Group distributivity and the interpretation of indefinites

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Abstract

This paper argues that lexical and operator-based analyses of distributivity are not in conflict, but should exist alongside each other to get a full account of all the relevant data. We use several contrasts between plural definites (e.g. *the girls*) and group NPs (e.g. *the group of girls*) to show that we need an operator-based analysis of distributivity; this kind of distributivity is available with plural definites but not with group subjects, which can be explained under the common assumption that group NPs denote atoms rather than sums and hence do not allow quantification over their individual parts. At the same time, we need a lexical theory of distributivity to account for the various distributive interpretations that we do find with groups.

The distributive interpretation of sentences like *The team is wearing an orange vest* provides a challenge to this story, but only if the indefinite *an orange vest* is analysed as a quantifier. We argue, however, that it should be analysed as a property, and that the distributive interpretation is actually a case of two-place lexical distributivity over a property and a group. Support for this non-quantificational analysis comes from the observation that the class of predicates that allows a distributive interpretation in these contexts seems to be precisely the class of 'incorporation predicates' (Le Bruyn, De Swart & Zwarts 2015) that allow bare complements in many languages.

Keywords: distributivity, quantification, group nouns, indefinites, semantic incorporation

1 Introduction

How do we make inferences about individuals based on sentences that involve predication over a plurality? For instance, why do we conclude from (1a) that it is the individual children who laughed, and from (1b) that each of the girls probably had a beer of her own?

(1)   a. The children laughed.

       b. The girls had a beer.

In the early 1980s, two different answers to this question were proposed. According to Scha (1981), there is no formal difference between the derivation of the *distributive* interpretation of the sentences in (1) - which supports the inference that the property expressed by the predicate holds of the single individuals that make up the plural denotation - and the derivation of the *collective* interpretation of sentences like the following, which does not support such an inference:

(2) The children $\left\{ \begin{array}{l} \text{gathered in the garden.} \\ \text{met last week.} \\ \text{are a good team.} \end{array} \right\}$

Unlike the examples in (1), the sentences in (2) do not involve the 'trickling down' of the predicate to individual members of the plurality but rather express that a certain property holds of the plurality as a whole. In both cases, according to Scha, the predicate applies directly to the denotation of the plural definite, and any information about the way its individual members participate in the expressed event is part of the lexical semantics of the predicate. We know that in order to be able to laugh one needs lungs and a vocal apparatus, and we know that individuals have this but groups or collections do not; hence, we interpret *The children laughed* as a statement about individual children. Similarly, we know that gathering cannot be done by single individuals but only by groups, and hence we interpret *the children gathered* as a statement about a collection of children. Thus, according to Scha's analysis, collectivity and distributivity inferences with referential expressions are not triggered by the compositional semantics of the sentences in question, but by lexical information.

However, the account most widely adopted is the one originating in Link (1983), which analyses distributivity in terms of a semantic operator comparable to the overt universal quantifier *each*.[1] This distributivity operator (henceforth D-operator) quantifies over the members of a plurality, allowing the predicate to apply to each of these individuals. According to the operator-based account, the semantics of (1a), for example, should be analysed as follows:

(3) $(D(\textbf{laugh}))(\textbf{the\_children}) = \forall x \in \textbf{the\_children} \; [\; \textbf{laugh}(x) \;]$

In the most radical version of the operator-based analysis, exemplified by Link (1983, 1987), there is a direct correlation between the semantic mechanism used and the interpretation derived: direct predication over a plural individual results in a collective interpretation; using a D-operator results in a distributive interpretation. This means that a plural distributive predicate like *laugh* must be interpreted via an operator-based mechanism, and a plural collective predicate like *gather* must be interpreted via direct predication. A sentence like (1b) (*The girls had a beer*) can be interpreted in both

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[1]Link (1983) proposes an operator $*$ that pluralises distributive predicates like *laugh*; from the algebraic properties of $*$ and the fact that its application is restricted to predicates that contain nothing but atomic individuals in their extension, it follows that whenever a plurality is in the extension of $*P$, P is true of all the atoms that make up the plurality. The D-operator as covert *each* was proposed in Link (1987) and further fleshed out by Roberts (1987). Unlike $*$, the application of the D-operator is not a priori restricted to a particular class of predicates, which enables a purely structural analysis of distributivity.

ways: if its semantics is derived by means of a D-operator, we get the distributive interpretation according to which each girl had a beer of her own, and if it is derived by means of direct predication, we get the collective interpretation according to which the girls shared the beer.

In practice, the operator-based analysis as it is usually adopted is somewhat less radical. Roberts (1987), citing Dowty (1987) as her influence, explicitly argues that applying a D-operator to a distributive predicate is unnecessary, because the distributive aspect is part of "the sense of the predicate". Just as there is no need to formally restrict the extension of the predicate *grasp* to those entities that have opposable thumbs, there is no need to restrict our formal semantics in such a way that distributive predicates can only apply to individuals (and collective predicates to pluralities): this restriction simply follows from their lexical meaning. Like Roberts, Winter (1997), while accepting that we need a D-operator to be able to adequately capture the truth conditions of more complex sentences like (1b), suggests that the simple cases like (1a) may involve direct predication and lexical semantics, as in Scha's analysis. A similar distinction between lexical and operator-based distributivity is adopted by Hoeksema (1988) and Champollion (2010).[2]

These more mixed approaches to distributivity agree with the observation made by various authors (Dowty, 1987; Verkuyl & van der Does, 1996; Verkuyl, 1994) that the line between collectivity and distributivity is not as clear-cut as Link's division suggests. Dowty (1987) notes that even many collective predicates enable certain inferences about individuals; he calls these inferences *subentailments*. For example, while we cannot infer (4b) from (4a), we can infer (4c):

(4)   a. The children gathered in the garden.
      b. *Each child gathered in the garden.
      c. Each child was in the garden.

If the inference from (4a) to (4c) were enabled by some covert operator, such an operator would need to be able to break up the lexical meaning of *gather* and distribute only part of it to the individual children. There is no way to do this in standard model-theoretic semantics, and even if there were, every subentailing predicate would need its own corresponding operator to ensure the distribution of only the intended meaning parts. Considering this, it is reasonable to assume that the inference from (4a) to (4c) is enabled not by a covert quantificational mechanism but by the lexical properties of the predicate *to gather*. But then, if the distributive inference from (4a) to (4c) can be lexically based, without actual quantification over individual children, the same should hold for the distributive inference from "The children laughed" to "Each child laughed". Put differently, if *part of* a predicate meaning can be distributed over members of a plurality by a lexical process, there is no reason why the same process couldn't be responsible for the lexical distributivity of *entire* predicate meanings, if this were supported by the semantics of the verb and the context. There seems to be little conceptual sense in a theory that allows for subentailment but not for full lexical distributivity.

A counterargument to this kind of reasoning, however, is brought up by Landman (1996, 2000) (who, as far as I am aware, is the only author who has explicitly argued against the possibility that at least some distributive interpretations could be due

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[2]Bartsch (1973) is an early example of an account of plurality in which distributivity is sometimes made explicit in the formal semantics, and sometimes left to lexical inferencing, but she is not very explicit about this aspect of her theory. In Kroch (1974), plural predication introduces a universal quantifier, but an additional interpretation rule ensures that distributive readings generated in this way come out as anomalous if they are incompatible with the lexical semantics of the predicate.

to lexical inferences). Landman's point is based on argument structure: whatever saturates the argument position of **laugh** in the sentence "The children laughed" is not just there to give the sentence a grammatical subject so it may end up as an expression of type t, it also receives the thematic agent role from the verb. If the subject argument of a distributive predicate could be a collection of individuals, Landman argues, this entire collection would be assigned the role of agent; but that would render the entire notion of 'agent' both meaningless and useless, since the collection itself is not in fact the agent of the expressed event (it's the individual children that are the laughing agents, not the group of children as a whole). So according to Landman, we really do need a quantificational mechanism that allows us to interpret "The children laughed" as expressing a whole series of laughing events, each with their own individual agent. On the other hand, with a collective verb like *gather*, the subject plurality as a whole should receive the agent role; the fact that there are certain subentailments to individuals does not change the fact that the agent of the gathering event is still the collection as a whole. So, on the one hand, we have a conceptual argument suggesting that what I have called the 'radical' Linkian approach, which assumes that covert quantification is the only way to derive a distributive interpretation, is somewhat too strict and that it is plausible that lexical semantics takes care of at least some distributive inferences. On the other hand, we have a similarly conceptual argument against this idea, suggesting that sentences cannot be properly interpreted when the individual agents of distributive events are not identified as such in the formal semantics. This means that the question of lexical distributivity needs to be decided on empirical grounds - can we demonstrate empirically whether we need to equip our theory with some lexical means of deriving distributive inferences (in addition to a formal one)?

Although Winter (1997, 2000) does not make an explicit empirical case for lexical distributivity, it is possible to make such a case on the basis of the data in Winter (2000). More recently, Champollion (2010) argues (following observations by Lasersohn (1989, 1995), Schwarzschild (1996) and others) that lexical distributivity freely allows intermediate or non-atomic interpretations when these are supported by the lexical semantics of the predicate, while operator-based distributivity only allows a nonatomic interpretation if this is made sufficiently salient by context. In both cases, lexical distributivity accounts for distributive interpretations that, according to Winter and Champollion, cannot be explained in terms of covert quantification.[3]

In this paper I provide some new empirical evidence along the same lines. I claim that an operator-based distributivity mechanism is unable to account for certain cases of distributivity involving group nouns (singular nouns referring to collections of things, like *committee* or *choir*):

(5) The committee laughed.

Sentence (5) clearly has a distributive interpretation, which has motivated some researchers (e.g. Bennett 1974, Pearson 2011, Magri 2012) to analyse the denotations of group NPs as pluralities that can be quantified over. However, in many cases, distribution over members of a group is not possible, as exemplified by the following contrast:

(6)   a. The children are hiding somewhere.
       $\Leftarrow$ For each child x, there is a place y such that x is hiding in y.
       $\Leftarrow$ There is a place y such that each child is hiding in y.
   b. The class is hiding somewhere.
       $\Leftrightarrow$ There is a place y such that each child is hiding in y.

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[3]Recent unpublished experimental work by Jakub Dotlačil and Adrian Brasoveanu also shows a processing difference between operator-based distributive inferences and distributive inferences that might be explained in terms of lexical reasoning (Jakub Dotlačil, p.c.).

Sentence (6b) cannot mean that each child in the class hid in a different place: the only available interpretation is one where *somewhere* takes wide scope, according to which there is a single place in which all the children are hiding. In contrast, sentence (6a) does have a distributive interpretation, which can be readily accounted for in terms of covert quantification: if (6a) involves a covert quantifier over children, this quantifier may take scope over the adverbial *somewhere*.

Based on contrasts like the one in (6), I show that group NPs in general do not allow distribution over individual members, which is in line with the common assumption that they are not associated with pluralities but with atoms (e.g. Link, 1984; Landman, 1989; Barker, 1992; Schwarzschild, 1996). If groups are atomic, it will not be possible to quantify over its individual members, as these are not accessible to the compositional semantics. This means that any distributive effects that we do find with group NPs - such as the distributivity in (5)) - cannot be derived by means of a D-operator. I conclude that we need a theory of lexical distributivity to account for interpretations like these.

An apparent counterexample to this conclusion are sentences like (7), which seem to involve a scopal ambiguity comparable to the one in (6a):

(7) The First Aid team is wearing an orange vest.

For many (although not all) native speakers, sentence (7) has a distributive interpretation according to which the individual First Aid team members are each wearing their own orange vest. However, I argue that this does not force us to adopt a covert quantifier over members of groups. Crucially, not all predicates allow a distributive interpretation when they appear with a group subject and an indefinite object; as I will show, this property seems to be limited to so-called HAVE-predicates Borthen (2003); Espinal & McNally (2011); leBruyn et al. (2015). Another property of HAVE-predicates is that many languages that do not generally allow singular nouns to appear without a determiner (like Spanish, Catalan, Norwegian, Romanian and Greek) allow them to take a bare singular complement; (8) shows an example involving the Greek equivalent of *to wear* (from Alexandropoulou, 2013):

(8) Forouse frako.
     wear.3SG frock.coat
     'S/he was wearing a frock coat'

The more or less standard approach to bare nominals is to analyse them as properties. Taking the correspondence between the class of HAVE-predicates and the class of predicates that allow distributivity over a group and an indefinite as a hint, I will argue that the indefinite in (7) too should be analysed as a property rather than a quantifier, which enables direct predication over the indefinite and, by that means, lexical distributivity over the instances of the property it denotes. This means that the distributive interpretation of sentence (8) can be regarded as a case of two-place lexical distributivity, comparable to the analysis of codistributivity cases in Scha (1981) and Winter (2000).

By strengthening both the case for an operator-based analysis of distributivity (to account for the various contrasts between group NPs and plural definites) on the one hand, and the case for a lexical theory of distributivity (to account for the various distributive interpretations that we do find with groups) on the other, this paper aims to show that these different accounts of distributivity are not in conflict, but should exist alongside each other to get a full account of all the relevant data. In addition, the paper provides new evidence for both the atomic nature of group nouns, the possibility for singular indefinites to denote properties even in argument positions (adding to the growing body of literature on non-quantificational interpretations of indefinites

in English, e.g. (Milsark, 1974; Carlson, 1977; Partee, 1987; McNally, 1992; Zimmermann, 1993; de Hoop, 1996; Mador-Haim & Winter, 2007)), and the idea that the class of HAVE-predicates is semantically special even in languages whose syntax does not reflect this.

The paper is structured as follows. In section 2, I introduce the two kinds of distributivity and the distinctions between them in more detail. I show that sentences with plural subjects generally have a wider range of interpretations than their group-subject counterparts: a sentence with a group NP subject can only receive a distributive interpretation if it is a non-quantificational sentence like (4). I propose an analysis according to which lexical distributivity is available with both plural and group noun subjects, while operator-based distributivity is available only with plural subjects; this is in line with the common assumption that group nouns denote atomic entities. Finally, I sketch a basic formal account of lexical distributivity in terms of pseudo-equivalences (**?**, following); I assume that the interpretation of lexically distributive predication is determined by a combination of lexical semantics (in the form of non-logical inferences that are listed as part of the lexical meaning of the verb) and world knowledge.

In section 3, I examine cases like *The team is wearing an orange vest* and propose that they, too, can be analysed as lexical distributivity if we assume that the indefinite denotes a property rather than a quantifier. Sticking closely to the literature on HAVE-predicates, I will assume that certain transitive predicates are ambiguous between an 'ordinary' version and an 'incorporating' version that takes a property-type complement. The second part of section 3 looks more closely at the various properties of linguistic phenomena that have been argued in the literature to involve non-quantificational indefinites, and shows that these properties apply to the group distributivity data as well.

In section 4, I will briefly address (and leave open) a remaining issue: the problem of assigning a property denotation to non-upward-entailing modified numerals.

Section 5 concludes the paper.

2 Two kinds of distributivity

Adopting the terminology of Winter (1997), I will call the two kinds of distributivity that I want to distinguish *Q-distributivity*, which corresponds to Link's D-operator-based distributivity, and *P-distributivity*, which corresponds to Scha's lexical semantics-based distributivity. Schematically:

(9)   a. *Radical operator-based approach:*

                    D-operator: No D-operator:
                  distributivity   collectivity
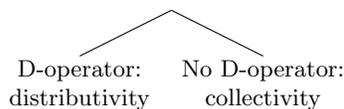
    b. *Advocated approach (based on Winter, 1997, 2000; Champollion, 2010):*

               D-operator: No D-operator
          Q-distributivity   (=direct predication):

                            collectivity   P-distributivity
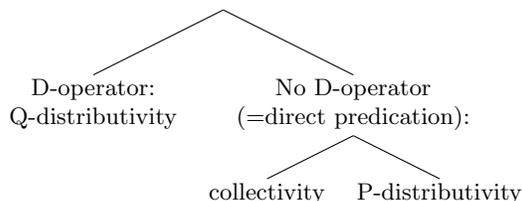
Because the analysis in (9b) lacks a one-to-one correspondence between interpretation and mechanics, it is important to keep the two apart in our terminology. I will use the terms *collectivity* and *distributivity* to refer to interpretations, as follows:

(10) Suppose we have a sentence S of the form X *Pred*, where X is a plural, conjunction or group noun, and *Pred* is a predicate. An *interpretation* of S is *distributive* if we infer that $[\![Pred]\!](x)$ for every member x of $[\![X]\!]$; otherwise[4][5] it is *collective*.

The two semantic mechanisms that I use to derive these interpretations are covert quantification (for example by means of a D-operator), and direct predication over a collection.[6] Formally:

(11) Suppose we have a sentence S of the form X *Pred*, where X is a plural, conjunction or group noun, and *Pred* is a predicate:

- Applying a *D-operator* derives the logical form $\forall x \in [\![X]\!] \; [[\![\text{Pred}]\!](x)]$
- *Direct predication over a collection* derives the logical form $[\![\text{Pred}]\!]([\![X]\!])$.

Finally, and somewhat obviously: a P-distributive interpretation is a distributive interpretation that I propose is derived by direct predication over a collection. A Q-distributive interpretation is a distributive interpretation that I propose is derived by the D-operator.

For now, I will put aside the question of the exact nature of P-distributivity and what it means for a distributive inference to be 'rooted in the lexical semantics of a predicate' - I will discuss these questions in more detail in section 2.3. My goal at this point is to show that we need *some* lexical theory of distributivity in additional to a formal one; to this end, we first need a clearer picture of the kind of distributive inferences that demonstrate the need for an operator-based distributivity mechanism.

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[4]For now, I am ignoring cases of 'intermediate distributivity', as in *Rodgers, Hammerstein & Hart wrote musicals* (Gillon, 1987), which is true not because each wrote musicals of their own or because the three of them wrote musicals together, but because Rodgers and Hammerstein collaborated to write musicals and so did Rodgers and Hart. The definition in (9) can be straightforwardly extended to accommodate such cases.

[5]In paraphrasing distributive interpretations in terms of universal quantification, I am also abstracting away from the well-observed fact that plural predication usually leaves room for exceptions (i.e. members of the subject collection for which the predicate does not hold). Thus, the sentence "The girls are linguists" (unlike the universal paraphrase "All the girls are linguists") can be true even if some of the girls are not linguists, especially if we are talking about a large number of girls. This particular kind of vagueness is known as *non-maximality* (Dowty, 1987; Brisson, 1998). There are three general strategies for dealing with non-maximality: it can be built into the semantics of the D-operator (e.g. Schwarzschild, 1996; Brisson, 2003); it can be treated as a property of direct predication (Landman 1989; Winter 2002), a view that predicts that non-maximality should be tied to lexical rather than operator-based distributivity; or it can be treated as a specific instance of a more general phenomenon of 'pragmatic slack' (Lasersohn, 1999). Since I will not address the issue of non-maximality in this paper, I will simply treat distributivity as more or less paraphrasable by universal quantification.

[6]I am using the word 'collection' in a pre-theoretical sense here to refer to NP denotations that are at least conceptually plural - the referents of plural NPs like *the girls*, conjunctions like *Mary, Jane and Sue* or collectives like *the group of girls*. I will remain agnostic on the ontological status of these collections, which depends on the larger theory of plural predication we would like to adopt and on the way we analyse singular group NPs like *the group*. Here are several options (some of which are more compatible with the ideas put forward in this paper than others). In Scha (1981), collections are analysed as sets, but so are all NPs - Scha's framework does not make any type-theoretic or sortal distinction between the denotations of singular and plural NPs. In Link (1983) and Schwarzschild (1996), plural NPs and conjunctions are analysed as sets (or sums, if we prefer a lattice-theoretical formalisation), while singular NPs are analysed as atomic entities; Winter (2002) is similar but also assumes that the sets associated with plurals and conjunctions can be mapped into an atomic entity through a typeshifting operation. In Landman (1996, 2000), collections can be either atomic or set-denoting (with two typeshifts mapping these different interpretations to each other), but only the latter denotation supports any distributive inferences. In de Vries (2015), all collection-referring NPs can denote either a set or (via a typeshift) an atom; the former denotation is associated with Q-distributivity, the latter with P-distributivity.

2.1 Q-distributivity

As several authors have shown in reply to Scha (1981) (e.g. Winter, 1997; Brisson, 1998), there are some distributive interpretations that cannot be reduced to a combination of direct predication and lexical semantics. Here is an example of a sentence for which a purely lexical approach (like Scha's) does not completely cover the truth conditions for the different interpretations available:

(12) The children are hiding somewhere.

If we analyse the adverb *somewhere* as an existential quantifier over locations, an analysis in terms of direct predication over a collection would result in the adverb's taking scope over the entire plurality of children:

(13) $\exists x$ [**location**$(x) \wedge$ **hide_in**(**the_children**,x)]

But this only allows an interpretation in which there is one particular place where the entire group of children is hiding, whereas (12) also has a distributive interpretation according to which each child is hiding in a different place. To derive the latter, the members of the plurality *the children* need to take scope over the existential quantifier introduced by *somewhere*. And the only way to allow *the children* to have wider scope than *somewhere* is to introduce another quantifier, as in (14):

(14) $\forall x \in$ **the_children** [$\exists y$ [**location**$(y) \wedge$ **hide_in**(x, y)]]

As we have seen, such a quantificational analysis is generally formalised with the help of a D-operator, a covert quantifier comparable to overt *each*. Without this D-operator, the plural denotation cannot take wide scope, and the meaning of the sentence is derived through direct predication as in (13).

In the literature, the argument for Q-distributivity is generally made based on the availability of a distributive interpretation for sentences with an indefinite object, such as "The girls are wearing a dress" or "The boys ate a sandwich". But the range of sentence types that demonstrate the need for a quantificational distributivity mechanism is much broader, as I will show in this section (and in the second part of this paper, I will argue that these indefinite-based cases are not examples of Q-distributivity at all). Two additional cases of Q-distributivity are covered in section 2.2.3. *DI* and/or *CI* are shorthand for 'distributive interpretation' and 'collective interpretation', as defined in (10).[7]

2.1.1 Disjunction.

The mathematical equivalence shown in (15) can be seen playing out in natural language in entailments like (16):

(15) $x \in (P \cup Q) \Leftrightarrow x \in P \vee x \in Q$

(16) Sue is walking or cycling.
      $\Leftrightarrow$ Sue is walking or Sue is cycling.

When we replace *Sue* in (16) with a plural definite, the entailment pattern gets a bit more complicated. A disjunctive sentence like (17) can be interpreted in two different ways:

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[7]Note that, according to the definition in (10), it is the entire VP that is relevant here, not just the verb; thus, (15) has a distributive interpretation not because we interpret both walking and cycling as properties of individuals, but because the whole predicate *be walking or cycling* can apply to each individual semanticist. Similarly, 'CI' in the case of (15) does not signify that the walking or the cycling are somehow performed collectively, but that the disjunction *be walking or cycling* applies to the collection of semanticists rather than the individuals. As will become clear, formulating the definition in this way will help us to separate Q- from P-distributivity since it takes into account the VP with all its internal structure, rather than only looking at the meaning of the verb.

(17) The semanticists are walking or cycling.
    $\Leftarrow$ For every semanticist x, x is walking or x is cycling.   *(DI)*
    $\Leftarrow$ The semanticists are walking or the semanticists are cycling.   *(CI)*

There are two ways to analyse (17), each of them corresponding to a possible interpretation of the sentence. According to the first analysis, the disjunction *walking or cycling* applies to each individual semanticist, which means that (17) is compatible with a situation in which part of the semanticists are cycling and the other part are walking. According to the second interpretation, the disjunction *walking or cycling* applies to the collection of semanticists as a whole: either they are all walking, or they are all cycling. While the second interpretation can be analysed in terms of direct predication over a collection, the first cannot: in order for the disjunction to apply to each individual semanticist, we need quantification over the set of semanticists.

2.1.2 Quantified expressions.

At the beginning of this section, we have already seen an example of Q-distributivity involving a quantified expression (*somewhere*); the following examples also involve quantifiers (a comparative quantifier in (18), and a numerical quantifier in (19)) ; all examples are similarly ambiguous between two interpretations. The examples were chosen in such a way that the DI does not entail the CI; hence, it is possible to imagine a situation that verifies the DI but falsifies the CI. This means that if we can accept a sentence as true in such a situation, we have to be able to derive the DI as a separate reading. It can be shown for each of the cases below that this is only possible by assuming covert quantification over the members of the subject plurality.

(18) The cows won fewer prizes at the fair than the pig.
    a. $\Leftarrow$ The cows together won fewer prizes than the pig.   *(CI)*
    b. $\Leftarrow$ Every cow won fewer prizes than the pig.   *(DI)*
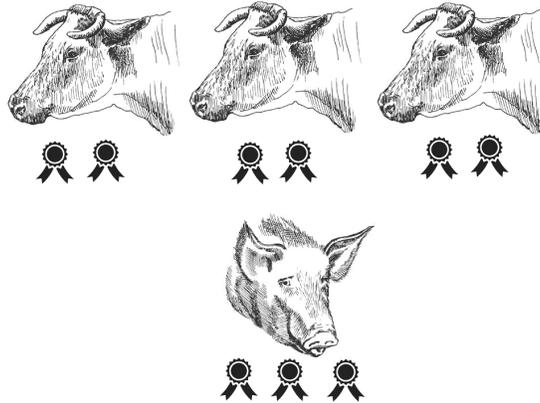
Figure 1: Cows, pigs and prizes

As a context for (18), imagine a country fair at which prizes are awarded to animals in various categories. One farmer brought three of her cows and her very best pig, and all four animals ended up winning a number of prizes. One possible distribution of prizes is depicted below in Figure 1; sentence (18) is true in this situation under its

first, distributive, interpretation, since the cows each have two prizes while the pig has three. However, it is false under its collective interpretation, since the cows together have six prizes, which is more than the pig has. Direct predication only gives us the CI: without quantification over individual cows, the quantifier *fewer prizes than the pig* necessarily takes scope over the entire subject plurality. Again, we need to assume some covert quantification mechanism in order to derive the distributive interpretation.

The reasoning is similar for the next example:

(19) These artists dress in black one day a week.
$\Leftarrow$ For every artist x, there is one day a week y such that x dresses in black on y. *(DI)*
$\Leftarrow$ There is one day a week y such that every artist dresses in black on y.   *(CI)*

Without quantification over individual artists, the only interpretation that can be derived is the CI, according to which all the artists dress in black on the same day of the week.

2.1.3   Pronoun binding.

When a pronoun or reflexive is bound by a plural definite subject, it can be interpreted as either referring back to the entire plurality, or to each of the members of the plurality individually (as when the pronoun is bound by a universal quantifier). The availability of the latter interpretation points to the presence of a covert quantifier in the derivation. I will provide Dutch examples here, to avoid the complications posed by dependent plurality in English, among other reasons.[8]

(20) Deze jongens worden woedend als je hun moeder beledigt.
These boys become furious when you their mother insult
'These boys get furious when you insult their mother(s)'

    a. $\Leftarrow$ These boys get furious when you insult their mum (the boys are brothers). *(CI)*

    b. $\Leftarrow$ For every boy x, x gets furious when you insult x's mum.   *(DI)*

Because the NP *hun moeder* 'their mother' is singular here, we would not expect the distributive interpretation (in a situation in which the boys are not siblings, which means that we are talking about more than one mother) unless the NP is interpreted in the scope of a quantifier. Hence, the fact that we can interpret (20) as true in such a situation provides another piece of evidence for the presence of a covert quantifier in the semantics of (20).

Dutch is also the source of the next example, which involves a reflexive anaphor. Unlike English, the Dutch third person reflexive pronoun *zichzelf* is not inflected for either number or gender; as (21) demonstrates, *zichzelf* can be interpreted as 'himself', 'herself', 'itself' or 'themselves'. This will make Dutch reflexive predication particularly

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[8] Winter (2000) provides an English example along the following lines:

(i) The boys will be glad when their mothers arrive.
   $\Leftarrow$ For every boy x, x will be glad when x's mother arrives.

However, most varieties of English really need the dependent plural *mothers* here to bring out the distributive interpretation, which means it is hard to tell whether the DI here is really due to covert quantification and not just a special case of the collective interpretation (for "The boys will be glad when the mothers of the boys arrive" to be true, it is only necessary for the boys to be glad when the mothers arrive, a condition that is satisfied when each boy is happy to see his own mother). When the singular *their mother* is used, most speakers are only able to get a collective interpretation in which the boys are all children of the same mother. In contrast, Dutch (sometimes) allows dependent plurality but does not require it, so the Dutch equivalent of "The boys will be glad when their mother arrives" can easily be interpreted both collectively and distributively.

useful when we will compare the behaviour of plurals with that of group nouns in section 2.2.

(21) $\left\{ \begin{array}{l} \text{Jantje vindt} \\ \text{De kinderen vinden} \end{array} \right\}$ zichzelf nogal slim.

Johnny considers / the children consider SELF.3SG/PL *rather clever*

'Johnny considers / the children consider himself/themselves rather clever'

When the subject is a plural definite like *the children*, two different interpretations arise, depending on whether we take the antecedent of *zichzelf* to be the entire group denoted by the subject, or each of the members of that group in turn:

(22) De kinderen vinden zichzelf nogal slim.

'The children consider themselves rather clever'

    a. ⟸ The children consider the children rather clever (as a group).   *(CI)*

    b. ⟸ For every child x, x considers itself rather clever.   *(DI)*

In a situation in which each child considers itself clever but thinks the other children are stupid, (22) is false on its collective interpretation but true on its distributive one. This interpretation cannot be derived if only the plurality *de kinderen* 'the children' as a whole may function as the antecedent of *zichzelf*, but it can be derived if we allow *zichzelf* to be bound by a quantifier over individual children.

To summarise, while simple distributive sentences like "The children laughed" might in principle be analysed in terms of direct predication over a collection, the truth conditions of more complex cases involving scope interactions and binding cannot be adequately captured without assuming covert quantification by something like a D-operator.

2.2 Contrasts between plurals and group NPs

In order to enable quantification over the members of a collection, this collection needs to be associated with a set on the compositional level, since quantifiers (the D-operator included) by definition only apply to sets. This is relevant because there is a class of noun phrases that intuitively seem to refer to the same collections as the plural definites we have been looking at so far, yet are generally taken to denote atomic entities: singular definites formed with group nouns like *team, committee, set,* or *pile.* If it is true that these group NPs are atomic, we expect them to 'fail' the Q-distributivity tests from the previous section. As we will see, this turns out to be the case: in this section I will show that none of the relevant sentences has a Q-distributive interpretation when the subject is a group NP rather than a plural. This result supports both the validity of our Q-distributivity tests and the atomic analysis of group NPs. In addition, I will use this contrast between plurals and group nouns to identify two more Q-distributivity tests.

Finally, I will show that group NPs, despite their incompatibility with Q-distributivity, do show distributivity effects (as has been recognised in most of the literature on this topic); this confirms the need for a theory of P-distributivity, without which we would be unable to account for these observations.

2.2.1 Group denotations as atoms

Group nouns are singular nouns that refer to seemingly plural individuals, such as *committee, team, collection, set, council* or *group* itself. In many contexts, they can be used interchangeably with a plural nominal that refers to the same collection of individuals:

(23) a. The $\left\{ \begin{array}{l} \text{choir} \\ \text{members of the choir} \end{array} \right\}$ sang beautifully.

  b. The $\left\{ \begin{array}{l} \text{council} \\ \text{councillors} \end{array} \right\}$ voted on the issue today.

  c. The $\left\{ \begin{array}{l} \text{bouquet} \\ \text{flowers} \end{array} \right\}$ has/have wilted.

Group nouns behave like plurals in other respects: they may appear as the argument of a collective predicate (24), and function as the antecedent of both discourse and bound plural anaphors ((25b) was found through Google along with many examples like it):[9]

(24) The committee gathered in the meeting room.

(25) a. The committee debated for two hours before *they* could agree on a solution.
  b. HUD will continue to enforce the Fair Housing Act to ensure that no family has *their* housing options limited because of *their* race.
  c. The crew was obviously enjoying *themselves* and having fun with the script.

In some varieties of English, most notably British English, they may also take plural agreement:[10]

(26) This art collective are always dressed in black.

Considerations like these led Bennett (1974) to treat group NPs as pluralities, denoting the set of the group's members; however, most researchers afterwards have argued that groups are not reducible to the set of their members, but are entities in their own right (Link, 1984; Landman, 1989; Barker, 1992; Schwarzschild, 1996, but see Pearson 2011, Magri 2012 and de Vries 2015:5 for a different account in the spirit of Bennett). This is intuitively reasonable: groups have identities, purposes and histories that may be independent of any properties of the group's members. In line with this, (27) shows that while plurals and proper name conjunctions inherit the properties shared by their members and vice versa (Link, 1983), this does not always happen with groups:

(27) Supposing the women are, and the committee consists of, Lily and Naomi:

  a. Lily is old and Naomi is old ⇔ Lily and Naomi are old ⇔ The women are old.
  b. *but:* Lily is old and Naomi is old ⇍⇒ The committee is old.

There are several other examples that show that a group NP denotation can be in the extension of a certain predicate while the plurality formed by conjoining the group's members is not, or vice versa; Barker (1992) lists many of them.

(28) a. The committee has two members.
  b. *The women/Lily and Naomi have two members.

(29) The women/Lily and Naomi are members of the committee ⇏ The committee is a member of the committee.

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[9] An elicitation study by Bock et al. (2006) found that British and American speakers are equally likely to follow up a group antecedent with a plural pronoun, regardless of whether the pronoun is bound by the antecedent or not. Examples (24b) and (24c) were both found on US websites reporting on local news. Since the ability of group NPs to function as the antecedent of plural pronouns is not limited to a particular dialect of English, it appears to be unrelated to their ability (in some varieties of the language) to occur with a plural VP.

[10] According to Corbett (2000), the same phenomenon is attested in various other languages, like Spanish, Old Church Slavonic, Samoan, the Brazilian language Paumarí and the Caucasian language Kumaxov. My mother-in-law, who is not a linguist, reported noticing plural agreement with singular group nouns in her studies of Ancient Greek, for which I found official support in a recent corpus study (Birkenes & Sommer, 2014).

Data like these suggest that group NPs (like *the committee*) do not have the same denotation as the corresponding pluralities (like *Lily and Naomi* or *the members of the committee*).

On independent grounds, Schwarzschild (1996) argues that their denotations must be atomic. His argument is based on contrasts like the following:

(30) a. Each of the boys is from Texas.

      b. *Each of the car was manufactured in the Czech Republic.

      c. *Each of the group is from Texas.

(31) a. *Part of the boys is/are from Texas.

      b. Part of the car was manufactured in the Czech Republic.

      c. Part of the group is from Texas.

In both of these cases, group NPs pattern with singular entities (*the car*), not with pluralities (*the boys*).

For various other empirical arguments that support an analysis of groups as atoms, see Barker (1992), Schwarzschild (1996), Chierchia (1998); Krifka (2003).[11]

Link, Barker, Schwarzschild and (up to a point) Landman all conclude that group NP denotations are atomic: they lack internal structure, their individual members are inaccessible to the compositional semantics. I will adopt this conclusion; as we will see, the data discussed in the next section are in line with it, adding more support to the groups-as-atoms analysis.

2.2.2 Distributivity behaviour of group nouns

Of the examples of Q-distributivity listed in section 2.1, all are unavailable with group NPs. Below, I repeat the examples, this time with group rather than plural subjects:

(32) The group is walking or cycling.

      $\nLeftarrow$ For every group member x, x is walking or x cycling.   *(DI)*

      $\Leftrightarrow$ The group members are walking or the group members are cycling.   *(CI)*

Recall from the data in (15) that both a distributive and a collective interpretation are available if the subject is a plural definite. However, if the subject is a group noun as in (32), only the latter is available. Sentence (32) is not entailed by the explicitly distributive statement below it, according to which the disjunction *walking or cycling* applies to each individual semanticist. It is, however, entailed by the second, collective statement, according to which the disjunction *walking or cycling* applies to the collection of semanticists as a whole: either they are all walking, or they are all cycling. In section 2.1, I have shown that only this second interpretation can be analysed in terms of direct predication over a collection; the first must be derived by means of a D-operator. The data in (32) suggest that this option is unavailable with a group noun subject.

Our next examples also run parallel to our earlier data in section 2.1, and show a similar contrast between plurals and group nouns:

(33) The herd/trio of cows won fewer prizes at the fair than the pig.

      $\nLeftarrow$ For every cow x, x won fewer prizes than the pig.   *(DI)*

      $\Leftrightarrow$ The cows together won fewer prizes than the pig.   *(CI)*

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[11]Krifka (2003), citing Barker (1992) and Kleiber (1989), mentions that group nouns seem to be incompatible with cardinality predicates such as *be numerous* or *be few*, suggesting that groups do not have countable members, but not everyone seems to agree with this judgement (cf. Champollion (2010:189) and the analysis of *be numerous* as an 'atom predicate' in Winter (2002).

(34) The class is hiding somewhere.
    $\nLeftarrow$ For every pupil x, there is a place y such that x is hiding in y. *(DI)*
    $\Leftrightarrow$ There is a place y such that every pupil is hiding in y. *(CI)*

(35) This art collective dresses in black one day a week.
    $\nLeftarrow$ For every artist x, there is one day a week y such that x dresses in black on y. *(DI)*
    $\Leftrightarrow$ There is one day a week y such that every artist dresses in black on y. *(CI)*

(36) Groep 8 wordt woedend als je hun moeder beledigt. (Dutch)
    'The 6th grade gets furious when you insult their mother'
    $\nLeftarrow$ For every 6th-grader x, x gets furious if you insult x's mother.
    $\Leftrightarrow$ The 6th-graders get furious when you insult their mum (the pupils are siblings).

(37) Mijn familie vindt zichzelf nogal slim. (Dutch; compare to (19))
    'My family considers REFL.3SG/PL rather clever'
    $\nLeftarrow$ For each of my family members x, x considers itself rather clever *(DI)*[12]
    $\Leftrightarrow$ My family considers my family rather clever (as a group). *(CI)*

In each of these cases, the only available interpretation is the CI (hence, the original sentence and the CI entail each other); distribution over individual group members is ruled out. As a consequence, sentence (33) can only be false in the situation depicted in fig. 1; sentences (34) and (35) must mean that everyone hid in the same place or dresses in black on the same day; sentence (36) presupposes that the pupils in the sixth grade are siblings; and finally, sentence (37) can be true even in a situation where my individual family members do not consider themselves particularly clever, as long as they feel that our family as a whole is.

The generalisation that emerges is that sentences with group subjects systematically lack a distributive interpretation that their plural-subject counterparts do have. As I have argued at the beginning of this section, this is expected under an analysis in which group NPs are associated with atomic individuals: since Q-distributivity involves quantifying over the members of a set by means of a D-operator, Q-distributive interpretations should only be available if the sentence subject denotes a set. The contrast between (15-20) on the one hand and (30-35) on the other thus supports an analysis of groups as atoms.[13]

2.2.3   Further examples of Q-distributivity

The Q-distributivity tests from section 2.1 were based on theory - given standard assumptions about disjunction, scope, and binding, we expect not to be able to derive distributive interpretations for the sentences involved unless distributivity involves covert quantification. These expectations are confirmed by the contrast between plural-subject and group-subject sentences, as summarised by the above generalisation. Now that we have established that we can diagnose Q-distributivity by checking whether it is available when the sentence subject is a group NP, we can in turn use this observation to identify additional Q-distributivity tests involving linguistic phenomena that different theories have different predictions about, and perhaps use the results to decide between competing theories (just as our original Q-distributivity tests provided

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[12]According to my judgement, P-distributivity is available with Dutch reflexive predicates. For example, a psychiatrist might say *Deze groep patiënten snijdt zichzelf* 'This group of patients cuts REFL.3SG/PL', just as an English-speaking psychiatrist might say *This group of patients self-harms*. However, in a small clause construction like *vinden zichzelf slim* 'consider REFL.3SG/PL clever', that does not involve a single reflexivised predicate, a distributive interpretation is clearly out.

[13]In British English, the missing Q-distributive interpretations in (32-35) reappear when the group NPs appear with a plural VP; related observations are made in Pollard & Sag (1994); Barker (1992). See de Vries (2013) for an in-depth investigation of this.

support for an atomic, rather than set-based, analysis of group NPs). In this section, I will mention two of these, and briefly discuss the theoretical implications.

Proportionality modifiers.   The first of these examples is from Dutch, where the adverb *gedeeltelijk* 'partly' modifies the telic predicate *kaalgeschoren* 'shaved bald' to indicate that the shaving-bald event was only partly completed:

(38) De studenten zijn gedeeltelijk kaalgeschoren.   *(Dutch)*
   The students are partly bald.shaven
   'The students were partly shaved bald'

   a. $\Leftarrow$ Part of the students have been shaven bald.   *(CI)*
   b. $\Leftarrow$ Every student has been shaven partly bald.   *(DI)*

If we take the group of students as a whole to be the incremental theme of the shaving-bald event, and this event was only partially completed, we get the collective interpretation according to which a part of the students were shaven bald. If we quantify over individual students, we get a partially completed shaving-bald event for each of them, resulting in the distributive interpretation according to which every student is now partly bald.

There is a possible objection to this, however. Perhaps the DI simply entails the CI in this case: a situation in which every student is shaved partly bald might be interpreted as a partially completed shaving-bald event involving the entire group, so the collective interpretation of sentence (38) would be verified in such a situation. However, when we compare the entailment pattern in (38) to that of its group-subject counterpart, we see that this cannot be the case:

(39) Het dispuut is gedeeltelijk kaalgeschoren.   *(Dutch)*
   The fraternity is partly bald.shaven
   'The fraternity was partly shaved bald'

   a. $\Leftrightarrow$ Part of the students have been shaven bald.   *(CI)*
   b. $\nLeftarrow$ Every student has been shaven partly bald.   *(DI)*

If the collective interpretation - a partially completed shaving-bald event with the entire fraternity as its theme - could be verified by a distributive situation in which each of the students has been partly shaved, we would expect (39) to have precisely the same range of interpretations as (38). However, in the case of (39), a distributive interpretation is clearly out: unlike (38), it is false in the described situation.[14] This shows that (a) we do need to derive the DI in (38b) as a separate (Q-distributive) reading, and (b) however we analyse adverbs like 'partially', we should take into account the fact that its behaviour depends on the semantic number of the sentence subject.

VP conjunction.   Another Q-distributivity test that I have not discussed in section 2.1 is VP conjunction, which shows a contrast between plural and group subjects that is very similar to the disjunction data:

(40)   a. The women are short and tall.
      b. # The committee is short and tall.

While (40a) is acceptable to many speakers, and is interpreted as equivalent to 'part of the women are short, the other part of the women are tall', this non-Boolean interpretation seems to be out for (40b). The only interpretation available for (40b) is an intersective one according to which each member of the committee is (impossibly) both short and tall, which makes the sentence anomalous.

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[14]I have checked this with several native speakers of Dutch, who all shared my intuitions about these sentences.

The issue of non-Boolean VP conjunction has received some attention in the literature (e.g. Krifka, 1990; Winter, 2001; Poortman, 2014). The contrast between plural and group subjects, however, seems to have gone unnoticed so far. It is unexpected under Krifka's account, which is explicitly designed to capture both (40a) and the non-Boolean interpretation of (41) with a single analysis:

(41) The flag is green and white.

Krifka posits an interpretation rule according to which sentences like (40a) and (41) are true if the subject denotation can be partitioned in such a way that the first predicate holds of one partition and the second predicate holds of the other one. Since the rule must be able to account for (41), it needs to be defined for both plural and singular entities. This predicts that the atomic entity corresponding to *the committee* should be able to be similarly partitioned into a short part and a tall part, which means that (40b) should be completely equivalent to (40a). However, we have seen that this is not the case.

The account in Winter (2001) is better equipped to deal with the plural/group contrast, since it only works on pluralities (Winter analyses singular predicate conjunctions like (41) as an independent phenomenon, following Lasersohn 1995). Under this account, the strong, Boolean meaning of (40a) is basic, but it is weakened under the influence of lexical knowledge that tells us that being short and being tall are mutually exclusive. The actual interpretation, then, will be the strongest interpretation compatible with this lexical knowledge - i.e., an interpretation according to which each of the women is either short or tall.[15]

As a Q-distributivity test, the VP conjunction test functions much the same as the disjunction test: since the non-Boolean interpretation can only be derived when the subject is a plurality, (40a), but not (40b), is true in a situation where part of the women is short while the rest is tall.

2.3 P-distributivity

All this does not mean, however, that group-subject sentences may never receive a distributive interpretation. The sentences in (42) show that group nouns, like plurals, allow both collective and distributive interpretations:

(42) a. The class $\left\{ \begin{array}{l} \text{gathered in the garden.} \\ \text{met last week.} \\ \text{is a good team.} \end{array} \right\}$

     b. The class $\left\{ \begin{array}{l} \text{laughed.} \\ \text{sang.} \\ \text{told riddles.} \end{array} \right\}$

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[15]Essentially, we can view plural predication as expressing a relation between two sets - a set of entities and a set of properties - where the Boolean interpretation can be expressed by universal quantification over both of these sets, as follows:

(ii) $[\![$ *The women are short and tall* $]\!] = 1$ iff $\forall \langle x, P \rangle \in \mathbf{woman} \times \{\mathbf{short}, \mathbf{tall}\} : P(x)$

In order to derive the non-Boolean interpretation, we can 'chip away' at the Cartesian product of **woman** and {**short**,**tall**} by removing ordered pairs until it is compatible with our lexical knowledge - for example, this weakened relation may contain either the pair $\langle \mathbf{w}_1, \mathbf{short} \rangle$ or the pair $\langle \mathbf{w}_1, \mathbf{tall} \rangle$, but not both. The result is a set of new, weakened relations with the mutual exclusivity of **short** and **tall** taken into account; the 'Extended Strongest Meaning Hypothesis' states that the strongest of these relations (i.e. the maximal subsets of **woman** $\times$ {**short**,**tall**} that are still compatible with our lexical knowledge) are used in evaluating the truth of the sentence.

For our purposes, the precise workings of the ESMH are not important - the important thing is that the above procedure is only defined for predication over pluralities, not for singular predication. This means that the same mechanism cannot be applied to derive a non-Boolean interpretation for (40b).

Following the argument made in the previous section and our conclusion that group NP denotations are atomic, this means that distributive interpretations like the ones in (42b) cannot be based on covert quantification over group members. The distributivity effects in (42b), then, have to be lexical in nature: the behaviour of group NPs makes clear that a formal, operator-based account of distributivity alone is not sufficient to cover the full range of distributivity data, and provides empirical support for the notion of P-distributivity. In this section, we will further explore this notion by trying to capture the lexical inferences underlying P-distributivity using *pseudo-equivalences* (following **?**), a kind of meaning postulates that hardwire the distributive properties of the predicate into its lexical entry, while leaving room for various nuances based on context and world knowledge.

Recall that, in our present approach, there is no formal semantic difference between collectivity and P-distributivity: they are modelled using precisely the same compositional mechanism. Rather, the distinction between the two is entirely lexical: both collectivity and P-distributivity are rooted in the lexical semantics of the predicate and our reasoning about parts and wholes with respect to the predicate meaning. Hence, as we have already seen, *The team laughed* receives a distributive interpretation, *The class is a good team* a collective one, and *The family gathered* is collective with respect to the predicate as a whole but distributive with respect to certain parts of the predicate meaning.

In principle, there are various ways we can go about formalising this idea, which should strike a balance between two extremes. One extreme is a completely lexicon-based approach, in which all possible collective and distributive inferences are listed as part of a predicate's lexical entry (for example, in the form of meaning postulates). The other extreme is an approach fully based on context, in which the lexical semantics of the relevant predicates is underspecified with respect to the way its meaning pertains to individual parts of the collections it applies to, and contextual/pragmatic factors like world knowledge and discourse goals are left to fill in the blanks. I will briefly discuss some reasons why the best approach is likely to be located somewhere in the middle - not as flexible as the pragmatic approach, but not as rigid as the fully lexical approach either.

2.3.1 Support for a lexicon-based approach: stubborn distributivity

While lexical semantics is of course closely related to world knowledge in the sense that words and their meanings enable us to express things about the world, it is not merely a way of capturing world knowledge a bit more formally. The lexical semantics of a word may impose restrictions on its meaning that do not seem to have anything to do with our understanding of how the world works, and this also holds for the availability of P-distributivity effects. As Schwarzschild (2009) observes, some predicates do not seem to be vague between a collective and a distributive interpretation, even though this might very well be possible according to our knowledge of the world. For example, according to Schwarzschild's judgements, sentence (43a) has no interpretation under which it means the same as (43b), and vice versa:

(43)   a. The boxes are large.

      b. The collection of boxes is large.

According to Schwarzschild, sentence (43b) can only mean that the collection itself is large, not that the boxes that make up the collection are. Sentence (43a) has the opposite meaning: it can only be used to express that the individual boxes are large, not that the boxes together are (compare *The boxes take up a lot of space*, which means

roughly the same but does have a collective interpretation in addition to a distributive one). For this reason, Schwarzschild calls predicates like *large* 'stubbornly distributive'.

Stubbornly distributive predicates are relevant to our present discussion because world knowledge tells us that largeness can be a property of individuals as well as collections, so if collective and P-distributive inferences were a matter of applying world knowledge to a lexically underspecified predication structure, we would expect both inferences to be available with *large*. The fact that this does not seem to be the case shows that an approach to P-distributivity that is fully based on pragmatic factors like context and world knowledge leads to overgeneration. A property like stubborn distributivity needs to be made explicit in the lexical semantics of *large* (but not *take up a lot of space*) in such a way that the plural/group contrast in (43) follows.

2.3.2 Support for a pragmatic approach

On the other hand, it can be shown that pragmatic reasoning does influence the availability of certain inferences from wholes to parts, which supports an analysis in which these inferences are not fully lexically specified. A commonly made argument for the involvement of pragmatic factors involves sentences like the following:

(44) a. The shoes cost 50.   (Lasersohn, 1995; Schwarzschild, 1996; Champollion, 2010)
      b. The new collection costs 50.

The most natural interpretation of (44a) is that the relevant shoes cost 50 *a pair* - an 'intermediate' (neither collective nor fully distributive) interpretation facilitated by our knowledge of the world, in which shoes are usually bought in pairs. While the intermediate interpretation of sentences like (44a) is usually invoked in arguments about the various properties of the D-operator (i.e., in discussions of Q-distributivity), the fact that this interpretation is also available for (44b) if it is uttered in the same shoe-shopping context shows that pragmatic factors influence P-distributive interpretations as well.

2.3.3 Pseudo-equivalences

In Scha (1981), the derivation of distributive and collective interpretations is governed by meaning postulates on the predicate, for example:

(45) $\mathbf{walk}(X)$ (where X is a non-singleton set) is interpreted as $\forall x \in X[\mathbf{walk}(x)]$

A more recent version of Scha's meaning postulates approach can be found in **?**. Winter and Scha propose a pseudo-formalisation of P-distributivity using *pseudo-equivalences*, which are non-logical and context-sensitive equivalences (written with a squiggly arrow $\leftrightsquigarrow$) between pairs of statements, designed to capture the lexical semantics of certain expressions. Just as the sentence pairs in (46a) and (46b) are pseudo-equivalent, so are the pairs in (47):

(46) a. The table is white. $\leftrightsquigarrow$ Every part of the table is white.
      b. The machine is broken. $\leftrightsquigarrow$ Some part of the machine is broken.

(47) a. The boys are tall. $\leftrightsquigarrow$ Every boy is tall.
      b. The books touch the ceiling. $\leftrightsquigarrow$ Some book touches the ceiling.

I will take Winter and Scha's pseudo-equivalences as my starting point, but make some adjustments to their form for several reasons. First, Winter and Scha do not address 'mixed' predicates, that may be interpreted both distributively and collectively (note that this distinction cannot be captured in terms of quantificational force; a non-maximally distributive interpretation like (47b) is still distributive. See also Landman

1996). But the existence of mixed predicates has always formed a problem for an approach to collectivity and distributivity based on meaning postulates (Roberts, 1987; Hoeksema, 1988), since it presumably means that those meaning postulates are only optional and that we need additional factors to determine whether they apply in a given context or not; this robs the theory of much of its explanatory power. Second, even though Winter and Scha tell us that their pseudo-equivalences are context-sensitive, nothing about the way they are formulated makes explicit how this might happen, since they do not include any contextually-defined variables. If we want our analysis to make any verifiable predictions about the way contextual factors influence the interpretation of predicates, we need to be more formally explicit about this.

At the end of this section, we will have built a general template for the pseudo-equivalences that govern the kind of part-whole inferencing that (P-)distributivity and collectivity are the result of, that takes into account both the previous two points and our discussion in sections 2.3.1 and **??** above.

Let's start with the challenge provided by mixed predicates. Many predicates, like *win* and *vote in favour*, are vague between a collective and distributive interpretation, or - given the right context - fall somewhere in between, as in the shoes example above:

(48)   a. Five boy/girl pairs played a game of chess against each other. (Each of) the girls won.

   b. Five girls played a football match against five boys. (*Each of) the girls won.

(49) The councillors voted in favour of the proposal.

   a. $\Leftarrow$ Each of the councillors voted in favour.

   a. $\Leftarrow$ The majority of the councillors voted in favour (i.e. the proposal got enough yes-votes to pass).

However, the above interpretations could all follow from a pseudo-equivalence like (50) if we allow for different contextually salient granularities in deciding what counts as the 'parts' of a collection (cf. Verkuyl & van der Does, 1996, who argue that the difference between collectivity and distributivity is more quantitative than qualitative).[16]

(50) **Template for pseudo-equivalences (captures collective and distributive interpretations of mixed predicates)**
      $P(X) \longleftrightarrow \forall x[x$ is a salient part of $X \to P(x)]$ (where X is a collection[17])

Consider the predicate *cost 50 euros*. In an ordinary clothing shop, where shoes are priced and sold in pairs, a partitioning of 'the shoes' into pairs of shoes might be the most contextually salient; but if the shop is going out of business and selling its entire inventory in bulk, the most contextually salient partitioning of 'the shoes' might be one in which it has just a single part, namely the entire collection of shoes. By allowing a collection to count as a part of itself, the collective interpretation of (49) could be captured by the context-sensitive application of the meaning postulate in (50).

Salient partitionings also appear to be relevant for certain non-maximally distributive interpretations, where a smaller subpart of a collection functions to 'represent' the collection as a whole. For example, whether the sentence "The girls are touching the ceiling" is true depends very much on the way the girls are grouped together in the context - if they are forming a human pyramid together, it is sufficient for just the girl at the top to be touching the ceiling, but if they are all in different locations, it is more

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[16]Compare also Schwarzschild's (1996) cover-based approach to (Q-)distributivity and Champollion's (2010) claim that Q-distributivity is usually atomic, while P-distributivity can easily distribute over larger non-atomic partitionings.

[17]Recall that 'collection' is our pre-theoretical term for any NP denotation that is conceptually plural, i.e. that refers to a collection of entities or objects (see footnote 6).

likely that we will only judge the sentence as true if each of the girls is touching the ceiling independently (cf. observations in Lasersohn, 1990). Similarly, a sentence like "The reporters asked the president questions" can be true if only a few of the individual reporters actually asked a question (Dowty 1987), because it is easy to regard a group of reporters at a press conference in terms of their collective function, rather than as a collection of salient individuals (and the non-maximal interpretation becomes more and more difficult the more the reporters are individuated).

But salience of the partitioning is not the only factor influencing the interpretation - there is, of course, also the contribution of the predicate itself. The pseudo-equivalence in (50) fails to capture, for example, the difference between collectively winning and 'collectively' touching the ceiling. If a football team wins a match, this is a truly collective property of the team as a whole: individual players can't win football matches. But when a human pyramid touches the ceiling, one of the individuals in the pyramid is touching the ceiling on everyone's behalf. While we can say that "the girls are touching the ceiling" if the girls as a whole form a salient group, *touch the ceiling* is still a distributive predicate, a property of individuals rather than collections. In order to capture this, we need a slightly different template from the on given in (50):

(51) **Template for pseudo-equivalences (captures maximal and non-maximal P-distributivity)**
$P(X) \longleftrightarrow \forall x[x \text{ is a salient part of } X \to \exists y \leqslant x[P(y)]]$

So, while the mixed predicate *to win* is lexically associated with a pseudo-equivalence like the one in (50), the purely distributive *to touch the ceiling* is associated with the template of the form (51), according to which saying that a predicate P holds of a collection X amounts to saying that every salient part of X contains an entity to which P applies (note that I am using $\leqslant$ here, not $\in$, since the pseudo-equivalence should be applicable to collections that correspond to atomic entities in the formal semantics).

To sum up, the 'salient part' requirement captures the way contextual factors are involved in the interpretation of predicates as (non-)maximally P-distributive or collective. While salient partitionings are important for all predicates, the availability of different pseudo-equivalence templates reflects the observation that different predicates impose different requirements upon these salient parts: they can either be agents or contain an agent. Of course, the templates may be dressed up with further lexical information to capture other particularities of individual predicates, such as the fact that certain subproperties of the predicate *gather* do distribute to all individual members of the subject collection (see Dowty 1987 for many excellent observations related to subentailments and what it means to 'take part' in a given event). And some predicates may not have pseudo-equivalences associated with them at all (such as the stubbornly distributive ones discussed in section 2.3.1).

2.4   Intermediate conclusion

In the first half of this paper, I have argued that distributivity effects can be derived in two different ways: either by context-based reasoning about parts and wholes in relation to a predicate meaning (P-distributivity), or by covert quantification over members of a collection (Q-distributivity). While P-distributivity is available with singular group NPs like *my family* or *the team*, Q-distributivity is limited to actual pluralities: in order to be able to quantify over members of a collection, those members need to be accessible to the compositional semantics. I have shown that the contrast between group NPs and plurals supports an analysis of groups as atoms, in line with Barker (1992) and Schwarzschild (1996) (but see author (2013, 2015) for a more nuanced view on this).

3 Polyadic P-distributivity with non-quantificational indefinites

In the previous section of this paper, I have analysed group NPs as atom-denoting, and argued that this accounts for the fact that Q-distributivity is unavailable in sentences with a group subject. However, there seems to be one exception to this generalisation. Consider the following sentence, which involves an indefinite object:

(52) The boys ate a pizza.

    a. ⇐ There is a pizza x such that the boys ate x.   *(CI)*

    b. ⇐ For each boy y, there is a pizza x such that y ate x.   *(DI)*

Sentences like (52), which have a distributive interpretation according to which the boys ate a pizza each, have been used by e.g. Winter (1997); Brisson (1998); Magri (2012) in support of a quantificational, operator-based account of distributivity. If the indefinite *a pizza* is analysed as a quantifier and there are no other quantificational elements in the sentence, *a pizza* will necessarily take scope over the entire sentence. This results in a collective interpretation of (52) according to which a pizza was eaten by the boys together, but it does not account for the distributive interpretation: for this, Winter and Brisson reason, we need an additional quantifier over individual boys that can take scope over *a pizza*.

Based on the generalisation proposed in the previous section (plurals allow Q-distributivity, group nouns do not), then, we expect the group-subject counterpart of (52) to lack a DI. However, this expectation is not borne out: sentence (53) is just as ambiguous as sentence (52).

(53) The team ate a pizza.

    a. ⇐ There is a pizza x such that the team ate x.   *(CI)*

    b. ⇐ For each team member y, there is a pizza x such that y ate x.   *(DI)*

The lack of contrast between (52) and (53) seems to provide a counterargument to the atomic analysis of group NPs as argued for here. Since this particular analysis lay at the basis of the more general empirical argument in favour of the P/Q distinction, we may suspect that the data in (53) affects the validity of this conclusion, too.[18] The apparent Q-distributivity over group nouns also happens with numerical indefinites; examples like (55) seem to be fine in all varieties of English I have encountered:

(54) This batallion received four insignia.   *(CI/DI)*

Finally, group distributivity is available with both direct and indirect indefinite objects:

(55) The children in Group A and Group B each made an origami animal. Group A gave the animal to a teacher, Group B gave it to a parent.   *(CI/DI)*

How to account for this apparent exception to the generalisation established in section 2.2? In principle, we have two ways out. The first is to reconsider the analysis of groups as atoms and claim that in cases like the above, the individual group members

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[18]The truth-value judgements for (52) and (53) are complicated by the fact that many English speakers cannot get a distributive interpretation for either of these sentences unless the object is a dependent plural ("The boys ate pizzas"). However, all of my informants who accept a singular in the case of (52) also accept one in the case of (53). And in Dutch, where dependent plurality is optional but the singular is preferred, the equivalent of (53) is unproblematic:

(54) De jongens aten een pizza.   *(CI/DI)*
    The boys ate-PL *a pizza*
    'The boys ate a pizza'

are accessible to the semantics, perhaps because group denotations can shift to pluralities under certain circumstances. Such a shift is proposed by Landman (1989) for independent reasons.[19] This line is pursued by Magri (2012), who mentions the distributive interpretation of sentences like (53-55) in support of his claim that group NPs denote sets rather than atoms. While this solution would account for the above data, it would also render the general pattern (as identified in section 2.2.2) inexplicable, so going down this road creates more problems than it solves.

The second way out is to claim that there is something special about indefinites. It is this approach that I will develop here: I will argue that the indefinite in (54) and (55) should be analysed as a property rather than a quantifier, which - for a certain class of predicates - enables direct predication over the indefinite and, by that means, P-distributivity over the instances of the property it denotes. This means that the distributive interpretation of sentence (55) (and possibly also (54)) can be regarded as a case of two-place P-distributivity, comparable to the analysis of codistributivity in Scha (1981) and Winter (2000).

3.1 Analysis: P-distributivity beyond unary predicates

While the examples of P-distributivity we have seen so far all involved intransitive predicates, with distribution over a single argument, there is no a priori reason that would limit P-distributivity to only one argument. Just as we can analyse sentence (56a) in terms of direct predication (as in (56b)), we can analyse a sentence like (56c) as a relation between two collections (as in (56d); see Scha 1981, Winter 2000). And just as (56b) is vague with respect to the involvement of particular individuals, (56d) is vague with respect to the particular relations: we cannot tell if all the boys and all the girls were involved in the kissing, how many boys were kissed by each of the girls or how many girls kissed each of the boys, but we do know that individual boys were kissed by individual girls.

(56)   a. The girls laughed.
       b. **laugh(the_girls)**
       c. The girls kissed the boys.
       d. **kiss(the_girls,the_boys)**

In order to be able to extend this analysis to cases of group distributivity with indefinite objects, we cannot analyse the indefinite as a generalised quantifier with existential force. Because there is no quantifier over group members, an existential quantifier

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[19]Landman proposes an operator ↓ that shifts group noun denotations to their corresponding pluralities (the set of the group's members). According to Landman, we need this operator to account for data like (iii):

(iiii) The Talking Heads are pop stars.

In Landman's analysis, the predicate *are pop stars* is a predicate over plural entities, which would lead to a mismatch with the group-denoting *The Talking Heads* unless the latter is able to shift into a plurality. But note that this only works (at least in American English) if the group name is morphologically plural:

(iv)   a. ??The Cure are pop stars.
      b. *The committee are good managers.

The contrast between (iii) and (iv) suggests that only groups with a morphologically plural name may denote pluralities. But in that case, we cannot be sure that we are actually dealing with groups: *The Talking Heads* might be an ordinary plural definite that denotes a plurality of entities, each of them a Talking Head. So there seems to be little reason to enrich our semantics with an operation that shifts atoms to their corresponding sets (at least based on these data).

In any case, the ↓-operator does not seem central to Landman's account of group semantics, which is otherwise compatible with an atomic approach to groups.

introduced by the indefinite would necessarily take scope over the whole group, yielding (for example) (57b) as the only possible interpretation of (57a):

(57)   a. The First Aid team is wearing an orange vest.

          b. There is an orange vest such that the First Aid team is wearing it.   *(CI)*

I propose that the indefinite in (57a) and similar sentences denotes a property, which I will treat here as something very similar to a group - a higher-order individual that allows P-distributivity over its individual instantiations. Thus, just as the verb in (56c) denotes a relation between two pluralities, it denotes a relation between a property and a group in (57a); and just as with (56c), any inferences about individual members of the group or individual instances of the property are due to P-distributivity, not based on quantification. I will refer to P-distributivity over multiple arguments as *polyadic* P-distributivity (or *binary* P-distributivity, in the case of transitive verbs).

Neither the idea of property-denoting indefinites nor the idea of polyadic P-distributivity is new. The latter was already assumed in Scha (1981) and empirically motivated (although not very explicitly) in Winter (2000); the former are the subject of a growing body of semantic literature. While classical Montagovian semantics treats indefinite noun phrases as generalised quantifiers with existential force, non-quantificational analyses of indefinites have been proposed at least since Milsark (1974) and Carlson (1977), in which they can denote properties or kinds (respectively), and the work of Kamp (1981) and Heim (1982), in which they are associated with free variables. McNally (1992) and Zimmermann (1993) propose that indefinites may be interpreted as properties (of type $\langle e, t \rangle$) even in argument positions, and this idea has subsequently been used to account for a wide range of semantic phenomena.

McNally (1992) discusses property-type indefinites in relation to *there*-sentences, arguing that the traditional distinction between weak and strong NPs of Milsark (1974) can be reduced to the distinction between property-type and quantificational NPs. de Hoop (1996) makes use of property-type indefinites in her analysis of light verb constructions like *take a walk* or *have a drink*. Zimmermann (1993, 2006) proposes that opaque verbs like *seek* take property-type arguments. Van Geenhoven (1998) links the property analysis of indefinites to the syntactic phenomenon of noun incorporation, proposing a semantic counterpart of this operation that is also argued for in Farkas & de Swart (2003) and Chung & Ladusaw (2004), among others. Mador-Haim & Winter (2007, 2015) show that, given standard assumptions about the semantics of PPs, assuming that indefinites may denote properties accounts for the observation that the indefinite in "We are far from a gas station" is interpreted universally ('far from all gas stations').

A recurring question in the literature on property-type expressions in argument positions is how they compose with the predicate. After all, there seems to be a type mismatch between the argument (which is of type $\langle e, t \rangle$) and the predicate function (which wants an entity). In principle, there are three ways to go about this. We might assume some special operation that composes verbs and property-type arguments (e.g. Chung & Ladusaw's Restrict or Van Geenhoven's Semantic Incorporation). Alternatively, we might adopt an operation that shifts the property into either a quantifier (e.g., a generic operator or the A typeshift from Partee 1987)[20] or the property's entity correlate (Chierchia, 1984, 1985; McNally, 1992; Mueller-Reichau, 2006; McNally, 2009) so that it can compose with the predicate by ordinary function application. The third option does not make use of any special formal operations, but assumes that (certain) transitive verbs are ambiguous between an 'ordinary' version (type $\langle e, et \rangle$) that wants an entity complement, and an 'incorporating' version (type $\langle et, et \rangle$) that wants a property (Dayal e.g. 2003; leBruyn et al. e.g. 2015; compare also Zimmermann's (1993,2006)

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[20]Thanks to an anonymous NALS reviewer for pointing out this option, which I had overlooked.

analysis of opaque verbs like *seek*).

For our present purposes, the third option seems to be most appropriate. The first and second options work very well for languages in which predicates systematically and productively combine with property-type complements, but as we will see, the class of predicates that pattern with *wear an orange vest* in allowing distributive interpretations with group NP subjects is actually rather small. Since this suggests that it is mainly the predicate that determines whether a property-type interpretation is available for the object, the second option - which operates directly on the object, independently from the predicate - does not seem a feasible approach. But the first approach will also overgenerate unless we find a way to restrict its application to just the relevant class of predicates. This leaves the third, ambiguity-based option as the easiest way to get the semantics right for the appropriate predicates, while making sure that this derivation is not available to predicates that do not allow binary P-distributivity when applied to an indefinite and a group NP.

3.2 'Incorporation' predicates

The fact that not all predicates are equally compatible with the group-distributive interpretations on which the present analysis is based (something that was first pointed out to me by Roger Schwarzschild (p.c.); the example in (58b) is due to an anonymous *Natural Language Semantics* reviewer) becomes apparent when we compare our earlier *pizza-* and *orange vest*-examples with the following:

(58) a. The football team married a supermodel.
          $\Leftrightarrow$ There exists a supermodel x such that the football team married x. *(CI)*
          $\nLeftarrow$ For each member of the football team y, there exists a supermodel x such that y married x. *(DI)*

      b. The class is hiding behind a tree.
          $\Leftrightarrow$ There is a tree y such that the class is hiding behind y. *(CI)* $\nLeftarrow$ For each pupil in the class x, there exists a tree y such that x is hiding behind y. *(DI)*

The transitive predicates with which a distributive interpretation is easily available are predicates like *wear*, *eat*, *drink*, *read*, *buy*, *make*, *give*, and *receive*; this seems quite similar to the class of predicates that may select for bare complements in languages like Norwegian, Spanish, Catalan, Romanian, and Greek (all languages that do not ordinarily allow nominals to appear without an article). Such bare complements are widely assumed to be property-denoting. Here are some examples (via leBruyn et al., 2015):

(59) Forouse frako.   *(Greek; Alexandropoulou 2013)*
      wear.3SG frock-coat
      'S/he was wearing a frock coat'

(60) Han striker genser.   *(Norwegian; Borthen 2003)*
      He-is knitting sweater
      'He is knitting a sweater'

(61) M'acabo de comprar cotxe.   *(Catalan; Espinal & McNally 2011)*
      REFL-*finish*.1SG *of buy car*
      'I've just bought myself a car'

Based on the existing literature, leBruyn et al. (2015) conclude that predicates that allow bare complements in these languages - which they call 'incorporation verbs' - fall

into the following classes:[21]

(62) a. consumption verbs (e.g. *to eat, to smoke*)

    b. creation verbs (e.g. *to write, to build*)

    c. transfer/transaction verbs (e.g. *to receive, to buy*)

    d. ownership/possession verbs (e.g. *to have, to own, to want, to look for*)

    e. usage verbs (e.g. *to use, to wear*)

If these predicates show up as a special class in language after language, there might be something universally special about their semantics - something that might also show up in languages that do not allow bare nominals, like English and Dutch. The group distributivity data confirm this: according to my intuitions (which are shared by the other native speakers of Dutch I consulted), there are very clear contrasts between the distributivity behaviour of predicates that fall into one of the classes in (62) and those that do not. For example, the (a) and (b) sentences in (63-64) both involve a group subject and an indefinite object, but while the (a) sentences can easily be interpreted distributively, only a collective interpretation is available for the (b) sentences:

(63) a. Na het *Io Vivat* sloeg het dispuut een pitcher bier achterover.   *(CI/DI)*
    after the Io Vivat knock the fraternity a jug beer backwards
    'After the *Io Vivat*, the fraternity knocked back a jug of beer.'

    b. Na het *Io Vivat* besproeide het dispuut een eerstejaars met bier. *(only CI)*
    after the Io Vivat sprayed the fraternity a freshman with beer
    'After the *Io Vivat*, the fraternity doused a freshman with beer.'

(64) a. Het korfbalteam heeft een foldertje over doping gekregen.   *(CI/DI)*
    the korfball.team has a leaflet about doping received
    'The korfball team received a leaflet about doping.'

    b. Het korfbalteam heeft een foldertje over doping boven de bar gehangen. *(only CI)*
    The korfball.team has a leaflet about doping above the bar put.up
    'The korfball team put up a leaflet about doping above the bar.'

(65) a. Groep 8 heeft een giraffe geboetseerd.   *(CI/DI)*
    Group 8 has a giraffe sculpted
    'The 6th grade has sculpted a giraffe.'

    b. Groep 8 heeft een giraffe verzorgd.   *(only CI)*
    Group 8 has a giraffe cared.for
    'The 6th grade has taken care of a giraffe.'

The picture in 3.2 represents the judgements of 20 Dutch speakers on the availability of group-distributive interpretations with these and other sentences. The underlined predicates correspond to Le Bruyn et al.'s incorporation verbs (two from each of the five classes in (62). The other predicates lack this property. We see that the incorporation verbs, despite being syntactically indistinguishable from the other predicates, all cluster at the top end of the scale[22], which means a group-distributive interpreta-

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[21]Following e.g.Borthen (2003) and Espinal & McNally (2011), and using insights from the literature on relational nouns and from Qualia Theory (Pustejovsky, 1995), leBruyn et al. (2015) argue that the common property of these predicates is that they all incorporate the semantics of *have* as their formal backbone; for each predicate, this basic *have*-semantics is dressed up with that predicate's particular (implicit) argument structure. The semantics they propose for incorporation verbs is somewhat more elaborate than the one I will use in this chapter, but it is fully compatible with the data and analysis presented here.

[22]An apparent exception is *bezitten* 'to own/possess', which does not score much better than most of the non-incorporation verbs, but since these judgements were acquired rather informally on the basis of just a single sentence per verb, it is hard to say whether there is something odd about *bezitten* or whether its low position on the scale is just an artefact.

tion was available to most speakers. In contrast, most informants felt that a group-distributive interpretation was not available for non-incorporation predicates like *in het schuurtje zetten* 'to put in the shed', *ten huwelijk vragen* 'to propose to' or *verbranden* 'to burn'. To sum up, the judgements on Dutch suggest that binary P-distributivity
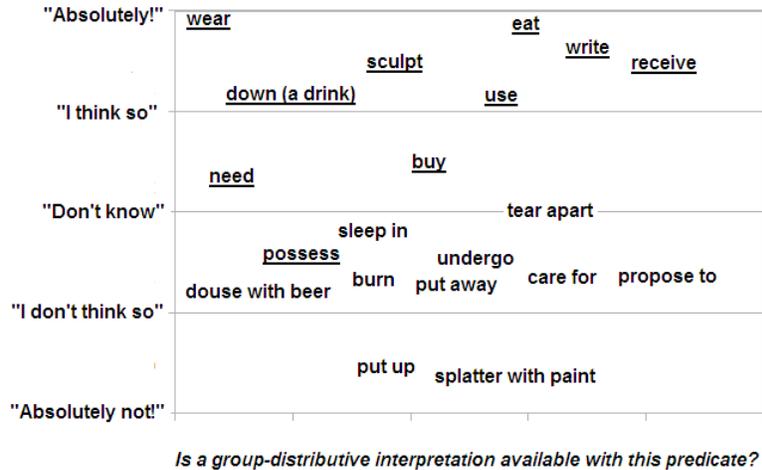
Figure 2: A visual representation of the aggregate judgements from 20 native Dutch speakers on the availability of a group-distributive interpretation for 20 different transitive verbs with an indefinite object. (Judgements were provided for the Dutch equivalents of these predicates. The intended group-distributive interpretations for each sentence were given in the form of a paraphrase, and informants were asked whether or not the sentence could be interpreted in that way. The different response options are given on the *y*-axis.)

over group subjects and indefinite objects is available only with predicates that select for a property-type complement.[23] In the remainder of this section, I will provide a formal semantics for these predicates that, combined with a lexical semantics captured by pseudo-equivalences, accounts for the observed P-distributivity effects.

3.3 Formal analysis

I will assume that languages like English and Dutch (that do not allow bare singulars) may derive a property denotation for full NPs by typeshifting quantifiers into properties, for example using the BE typeshift from Partee (1987):

(66) $BE(Q) = \{x|\{x\} \in Q\}$[24]

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[23]I do not expect the native speaker judgements on comparable English data to be much different; English speakers may prefer a dependent plural over a singular indefinite, but that preference will affect all sentences equally, preserving the difference between the two classes of predicates.

[24]For example, if Q is the generalised quantifier corresponding to *an orange vest*, the set Q will consist of all sets that include at least one orange vest as a member. It follows that if the set is a singleton, its member will necessarily be an orange vest. The set $BE(Q)$ includes all the members of the singletons in Q, so assuming that all orange vests in the universe have at least one property that they do not share with any other orange vest, $BE(Q)$ will end up equivalent to precisely the set of orange vests.

Further, I will assume the following semantics for the 'incorporation' entries of predicates like **wear** and **eat**, with an interpretation that is related to their regular $\langle e, et \rangle$ type entries by a pseudo-equivalence similar to the ones we have seen in section 2.3.3:

(67) $\mathbf{R}_{IV\langle et,et \rangle} = \lambda P_{et} \lambda X_e [\mathbf{R}_{IV}(X, P)] \longleftrightarrow$
    $\forall x [x$ is a salient part of $X \rightarrow \exists y [P(y) \wedge \mathbf{R}_{reg}(x, y)]]$
    where $\mathbf{R}_{IV}$ is the incorporating version of a predicate and $\mathbf{R}_{reg}$ its regular version, and X is a collection.[25]

What the pseudo-equivalence says is the following. Asserting that a proposition derived by applying an incorporating predicate $\mathbf{R}_{IV}$ to a property P and a collection X is true, amounts to asserting that every salient part of X is R-ing some member of the set P. For example, $\mathbf{eat}_{IV}(\mathbf{the\_team},(BE(\mathbf{a\_pizza}))$ is true if every salient part of the team is in an $\mathbf{eat}_{reg}$ relation with a member of the set **pizza**. As in section 2.3.3, the 'salient part' requirement leaves room for various contextual factors to influence which parts of X the predicate is P-distributed over, such that the eventual interpretation may be distributive, collective or intermediate.

    The semantics and pseudo-equivalence template in (67) are not very sophisticated, but suffice for our present purposes. See for example Dayal (2003); Espinal & McNally (2011); leBruyn et al. (2015) for more detailed proposals on the semantics of incorporation predicates.

4   Additional evidence for a property analysis

4.1   Underspecification versus ambiguity[26]

In the present analysis, polyadic P-distributivity is analysed as a relation between multiple collections and/or properties that is underspecified with respect to the relations that hold between particular members or instantiations of these arguments. As I have already argued, this means that the difference between P-distributivity and collectivity is a matter of vagueness, not ambiguity.

    Now that I have hypothesised that P-distributivity is not limited to one-place predicates, we can put this hypothesis to the test by using a well-known ambiguity test: VP ellipsis. The examples in (68) show how VP ellipsis can distinguish underspecification from ambiguity:

(68)   a. Sue is tall and her baby daughter is, too.

       b. An American flag was hanging in front of every building, and a Dutch flag was, too.

       c. Mary went to the bank and Sue did, too.

Sentence (68a) can be true even if the criteria for tallness are quite different for an adult woman than they are for babies: *tall* is underspecified with regard to the precise degree of tallness required, and nothing stops both conjuncts from using a different standard of comparison (Sue is tall because her height exceeds the average for adult women, her daughter might be tiny compared to Sue, but can still be called 'tall' because she is tall compared to other babies in her age group). In (68b), on the other hand, it is not possible to assign different interpretations to both conjuncts: if we interpret the first conjunct with surface scope, we have to interpret the second conjunct with surface scope as well, and the same goes for the inverse scope reading. Lexical ambiguity can be distinguished from vagueness in the same way: example (68c) cannot be used if

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[25]I have chosen purely for convenience to represent 'collections' as entities here, but see footnote 6 for some other options.

[26]Thanks to Lucas Champollion (p.c.) for pointing out this issue and the VP-ellipsis test to me.

Mary went to the kind of bank where one does one's money-related business while Sue went for a walk along the river. Assuming that VP ellipsis is only possible if the second conjuncts semantically parallels the first, this means that lexical meaning and scope ambiguities should be reflected in the logical form of a sentence, while standards of comparison should not.

If the distinction between P-distributivity and collectivity is like the distinction between tall-for-an-adult and tall-for-a-baby, we expect to be able to assign different interpretations to the conjuncts of a VP ellipsis structure. If, on the other hand, the distinction is a matter of structural or lexical ambiguity, we expect that both conjuncts should receive the same interpretation: either both collective, or both distributive. The example in (69) and its Dutch equivalent in (70) suggests that the first option is the right one:

(69) The adults had a pizza and the children did too. Only the children had to share a pizza with each other, while the adults each got their own.

(70) De volwassenen hebben een pizza gegeten en de kinderen ook. De kinderen moesten hun pizza delen, maar de volwassenen hadden elk een eigen pizza.

I believe that the second sentence in (69) and (70) does not contradict the first; the handful of English and Dutch-speaking informants I informally surveyed also agreed that there is no contradiction (with the exception one English speaker who was unable to interpret *have a pizza* distributively). This suggests that the difference between P-distributivity and collectivity is a matter of vagueness: there is nothing in the formal semantics of the sentence that enforces a particular pizza-to-people ratio. A similar conclusion is reached by Kratzer (2008) on the basis of the following short discourse, which she judges consistent (note that *cook* is a creation verb, and hence an incorporation predicate):

(71) The two chefs cooked a stew, and the two students did, too. The chefs were very experienced, so they each prepared a Moroccan tagine. The two students worked together on a Boeuf Bourguignon.

The present analysis, according to which P-distributivity over indefinite objects is only possible with incorporation verbs, also predicts that non-incorporation predicates will not be similarly vague between a collective and a distributive interpretation. Non-incorporation predicates are not compatible with property-type arguments; indefinite complements of non-incorporation verbs therefore have to be interpreted as existential quantifiers. According to the by now familiar reasoning, this means that any distributivity effects with these predicates should be analysed as Q-distributivity, i.e. by means of universal quantification over the members of the subject set that takes scope over the existential quantifier introduced by the object. Since this is structurally different from the logical form that underlies collectivity, we expect it to be impossible for the antecedent predicate to be interpreted distributively and the elided predicate collectively, or vice versa, if said predicate does not involve an incorporation verb. And as (72) shows, this does seem to be the case: unlike the two sentences in (70), the sentences in (72) seem to contradict each other.

(72) The adults carried a piano upstairs and the children did, too. # Only the children carried a piano together and the adults each carried a (different) piano on their own.

Thus, the results of the VP-ellipsis test confirm both the distinction between incorporation and non-incorporation predicates with respect to the availability of P-distributivity, and the claim that the difference between P-distributivity and collectivity is a matter of vagueness rather than ambiguity.

4.2 Parallels with other phenomena involving non-quantificational indefinites

The generalisation that only incorporation verbs allow group-distributive interpretations in sentences involving an indefinite object (like "The team is wearing an orange vest") has already provided us with an important parallel between these interpretations and various other linguistic phenomena that have been argued in the literature to involve property-type or at least non-quantificational indefinites. In this section, we will take a look at the indefinite objects themselves, and see to which extent they show behaviour characteristic of property-type indefinites.

First, I will discuss some examples that suggest that adding modifiers to the indefinite reduces its ability to receive a property interpretation, which is in line with the observation that group-subject sentences with heavily modified objects (e.g. "The team is wearing a torn and dirty orange vest that they found in a charity shop") cannot easily be interpreted distributively. Secondly, we will look at the contrast between *a*- and *some*-indefinites; while the former may receive both a quantificational and a non-quantificational semantics depending on the context, the latter can only be interpreted quantificationally (Farkas 2002). This contrast influences the possible interpretations of various phenomena involving property-type indefinites, including group distributivity.

4.2.1 Influence of descriptive weight

Not all indefinites easily receive a non-quantificational interpretation. In general, non-quantificational interpretations are increasingly hard to get the more specific or descriptively heavy we make the indefinite, as shown by the contrasts below:

(73) Opaque verbs (Zimmermann, 1993, 2006):

    a. John is looking for a secretary.
    b. John is looking for a tall secretary in a bottle-green cardigan.

On its opaque reading, (73a) is interpreted to mean that John is looking for *any* secretary, not a particular one; it also has a transparent reading according to which there is a particular person that John is looking for who happens to be a secretary. In contrast, I am unable to get the opaque reading for (73b): it only has the transparent reading. If we claim, with Zimmermann, that opaque readings result when the verb takes a property-type complement, this suggests that property denotations are unavailable, or at least not as easily available, for very specific indefinite NPs.

(74) Eigenspace semantics (Mador-Haim & Winter, 2007):

    a. We're far from a gas station.
    b. We're far from a large gas station where a friend of mine works.

The same pattern again appears in (74a-b). Sentence (74a), despite the fact that it involves an indefinite object, has a prominent 'universal' interpretation according to which we are far from *all* gas stations. This can be accounted for under the assumption that *a gas station* may denote a property. According to the spatial semantics adopted by Mador-Haim and Winter, the location function associated with the preposition, when applied to a property, returns the location or 'eigenspace' of the entire set of gas stations, rather than that of a particular individual gas station. Being far from a collection of elements entails being far from each element in the collection, hence the universal interpretation. Again, this interpretation seems harder to get when the indefinite object is more descriptively heavy (as already observed by Iatridou, 2007; Mador-Haim & Winter, 2015); in sentence (74b), for example, the existential interpretation is much more salient than the universal one, even though the existence of multiple gas stations that fit the description is not particularly unlikely.

As a third example, consider light verb constructions like *have a laugh*, *take a walk* or *make a fuss*, where the verb is semantically (nearly) empty and all content is provided by the indefinite noun (such that the aforementioned examples may be paraphrased by a verb - *to laugh*, *to walk*, *to fuss* - without loss of information):

(75) Light verbs (de Hoop, 1996):

    a. John took a walk.

    b. John took a rather difficult walk.

The *a*-indefinite in (75a) shows all the signs of property denotation: it is nonspecific, number neutral, and scopes with the verb; in line with this, De Hoop analyses light verb constructions like the above in terms of property-type indefinites. On the other hand, while (75a) can easily be paraphrased by saying something like "John walked around", the indefinite *a rather difficult walk* in (75b) intuitively seems to refer to a specific walking route[27]. Again, this fits the pattern established by the previous examples: the more specific or descriptively rich an indefinite gets, the more likely it is to receive an existential interpretation.

Group distributive sentences like "The team is wearing a blue shirt" conform to this pattern: the more modifiers we add to the object NP, the more the anomalous collective interpretation seems to be forced.[28] For example, sentence (76) suggests that the team as a whole is somehow wearing a single specific shirt; the distributive interpretation, according to which each team member is wearing a shirt matching that particular description, is much less salient (even though it is more likely).

(76) # The First Aid team is wearing a torn and dirty orange vest.

Under an existential interpretation of *a torn and dirty blue shirt* this observation is unexpected. The plural-subject counterpart of (76) does not show an effect of descriptive weight; the full sentences in (77) can be interpreted distributively as easily as the lighter versions can:

(77)   a. The children are wearing a (torn and dirty) orange vest.

    b. De kinderen dragen een (vies, gescheurd en in een kringloopwinkel aangeschaft) oranje hesje.
       'The children are wearing a (dirty, torn and bought in a thrift shop) orange vest'

But if specific/descriptively heavy indefinites generally resist non-existential interpretations, these facts are just what we would expect if the distributive interpretation of group-subject sentences like "The team is wearing an orange vest" has to be analysed in terms of such non-existential indefinites, while an alternative analysis (using the D-operator) is available for plural-subject sentences.

4.2.2 *A* versus *some*

A very similar argument can be made on the basis of a contrast between *a*- and *some*-indefinites. As observed by (e.g. **?**), *a*-indefinites can easily be analysed as predicates or properties, while *some*-indefinites are nearly always quantificational ('stubbornly quantificational', as Farkas calls them). This contrast between *a* and *some* is reflected

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[27]Note that this is not a consequence of making the indefinite descriptively heavy *per se* - sentences like "John took a calming aimless walk", like (75a), do not seem to refer to a specific walking trail either. The difference seems to be that *calming* and *aimless* are subject-oriented modifiers, while *rather difficult* modifies *walk* itself; the latter seems to force the existential interpretation of *a walk*.

[28]This influence of modification was first pointed out to me by Anna Szabolcsi (p.c.).

by nearly all of the previously-mentioned phenomena that have been argued in the literature to involve property-type indefinites (unless otherwise specified, the judgements here are my own):

(78) *Be*-predicates:

    a. John is a linguist.

    b. John is #some linguist. (on the intended interpretation)

In (78a), it is predicated of John that he is a linguist - *a linguist* is of type $\langle e, t \rangle$ and the sentence is entirely on a par with, for example, a sentence like *John is tall*. In contrast, (78b) cannot express such a simple predication. Its most readily available interpretation is a taxonomic one that may be paraphrased as 'John is a (specific or nonspecific) kind of linguist'; in addition, it has an (albeit slightly strange) identity reading with *is* as a full verb, paraphraseable as 'There is some linguist and this person is John'. Neither reading involves a predicate **linguist** of type $\langle e, t \rangle$, suggesting that this is not a possible denotation for the indefinite *some linguist*. Similarly:

(79) Opaque verbs:

    a. John is looking for a secretary.

    b. John is looking for some secretary.

As we have seen before, (79a) has both an opaque and a transparent reading. In contrast, (79b) only seems to have the latter (in addition to a 'some kind of'-reading comparable to the one in (79b)). Under a property analysis of opaque verb complements, this suggests that property denotations are unavailable for *some*-indefinites.

(80) Eigenspace semantics:

    a. We're far from a gas station.

    b. We're far from some gas station.

The same pattern again appears in (80a-b): as Mador-Haim and Winter (2015) note, the 'universal' interpretation of (80a), which they derive by analysing *a gas station* as a property, is unavailable with the *some*-indefinite in (80b).

    The contrast can also be observed with light verb constructions:

(81) Light verbs:

    a. John took a walk.

    b. John took some walk.

Unlike the light verb reading of (81a), (81b) cannot be paraphrased as 'John walked' without loss of information, because unlike (81a) it asserts that there exists a *particular* walking route that John took. Again, the *some*-indefinite only seems to have a quantificational interpretation, while the *a*-indefinite can denote either a quantified expression or a property.[29]

    The above contrasts suggest, in line with Farkas's (2002) claim about the 'stubbornly quantificational' nature of *some*-indefinites, that property denotations are not available (or at least much less readily so) for *some*-indefinites than they are for *a*-indefinites. Since the P-distributivity approach advocated for in this chapter attributes certain group distributivity effects to the involvement of property-type indefinites, it predicts that these effects will be easily available with *a*-indefinites, but not with *some*. And this does seem to be the case:

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[29]With existential *there*-sentences (which (McNally, 1992) argues involve property-type NPs), the contrast is less clear - "There is some tree in the garden" is fine, and although a taxonomic kind reading ('some kind of tree') seems the most readily available, it also has a reading on which its meaning is identical to that of "There is a tree in the garden". Neither does the descriptive weight of the indefinite seem to influence its grammaticality in a *there*-sentence (apart from a required heavy NP shift): a sentence like "There is a tree in the garden that my best friend planted there ten years ago" is fine.

(82)   a. The team is wearing an orange vest.

       b. The team is wearing some orange vest.

Sentence (82b) has a salient (albeit unlikely) collective interpretation according to which the entire team is wearing the same vest together; but I find it very hard to interpret distributively.[30]

     This difference between *a*- and *some*-indefinites is unexpected under an analysis of our group distributivity data in which *an orange vest* denotes a quantifier (just like *some orange vest*), but it is precisely what we would expect if the availability of a distributive interpretation in (82) depends on the availability of a property interpretation for the object.

5   Remaining issues: modified numerals

A case of binary P-distributivity I have not mentioned so far involves modified numerical indefinites:

(83)   The battalion received $\left\{ \begin{array}{l} \text{exactly one medal.} \\ \text{less than four medals.} \\ \text{at most two medals.} \end{array} \right\}$

(83) is true if every *member* of the battalion received the number of medals mentioned, so under our analysis of group distributivity, the indefinites in (83) should be able to denote properties. Modified numerals may also appear in de dicto readings with opaque predicates (84a), *there*-sentences (84b) and with *be*-predication (84c):

(84)   a. Lily wants to adopt exactly four orphans.

       b. There are less than four cats in the garden.

       c. These are exactly / at most 20 dots.

According to the latter fact, they count as property indefinites under our definition; considering their analyses of de dicto readings and existential sentences, respectively, Zimmermann and McNally also need to claim that they denote properties.

     However, a property analysis of these modified numerals is problematic (McNally 1992). Because they are not upward entailing, *exactly n*, *less than n* or *at most n* exhaustively cover a domain: (84a) is incompatible with Lily wanting to adopt more than four orphans, and (84b) is incompatible with there being more than three cats in the garden. In other words, stating that a predicate P holds for *exactly n* or *at most n* entities also amounts to stating that P does *not* hold for the rest of the entities in the domain. This contrasts with unmodified numerical indefinites like *four orphans* or *two*

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[30]According to my own judgements, it is possible to get a distributive interpretation for (82b) if one puts in some effort to read *some orange vest* as 'some *kind of* orange vest'. This interpretation may be paraphrased as 'There is a kind of orange vest v such that the team is wearing instantiations of v'. Since this reading involves a quantificational interpretation of the indefinite (with quantification over subkinds of *orange vest* rather than over individual vests), but shows distributivity effects regardless, one might wonder whether quantification over subkinds would not be enough to account for the group distributivity data, eliminating the need for an analysis based on property-denoting indefinites. However, while it is well possible for quantification over subkinds to be involved in deriving at least some of the possible distributive interpretations with group NP subjects, the involvement of non-quantificational indefinites is independently supported by the evidence in this section. It should also be noted that an analysis of group distributivity based on quantification over subkinds is still incomplete without an account of the process that licenses the inference that it is not the kind itself that is being worn by the team members, but its *instantiations*, which is precisely the sort of process that is captured by the notion of polyadic P-distributivity. In short, the observation that quantification over subkinds might be responsible for some distributivity effects with group subjects does not invalidate any of the claims made in this paper.
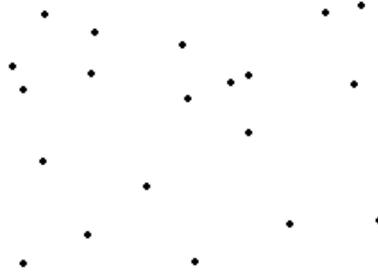
Figure 3: An array of dots as a context for sentence (84c))

cats, which are monotone increasing and hence compatible with the existence of more orphans or more cats of which the expressed property holds.

All this means that it is unclear how the truth conditions associated with the non-increasing modified numerals in (83) and (84) could be derived without quantification over the domain of medals, orphans or cats; and yet, their appearance in sentences like (83) and (84) seems to call for a non-quantificational analysis.

McNally (1992) proposes to solve the problem by assuming that *exactly* and *at most* do not modify the indefinites themselves; rather, they should be treated as adverbial modifiers comparable to *only* or *even*. Evidence for this claim is the fact that *exactly* and *at most* can appear in other positions in the sentence without changing its semantics:

(85)   a. At most, there were four cats in the garden.

        b. Lily wants to adopt four orphans exactly.

In McNally's analysis, *exactly* and *at most* are applied to propositions associated with ordered alternative sets; essentially, $[\![at\ most]\!](p)$ or $[\![exactly]\!](p)$ means that there are no true propositions in this alternative set that are ranked higher than p. Thus, $[\![at\ most]\!]([\![there\ were\ four\ cats\ in\ the\ garden]\!])$ would be false if the alternative proposition *There were five cats in the garden* were true, since the latter (a semantically stronger statement) is ranked higher than the former.

The analysis of modified numerals proposed in Brasoveanu (2013)[31] is technically very different from McNally's, but similar in spirit in the sense that modified numerals are assumed to make two separate semantic contributions: the contribution to the at-issue content is the maximal set of entities that satisfy both predicates (e.g., the maximal set of entities that are cats and are in the garden), whereas the cardinality requirement is enforced separately, in the form of a postsupposition.

However, although both McNally's and Brasoveanu's analyses can solve our problem for *at most* and *exactly*, they both leave *less than* unaccounted for - in McNally's case, because *less than* clearly cannot be reanalysed a propositional modifier, and in Brasoveanu's, because his analysis only applies to so-called Class B numerals (Nouwen, 2010) and *less than* is Class A. So it seems that a truly satisfying property analysis of non-upward entailing modified numerals, that does not result in the wrong truth conditions, has yet to be given. I will not attempt to do so here, but leave it as an open question.

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[31]I am indebted to an anonymous NALS reviewer for attending me to Brasoveanu's paper.

6   Conclusions

We started out the second part of the paper with an apparent counterexample to the analysis of group NPs (and, consequently, to our empirical argument in favour of P-distributivity) that was presented in the first part. However, I argued that this apparent case of Q-distributivity with group nouns - sentences with an indefinite object like "The team is wearing an orange vest" - can be analysed in terms of P-distributivity if we assume a property analysis of the *a*-indefinite, following much recent literature. The most important support for this claim comes from the observation that the class of predicates that allow the relevant distributive interpretations coincides with the class of 'incorporation' predicates that allow a bare object in languages like Catalan, Greek and Norwegian. Thus, the evidence on group distributivity presented in this paper suggests that these predicates have special semantic properties even in languages like Dutch and English that never allow bare nouns in object position, and adds another item to the list of proposed semantic phenomena that involve property interpretations for full NPs in argument positions.

There is another 'moral' to this paper, which involves the way we study distributivity in general. Since distributivity is arguably not a unified phenomenon, we should be careful to draw conclusions about the formal semantic analysis of sentences involving collections based on distributivity effects: not all distributivity involves semantic plurality or quantification. In order to make sure that our data actually have something to say about the particular formal theory we need evidence (or counterevidence) for, we need to pay close attention to the linguistic context (whether the subject is a plural or a group NP; the morphosyntactic number of the VP; the type of indefinite object; whether the VP involves an incorporation predicate or not...) and use it to bring out the empirical distinction between P- and Q-distributivity. Only then can we draw sound conclusions on the nature of the D-operator or the way lexical and pragmatic factors are involved in the interpretation of distributive sentences.

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