective and distributive disambiguations of a sentence. This is because MC and IEP cannot help us decide between distributive and collective readings of the same level. However, this seems to adhere with our intuitions that both are equally natural.

The advantage of our account over Gillon's treatment of anaphora is that it makes the readings in which structure is preserved, the default ones. To see this, note that there are other possible readings of the second conjunct of (90), which do not preserve structure. In particular, there is a reading which takes the second predication to be i-coll (i.e. no-one agrees with any other person, regardless of whether they are students or lecturers), and is represented as $^{\bullet}Q^{1/2}(flat(a_i^2))$. Moreover, there is a reading which takes it to be p-coll, but applied to another (contextually determined) structure, and is formalised as $Q^{1/2}(str(flat(a_i^2)))$. However, none of these is as easily accessible as the p-coll and p-dist readings that our theory takes as preferred. Our account explains why: both of them make use of *flat* and/or *str*, against MC and IEP.

Finally, our theory enjoys a further nice feature with regard to anaphora: it can handle cases involving anaphoric reference across collective and distributive readings (of any given level).[36] Recall that we analysed collective readings as resulting from a certain sentence form, $P^k(t^k)$, and distributive ones as resulting from another one, $^{\bullet}P^k(t^{k+1})$, rather than from a lexical or grammatical feature of the subject or the predicate. This is convenient for two reasons. First, the fact that we do not take terms to be the locus

36 This is irrelevant for the comparison with cover-based semantics, which can also handle these cases.

of distributivity/collectivity allows us to tackle subject anaphora across collective and distributive predications:

(91) The players are motivated. They get along very well.

We simply analyse the sentences in (92) as $^{\bullet}P^{0}(a_i^1)$and $P^{1}(a_i^1)$, respectively.

Second, the fact that we admit mixed predicates allows us to tackle predicate anaphora across distributive and collective uses of one and the same predicate:

(92) The children carried a box upstairs. And so did my sister and I.

Suppose (92) is describing a situation in which some children carried a single box altogether and two adults each carried a different box. In this framework, we can simply represent this reading by analysing the first sentence as $P^{0/1}(a_i^1)$ and the second one as $^{\bullet}P^{0/1}(b_i^1)$.

To recap, our treatment of anaphora makes more accurate predictions than Gillon's, since despite allowing for anaphora across predications which demand or take into account different structures for their subject, it also predicts that in many cases structure is in fact preserved. Under this account, no structural information is lost by anaphoric reference, although it may be ignored or enhanced with additional structure by the anaphoric predication. Moreover, our analysis deals successfully with anaphoric reference across collective and distributive sentences.

4.4 *Summarising the analysis' main predictions*

Before finishing the article by considering a possible objection, let me summarise the main predictions of the account.

(i) Other things being equal, **readings that ignore the structure conveyed by the subject are deemed less accessible** (under our analysis, these are the readings that make use of *flat*). E.g. (74)(=80).
(ii) Other things being equal, **readings that demand more structure than conveyed by the subject are deemed less accessible** (under our analysis, these are readings that make use of *str*). E.g. (21)(=78).
(iii) The **preference relation between readings is sensitive to the repeated positing or ignoring of structure** (under our analysis, the iterated use of *str* and *flat*): the more a reading requires us to do so, the less preferred it is. E.g. (22)(=83).
(iv) The **preference relation can be overruled**, i.e. readings which posit additional structure or ignore structure can be preferred in a certain context. Under our analysis, this occurs in situations in which the corresponding pragmatic principles are overruled themselves. E.g. (85).

Finally, recall that **the analysis is silent about the preference relation holding between some readings**. In other words, it does not give us a total order between all the readings of each sentence (e.g. (79)(=84)). It is worth mentioning this, since I took it as a welcome result of the analysis.

4.5 *A potential objection: simplicity*

As mentioned at various points, one of the alleged advantages of cover-based semantics is that it does not demand an expansion of the domain of interpretation: the same kind of domain needed to analyse basic plurality suffices to analyse structured plurality, namely, a domain of basic pluralities (in our framework, a domain of individuals and basic sets thereof). By contrast, the analysis proposed here is inflationary, it demands that we expand

our domain with nested sets, in particular, sets of sets of individuals and sets of sets of sets of individuals.

It is usually accepted that ontological parsimony is among the meta-theoretical properties our theories should aspire to have. Thus ontologically less costly theories are to be preferred over more costly ones. Note that not only philosophers worried about metaphysical parsimony are moved by this kind of considerations. So are linguists who strive for simplicity more generally in their theories. In fact, this is one of the motivations behind the cover-based accounts.

An important notion of ontological cost is the one that tracks the variety of kinds of objects contained in the domain of interpretation of one's theory. In this sense, the theory developed in this article seems to be at a disadvantage with respect to cover-based semantics. But is this criticism fair? I think not, since on closer examination the claim that cover-based semantics does not incur a loss in simplicity with respect to basic plural semantics is mistaken.

In order to see this, let me first argue that the way in which Schwarzschild tries to account for p-coll predications in terms of binary relations holding between pluralities does not work (see Sect. 3.2). If it did work, one could argue that Schwarzschild's proposal is advantageous with regard to simplicity, since not much has been added to our old theory of basic plurality: we already had monadic properties which applied to basic sets, so what is stopping us from admitting their polyadic counterparts? However, Schwarzschild's proposal is not satisfactory, since it does not cover all cases of p-coll predication. Although the analysis of a sentence like (27) seems correct, this proposal does not work in all cases, since some predicates have readings which cannot be accounted for in terms of binary relations holding between sets of individuals. To see this, consider the following example from Linnebo & Nicolas (2008):

(93) Your children, his children and my children play against each other.

Suppose that (93) describes a 3-way game in which each team plays against the other two simultaneously. In this case, (93) cannot be analysed as simply describing binary relations holding between sets of children; (93) is not made true by a situation in which three teams play three different 2-way games. Thus, an analysis in terms of binary relations would not do the trick here. Linnebo and Nicolas have also given an example with a non-reciprocal predicate:

(94) The square things, the blue things and the wooden things overlap.

(94) cannot be rephrased in terms of a binary relational predicate: it is not enough for the truth of (94) that the square things overlap the blue things, the blue things overlap the wooden things and the wooden things overlap the square things. The three collections need to overlap with one another. Thus, Schwarzschild's binary analysis would not work here either. Another possibility would be to analyse it in a way which departs more heavily from surface form, namely, as saying that there is something which is square, blue and wooden. However, as pointed out by Linnebo and Nicolas, this analysis would make *overlap* a defined expression, '[b]ut it seems extremely plausible that 'overlap' can be taught to a child as a lexical atom and is in fact primitive' (Linnebo & Nicolas, 2008, p. 194). To give one last example, consider:

(95) The members of each party compete for the same seats.

And suppose that the intended reading of this sentence is that three groups of people (the members of three different parties) compete against each other for the same seats in some sort of assembly. Once again, Schwarzschild's analysis would not be able to account for this interpretation.

At this point one may think that we should analyse these predications as simply involving ternary relations, but this will not work either, since clearly predicates like *play against each other*, *overlap* and *compete for the same seats* can apply to any number of pluralities.

Alternatively, one may take them to stand for plural multigrade relations: relations which do not have a fixed arity and whose argument positions admit sets of individuals.[37] Nevertheless, I believe that at this point it would be much more difficult to argue that cover-based semantics is simpler than an inflationary proposal like ours. This is because there does not seem to be any gain in trading multigrade plural relations for predicates which can hold of nested sets. In other words, the multigrade route would avoid taking seriously the idea of a predicate holding of a nested set only at the price of taking seriously the idea of a predicate having an indefinite number of plural argument positions. Clearly, either path carries an associated cost. In the former case, the cost is ontological – we need to expand our domains with new sorts of entities; in the latter, it is conceptual – we need to accept the notion of a plural multigrade relation amongst our primitive conceptual toolkit. Prima facie there are no reasons to prefer costs of one sort or the other, which makes it practically impossible to carry out a cost-benefit comparison between the two theories. Since, as far as I am aware, there is no compelling argument for the preference of conceptual over ontological costs, I conclude that the criticism that inflationary semantics are meta-theoretically less simple than the cover-based semantics should be dismissed.

Moreover, even if one could somehow establish that conceptual costs are preferable to ontological ones, this would not necessarily imply that our framework is meta-theoretically inferior to cover-based semantics, since some philosophers and logicians have argued that the kinds of commitments our theory has are, in fact, conceptual (or, as usually dubbed in these debates following Quine, ideological). This philosophical position is an extension of the view that plural terms are not ontologically committing, that is, that they do not refer to new entities, such as sets of individuals, but rather to the individuals themselves, albeit in a new way: plurally.[38] A natural extension of this view is that just as plurals are innocent, so are structured plurals. The latter do not refer to special objects, such as sets of sets of individuals, but rather, refer to the individuals themselves, albeit in a yet newer way: structured-plurally. Thus, this line of thought goes, when we speak of set of sets of individuals in the description of the semantics of structured plurals, this talk should not be taken at face value, but rather as shorthand for a structured plural way of talking, which, in most languages, is not available. Thus, according to this view, the ontological commitments of a theory like ours are exactly the same as those of any first-order theory – i.e. to the existence of basic individuals. However, its conceptual commitments are stronger – i.e. not only to singular reference, but also to plural, structured plural and even super-structured plural reference.[39] I will not get into more detail regarding this philosophical view and

37 The term 'multigrade relation' was coined by Leonard & Goodman (1940, p. 50). See MacBride (2005) for a discussion of this notion.

38 This view was proposed in Boolos (1984) and Boolos (1985) and has been defended, among others, by Lewis (1991), Yi (2005), McKay (2006) and Oliver & Smiley (2016).

39 This view is admittedly less popular than its basic plural version, but it has been defended by some. See Rayo (2006), Oliver & Smiley (2016) and Grimau (forthcoming).

the context where it is discussed. My point, however, already stands: even if one could develop a compelling argument to the effect that conceptual costs are less problematic than ontological ones, the advocate of inflationary semantics would still have room left to defend her position.

5 CONCLUDING REMARKS

In this article, I have proposed a semantic theory of structured plurality which combines elements of both inflationary and cover-based accounts. I hope to have shown that by capitalising on the operation of two independently motivated pragmatic principles (MC and IEP), this theory manages to incorporate into its formalism some of the mechanisms involved in determining the accessibility degree of the various readings of ambiguous sentences. In turn, this provides a more satisfactory treatment of various forms of anaphora. Context, understood in a broad sense, plays a twofold role in my account. On the one hand, context serves to saturate $IntCov_{t^k}$, whenever present. Recall that $IntCov_{t^k}$ is a context-dependent variable denoting an intermediate cover of the set denoted by t^k which replaces t^k whenever *str* applies to it. On the other, context is relevant in that it is only in context that MC and IEP come into play. Thus, it is only because sentences are uttered in a context that our story about the preference of interpretations can work.

As well as proposing a semantic analysis of structured plurality I hope to have provided some new data and examples relevant for the debate. In particular, I hope to have described a richer variety of overtly structured plural terms and to have made a case that there is a significant number of predicates that can (and sometimes must) take structure into account, against what is often claimed in the literature.

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Appendix

In this appendix, I present a preliminary compositional analysis of the different sorts of structured NPs presented in Sect. 2.2. This analysis is more detailed than the one used for my discussion, where I only distinguished between basic terms (variable and constants) and complex terms mimicking RC-coordinations.

As before, I use constants and variables, but these are now reserved for simple definite NPs. First, I represent terms such as as *Anna*, *this* or *he* as a^0 or x^0. Analogously, I represent simple definite plural NPs, such as *the Outer Hebrides*, *these* or *they* uniformly as a^1 or x^1.

I use the following notation for definite descriptions: $a^k : P^k(a^k)$. This can be read as 'the individual/plurality/structured plurality/super-structured plurality that instantiates P^k'. These expressions are of type k.

As explained in Sect. 2.2, plural definite descriptions are ambiguous between the unique and the exhaustive reading. According to the analysis I am proposing here, this amounts to the fact that, for instance, the description *the students who met for a drink* can be analysed either as $a^1 : met^1(a^1)$ (unique, type 1) or as $a^2 :^{\bullet} met^1(a^2)$ (exhaustive, type 2).

Hereafter, I will use a more precise notation for the application of the $^{\bullet}$-operator to polyadic predicates: I will apply the operator to each of its positions separately rather than to the predicate itself. I indicate this by placing the operator in front of the relevant index. For example $R^{\bullet 0,1}$ is distributive in its first position, but collective in its second one.

Finally, note that I will sometimes apply the bullet operator iteratively. This is allowed by the definition of the operator. For example $^{\bullet\bullet}P^0(a^2)$means that every basic set a^1 in a^2 is such that every individual a^0 in it instantiates P^0.

In what follows I illustrate the analysis of each kind of expression with an example.

Coordinate NPs

I take the conjunction RC-coordinator as a multigrade function that admits n arguments of type k_i, a^{k_1},...,a^{k_n}, and delivers an expression of type $k_i + 1$ for $k_i = max(k_1, ..., k_n)$: $[a^{k_1} \& ... \& a^{k_n}]$ (I will follow the convention to omit external brackets). There are at least three kinds of RC-coordinations that give rise to structured readings. First, there are simple coordinate plural NPs. For example:

Example	*the cats and the dogs*
Analysis	$[a^1 :^{\bullet} Cat^0(a^1)] \& [b^1 :^{\bullet} Dog^0(b^1)]$ (type 2)

Secondly, we have nested coordinations of singular NPs.

Example	*Serena and Venus, and Pau and Marc*
Analysis	$[s^0 \& v^0] \& [p^0 \& m^0]$ (type 2)

Finally, I call 'partial coordinated plural NPs' expressions like *the children from Czechia and from Slovakia* or *the Slovak and the Czech children*, which consist of the coordination of a NP and a NP constituent.[40] My working hypothesis is that these expressions are ambiguous between two readings: a basic one and a structured one. This is because the coordinator can be interpreted as linking two predicates: *are from Czechia/are from Slovakia*, *are Czech/are Slovak*. But also as linking two plural definite descriptions, one of

Example	*the children from Czechia and from Slovakia* *the Slovak and the Czech children*
Analysis 1	$a^1 : {}^{\bullet}Child^0(a^1) \wedge ({}^{\bullet}Cz^0(a^1) \vee {}^{\bullet}Sl^0(a^1))$ (type 1)
Analysis 2	$[a^1 : {}^{\bullet}Child^0(a^1) \wedge {}^{\bullet}Cz^0(a^1)] \& [b^1 : {}^{\bullet}Child^0(b^1) \wedge {}^{\bullet}Sl^0(b^1)]$ (type 2)

40 These are argued by Schwarzschild (1996, Ch. 4) to pose a challenge for inflationary views.

which has some elided components. Under the first reading, both expressions are analysed as involving a complex disjunctive predicate. Under the second reading, they are structured plurals consisting of a coordination of two plural definite descriptions. Investigating which is the specific mechanism that transforms the 'incomplete' coordinate into the referring expression picking out the Slovak children falls outside the scope of this article.

Plural definite descriptions formed with lexical collective predicates

Whenever one of the predicates involved in a description is of type 1 or higher, the resulting description can have a structured reading (i.e. under its exhaustive interpretation). This follows in my analysis from the restriction that P^k predicates can only accept arguments of type k. For instance, when a type 1 predicate is the only predicate of a definite description, we have:

Example *the co-workers*
Analysis $a^2 : {}^{\bullet}Cowork^1(a^2)$ (type 2)

This also occurs whenever there are predicates of lower type involved:

Example *the numbers whose product is larger than 25*
Analysis $a^2 : {}^{\bullet\bullet}Num^0(a^2) \wedge {}^{\bullet}Prodlarg25^1(a^2)$ (type 2)

Example *the co-workers that are allergic to gluten*
Analysis $a^2 : {}^{\bullet}Cowork^1(a^2) \wedge {}^{\bullet\bullet}Allerg^0(a^2)$ (type 2)

Plural definite descriptions with a VP with a quantificational object

In the case of plural definite descriptions involving a predicate with a quantificational object, we need to disambiguate the scopal relations between the different elements involved. The following are the representations of two examples under their structured readings:

Example *the cars parked in each lane*
Analysis $a^2 : {}^{\bullet\bullet}Car^0(a^2) \wedge \forall x^1 \in a^2 \exists x^0(Lane^0(x^0) \wedge Parked^{\bullet 0,0}(x^1, x^0))$ (type 2)

Example *the students forming lines*
Analysis $a^2 : {}^{\bullet\bullet}Student^0(a^2) \wedge \forall x^1 \in a^2 \exists x^0(Line^0(x^0) \wedge Form^{1,0}(x^1, x^0))$(type 2)

In the first case, *the cars* takes wider scope than *each lane* and this is what gives rise to a structured reading. Analogously, in the second case it is also the fact that *the students* takes scope over *lines* what facilitates the structured reading.

Note that here I have used universal quantifiers to express distributivity for the sake of clarity, but I could have just as well used the $^{\bullet}$-operator. For example, I could have formalised the first example as: $a^2 : {}^{\bullet\bullet}Car^0(a^2) \wedge {}^{\bullet}(\exists x^0(Lane^0(x^0) \wedge Parked^{\bullet 0,0}(a^2, x^0)))$. This would demand taking $\exists x^0(Lane^0(x^0) \wedge Parked^{\bullet 0,0}(..., x^0))$ as a type 1 monadic predicate whose single argument position corresponds with the first position of $Parked^{\bullet 0,0}$.

Doubly plural NPs

Finally, we have doubly plural NPs. Some of them consist of NPs formed with a pluralized numeral determiner, as in Finnish and Icelandic, while others consist of NPs where the head noun has a double plural suffix, as in Khamtanga.

In the Finnish example, I treat numerals as denoting degree-type objects (note that our models would need to be expanded accordingly).

Example from Finnish	$kahdet_{PLNumDet}$ $paperit_{PLNom}$
	the two_{PL} papers
	'the two pluralities/piles of papers'
Analysis	a^2 :•• $Paper^0(a^2) \wedge \lvert a^2 \rvert = 2$ (type 2)
Example from Khamtanga	$l\acute{a}lle_{2PL}$-d_{def}
	the_{def} bee_{2PL}
	'the pluralities/swarms of bees'
Analysis	a^2 :•• $Bee^0(a^2)$ (type 2)