# Shifting sets, hidden atoms

## the semantics of distributivity, plurality and animacy

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# Shifting sets, hidden atoms

## the semantics of distributivity, plurality and animacy

# Vermomde verzamelingen en ogenschijnlijke atomen

## de semantiek van distributiviteit, meervoud en bezieldheid

(met een samenvatting in het Nederlands)

Proefschrift

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# Contents

# Acknowledgements

In the introduction to his 'Jerusalem Lectures' on events and plurality, Fred Landman (whom I will spend some parts of this dissertation agreeing with, but nowhere as strongly as here) writes:

> If you do not have the enviable temperament for writing a Book - a Coherent and Comprehensive Account of a Certain Topic, and you find yourself writing a book instead, you have to find a way of tricking yourself into actually getting it done. This is because the Book is always hovering over the horizon: you are swimming in an ocean of topics that cannot possibly be left out, and literature which obviously needs to be not just mentioned but analyzed and discussed thoroughly, and it's just impossible. And while the book takes shape, these problems actually increase, and with them the threat of paralysis.

In getting me to abandon my pursuit of the elusive *Book* in favour of a much more attainable *book*, no one has been more helpful than my supervisor (and later, deservedly, first promotor), Yoad Winter. Without him, this dissertation would probably have been twice as long, infinitely more rambling, and undoubtedly very silly at points, and I'm extremely grateful for the many hours he has put in reading, rereading, rerereading and occasionally even rererereading its chapters at their various stages of development. I've learned an incredible lot from working with Yoad, and he has been instrumental in not just my development into a better semanticist, but into a better and more grown-up person in general.

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The very short and unofficial visit I paid to NYU and Rutgers in October 2012 marked a turning point in my PhD career in many ways. Realising that my work was taken seriously by people outside of Utrecht boosted my academic confidence and gave me the energy to keep going. Thank you, Anna Szabolcsi, Lucas Champollion, Chris Barker, (again!) Roger Schwarzschild, and Veneeta Dayal, for taking the time to discuss my work with me, providing me with a small but significant platform to present it, and for being so incredibly nice, inspiring and brilliant.

I came to Utrecht in 2008 to become a computational linguist (the summer previous, I had taken an ESSLLI course taught by Michael Moortgat, understood next to nothing of it, and considered this an interesting challenge). But it didn't take me a long time to realise that I'd much rather do semantics - and that I had accidentally managed to end up in the very best place for it. Over the years, my fellow semanticists here at UiL OTS have taught me a great deal, and I've enjoyed collaborating with them on various research projects, teaching, and the organisation of talks, workshops and conferences. When I was working on my MA degree in Utrecht, many people contributed to my semantic education and/or supervised parts of my work: thank you, Min Que, Henriëtte de Swart, Rick Nouwen, Joost Zwarts, Marijana Marelj (whose lessons in rigidly thinking through the implications of a theory - and general amazingness - I still treasure), Eddy Ruys, and Herman Hendriks. Thanks also to my fellow PhD students, in particular my paranymph Eva Poortman, Assaf Toledo, Anja Goldschmidt, Maartje Schulpen, Stavroula Alexandropoulou, Dominique Blok, Lisa Bylinina, and Anna Chernilovskaya (also: Lena Karvovskaya from Leiden University and Matthijs Westera from ILLC/University of Amsterdam) - you were all a joy to

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Now to the really important parts. As a little girl, I possessed enough common sense to realise that my dad probably wasn't the strongest man in the world; still, I was pretty sure that he was the cleverest. Accordingly, I spent much of my life trying to become as learned as my dad (I guess I have surpassed him now!). But even though it's easy to point to my father as my main scientific influence, I recently realised that it was actually my mum who taught me the basics of Aristotelian logic when I was ten (I remember all the confusions of material implication, and the thrill of discovering the fallacy in an invalid syllogism). It was also my mum who instilled in me her love of language(s). I don't think I'd have managed to end up where I am now without my parents - is it weird to say that I'm proud of them? Anyway, thank you. Many thanks also to my parents-in-law, who have been almost equally supportive and all-around wonderful; to my brilliant, funny, charismatic and always impeccably dressed brothers Homme and Evert, and to all remaining (extended) family, friends, roommates, neighbours & everyone else who has been part of my life in the past couple of years.

Cliché has it that life is what happens to you when you're busy making other plans, and so, in the year that was supposed to be all about dissertation-writing,

I suddenly found myself embarking on an entirely different adventure. Baby Roanne, you don't really produce any useful linguistic data yet so I don't have much to thank you for, but I do think you're pretty amazing.

Finally, Klaas, for continuing to put up with a logistically challenged nerd who has no problem leaving shoes and dirty laundry all over the house but gets hysterical when anyone messes up the order of her books - thank you. You make my world an infinitely more wonderful place.

A final note about something else that is quite important to me.

I wrote part of this dissertation in the wee hours of night while volunteering as a night watch at an Utrecht homeless shelter. Being surrounded by people who have absolutely nothing - not even the legal right to be where they are - made me realise how incredibly privileged I am to be able to earn a living pondering the application of set theory to natural language meaning. It also made me realise (again) that science should not exist to build ivory towers for a select few, but to make the world a better and more just place for everyone. Even if we're not directly saving lives, there are many small things we can do, like freely sharing our knowledge instead of hiding it behind paywalls, promoting equal opportunities for women and minorities, spending taxpayers' money fairly and with integrity, keeping our ecological footprints small, or even just acknowledging the presence of the cleaning lady. To the reader of this dissertation and everyone else, I promise I will try my best.

# CHAPTER 1

# Introduction

When it comes to the interpretation of morphosyntactically singular and plural referential noun phrases, it seems natural to assume a corresponding difference between semantically singular and plural individuals, and associate morphosyntactically singular NPs with the former and morphosyntactically plural NPs with the latter. In a set-theoretical version of such a system, for example, the singular NPs in (1a) could be associated with entities ('atoms') and the plural NPs in (1b) with sets of entities:

(1) a.

| *Singular NP:* | *Referent (for example):* |
|---|---|
| Mary | **mary** |
| the girl | **mary** |
| our guinea pig | **bert** |

b.

| *Plural NP:* | *Referent (for example):* |
|---|---|
| Mary and Sue | {**mary**, **sue**} |
| the girls | {**mary**, **sue**, **jane**} |
| our guinea pigs | {**bert**, **ernie**} |

However, there are several reasons why this one-to-one correspondence between morphosyntactic and semantic number may turn out to be too simple. For example, there are NPs that are morphosyntactically singular but refer to collections of individuals, displaying all kinds of 'plural' behaviour like the

ability to bind plural pronouns, compatibility with predicates that normally require a plural argument, and (in some languages) the ability to occur with a morphosyntactically plural VP ((2-4), respectively). And in predicative position, they can function as predicates over plural individuals despite being morphosyntactically singular themselves ((5)):

(2) Every team loves *their* tough guys and thinks the other teams' are idiot thugs.[1]

(3) { *Mary / The girls / The committee } gathered / met / split up.

(4) My family are early risers. *(British English)*

(5) John and Mary are a happy couple.

Because of behaviour like this, group NPs like *the committee* or *my family* have been analysed as semantically plural in some of the literature (e.g. Bennett 1974; Pearson 2011; Magri 2012), which results in a system in which morphosyntactic and semantic number do not always match. Others (e.g. Barker 1992; Schwarzschild 1996) claim that these NPs, in spite of appearing 'plural' in some respects, nevertheless denote singular individuals (that just happen to have a very salient conceptual part-whole structure). This means that we need additional ways to map singular individuals into plural ones or vice versa, in order to be able to account for mixed predication structures like (5): if nouns like *couple* range over singular individuals but NPs like *John and Mary* denote plural ones, the former should not be able to function as a predicate over the latter unless our semantics is equipped with a mechanism that either maps the predicate into a predicate over sets, or the argument into a singular entity. So, regardless of whether we analyse group NPs as semantically plural or singular, their existence complicates the clear singular/plural split as pictured in (1).

Group NPs are not the only reason why the relation between morphosyntactic and semantic number may well turn out not to be a one-to-one mapping. Many researchers have proposed, for various reasons, that morphosyntactically plural NPs like the ones in (6b) may be interpreted as a kind of 'group entity', which is semantically singular (e.g. Link 1984; Landman 1989; McNally 1993; Winter

[1] Sentence (2) was found via Google (search term 'team loves their').

2001a). In many cases the motivation for this claim is at least partly theory-internal, but here is one that is more intuitive (based on data in Mador-Haim & Winter 2012):

(6) a. Mary kissed the boys
⇔ Mary kissed $\text{boy}_1$ and Mary kissed $\text{boy}_2$ and... Mary kissed $\text{boy}_n$.

b. The mouse is hiding in the apples
⇔ The mouse is hiding in $\text{apple}_1$ and the mouse is hiding in $\text{apple}_2$ and... the mouse is hiding in $\text{apple}_n$

While we interpret (6a) to mean that the *kiss*-relation holds between Mary and each of the boys, the same does not hold for (6b): the most salient interpretation of sentence (6b) is one under which *the apples* means something like 'the *heap of* apples'. Under this interpretation, the sentence does not require the mouse to actually have made its way into any individual apple, let alone each of them: it is sufficient for the mouse to be sitting among the apples, as long as the apples form a coherent whole together that makes it easy to perceive them as a single, complex 'heap entity' (it does not work if the apples are strewn randomly across the floor). The **in**-relation, then, does not hold between the mouse and any individual apples, but between the mouse and a 'heap entity' that incorporates both the apples and the spaces in between the apples. Thus, sentences like (6) suggest that morphosyntactically plural NPs can, at least under the right circumstances, behave like semantically singular entities. Again, this gives us a mismatch between morphosyntactic and semantic number that complicates the simple picture in (1).

The aim of this dissertation, then, is to investigate the relationship between morphosyntactic and semantic number of both NPs and VPs - in particular, whether a fully functioning account of semantic number needs to allow for the kind of mismatches between morphosyntax and semantics as described above. I will argue that it does: in order to account for all the relevant data, our system should allow both singular NPs to be associated with sets, and plural NPs to be associated with entities. I will propose that this semantic flexibility is regulated by two different mechanisms. The first is the need to avoid type mismatches between subject and predicate: semantically plural NPs must be shifted into semantically singular ones when they are combined with a semantically singular predicate. The second factor that determines whether a given NP is interpreted as semantically singular or plural is the degree of animacy of its referent: the

more animate an NP, the more likely it is to be interpreted as semantically plural, and the more inanimate, the more likely it is to be interpreted as semantically singular - regardless of its morphosyntactic number. I will suggest that this is related to individuation (cf. Corbett 2000; Grimm 2012): the more we care about the individual members of the collection to which a given NP refers, the higher the likelihood that the NP will be interpreted as semantically plural; if, on the other hand, distinguishing the individual members is not very important (as with the heap of apples above), the NP in question is more likely to be interpreted as a singular complex 'group entity', that does not formally distinguish its member parts.

## 1.1 Structure of the dissertation

The argument is built up as follows.

I will start out by presenting, in **chapter 2**, a basic theoretical framework for the semantics of number, containing various formal tools that we can use to analyse the data presented in subsequent chapters.

In **chapter 3** (and, partly, chapter 4), I will develop a range of tests to determine whether a given NP is interpreted as semantically singular or plural, based on the availability of *distributive* interpretations in various contexts. A predicate $P$ is distributive if it follows from $P$'s being true of a group of individuals that $P$ is true of each of the individual members of that group. For example, it is possible to infer (7b) on the basis of (7a):

(7) a. The cats (which are called Fluffy and Mittens) are purring.

b. Fluffy is purring and Mittens is purring.

There are essentially two competing theories on the origin of such distributive interpretations. The first and most widely adopted one, which originated in Link (1983), treats it as a kind of universal quantification over the members of the plural individual associated with the sentence subject - in the case of (7a), the set consisting of **fluffy** and **mittens**. According to this theory, distributive inferences like the one from (7a) to (7b) can only occur when the subject is semantically plural, because singular individuals do not have members that can

be quantified over. If this is correct, the availability of distributivity would be a good diagnostic for the semantic number of an NP.

However, another possible theory of distributivity does not link its availability to semantic number - Scha (1981), for example, proposes that distributivity has nothing to do with the formal properties of plural predication, but that it is a non-logical inference that follows from reasoning about the lexical meaning of the predicate in a particular context. If it turns out that a lexical theory like Scha's does a better job of accounting for the relevant data, we cannot use the availability of distributivity as a diagnostic for semantic plurality.

A third option is to combine the two theories and assume that both formal and lexical mechanisms can underlie distributivity: while some kind of quantificational operator is necessary to account for all the data, many distributive inferences can in principle be analysed without such a quantificational mechanism, in terms of lexical properties of the predicates involved. This is the approach that I will argue for in chapter 3 (building on earlier proposals by e.g. Dowty 1987, Hoeksema 1988; Winter 1997, 2000; Champollion 2010). I will show that neither lexical nor quantificational distributivity is, on its own, sufficient in order to account for all the relevant data, and that a fully functional theory of distributivity need both mechanisms. The point is exemplified by contrasts like the following:

(8) a. The committee laughed
⇔ Each of the committee members laughed.

b. The committee is hiding somewhere
⇏ Each of the committee members is hiding somewhere.

I will show that all distributive inferences that could, in principle, be explained in terms of lexical reasoning, are available when the subject is a group NP like *committee* in (8a). However, distributive inferences that cannot be derived without some kind of quantification over individuals are systematically unavailable with group subjects. The two statements in (8b) are not equivalent because only the second one is compatible with a situation in which each committee member is hiding in a different location, an interpretation that cannot be derived unless *somewhere* is outscoped by a quantifier over individual committee members. The fact that the group-subject sentence lacks this interpretation indicates that such distributive quantification is unavailable.

The contrast in (8) supports an analysis of group NPs as semantically singular (and hence impossible to quantify over), as well as the need to assume

two different possible sources for distributive inferences: one quantificational (which, as (8b) shows, is unavailable with group subjects), one lexical (which, as (8a) shows, is available with group subjects). Thus, the contrast in (8) shows that it is possible to use the availability of certain inferences, but not of others, as a diagnostic for semantic number. Structural phenomena like the appearance of an overt quantifier (*somewhere* in (8b)) provide a context that enables us to distinguish the two types of distributivity: if a distributive inference is supported in such a context, it has to be quantificational in nature. I will call these contexts *Q-distributivity tests* ('Q' for 'quantificational') and introduce a whole range of them in chapter 3. Because quantificational distributivity is only available with semantically plural subjects, these Q-distributivity tests all function as a diagnostic for semantic plurality.

**Chapter 4** addresses an apparent problem with the previous chapter's claim that group NPs are incompatible with Q-distributivity. In sentences like (9), assuming that the indefinite *a blue shirt* denotes an existential quantifier, we expect it to take scope over the entire sentence, resulting in an interpretation according to which the entire team is squeezed, improbably, into a single blue shirt (compare (8b)):

(9) The team is wearing a blue shirt.

However, the most salient interpretation of (9) is one according to which each team member is wearing his or her own blue shirt. From this one might conclude that it is possible to quantify over individual team members after all and that group NPs should be analysed as sets rather than atoms (cf. Magri 2012); however, this goes against the general pattern identified in chapter 3. I therefore propose that the indefinite *a blue shirt* in (9) does not denote an existential quantifier but an (individual correlate of a) property, following many other examples of property analyses of indefinites in the literature (e.g. Milsark 1974; McNally 1992; Zimmermann 1996; Mador-Haim & Winter 2007). The distributive interpretation of (9) can then be analysed in terms of 'Scha-style' lexical distributivity over multiple arguments of the same predicate.

**Chapter 5** takes us back to the main issue of the relation between morphosyntactic and semantic number. Because the Q-distributivity tests from chapter 3 enable us to distinguish predication over sets from predication over atoms, we can now start investigating which factors influence the interpretation of

predicates and their arguments as singular or plural. In chapter 5, we will look at the role of number marking on the VP; in chapter 6, at the role of animacy.

Based on data from British English, I will argue that quantificational (but not lexical) distributivity has to be licensed by plural number marking on the VP. Since Q-distributivity requires a semantically plural subject, it also requires a semantically plural predicate (i.e., a predicate over sets) to match; I claim that only morphosyntactically plural VPs are able to denote such semantically plural predicates. This claim is supported by the behaviour of British English sentences with a group NP subject. As it turns out, the claim from chapter 3 that group NPs do not allow Q-distributivity does not capture the behaviour of group NPs completely: in British English, where singular animate group NPs can take either a singular or a plural VP, group NPs are only incompatible with Q-distributivity if they appear with a morphosyntactically singular VP. If they occur with a plural VP, the sentence can be interpreted Q-distributively. Since Q-distributivity functions as a diagnostic for semantic number, this means that morphosyntactically singular group NPs are associated with atoms when the VP is singular, but with sets when the VP is plural.

To capture this mixed atom/set behaviour of group NPs, I propose that they originate as sets, but are forced to shift into an atomic 'group entity' if the VP is morphosyntactically singular. The reasoning is as follows. If only morphosyntactically plural VPs are able to denote semantically plural predicates, and morphosyntactically singular VPs can therefore only be interpreted as semantically singular, combining a group NP with a singular VP leads to a type mismatch: since the latter denotes a predicate over singular individuals, it cannot be applied to a semantically plural argument. In order to repair this type mismatch and enable the predicate to apply to its argument, the group NP has to be interpreted as semantically singular; as a result, Q-distributivity is unavailable. On the other hand, if the VP is morphosyntactically plural, Q-distributivity is licensed and no typeshifts are necessary. This analysis explains both the pattern in chapter 3 and the behaviour of British English group NPs in a way that follows directly from the basic assumptions about the semantics of number that were made in chapter 2.

Finally, in **chapter 6**, I explore the relationship between semantic number and animacy by means of three different case studies of Dutch and Afrikaans. The animacy connection came up implicitly in chapter 5: according to the analysis presented there, the group NPs that are associated with sets rather than atomic

entities are precisely those NPs that allow a plural VP in British English, which animate (in particularly human) group NPs do, but inanimate ones do not. This suggests that there is a link between semantic plurality and animacy that holds more or less independently of an NP's morphosyntactic number. In this final chapter, I claim that the opposite also holds: inanimate NPs are quite likely to be interpreted as semantically singular, even if they are morphosyntactically plural.

The first case study (of partitive NPs in Dutch, inspired by data from Pearson 2011) provides support for an analysis of group NPs as basically set-denoting even in languages where they never take a plural VP, suggesting that there is nothing unique about the semantics of British English group NPs: rather, the set-like behaviour of British English group NPs appears to be a universal property of these NPs brought out by the fact that British English grammar allows this particular agreement mismatch between a singular group NP and a plural VP. In addition, it shows that inanimate NPs tend to be interpreted as atom-denoting, regardless of their morphosyntactic number.

The second case study applies several of the Q-distributivity tests from chapter 3 to Afrikaans (which does not mark number on the VP). The results show that sentences with plural human subjects are more likely to be interpreted Q-distributively than sentences with plural non-human and inanimate subjects, which, under the assumptions made in this dissertation, means that the former are more likely to be interpreted as set-denoting than the latter (despite their morphosyntactic plurality).

For the third study, which again looks at Dutch, I paired both plural and collective NPs of varying animacy with 'group-level' atom predicates like *be constituted* and *have x members* and obtained grammaticality judgements for the resulting sentences. While human and non-human animate plural subjects are extremely degraded with these predicates (an observation often made in the literature), the sentences with inanimate plural subjects turned out to be relatively acceptable, suggesting that the former cannot easily be shifted into a group entity but the latter can.

The chapter ends with a discussion of the questionnaire results in light of the abundant typological literature on the relationship between animacy and morphosyntactic number (as summarised by Corbett 2000), offering several directions for further research.

**Chapter 7** concludes this dissertation.

# CHAPTER 2

## Laying the groundwork

In this chapter, I present the various assumptions on plurality, distributivity and other related topics that I will be building on in this dissertation, and put together a 'formal toolbox' that I will use to analyse the semantic data presented in chapters 3-6. It will contain several very common assumptions distilled from four decades of semantic literature on plurality (which I will present without much discussion or argument) and a few more controversial or unusual assumptions, to which I will pay a bit more attention.

Section 2.1 discusses the basic mechanisms of pluralisation of (both nominal and verbal) predicates. Section 2.2 introduces the traditional distinction between collectivity and distributivity; we will formalise this distinction in set-theoretical terms, starting from the assumption that predicates in their uninflected form range either over atoms or over sets of atoms (following several earlier proposals and in particular Winter 2002). Section 2.3 introduces the notion of 'impure' atomicity, and adds a mapping from sets to impure atoms to our formal toolbox. Finally, section 2.4 concludes this chapter.

## 2.1 Plurality

If singular noun phrases like *Mary* or *the girl* are associated with entities in a model (via generalised quantifiers over the domain of entities), it intuitively

makes sense to treat plural noun phrases like *Mary and Sue* or *the girls* as sets of entities, and accordingly, to analyse plural predication in terms of membership of a set of sets. This is exemplified in (10):

(1) a. Mary is a linguist and Sue is a linguist and Jane is a linguist.
$\mathbf{m} \in \mathbf{linguist}$ and $\mathbf{s} \in \mathbf{linguist}$ and $\mathbf{j} \in \mathbf{linguist}$

b. Mary, Sue and Jane are linguists.
$\{\mathbf{mary}, \mathbf{sue}, \mathbf{jane}\} \in \mathbf{linguists}$

To capture the entailment between (1a) and (1b), the denotation of *linguists* needs to be derived in a systematic way from the denotation of *linguist*: the latter denotes the set of all linguists, so the former should denote the set of all possible combinations of those linguists, which we can compute by taking the powerset of **linguist** and removing the empty set (cf. Bartsch 1973; Bennett 1974; Hoeksema 1983; Link 1983, and many others afterwards). We will call this operation *pluralisation* of the predicate, and use the notation $*$ (from Link 1983, although we will not use Link's definition):

(2) **Predicate pluralisation**
$*P := \wp(P) - \{\varnothing\}$

The way $*$ is defined guarantees both the entailment from (2a) to (2b) and vice versa. The first entailment captures a property of plural predication known as *cumulativity*: if **mary**, **sue** and **jane** are all in the extension of the singular predicate **linguist**, then any set containing one or more of these individuals will be in the extension of the plural predicate $*$**linguist**. So if (2a) is true, (2b) must also be, as are the 'intermediate' statements ''Mary and Sue are linguists'', ''Mary and Jane are linguists'', and ''Sue and Jane are linguists''. The second entailment - from (2b) to (2a) - captures the property of *distributivity*: if the set {**mary**, **sue**, **jane**} is a member of plural $*$**linguist**, then so are all of its subsets; also, it follows that the entities **mary** and **sue** and **jane** are all members of singular **linguist**. So if (2b) is true, so is (2a), and so are all intermediate statements.

Since a single operation, $*$, is responsible for both directions of the equivalence between (2a) and (2b), semantic plurality and distributivity are inextricably tied up: we cannot turn a predicate over singular individuals into a predicate over plural individuals without, in the process, endowing it with the property of distributivity.

In function notation, we can represent $*$ by means of universal quantification, as follows:

(3) $*_{(et)(et)t} := \lambda P_{et} \lambda X_{et}. \forall x \in X[P(x)]$

So, $(*P)(X) = 1$ if and only if $P(x) = 1$ for all $x \in X$; this directly captures the entailments from (1a) to (1b) and vice versa. It also follows from this definition that if $(*P)(X) = 1$, then $(*P)(Y) = 1$ for all subsets $Y$ of $X$; this captures the intermediate entailments.

Although I will adopt a set-theoretical rather than a functional perspective throughout most of this dissertation (unless otherwise stated), the fact that $*$ introduces a universal quantifier will be central to the argument, and is useful to keep in mind.[1]

We have seen that pluralisation with $*$ turns any set-denoting predicate into a set of sets. As to how the correct denotation for the coordinated subject NP is derived, I will just assume without going into too much detail that coordination of multiple entity-denoting expressions (e.g. *Mary and Sue*) gives us the set of those entities (e.g. {**mary**, **sue**}), and coordination of multiple set-denoting expressions (e.g. *The girls and the boys*) gives us the union of those sets (e.g. {**mary**, **sue**, **paul**, **george**}; cf. Schwarzschild 1996). For extensive discussion of NP coordination, see Hoeksema (1988); Krifka (1990); Schwarzschild (1996); Winter (2001b), among others.

I will not be talking much about coordinated NPs in this dissertation; rather, the kind of plural NP I will be using for most examples are plural definites, like *the girls*. For singular definites, we can interpret THE as the iota operator, that picks out the unique member of a set if such a unique member exists. For plural noun denotations, we want THE$(*N)$ to be defined even if $*N$ has more than one member (which it will have in nearly all cases), so we cannot translate plural THE as $\iota$. Rather, what plural THE should do is pick out the largest set in

[1] In representing pluralisation by universal quantification, I am abstracting away from the well-observed fact that plural predication usually leaves room for exceptions (i.e. members of the subject set 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 $*$ (e.g. Schwarzschild 1996; Brisson 2003); it can be treated as a property of predication over impure atoms (cf. section 2.3; Landman 1989; Winter 2002), in which case non-maximality is more or less a direct consequence of *not* involving $*$; 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 dissertation, I will simply treat distributivity as more or less paraphraseable by universal quantification.

$*N$, such that in effect, the denotation of *the girls* in a model is just the set of girls in that model. This 'largest set', in more general terms, is the *maximum*: the smallest element in an ordered set such that it is greater than or equal to all elements in that set.

(4) **Plural** THE
$\text{THE}_{((et)t)et}(*N) := \text{MAX}(*N)$

In fact, the same definition can be extended to cover singular THE (Sharvy 1980; Link 1983). If a set has just a single member, the maximum operator reduces to iota: the unique element in a singleton set is trivially greater than or equal to all elements of that set (since it is always equal to itself), so THE applied to that set will return that member. For unordered sets with more than one member, the maximum will be undefined; for example, in (5b), the set corresponding to singular *girl* contains no element that is greater than or equal to all elements in that set, and this will be the case for all unordered sets of entities that contain two or more distinct members.

(5) Denotations for *the girl* and *the girls* in different models, derived using the maximum operator:

a. $M_1$: $\mathbf{girl} = \{\mathbf{mary}\}$
$\text{THE}(\mathbf{girl}) = \mathbf{mary}$
$\text{THE}(*\mathbf{girl}) = \{\mathbf{mary}\}$

b. $M_2$: $\mathbf{girl} = \{\mathbf{mary}, \mathbf{sue}\}$
$\text{THE}(\mathbf{girl})$ = undefined
$\text{THE}(*\mathbf{girl}) = \text{MAX}(\{\{\mathbf{mary}\}, \{\mathbf{sue}\}, \{\mathbf{mary}, \mathbf{sue}\}\}) = \{\mathbf{mary}, \mathbf{sue}\}$

So, we will use the following generalised definition for THE:

(6) **Generalised** THE
$\text{THE}_{(\sigma t)\sigma}(N_{\sigma t}) := \text{MAX}(N)$ (where $\sigma$ represents any type)

### 2.1.1 Sets versus lattices

In the literature, semantic theories of plurality are generally formalised using either set theory (a tradition starting with Bartsch 1973; Bennett 1974; Hausser 1974) or lattice theory (an alternative approach proposed by Link 1983). Both are associated with their own advantages and disadvantages (see Champollion 2010, for an overview). An important difference is the way the domain of

singular and plural individuals is structured. In set-theoretical approaches to plurality, singular and plural individuals are usually of different types ($e$ and $et$, respectively)[2]. In a lattice-theoretical approach, both singular and plural individuals are of type $e$; the domain of singular and plural entities ('atoms' and 'sums') has the structure of a complete join semilattice (fig. 1). Lattice

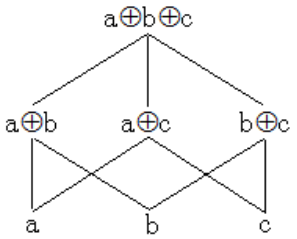



Figure 2.1: The complete join semilattice built on three atomic entities $a$, $b$ and $c$.

theory is often used by semanticists who want to emphasise the link between different kinds of part-whole structures in natural language, including those that lack atomic minimal parts, like mass terms and degree scales (e.g Link 1983; Champollion 2010). However, for the domain of count nouns - which I will be concerned with in this dissertation - the relevant semilattices are isomorphic to a power set structure with the empty set removed (Landman 1989), which means that for the present purposes it does not really matter which formalism we pick. I will continue to use a set-theoretical implementation of the various ideas I will propose in this dissertation, mainly because many of them capitalise on certain semantic differences between singular and plural individuals, which I feel are expressed more clearly in set-theoretical terms.

## 2.2 Distributivity and collectivity

The intuitive approach to predicate pluralisation presented in section 2.1, according to which plural predicates denote sets of sets and pluralisation and distributivity are two sides of the same coin, lies at the basis of many early theories of plurality (e.g. Bennett 1974; Hoeksema 1983; Link 1983). However,

[2]An exception is Scha (1981), in which singular individuals denote singleton sets while plural individuals denote non-singletons.

not all plural predicates are distributive. For example, in (7a-b), we cannot analyse the plural predicates *gathered* and *are a good team* as sets of sets derived from their singular equivalents by $*$, because that would result in the unwanted distributive entailment that each of the cats gathered on the roof and each of the girls is a good team.

(7) a. The cats gathered on the roof.

b. The girls are a good team.

Predicates like *gather* and *be a good team* are traditionally called *collective*. Unlike distributive predicates like *be a linguist* and *smile*, they are 'inherently' plural; in our framework, we will analyse them as predicates whose set-of-sets denotation is basic rather than derived by $*$.

In addition to distributive and collective predicates, the traditional classification also includes 'mixed predicates', that can behave like either. For example, in (8), the predicate *won* can be interpreted either distributively (in (8a)) or collectively (in (8b)):

(8) 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.

Predicates like *win* are often formalised as predicates that include in their extension both singular individuals (the individual girls from (8a)) and plural ones (the girl team from (8b)). Link (1987) proposes a special operator, $D$, to deal with the distributive interpretation of mixed predicates; $D$ is like $*$, but applies only to the atoms in the predicate's extension. With the addition of $D$ to the system, distributivity is essentially divorced from pluralisation and treated as a more or less independent phenomenon (Link describes $D$ as a 'quantificational adverb'). There is also the additional problem of trying to implement mixed predicates and $D$ in the set-theoretical system we have adopted here, as it assigns different types to singular and plural individuals ($e$ and $et$, respectively).

However, there is nothing inevitable about the notion of 'mixed predicate' as a formally distinct class of predicates - there are at least two different frameworks that explicitly do without them. One is the framework developed by Landman (2000), in which all uninflected predicates - collective, distributive, or 'mixed' - range over atoms (corresponding to either individual entities or 'group

entities' - for more on the latter, see section 2.3). The other, which I will adopt in this dissertation (with some minor alterations) is that of Winter (2002), who proposes a two-way classification of predicates that cross-cuts the traditional three-way collective/distributive/mixed typology. Adopting this system allows us to analyse all predicates (including those like *win*) in a way that preserves the direct relation between pluralisation and distributivity, and can easily be formalised in set-theoretical terms.

### 2.2.1 Winter's classification: atom and set predicates

Winter (2002) distinguishes two classes of predicates, which he calls *atom predicates* and *set predicates* and which roughly (but not entirely) correspond to the traditional distributive/collective distinction. Class membership is decided by a truth-conditional criterion, as follows:

(9) a. { All the / No / At least two / Many } girls PRED

b. { Every / No / More than one / Many a } girl PRED

(10) **Atom predicates**
If ((9)a) is truth-conditionally equivalent to ((9)b), or if both of them are ungrammatical/anomalous, then PRED is classified as an atom predicate

**Set predicates**
If ((9)a) has different truth conditions from ((9)b), or if one of them is ungrammatical/anomalous, PRED is classified as a set predicate.

(11) a. All the cats purred.

b. Every cat purred.

(12) a. All the cats gathered on the roof.

b. *Every cat gathered on the roof.

(13) a. All the girls won the match.

b. Every girl won the match.

(14) a. All the committees are good teams.

b. Every committee is a good team.

Sentences (11a) and (11b) are truth-conditionally equivalent, which means that *purr* is categorised as an atom predicate. On the other hand, *gather* is classified as a set predicate, since (12a) and (12b) are not equally grammatical. The sentences in (13) show that the traditionally 'mixed' predicate *win the match* counts as an atom predicate by Winter's criteria. Finally, the sentences in (14), which are truth-conditionally equivalent, show that the traditionally collective predicate *be a good team* is classified as an atom predicate.

The distinction between atom predicates and set predicates is primarily intended descriptively, but the terminology is not accidental: Winter assumes that atom predicates, in their basic (uninflected) denotation, range over atomic entities (i.e. are of type *et*), while uninflected set predicates range over sets of entities (i.e. are of type *(et)t*). While this distinction is familiar from our earlier discussion, Winter expands on it a bit by developing an explicit theory of the interpretation of morphosyntactic number. In addition to the atom/set distinction, he also assumes that morphologically singular predicates all range over atoms, and morphologically plural predicates all range over sets. In order to achieve this, we need both a pluralisation operation for atom predicates and a singularisation operation for set predicates. We have already seen the pluralisation operator $*$ at work. The singularisation operation Winter proposes takes just the singleton sets in the predicate's original extension and returns the set of all the entities in the union of these singletons. This enables him to analyse singular set predication over group NPs such as *the committee*:

(15) a. If $\mathbf{meet\_weekly} = \{\{\mathbf{mary}, \mathbf{jane}, \mathbf{bill}\}, \{\mathbf{comm\_1}, \mathbf{comm\_2}\}, \{\mathbf{comm\_2}\}\}$
then $\mathbf{meet\_weekly}_{sg} = \{\mathbf{comm\_2}\}$

b. Committee 2 meets weekly.
$= \mathbf{comm\_2} \in \mathbf{meet\_weekly}_{sg}$

I will not be using this version of the singularisation operation, because (as we will see) it does not work very well within the theory of group nouns that I will develop in chapter 5. Instead, I will adopt another operation from Winter (2001a) that also has the effect of singularising a set predicate, albeit in a somewhat different way:

(16) **Predicate singularisation**[3]
$\Uparrow\mathcal{P}_{et,t} =: \{(\uparrow P)_e \mid P_{et} \in \mathcal{P}\}$

Here, $\uparrow$ is a function that takes a set and maps it to the corresponding *impure atom* (see section 2.3), which we can think of as a set 'grouped into' a single conceptually complex but semantically singular entity. Thus, the singularisation operator $\Uparrow$ takes a set of sets and returns the set of all impure atoms corresponding to those sets; the result is a singularised predicate of type $et$.

Here are some examples of predicates with different number features and their formal analysis:

(17) a. The boys are smiling.
[[are smiling]] = $*$**smile**

b. The cricket team is smiling.
[[is smiling]] = **smile**

(18) a. The councillors meet weekly.
[[meet]] = **meet**

b. The city council meets weekly.
[[meets]] = $\Uparrow$**meet**

In the next section, we will have a closer look at the impure atom mapping.

## 2.3 Impure atoms

As already mentioned, the final tool in our set-theoretical toolbox will be a type-shifting operation that maps sets into their corresponding 'impure' atoms (cf. Link 1984; Landman 1989; Winter 2002), which we will write as $\uparrow$ (following Landman 1989).

[3]This is a generalised version of the $\downarrow$ operation from Winter (2001a:243), which Winter proposes (together with some additional meaning postulates) in order to deal with predication structures like (i) and entailments like the one in (ii):

(i) The students are a good team.

(ii) The math department has a car. $\Rightarrow$ The members of the math department have a car.

Unlike Winter's $\downarrow$ mapping, that is stipulated to apply only to nominal predicates, the singularisation operation proposed here applies more generally to all set predicates. (Note that Winter's use of the $\uparrow$ and $\downarrow$ notation is quite different from Landman's (1989); notationally I am following the latter, associating $\uparrow$ with a mapping from sets to atoms and $\downarrow$ with a mapping from atoms to sets.)

(19) **Impure atom formation**
If $X_{et}$ is the denotation of a referential NP, $(\uparrow X)_e$ is the *impure atom* corresponding to $X$.

The notion of impure atomicity captures the intuition that we sometimes conceptualise a collection of entities as an entity in itself - we can talk about a collection of things without really knowing or caring which individual entities make up the collection (this observation is often made about group nouns like *council* or *family*, but it holds for 'ordinary' plurals just the same). However, the main reason I will be adopting impure atom formation here is not its conceptual value or psychological realism - which we can debate - but its usefulness as a formal tool (which will mainly become apparent in chapter 5).

I will assume that the impure atom typeshift is freely available for referential plural NPs (but see chapter 6 for a nuancing of this position), and sometimes required for type-matching reasons (see chapter 5 and section 3.5 of chapter 3). The reverse operation, $\downarrow$ (which maps conceptually complex entities into the corresponding set of individual members of that entity, and is often invoked in the literature on group nouns (cf. chapter 5)), will not be part of our toolbox.

### 2.3.1 Impure atoms and different 'roles'

The definition in (19) defines impure atom formation as a one-to-one mapping, with a single impure atom corresponding to each set. However, we might wonder whether it would not be more accurate to describe the relationship between sets of individuals and group entities built from those sets as a one-to-many relation instead. It is possible, for example, for two distinct committees A and B to consist of precisely the same members (Landman 1989; Barker 1992), which suggests that sets should be able to correspond to more than one impure atom. Otherwise, it seems difficult to account for the fact that (20a) and (20b) do not entail each other:

(20) a. Committee A paid an official visit to South Africa. *(From Landman 1989)*

b. Committee B paid an official visit to South Africa.

However, as Landman (1989) shows, this non-substitution problem also arises with other referential NPs, including non-group singulars like *the judge* or *the hangman*, which means that it cannot be accounted for in terms of some property of the relation between sets and impure atoms. For example, (21a) and (21b)

do not entail each other even if the judge and the hangman are necessarily the same person; if this person is John, I can utter the sentence in (22) without contradicting myself.

(21) a. The judge is on strike.

b. The hangman is on strike.

(22) John is on strike and John is not on strike.

The key here seems to be the observation that the same individuals - whether they be judges, a committee, or John - can have many different roles or functions, and have different properties in each role. Thus, just as John-as-a-judge can be on strike while John-as-a-hangman is executing people as usual, the same group of people can be on an official visit to South Africa in their role as Committee A, but not be on an official visit to South Africa in their role as Committee B. Any formal system that incorporates this notion of different roles (for example, the intensional system developed for this purpose by Landman 1989) can in principle account for the nonentailments in (21) and (20) in precisely the same way; there is no need to turn our $\uparrow$ mapping into a one-to-many relation in order to deal with the latter. (I will briefly return to this point in section 5.4.1.)

### 2.3.2 Previous works on the impure atom mapping

Impure atoms were introduced in Link (1984) as a way of dealing with the interpretation of complex NPs such as the one in (23):

(23) a. The cards below 7 and the cards from 7 up were separated.

b. The cards below 10 and the cards from 10 up were separated.

Without impure atoms, our system assigns precisely the same denotation to *the cards below 7 and the cards from 7 up* and *the cards below 10 and the cards from 10 up*, since both coordinated NPs together refer to the exact same set of cards. However, the sentences in (23) do not have the same interpretation: the way the cards are separated into two piles according to (23a) is clearly different from the way the cards are separated according to (23b). For Link (1984) and Landman (1989), this is evidence that the two subject NPs in (23) have different semantic structures. Rather than denoting the entire set of cards, they both denote a distinct set of impure atoms that correspond to the particular groups of cards expressed by the NP coordinates:

(24) a. [[The cards below 7 and the cards from 7 up]] =
$\{\uparrow\{2,3,4,5,6\}, \uparrow\{7,8,9,10,J,Q,K,A\}\}$

b. [[The cards below 10 and the cards from 10 up]] =
$\{\uparrow\{2,3,4,5,6,7,8,9\}, \uparrow\{10,J,Q,K,A\}\}$

However, Schwarzschild (1991, 1996) argues extensively against the need for impure atomicity, claiming that the different interpretations of the subject NP in (23) do not exist as separate readings but are rather determined pragmatically. Also, Schwarzschild argues, assuming a freely available impure atom mapping overgenerates, as it predicts the acceptability of sentences that are in fact ungrammatical or anomalous:

(25) a. Part of the car / the whole car was made in Italy.

b. *Part of the boys / the whole boys were in Italy.

(26) a. The board of advisors is composed of two lawyers and an ethicist.

b. # The advisors are composed of two lawyers and an ethicist.

As (25a) shows, the expressions *part of X* and *the whole X* are fine when *X* refers to an atomic entity; if *the boys* were able to refer to an atomic entity, then, we would expect the sentences in (25b) to be just as good.[4] Similarly, if predicates like *composed of lawyers and ethicists* are acceptable with impure atoms (as (26a) shows) and plural NPs were able to denote impure atoms, there is no reason why (26b) should be out.[5]

As Winter (2001a) points out, however, a system that lacks a way to formally relate the set denotation of *the advisors* to the atomic denotation of *the board* runs into trouble when faced with sentences like those in (27):

(27) a. These four people are our board of advisors.

b. Mary and Sue are a happy couple.

The fact that these predication structures are grammatical and interpretable indicates that there must be a denotation available for an NP like *these four people* that has the appropriate semantic type for a member of the predicate *are our board of advisors*. So either we should be able to analyse predicates like

[4]See section 6.1 for a related discussion on British English data from Pearson (2011) and some new Dutch data, where the judgements are a bit different from what Schwarzschild claims here.

[5]I return to the issue of 'group-level' predicates in chapter 6 as well, in particular section 6.3.

*our board of advisors* and *happy couple* as predicates that range over sets, *or* we should be able to analyse NPs like *these four people* and *Mary and Sue* as atoms. By rejecting the latter option, Schwarzschild is forced to adopt the first (which he does in a footnote, stipulating a mapping from atoms to sets whose availability is restricted to just NPs in predicative position). The upshot is that *some* kind of mapping between atoms and sets cannot be avoided; anyone who adopts a mapping from sets to impure atoms will have to find a way to account for contrasts like those in (25-26), while anyone who adopts the opposite mapping from atoms to sets will need to explain why its application is restricted in the way it is without resorting to ad hoc stipulations. (In chapter 5, I will argue that group nouns like *board* and *couple* range over sets, enabling an analysis of the predication structures in (27) without requiring a typeshift of the subject; however, as I will show, this analysis of group nouns is made possible precisely because we have included a mapping to impure atoms in our formal toolbox.)

Regardless of the above considerations, impure atoms have proven to be a handy tool for the analysis of many natural language phenomena. I will include a short overview here of several semantic phenomena that have been analysed using impure atoms, since the impure atom mapping is probably the most controversial of the various background assumptions discussed here, as well as the least well-documented.

McNally (1993) proposes that so-called 'comitative' NPs in Russian and Polish - a special kind of coordinated NP - should be analysed as impure atoms, since unlike ordinary NP coordinations they do not allow distribution of the VP over the coordinates. For example, while the Russian sentence in (28a) is true in a situation in which Anna and Masha won 1000 rubles each, the sentence in (28b), which involves comitative coordination, can only receive a collective interpretation according to which Anna and Masha won the 1000 rubles together.

(28) a. Anna i Maša vyigrali 1000 rublej.
*Anna*-NOM *and Maša*-NOM *won*-PL *1000 rubles*
'Anna and Maša won 1000 rubles'

b. Anna s Mašej vyigrali 1000 rublej.
*Anna*-NOM *with Maša*-INSTR *won*-PL *1000 rubles*
'Anna and Maša won 1000 rubles'

For a reply to McNally that explains the comitative data in terms of pragmatics rather than the semantic structure of the NP, see Dalrymple et al. (1998).

Kwak (2003) and Joh (2008) make use of impure atoms to account for certain semantic differences between two types of plural NPs in Korean, one of which is formed using a plural suffix *-tul*, the other of which is an uninflected noun that can be interpreted as either singular or plural depending on the context. While the *tul*-plural behaves just like a definite plural in English, the 'bare-formed' plural (as Kwak and Joh call it) behaves semantically like an atomic individual rather than a set. For example, unlike *tul*-plurals, it is incompatible with distributive particles like *kakca* 'each':

(29) a. Haksayng-tul-i kakca sensayngnim-kkey cilmwun-ul ha-yss-ta.
*Student*-Pl-Nom *each teacher*-Dat *question*-Acc *do*-Past-Decl
'Students each asked questions to a teacher'

b. #Haksayng-∅-i kakca sensayngnim-kkey cilmwun-ul ha-yss-ta.
*Student*-Nom *each teacher*-Dat *question*-Acc *do*-Past-Decl
'Students each asked questions to a teacher'

Based on this and similar data, Kwak and Joh argue that Korean *tul*-plurals denote sets, while bare-formed plurals denote impure atoms corresponding to those sets.

A third example of the use of impure atoms in recent semantic theories is Mador-Haim and Winter (2012), who appeal to impure atomicity to account for the interpretation of English locative PPs with a definite plural complement. In the situation depicted in fig. 2.2, sentence (30) is true even though all the individual utility poles are located further than 10 meters from the house, which we would not expect if the spatial location of 'the utility poles' is just the union of the locations of the individual poles.

(30) The house is exactly 10 meters away from the utility poles.

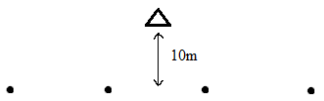



Figure 2.2: A house and a row of utility poles.

However, if we group the utility poles together into a single entity (which is a natural thing to do considering their function and neat linear configuration),

the resulting entity - to which we might refer as 'the row of utility poles' - *is* located at exactly 10 meters from the house, which would account for the fact that (30) is true in such a situation.

To sum up, impure atoms are evidently useful in describing and formalising natural language phenomena, and as such they will be playing a central role in this dissertation. As we will see, mapping from sets to impure atoms will be a key part of the various semantic analyses presented in chapters 3 and 5, which will provide additional empirical justification for the idea; in chapter 6, I will address (among other things) Schwarzschild's objection that such a mapping overgenerates.

## 2.4 Summary and conclusions

In this chapter, I have put together the basic toolbox that I will be using to formalise the plurality- and distributivity-related phenomena that will be studied in this dissertation. I outlined a basic set-theoretical approach to the pluralisation of atom predicates, which emphasises the close relationship between semantic plurality and distributivity as two sides of the same coin (in this it is very close in spirit to the work of Fred Landman, although many details differ). As a side-effect of this, I rejected the notion of 'mixed predicates' as a separate formally distinct class of predicates: instead, I adopted the two-way classification of Winter (2002), which takes the additional step of relating semantic and morphosyntactic number in a systematic way. Finally, I returned some flexibility to the system by assuming a freely available typeshift from sets to atomic denotations for referential plural NPs.

# CHAPTER 3

## P- and Q-distributivity

In the previous chapter, we have been treating distributivity as an inevitable property of pluralised atom predicates, inseparable from the process of pluralisation itself: the pluralisation operator and the distributivity operator are one and the same. In this chapter, I argue that this cannot be the whole story, and that distributivity effects are actually a bit more varied. In particular, I claim that distributivity effects can also occur with singular predication as a consequence of lexical reasoning about the meaning of the predicate (cf. Scha 1981; Roberts 1987; Hoeksema 1988; Winter 1997; Champollion 2010). The main evidence for this will be the availability of (limited) distributivity effects with group NPs like *the team*, which are generally taken to be semantically singular, and in fact are shown to be incompatible with $*$-based distributivity. Following Winter's (1997) terminology, I will refer to $*$-based distributivity as *Q-distributivity*, and to lexical distributivity as *P-distributivity*. The two kinds of distributivity can be distinguished using a couple of tests that I will develop in this chapter. In our set-theoretical framework, P-distributivity is formalised in terms of predication over impure atoms.

The chapter is structured as follows. In section 3.1, I discuss the notion of P-distributivity in more detail, including a couple of conceptual arguments both for and against. In section 3.2, I use the observation made in section 2.1 that $*$

essentially functions like a quantifier to identify a series of contexts in which the observed distributivity effect have to be explained in terms of Q-distributivity, showing that P-distributivity alone cannot account for the full range of distributivity data. In section 3.3, I show that Q-distributivity is unavailable in these contexts if the subject is a group NP, but that certain distributive effects are still available with group NPs, showing that Q-distributivity alone cannot account for the full range of distributivity data either. Section 3.4 contains a formalisation of the notion of P-distributivity in terms of predication over impure atoms. Finally, section 3.5 offers some speculation about the syntax of Q-distributivity; I argue based on data from Dutch that coordination of a collective and a Q-distributive VP is not possible, which provides some support for the assumption that predicate pluralisation is not a lexical but a structural process, in which $*$ occupies a separate syntactic projection of its own. Section 3.6 concludes the chapter.

## 3.1 P-distributivity

In chapter 2, we have treated distributivity as the direct consequence of applying the $*$ operator to a predicate, which is essentially a quantificational process: because of the way $*$ is defined, a set is in the extension of a pluralised predicate if and only if every individual member of that set is in the extension of the original non-pluralised predicate. This view of distributivity is due to Link (1983). But there is a possible alternative way to derive distributivity effects, as argued for by Scha (1981): in Scha's theory of plurality, collectivity and distributivity inferences with referential expressions are not triggered by the compositional semantics of the sentences in question, but by lexical information. Thus, there is no formal difference between the derivation of the distributive sentence in (1a) and the collective sentence in (1b): both involve direct application of the predicate to the plurality expressed by *the children*. (In Scha's system, there is no structural difference between singular and plural predication because he treats both singular and plural NPs as set-denoting; hence, all VPs denote sets of sets, and already include plural individuals in their extension from the beginning.)

(1) a. The children laughed.
**laughed**(**the_children**)

b. The children gathered in the garden.
**gathered_in_the_garden**(**the_children**)

The process underlying the distributive inference in (1a) and the collective inference in (1b) is the same in both cases: we draw conclusions about the way the individual members participate in the expressed event by using our knowledge of the world and of the predicate's lexical meaning. 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, distributivity is not a direct consequence of the semantic pluralisation of a predicate (which does not exist in his system), but purely a lexical property of certain verbs.

Many authors have incorporated Scha's idea of lexical distributivity into a Linkian framework, arguing that distributivity effects can be either lexical or structural (i.e. due to $*$). For example, Roberts (1987) writes that ''the fact that a particular lexical item is a group predicate or a distributive predicate doesn't really need to be specified independently: it follows from the sense of the predicate itself. (...) What is it to be a pop star or to walk or to die? The actions or states denoted by these verbs can generally only be performed or endured by an individual with a single will and consciousness. It is for this reason that we think of them as distributive'' (p. 124). This intuition was built into the theory more explicitly by Winter (1997), who distinguishes *Q-distributivity* (for 'quantificational distributivity') and *P-distributivity* (for 'predicate distributivity'); the first is our familiar $*$-based distributivity, while the second is Scha's lexical distributivity. A similar distinction is adopted by Hoeksema (1988) and Champollion (2010).[1]

These more mixed approaches to distributivity agree with the observation made by various authors (Dowty 1987; Verkuyl and van der Does 1996; Verkuyl 1994) that the line between collectivity and distributivity is not as clear-cut as suggested by the way we have set up our formal system so far. Dowty (1987) notes that even many collective predicates enable certain inferences about individuals; he calls these inferences *subentailments*. For example, while we

[1]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.

cannot infer (2b) from (2a), we can infer (2c):

(2) 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 (2a) to (2c) were enabled by some $*$-like 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 (2a) to (2c) 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 (2a) to (2c) 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. There seems to be little conceptual sense in a theory that allows for subentailment but not for complete P-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 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, which according to Landman plays a crucial role in our interpretation of the sentence. If the subject argument of a distributive predicate could be an entire plurality, Landman argues, this entire plurality would end up with the role of agent; but that would render the whole notion of 'agent' both meaningless and useless, since the plurality 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 plurality as a whole.

Since what this gives us is two conceptual arguments with completely opposite conclusions, it seems clear that we will not be able to decide on purely conceptual grounds whether we should make room for P-distributivity in our formal framework. What, then, about empirical grounds - can we demonstrate empirically whether we need something like P-distributivity as part of our theory?

Winter (1997), who introduced the term 'P-distributivity', does not make an explicit empirical case for it, although it is possible to make such a case on the basis of the data in Winter (2000). In the same vein, Champollion (2010) argues (following observations by Lasersohn 1989, 1995; Schwarzschild 1996, and others) that P-distributivity freely allows intermediate or non-atomic interpretations when these are supported by the lexical semantics of the predicate, while Q-distributivity only allows a nonatomic interpretation if this is made sufficiently salient by context. In both cases, P-distributivity accounts for distributive interpretations that, under Winter's and Champollion's assumptions, cannot be explained in terms of covert quantification. In this chapter I provide some new empirical evidence along the same lines. First, however, we need to set up the stage for this argument by taking a closer look at Q-distributivity.

## 3.2 Q-distributivity

So far, our discussion of Q-distributivity has been rather abstract and technical. In this section, we will take a more linguistic look at Q-distributivity. Our earlier observation that Q-distributivity is essentially a quantificational phenomenon will become more concrete as we study the way it interacts with several other natural language phenomena and identify several contexts in which the observed distributivity effects can only be accounted for in terms of $*$. As a result, we will end up with a list of tests that we can use to distinguish Q- from P-distributivity, which will prove useful in the remainder of this chapter and in chapters 5 and 6.

As several people have pointed out in response to Scha (e.g. Winter 1997; Brisson 1998), distributivity effects cannot be reduced completely to P-distributivity.

In the following subsections, I will discuss a couple of examples of distributive interpretations in different linguistic contexts that need the kind of covert quantificational mechanism provided by $*$. In this section, I will discuss VP disjunction (3.2.1), interaction with other quantifiers (3.2.2), and anaphora (3.2.3). (In section 4, I will discuss two additional cases of Q-distributivity that only become obvious when we contrast plurals with group NPs: VP conjunction and Dutch proportionality adverbs (3.3.3).) In all cases, I will be contrasting 'distributive' and 'collective' interpretations, which I will for the present purposes define as follows:

(3) **Distributive and collective interpretations**
Suppose we have a sentence $S$ of the form $X$ *Pred*, where $X$ is a plural, conjunction or group NP, and *Pred* is a predicate. An *interpretation* of S is *distributive* if we infer that *Pred* holds for every member $x$ of $X$; otherwise[2] it is *collective*.

This means that in sentences like ''The children are singing or dancing'' (which we will look at shortly), the crucial factor in deciding which interpretations are available is the interpretation of the entire predicate *are singing or dancing*, not just the individual verbs. According to the above definition, this sentence can be interpreted distributively just in case the entire disjunction *singing or dancing* can hold for each individual child; whether the coordinated verbs themselves express properties of individuals or collections is irrelevant here. As we will see, 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, and not just verb semantics.

### 3.2.1 VP disjunction

As shown in (4), analysing predicate disjunction by set union is mathematically equivalent to analysing it as a predicate formed by lambda abstraction and sentential disjunction. We can see this equivalence playing out in natural language in entailments like (5):

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

[2]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 (3)can be straightforwardly extended to accommodate such cases.

(5) Sue is singing or dancing.
⇔ Sue is singing or Sue is dancing.

When we replace *Sue* in (5) with a plural definite, the entailment pattern gets a bit more complicated, however. A disjunctive sentence like (6) can be interpreted in two different ways:

(6) The children are singing or dancing.

a. ⇐ The children are singing or the children are dancing. *(CI)*[3]

b. ⇐ For every child $y$, $y$ is singing or $y$ is dancing. *(DI)*

We see that there are two ways to analyse (6), each of them corresponding to a possible interpretation of the sentence. According to the first analysis, the disjunction *singing or dancing* holds of the group of children as a whole; this makes it equivalent in meaning to (6a). No quantification over individual children is needed in order to derive this interpretation. According to the second analysis, the disjunction *singing or dancing* holds not of the group as a whole but of each of the individual children, which makes it equivalent to (6b). In order to derive the second analysis, we need to access the individual children by quantifying over the plurality denoted by the subject. Under our current assumptions, this can be done using $*$, as follows:

(7) $[[\textit{the children}]] \in *(\mathbf{sing} \cup \mathbf{dance})$
$\Leftrightarrow \forall y \in [[\textit{the children}]] : y \in \mathbf{sing} \cup \mathbf{dance}$
$\Leftrightarrow \forall y \in [[\textit{the children}]] : y \in \mathbf{sing}$ or $y \in \mathbf{dance}$

The logical form in (7) is a clear example of Q-distributivity: it can only be derived assuming the quantificational mechanism provided (in our framework) by the $*$ operator. Since the interpretation it represents is truth-conditionally distinct from the collective interpretation in (6a) (the former, but not the latter, is true in a situation in which part of the children are singing while the rest are dancing), sentences like (6) provide us with a truth-conditional test for the availability of Q-distributivity. If a sentence of the form *X Pred1 or Pred2* can be interpreted as true in a 'mixed' situation (in which *Pred1* is true of one part of $X$ and *Pred2* of the other), it must have a Q-distributive interpretation. Conversely, if it cannot be true in that situation, it cannot have a Q-distributive interpretation.

[3]Here, 'CI' and 'DI' are shorthand for 'collective interpretation' and 'distributive interpretation' as defined in (3).

### 3.2.2 Interaction of $*$ with other quantifiers

For this and the remainder of the Q-distributivity tests in this section and section 4, I will not make the formal derivation as explicit as in the previous section; this is partly because they involve semantic phenomena for which there are a lot of different analyses around that I do not want to choose from, and partly because the idea should be clear by now: the Q-distributive mechanism provided by $*$ enables quantification over the individual members of the subject plurality, which makes an interpretation available that direct predication (without $*$) cannot provide.

The data in this section all involve the interpretation of sentences that contain some overt quantificational element. Since the $*$ operator essentially introduces a universal quantifier into the semantics, we expect it to be able to take scope over any other quantifiers in the sentence; this produces an interpretation that is truth-conditionally distinct from readings where $*$ takes narrow scope or is absent. If a particular sentence has such an interpretation, then, it is evidence for the presence of the $*$-operator.

The entailments in (8) provide a concrete example of this reasoning:

(8) The children admire someone famous.

a. $\Leftarrow$ There is a famous person $x$ such that the children admire $x$. *(CI)*

b. $\Leftarrow$ For every child $y$, there is a famous person $x$ such that $y$ admires $x$. *(DI)*

If we analyse the NP *someone famous* as an existential quantifier, an analysis in terms of direct predication would result in the object's taking scope over the entire plurality of children:

(9) $\exists x$ [**famous_person**($x$) $\wedge$ **admire**(**the_children**,$x$)]

However, this only accounts for the entailment in (8a), according to which there exists one particular famous person that the entire group of children admires. The second possible interpretation of (8), that corresponds to the entailment in (8b), cannot be derived in this way, since it requires the existential quantifier to take scope below *the children*. And the only way to allow *the children* to have wider scope than *someone famous* is to introduce another quantifier, as in (10):

(10) $\forall y \in$ **the_children** [ $\exists x$ [**famous_person**($x$) $\wedge$ **admire**($y, x$) ] ]

We have already seen that this kind of quantification over individual children is precisely what $*$ provides when it is applied to the predicate.

The following examples work in a similar way: they, too, involve quantifiers (a comparative quantifier in (11), and a numerical quantifier in 12); and 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.

Example (11) shows a comparative construction that can be interpreted both collectively and distributively:

(11) 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)*

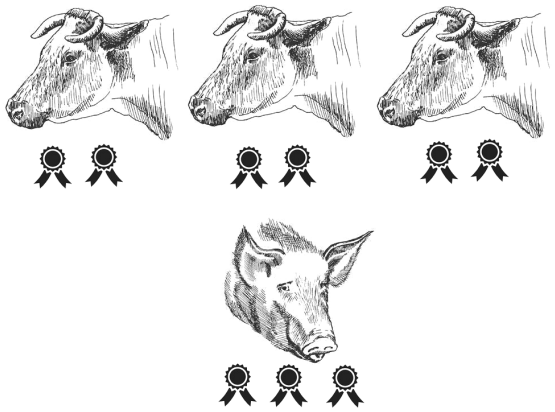


Figure 3.1: Cows, pigs and prizes

As a context for (11), imagine a country fair at which prizes are awarded to animals in various categories. One farmer brought three of his cows and his very best pig, and all four animals ended up winning a number of prizes. One possible distribution of prizes is depicted below in Figure 3.1; sentence (11)

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:

(12) These artists dress in black one day a week.
⇐ For every artist $x$, there is one day a week $y$ such that $x$ dresses in black on $y$. *(DI)*
⇐ 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 collective one, according to which all the artists dress in black on the same day of the week.

A final note is in order here. In the preceding list of Q-distributivity tests, I deliberately have not used the example sentences involving an indefinite object that are usually invoked against Scha's theory of distributivity (cf. Winter 1997; Brisson 1998, 2003):

(13) The boys are eating a pizza.

a. ⇐ There is a pizza that the boys are eating. *(CI)*

b. ⇐ For every boy $x$, there is a pizza that $x$ is eating. *(DI)*

The reasoning here is again the same: if *a pizza* is given a quantificational analysis, and there are no other quantificational elements in the sentence (as in Scha's lexical theory of distributivity), *a pizza* will necessarily take widest scope and the only interpretation we will end up with is (13a). However, this reasoning depends on the indefinite *a pizza* being analysed as quantificational, and in chapter 4 I will argue that this is not the only possibility and that *a*-indefinites may also receive a property analysis in contexts like (13). As we will see, this enables us to derive a P-distributive interpretation for sentence like (13), which means that they cannot be used as a reliable test for Q-distributivity.

### 3.2.3 Anaphora

Our third class of examples involves pronoun binding. When a pronoun or reflexive is bound by a plural 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.[4]

(14) 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. ⇐ These boys get furious when you insult their mum (the boys are brothers). *(CI)*

b. ⇐ 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 (14) as true in such a situation provides another piece of evidence for the presence of a covert quantifier in the semantics of (14).

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 (15) demonstrates, *zichzelf* can be interpreted as 'himself', 'herself', 'itself' or 'themselves'. This will make Dutch

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

(i) The boys will be glad when their mothers arrive.
⇐ 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.

reflexive predication particularly useful when we will compare the behaviour of plurals with that of group nouns in section 3.3.

(15) { Jantje vindt / De kinderen vinden } 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:

(16) De kinderen vinden zichzelf nogal slim.
'The children consider themselves rather clever'

a. $\Leftarrow$ The children consider the children rather clever (as a group). *(CI)*

b. $\Leftarrow$ 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, (16) 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 conclude: while simple distributive sentences like ''The children laughed'' might well be analysed in terms of P-distributivity, the above examples all show that Scha's theory of plurality is unable to account for the full range of distributivity data. The truth conditions of more complex sentences involving phenomena like scope interactions and binding cannot be adequately captured without assuming covert quantification by $*$ (or, more generally, some kind of distributivity operator).

## 3.3 Distributivity effects with group NPs

We have been interpreting Q-distributivity in terms of semantic plurality: the same operator $*$ that pluralises atom predicates is responsible for Q-distributivity. Q-distributivity occurs 'automatically' when a starred predicate applies to a

semantically plural argument. From this it follows that Q-distributivity is only available when the subject denotation is semantically plural: if the subject denotation is semantically singular (i.e. of type $e$), the predicate cannot be starred, and Q-distributivity is out. Or, to put it differently, since $*$ is essentially a quantifier and only sets can be quantified over, we predict that Q-distributivity is only possible when the subject denotes a set.

Why is this relevant? As it turns out, there is a class of noun phrases that intuitively seem to refer to the same collections[5] as the plural definites we have been looking at so far, yet are generally taken to have an atomic denotation: singular definites formed with group nouns like *team, committee, set*, or *pile*. If it is true that these 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. In addition, I will use this contrast between plurals and group nouns to identify two more Q-distributivity tests. This result supports both the validity of our Q-distributivity tests and the atomic analysis of group NPs. Finally, I will show that group NPs, despite their incompatibility with Q-distributivity, do show distributivity effects; this confirms the need for a theory of P-distributivity, without which we would be unable to account for these observations.

### 3.3.1 Groups as atoms

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

(17) a. The { choir / members of the choir } sang beautifully.

b. The { council / councillors } voted on the issue today.

c. The { bouquet / flowers } has/have wilted.

Group nouns behave like plurals in other respects: they may appear as the argument of a collective predicate (18), and function as the antecedent of both

[5] I'm using the word *collection* in a pretheoretical, descriptive sense here to refer to any conceptually plural referent, i.e. plural as well as group denotations.

discourse and bound plural anaphors ((19b-c) were found through Google along with many similar examples):[6]

(18) The committee gathered in the meeting room.

(19) 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 a plural VP:[7]

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

Considerations like these led Bennett (1974) to treat group nouns 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 and Magri 2012 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, (21) 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:

(21) Supposing the women are, and the committee consists of, Mary and Sue:

a. Mary is old and Sue is old $\Leftrightarrow$ Mary and Sue are old $\Leftrightarrow$ The women are old.

b. *but:* Mary is old and Sue is old $\not\Leftrightarrow$ The committee is old.

[6] 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 (18b) and (18c) 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.

[7] 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.

There are several other examples that show that a group noun 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.

(22) a. The committee has two members.

b. *The women/Mary and Sue have two members.

(23) The women/Mary and Sue are members of the committee ⇏ The committee is a member of the committee.

Data like these suggest that group nouns (like *the committee*) do not have the same denotation as the corresponding pluralities (like *Mary and Sue* 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:

(24) 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.

(25) 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 nouns 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).[8]

Link, Barker, Schwarzschild and (up to a point) Landman all conclude that group noun 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.

[8]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)).

### 3.3.2 Distributivity behaviour of group nouns

Of the examples of Q-distributivity listed in section 3.2, all are unavailable with group NPs. Below, I repeat the examples, this time with group rather than plural subjects:

(26) The team is singing or dancing.

a. $\Leftrightarrow$ The team members are singing or the team members are dancing. *(CI)*

b. $\not\Leftarrow$ For every team member $x$, $x$ is singing or $x$ is dancing. *(DI)*

Recall from the data in (6) that both a distributive and a collective interpretation are available if the subject is a plural definite; the former, but not the latter, is true in a mixed situation in which part of the team members are singing while the others are dancing. Its group-subject counterpart in (26), however, cannot be interpreted as true in such a situation, which shows that it only has a collective interpretation. According to this interpretation (paraphrased in (26a)), the disjunction *singing or dancing* applies to the team as a whole: either they are all walking, or they are all cycling. In section 3.2.1, I have shown that only this interpretation can be analysed in terms of direct predication; the other, distributive interpretation can only be derived by means of $*$. The data in (26) suggest that this option is unavailable with a group NP subject.

Our next examples also run parallel to our earlier data in section 3.2, and show a similar contrast between plurals and group nouns:

(27) The class admires someone famous.

a. $\Leftrightarrow$ There is a famous person $x$ such that the pupils admire $x$. *(CI)*

b. $\not\Leftarrow$ For every pupil $y$, there is a famous person $x$ such that $y$ admires $x$. *(DI)*

(28) The trio of cows won fewer prizes at the fair than the pig.

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

b. $\not\Leftarrow$ For every cow $x$, $x$ won fewer prizes than the pig. *(DI)*

(29) This art collective dresses in black one day a week.

a. $\Leftrightarrow$ There is one day a week $y$ such that every artist dresses in black on $y$. *(CI)*

b. $\not\Leftarrow$ For every artist $x$, there is one day a week $y$ such that $x$ dresses in black on $y$. *(DI)*

(30) Deze groep wordt woedend als je hun moeder beledigt.
'This group gets furious if you insult their mother'

a. $\Leftrightarrow$ The group members have the same mother and get furious if you insult her. *(CI)*

b. $\not\Leftarrow$ For every group member $x$, $x$ gets furious if you insult $x$'s mum. *(DI)*

(31) De klas vindt zichzelf nogal slim.
'The class considers SELF.3SG/PL rather clever'

a. $\Leftrightarrow$ The class considers the class rather clever (as a group). *(CI)*

b. $\not\Leftarrow$ For every pupil $x$, $x$ considers itself rather clever *(DI)*

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 (27) requires that the same famous person be admired by all children in the class; sentence (28) can only be false in the situation depicted in fig. 3.1; sentence (29) must mean that all artists in the collective dress in black on the same day of the week; in sentence (30), the members of the group all have to be children of one and the same mother; and finally, sentence (31) requires that the pupils in the class collectively feel that they are clever as a group, regardless of what each individual pupil thinks about his or her own cleverness. (Since the third person reflexive pronoun *zichzelf* is not marked for number, and can be bound by singular as well as plural NPs, the contrast between (31) on the one hand and (16) on the other cannot be due to any morphosyntactic properties of the anaphor that might make either a singular or a plural antecedent more salient.)

The generalisation that emerges is that sentences with group noun subjects systematically lack a distributive interpretation that their plural-subject counterparts do have. As already suggested in the introduction to this section, this generalisation can be accounted for in terms of the atomicity of the subject denotation. If a group NP denotation lacks internal structure, it has no individual members that can be quantified over, hence Q-distributivity is out. The contrast between the data in sections 3.2.1 to 3.2.3 on the one hand and (24-29) on the other thus supports an analysis of groups as atoms.

### 3.3.3 Two more Q-distributivity tests

The Q-distributivity tests from section 3.2 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. 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 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:

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

a. ⇐ Part of the students have been shaven bald. *(CI)*

b. ⇐ 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 (32) would be verified in such a situation. However, when we compare the entailment pattern in (32) to that of its group-subject counterpart, we see that this cannot be the case:

(33) 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. $\not\Leftarrow$ 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 (33) to have precisely the same range of interpretations as (32). However, in the case of (33), a distributive interpretation is clearly out: unlike (32), it is false in the described situation.[9] This shows that (a) we do need to derive the DI in (32b) 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 3.2 is VP conjunction, which shows a contrast between plural and group subjects that is very similar to the disjunction data:

(34) a. The women are short and tall.

b. # The committee is short and tall.

While (34a) 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 (34b). The only interpretation available for (34b) is an intersective one according to which each member of the committee is (impossibly) both short and tall, which makes the sentence anomalous.

The issue of non-Boolean VP conjunction has received some attention in the literature (e.g. Krifka 1990; Winter 2001b; 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 (34a) and the non-Boolean interpretation of (35) with a single analysis:

(35) The flag is green and white.

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

Krifka posits an interpretation rule according to which sentences like (34a) and (35) 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 (35), 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 (34b) should be completely equivalent to (34a). However, we have seen that this is not the case.

The account in Winter (2001b) is better equipped to deal with the plural/group contrast, since it only works on pluralities (Winter analyses singular predicate conjunctions like (35) as an independent phenomenon, following Lasersohn 1995). Under this account, the strong, Boolean meaning of (34a) 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.[10]

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, (34a), but not (34b), is true in a situation where part of the women is short while the rest is tall.

[10]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) $[[\textit{The women are short and tall}]] = 1$ 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 (34b).

### 3.3.4 P-distributivity with groups; conclusion

As we have seen, the availability of Q-distributivity can be used as a diagnostic for semantic number, with the result that group NPs like *the team* and *my family* are not semantically plural. However - and now we are finally back to the question of empirical support for P-distributivity - group NPs are not generally incompatible with distributive interpretations. We have already seen some examples in (17). Here are a few others:

(36) a. The team smiled.

b. My family has blue eyes.

c. The jury got up and left the room.

The predicates in these sentences are all interpreted distributively according to the definition in (3): all sentences in (36) can be accurately paraphrased by means of (near-)universal quantification over the members of the collection expressed by the subject. We interpret *smiled* in (36a) as something the individual team members did, *has blue eyes* in (36b) as an individual characteristic of my relatives, and *got up* and left the room as actions of individual jurors.

I conclude (contra Landman) that collections are fine as the subject of a distributive predicate even if they are not semantically plural (so if we accept Landman's reasoning, this might imply that we have to rethink our conception of the 'agent' role). This means that the data in (36) show that we cannot do without the concept of P-distributivity: since we cannot explain distributivity effects with groups in terms of $*$, we need to assume that distributive inferences can also occur with semantically singular predicates, if the lexical semantics of the predicate supports them. The data in this chapter thus show that we can neither do without Q-distributivity, nor without P-distributivity: in order to account for the full range of distributivity data, we need both as part of our toolbox.

In the remainder of this chapter, I will tie up some loose ends considering the formal implementation of P-distributivity (section 3.4) and the syntax of $*$ (section 3.5).

## 3.4 Embedding P-distributivity in our formal framework

Within the set-theoretical framework introduced in chapter 2, we will formalise P-distributivity in terms of (singular) predication over impure atoms. (In fact, by assuming a typeshift to impure atoms in chapter 2, I have already built the necessity for something like P-distributivity into the system, since impure atoms cannot really take part in meaningful predication structures otherwise.)

We will assume that uninflected atom predicates[11] may range over both pure and impure atoms, where an impure atom $\uparrow X$ is in the extension of a predicate $P$ just in case the individual members of $X$ are in the extension of $P$ (exactly how many individual members of $X$ have to be members of $P$ depends on the lexical meaning of $P$ and various other factors; cf. footnote 1, chapter 2).

I will further assume that, in order to receive an atomic interpretation, plural NPs have to be mapped into impure atoms with $\uparrow$, while group NPs denote impure atoms to begin with (this is a temporary assumption, just for present purposes: in chapter 5 I will adopt a different analysis of group denotations according to which they also start out as sets). This gives us the following options:

(37) *Possible logical forms underlying a P-distributive interpretation:*

a. [[The group is tall]] = **tall**(**the_group**)

b. [[The boys are tall]] = **tall**($\uparrow$**the_boys**)

### 3.4.1 A pseudo-formalisation of P-distributive inferences

All this does not actually tell us how P-distributive interpretations are derived - merely what the compositional semantics of P-distributive sentences should look like in order for said interpretation to be derivable. In Scha (1981), the derivation of distributive and collective interpretations is governed by meaning postulates on the predicate, for example:

[11] At least verbal and adjectival atom predicates. Many nominal predicates are not compatible with group subjects in their singular form, which would mean under our current assumptions that they do not include impure atoms in their extension. For example:

(iii) a. *This family is my guest.

b. *This couple is a dentist.

I do not know where this difference between verbal and adjectival predicates on the one hand and nominal predicates on the other should come from.

(38) $\mathbf{walk}(\uparrow X)$ is interpreted as $\forall x \in X[\mathbf{walk}(x)]$[12]

A more recent version of Scha's meaning postulates approach can be found in Winter and Scha (to appear). 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 (39a) and (39b) are pseudo-equivalent, so are the pairs in (40):

(39) 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.

(40) a. The boys are tall. $\leftrightsquigarrow$ Every boy is tall.

b. The books touch the ceiling. $\leftrightsquigarrow$ Some book touches the ceiling.

What about predicates that are not necessarily interpreted distributively? As is well-known, sentences can be vague between a collective and distributive interpretation, or - given the right pragmatic context - fall somewhere in between (the sentences in (41) are repeated from chapter 2; (42) is due to Schwarzschild 1996):

(41) 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.

(42) The shoes cost 50 dollars.

a. $\Leftarrow$ All the shoes together cost 50 dollars. *(CI)*

b. $\Leftarrow$ Each shoe costs 50 dollars. *(DI)*

c. $\Leftarrow$ Each pair of shoes costs 50 dollars. *(intermediate)*

According to Roberts (1987) and Hoeksema (1988), the existence of predicates like *win* and *cost 50 dollars* poses a problem for an approach based on meaning postulates, because this would force the meaning postulates (or pseudo-equivalences) to be optional. Winter and Scha do not explicitly address this, but

[12] I have adapted Scha's formalisation to fit our particular semantic framework; in Scha's own analysis both singular and plural individuals are of type *et* and there is nothing like our impure atom mapping, so his original formalisations look a bit different.

it seems to me that the above interpretations could all follow from a meaning postulate like (43) if we allow for different contextually salient granularities in deciding what the 'parts' of an impure atom are (cf. Verkuyl and van der Does 1996).

(43) $\mathbf{cost\_50\_dollars}(x) \leftrightsquigarrow \forall x'[x' \text{ is a salient part of } x \rightarrow \mathbf{cost\_50\_dollars}(x')]$
(where $x$ is an impure atom)

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 went out of business and is 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 an impure atom to count as a part of itself, the collective interpretation of (42) could be captured by the context-sensitive application of the meaning postulate in (43).

If treating the collective interpretation of a predication over an impure atom[13] as a special case of distributivity in this way makes us feel uncomfortable, it is possible to generalise our pseudo-equivalences in a way that captures both collective and distributive interpretations without subsuming the former under the latter:

(44) $P(x) \leftrightsquigarrow \forall x'[x' \text{ is a proper part of x} \rightarrow x' \text{ participates in the event or state associated with } P]$

Context and additional lexical knowledge can fill in what it means to 'participate in the event or state associated with $P$' for any given $P$. In the case of *win*, for example, we know that there are two distinct ways to take part in a winning event: either you defeat an opponent yourself, or a team that you are member of defeats its opponent. In both cases, the pseudo-equivalence in (44) comes out true, even though the right-hand statement does not allow an impure atom to count as a part of itself.

### 3.4.2 Tying up another loose end: collectivity

The reasoning that lay at the basis of our adopting the notion of P-distributivity - atom predicates are compatible with, and can be interpreted distributively with, atom-denoting subjects - does not just hold for atom predicates. As evidenced

[13] This is the kind of collectivity that I will call 'atom collectivity' in section 3.4.2.

by examples like (18), group NPs are also compatible with set predicates. This means that set predicates should also be able to range over impure atoms, and that collectivity effects may *also* be derived in two different ways:

(45) a. [[The group gathered]] =⇑**gather**(**the_group**)

b. [[The boys gathered]] = **gather**(**the_boys**)

In both (45a) and (45b), we conclude that the gathering was done by the boys or group members collectively, but the underlying logical forms are different. In (45b), the collective inference is supported by the formal semantics of set predication: plural, non-distributive predication over a set of entities. In (45a), however, the formal structure of the predication is singular predication over an impure atom, which, as we have seen, does not in itself support any kind of inference about the individual involvement of group members: we need to rely on the lexical meaning of the predicate *gather* to tell us that the sentence is a statement about a collectively performed action rather than a distributive one (cf. Scha's analysis of collectivity inferences). This means that singular predication over an impure atom is vague with respect to collectivity/distributivity inferences: we are free to interpret it either collectively or P-distributively or something in between, depending on the lexical semantics of the predicate and our world knowledge.

I will call the two collectivity options in (45) 'atom collectivity' and 'set collectivity', respectively (we could also think of them as 'Scha-style' and 'Link-style' collectivity, to emphasise the parallel with our discussion of the two different ways to derive distributivity effects); the distinction is relevant to the discussion in the next section.

(46) *Possible predication forms and their interpretation*

a. $*P_{et}(X_{et})$: Q-distributive

b. $P_{et}(x_e)$, with $x$ an impure atom: vague between P-distributive and atom-collective

c. $P_{(et)t}(X_{et})$: set-collective

## 3.5 Remarks on the syntax of Q-distributivity

In his original 1983 paper, Link conceived of pluralisation as a lexical phenomenon, in which starred predicates entered the derivation directly from the

lexicon. An alternative view (which I will refer to as the 'structural' view) is to regard the operator $*$ as a separate lexical item that combines with the predicate compositionally. For example, in Sternefeld (1998); Beck (2001); Beck and von Stechow (2007), $*$ has its own syntactic projection with the VP as its complement; Sternefeld (1998) and Joh (2008) argue explicitly that $*$ is the semantic translation of plural verbal morphology. See also Kratzer (2008) for an overview of and comparison between both positions (Kratzer herself argues for an analysis that incorporates both lexical and structural pluralisation).

It is easy to confuse the debate on where $*$ applies with the P- and Q-distributivity distinction presented in this chapter, but it is not the same. In the semantic framework I have developed in chapter 2 and the current chapter, Q-distributivity is an unavoidable consequence of pluralisation with $*$ (and therefore an inherent property of plural atom predication), while P-distributivity is an optional, context-sensitive property of *singular* predication (so explicitly *not* due to $*$). Seen in this way, any debate about where and how $*$ applies to predicates is a debate about the nature of Q-distributivity, with no bearing on P-distributivity.

That said, the distinctions between P- and Q-distributivity on the one hand and between lexical and structural Q-distributivity on the other, while technically independent, are not unrelated. As it turns out, many if not all the Q-distributivity tests presented in section 3.2 of this chapter can also be used as arguments in favour of a structural view of $*$ (and many of the arguments in favour of lexical $*$ that Kratzer puts forward could also be accounted for in terms of P-distributivity). Take for example the Q-distributivity test of VP disjunction (section 3.2.1). As (47) shows, assuming that the denotations of *sang* and *danced* are 'born' pluralised predicts that the sentence will be false in a 'mixed' situation in which Sue and Jane sang and Mary danced, but in fact we understand it as true in such a case.

(47) a. The girls sang or danced.

b. if $[[\textit{sang or danced}]] = [[\textit{sang}]] \cup [[\textit{danced}]] = *\mathbf{sing} \cup *\mathbf{dance}$,
then $[[\textit{sang or danced}]] = \{\{\mathbf{sue}\}, \{\mathbf{jane}\}, \{\mathbf{sue}, \mathbf{jane}\}\} \cup \{\{\mathbf{mary}\}\}$
$= \{\{\mathbf{sue}\}, \{\mathbf{jane}\}, \{\mathbf{sue}, \mathbf{jane}\}, \{\mathbf{mary}\}\}$
which means that $\{\mathbf{mary}, \mathbf{sue}, \mathbf{jane}\} \notin [[\textit{sang or danced}]]$

Compare this to the derivation in (7), where $*$ applies to the entire coordinated VP *sang or danced*: unlike the derivation in (47b), this derives the right truth conditions for (47a). The fact that (47a) is true in a mixed situation thus

supports an analysis in which predicates are 'born' singular and pluralised somewhere in the course of the derivation, rather than one in which they enter the derivation already pluralised. Moreover, it suggests that $*$ applies relatively late in the derivation, at a level higher than VP.

In this section, I will provide some additional support for the latter conjecture, based on the observation that VP coordination of a set predicate and a Q-distributive atom predicate does not seem to be possible.

Dowty (1987) observes that it is possible to coordinate collective and distributive predicates, as in (48) (the same point was made independently by Roberts 1987 and Lasersohn 1989):

(48) The students closed their notebooks, left the room and then gathered in the hallway after class.

Dowty, who takes for granted that all distributive inferences are operator-based, argues that this shows that the distributivity operator applies to individual predicates, rather than to the subject NP (a third option, which he does not consider but is also ruled out by this reasoning, is that it applies to the entire VP coordination at once). However, this reasoning crucially depends on the assumption that we cannot have distributivity without $*$, an assumption that I have shown to be incorrect in this chapter. If *closed their notebooks* and *left the room* are P-distributive, the intended interpretation can be derived without needing a distributivity operator anywhere, by treating all coordinated predicates as semantically singular and the subject as an impure atom. In short, the coordination in (48) is not guaranteed to tell us anything about the properties of $*$. The real question, therefore, is whether coordination of a collective and a *Q-distributive* predicate is possible (or, to be even more precise, coordination of a set predicate and a Q-distributive atom predicate).[14]

According to my own judgements[15], this does not actually seem to be the case. Let us have a look at a couple of examples ('DI' and 'CI' here refer to the interpretation of the second conjunct).

[14]The example often cited in later literature is Lasersohn's (1989) ''John and Mary met in the bar and had a beer'', which is compatible with a distributive interpretation of *had a beer*. In the next chapter, I will argue why this, too, is not necessarily Q-distributivity despite the involvement of an indefinite object. See also the final part of section 3.2.2.

[15]I have not done any systematic data-gathering here, although I have asked a couple of other Dutch native speakers for their judgements and they mostly agreed with me. Still, it would be worthwile to test this more systematically and in more languages.

(49) The guests are surrounding the happy couple and singing or dancing.

a. ⇔ The guests are surrounding the happy couple and singing or the guests are surrounding the happy couple and dancing. *(CI)*

b. ⇍ The guests are surrounding the happy couple and for each guest $x$, $x$ is singing or $x$ is dancing. *(DI)*

(50) John and Mary will meet in a bar and spot someone famous.

a. ⇔ There exists a famous person $x$ such that John and Mary will meet in a bar and spot $x$. *(CI)*

b. ⇍ John and Mary will meet in a bar and for each of them, there exists a famous person $x$ such that s/he will spot $x$. *(DI)*

(51) Jan en Marie moeten zonder ruzie uit elkaar gaan en goed voor hun kind zorgen. *(Dutch)*
*Jan and Marie must without fight from each.other go and well of their child take.care*
'John and Mary should separate without fighting and take good care of their child.'

a. ⇔ John and Mary should separate without fighting and take good care of the child they have together. *(CI)*

b. ⇍ John and Mary should separate without fighting and each take good care of their own child. *(DI)*

Comparing these examples and the available interpretations to the data in (6), (8) and (14), we see that the Q-distributive interpretation systematically disappears when the predicate is coordinated with a set predicate. In (49), all the guests have to be either singing or dancing; there is no 'mixed' interpretation. In (50), *someone famous* necessarily takes scope over *John and Mary*. And in (51), *hun kind* 'their child' needs to refer to one child who is the child of both John and Mary.

One way to interpret these data is as support for an analysis in which (some appropriate version of) the distributivity operator applies to NPs, so that a single NP cannot be semantically compatible with both a set and an atom predicate (cf. Bennett 1974 and more recently Ouwayda 2011, 2014). But since this would require an extensive revision of our background assumptions, we will not explore this further here.

Instead, I propose to account for this in terms of a third option not mentioned by Dowty: $*$ applies not at the level of the VP itself, but higher, at the functional level where verb inflection is located (IP) (cf. Roberts 1987). Another way of putting this is that $*$ always has to be licensed by plural morphology - it is not a freely available operation, like singularisation or impure atom formation. (This idea also fits in nicely with our general approach of treating Q-distributivity as a 'side-effect' of pluralisation.) So, if we have multiple coordinated VPs headed by a single IP, there are only two options: either $*$ applies to its complement, i.e. the intersection of all coordinated predicates, or it does not. When both coordinated predicates are atom predicates, the result of applying $*$ to their intersection is indistinguishable from taking the intersection of two starred predicates:

(52) $[[\textit{are singing and dancing}]] = *(\mathbf{sing} \cap \mathbf{dance})$
$:= \wp(\mathbf{sing} \cap \mathbf{dance}) - \{\varnothing\}$
$= (\wp(\mathbf{sing}) \cap \wp(\mathbf{dance})) - \{\varnothing\}$
$= (\wp(\mathbf{sing}) - \{\varnothing\}) \cap (\wp(\mathbf{dance}) - \{\varnothing\})$
$=: *(\mathbf{sing}) \cap *(\mathbf{dance})$

However, when one of the coordinated predicates is a set predicate, things change. Since uninflected atom predicates range of atoms and uninflected set predicates range over sets, they do not have the same type, and hence cannot be coordinated (and even if we do allow for the coordination of differently-typed predicates, their intersection will be empty). So the only way to interpret a coordinated atom and set predicate when $*$ is not available at VP level is to singularise the set predicate first. The result will be a set consisting of just the impure atoms that are members of both predicates:

(53) $[[\textit{gathering in a circle and dancing}]] =$
$\mathbf{gather}_{(et)t} \cap \mathbf{dance}_{et}$ *type mismatch*
$(\Uparrow\mathbf{gather})_{et} \cap \mathbf{dance}_{et}$ *type mismatch resolved*
$\Leftrightarrow \{x = \uparrow X \mid X \in \mathbf{gather} \text{ and } x \in \mathbf{dance}\}$

So, from our assumptions in chapter 2 plus the stipulation that $*$ applies at IP level, the only possible denotation of a coordination like *gathered in a circle and danced* (if we rule out type mismatches) is a set of impure atoms. At this point we could apply $*$; this would result in a predicate over sets of impure atoms, appropriate for the denotation of a plural group NP (e.g. *the committees*).[16] As

[16] For more on the semantics of group NPs, see chapter 5.

predicted, such a predication will be true iff each of the committees is gathering in a circle and dancing (54). Alternatively, we could not apply $*$[17] and end up with a predicate over impure atoms, which could then be applied to any plural subject, provided this gets mapped into an impure atom first (55).

(54) $(*((\Uparrow\mathbf{gather}) \cap \mathbf{dance}))(\mathbf{the\_committees})$
$= 1$ iff $\forall x \in \mathbf{the\_committees} : x \in \Uparrow\mathbf{gather}$ and $x \in \mathbf{dance}$

(55) $((\Uparrow\mathbf{gather}) \cap \mathbf{dance}))(\uparrow\mathbf{the\_girls})$
$= 1$ iff $\uparrow\mathbf{the\_girls} \in \Uparrow\mathbf{gather}$ and $\uparrow\mathbf{the\_girls} \in \mathbf{dance}$
$\Leftrightarrow \mathbf{the\_girls} \in \mathbf{gather}$ and $\uparrow\mathbf{the\_girls} \in \mathbf{dance}$

As we have seen, predications over impure atoms are vague between a P-distributive and an atom-collective interpretation; in the above case, the lexical semantics of *gather* supports an atom-collective inference, and the lexical semantics of *dance* a P-distributive one.

It should now already become clear how this analysis may account for the lack of a Q-distributive interpretation of the second conjunct in predicate coordinations like *are surrounding the happy couple and [singing or dancing]*: because the denotation of such a coordination is necessarily a set of impure atoms, the contribution of *singing or dancing* to that set are precisely those impure atoms that are either members of **sing** or of **dance**. An impure atom corresponding to a certain set $X$ will be a member of a predicate $P$ just in case the members of $X$ are also members of $P$. So *singing or dancing* only contributes groups of singers and groups of dancers, not mixed groups consisting of some singers and some dancers. This is the case regardless of whether or not we apply $*$ to the set corresponding to *are surrounding the happy couple and [singing or dancing]*. Formally:

(56) [[*surrounding the happy couple and [singing or dancing]*]] =
$\mathbf{surround}_{(et)t} \cap (\mathbf{sing}_{et} \cup \mathbf{dance}_{et})$ *type mismatch*
$(\Uparrow\mathbf{surround})_{et} \cap (\mathbf{sing}_{et} \cup \mathbf{dance}_{et})$ *type mismatch resolved*
$\equiv \{x = \uparrow X \mid X \in \mathbf{surround}$ and $x \in \mathbf{dance}$ or $x \in \mathbf{sing}\}$

[17] I have been implicitly assuming that $*$ is optional, even for syntactically plural atom predicates. The precise link between plural morphology and $*$ is something that any 'structural' theory of pluralisation will have to solve: to make the theory work, we need to assume that $*$ is *licensed* by plural morphology but not *denoted* by it. How to implement this formally is a really interesting question that I will not however address here, because it seems to me that the solution will require a considerable syntactic component that is beyond the scope of this dissertation.

So the observation that the Q-distributive interpretation of *singing or dancing* seems to disappear when it is coordinated with a set predicate is accounted for by our theory of plurality together with the assumption that $*$ may only apply at the IP level.

Let's sum up this section. The Dutch and English coordination data suggest that VP coordination of a set-collective and a Q-distributive predicate is not possible, which does not fit with a theory of pluralisation according to which the $*$ operator applies to predicates at the level of the VP itself (either because VPs are 'born plural', as in lexical theories of pluralisation, or because they are pluralised in syntax immediately after entering the derivation). Instead, it suggests that pluralisation happens at a syntactic level higher than VP; I have proposed that it applies at IP, where it is licensed by the presence of plural inflection. The upshot of this is that semantic pluralisation is closely related to the presence of plural morphology; in chapter 5, I will provide more evidence for this idea.

## 3.6 Conclusions

In this chapter, I have argued that distributivity effects can be derived in two different ways: either by world knowlegde-based reasoning about parts and wholes in relation to a predicate meaning (P-distributivity), or by covert quantification over members of a collection, which is a direct effect of predicate pluralisation with $*$ (Q-distributivity). P-distributivity is available with both morphosyntactically plural NPs and with group NPs, but in both cases the formal analysis is the same: singular predication over an impure atom. Q-distributivity is available with plural NPs but not with group NPs, a contrast that supports an analysis of groups as atomic entities.

In addition, I have presented some support for a structural, clausal analysis of $*$, according to which it is not part of the VP itself but applies at a separate syntactic level higher up in the derivation, where it is licensed by the presence of plural number inflection.

# CHAPTER 4

## Polyadic P-distributivity and indefinites as properties

This chapter will be devoted to an issue that briefly came up in the previous one: the analysis of distributivity in sentences with an indefinite object.

(1) The boys ate a pizza.

Sentences like (1), which have a distributive interpretation according to which the boys ate a pizza each, have been used by e.g. Winter (1997); Brisson (1998) in support of a quantificational, $*$-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 (1) 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*. The pluralisation operator $*$ provides such a quantifier.

In chapter 3, we 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. Sentences like (1), however, provide a problem for this account. If we replace *the boys* from (1) with a group NP, it would follow from our analysis in chapter 3 plus the above reasoning that the distributive interpretation should disappear. However, it does not: sentence (2) is just as

ambiguous as sentence (1).

(2) The team ate a pizza.

a. $\Leftarrow$ There is a pizza $x$ such that the team ate $x$. *(CI)*

b. $\Leftarrow$ For each team member $y$, there is a pizza $x$ such that $y$ te $x$. *(DI)*

The lack of contrast between (1) and (2) thus seems to provide a counterargument for the atomic analysis of group NPs as argued for in chapter 3. Since this particular analysis was an essential component of the empirical argument presented in that chapter (according to which we need both P- and Q-distributivity as part of our semantic toolbox), we may wonder how these data affect the validity of this conclusion.

In this chapter, I will argue that it will not be necessary to revise our particular analysis of group NPs and P-distributivity; rather, the claim that sentences like (1) cannot be analysed without Q-distributivity is wrong. I claim that the indefinite in (1) and (2) may be analysed as (an individual correlate of) a property rather than a quantifier, which 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 (2) (and possibly also (1)) can be regarded as a case of two-place P-distributivity, comparable to the analysis of codistributivity cases in Scha (1981) and Winter (2000).

The chapter is structured as follows. In section 4.1, I will take a closer look at the relevant data and their possible implications for our theory of group NPs and P-distributivity as presented in chapter 3. In section 4.2, I will account for these data in terms of a property analysis of indefinites. In section 4.3 I will explore two alternative accounts of the data, and show that none of them accounts for the data as fully as the property analysis does. Finally, in section 4.4 I will address some remaining issues, looking (among other things) at the interaction of P-distributivity and number implicatures, so-called 'stubbornly distributive' predicates that lack expected P-distributive interpretations, and the problem of assigning a property denotation to non-upward-entailing modified numerals. Section 4.5 concludes this chapter.

## 4.1 Distributivity effects with group nouns and indefinites

The truth-value judgements for (1) and (2) 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 (1) also accept one in the case of (2). And in Dutch, where dependent plurality is optional but the singular is preferred, the equivalent of (2) is unproblematic (from this point on, I will not explicitly paraphrase the available interpretations every time, but simply use 'CI' and 'DI' to indicate whether they are available):

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

b. Het team draagt een blauw shirt. *(CI/DI)*
*The team wears a blue shirt*
'The team is wearing a blue shirt'

The apparent Q-distributivity over group nouns also happens with numerical indefinites; examples like (4) seem to be fine in all varieties of English I have encountered:

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

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

(5) 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 3.3.2? 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 *are* accessible to the semantics, perhaps because group denotations can shift into sets under certain circumstances. Such a shift - the opposite of our impure atom mapping $\uparrow$ - is proposed by Landman (1989)

for independent reasons.[1] This line is pursued by Magri (2012), who mentions the distributive interpretation of sentences like (3-5) 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 chapter 3) 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 numerical and *a*-indefinites. It is this approach that I will develop here.

## 4.2 Analysis: P-distributivity beyond unary predicates

In this section, I propose that the group distributivity cases with indefinite objects can all be accounted for if we analyse them as cases of P-distributivity. 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 (6a) in terms of direct predication over an impure atom (as in (6b)), we can analyse a sentence like (6c) as a relation between two impure atoms (as in (6d); cf. Scha 1981). And just as (6b) is vague with respect to the involvement of particular individuals, (6d) is vague with respect to the particular relations: we cannot tell if all the boys and all the girls were involved

[1] Landman proposes an operator $\downarrow$ 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 (i):

(i) 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 set. But note that this only works (at least in American English) if the group name is morphologically plural:

(ii) a. ??The Cure are pop stars.

b. *The committee are good managers.

The contrast between (i) and (ii) 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.

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

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.

(6) 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 introduced by the indefinite would necessarily take scope over the whole group, yielding (for example) (7b) as the only possible interpretation of (7a):

(7) 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 (7a) and similar sentences denotes a property, which I view here as something very similar to a group - a higher-order entity that allows P-distributivity over its individual instantiations. Thus, just as the verb in (6c) denotes a relation between two pluralities, it denotes a relation between a property and a group in (7a); and just as with (6c), any inferences about individual members of the group or individual instances of the property are due to P-distributivity, not based on quantification.

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 Carlson (1977) and Milsark (1974), in which they can denote kinds or properties, and the work of Kamp (1981) and Heim (1982), in which they denote free variables. McNally (1992) and Zimmermann (1993) propose that indefinites may also be interpreted as properties (of type $\langle e, t\rangle$) even outside of the predicate position, 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 and de Swart (2003) and Chung and Ladusaw (2004), among others. Assuming that indefinite PP complements denote properties, Mador-Haim and Winter (2007, 2012) argue that a puzzling contrast between the interpretations of certain PPs follows naturally.[2]

There are several definitions of what precisely counts as a property-type indefinite; I follow e.g. Chierchia (1998) in defining them as those indefinites that are allowed in predicative position. Thus, the NPs in (8a-b) count as properties, the ones in (8c) do not:

(8) a. John is { a doctor. / a friend of mine. }

b. John, Mary and Sue are { doctors. / three friends of mine. }

c. John is { *some doctor. / *some friend of mine. / ??a doctor I met at a conference ages ago. }[3]

A recurring question in the literature on property indefinites in argument position is how they compose with the predicate. After all, unless the relevant predicates are systematically ambiguous, there is 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 two ways to go about this: there might be some special operation that composes verbs and property-type arguments (e.g. Chung & Ladusaw's Restrict or Van Geenhoven's Semantic Incorporation), or the

[2] See also section 4.3.2.

[3] The third sentence is not ungrammatical per se, but it is much more likely to be interpreted as an identity statement: an answer to the question 'Who is John?' rather than 'What is John?', where *a doctor I met at a conference ages ago* is an argument and not a predicate.

property might shift into its entity correlate (cf. Chierchia 1984, 1985; McNally 1992; Mueller-Reichau 2006; McNally 2009). I think the second approach is the most appropriate in this case: we have been talking about P-distributivity as involving reasoning about entities with a salient part-whole structure, and an individual correlate of a property seems just this kind of thing.

What, then, is an individual correlate of a property? Chierchia (1984, 1985), following a much earlier observation by Frege, notes that we can attribute properties to entities but also to other properties, suggesting that properties can function both as predicates and as arguments:

(9) a. The sky is blue.
b. (Being) blue is beautiful.

He proposes a typeshift $\cap$ that turns properties (type $\langle e,t\rangle$)[4] into their entity correlates (type $e$), such that (9a-b) can be analysed as follows:

(10) a. **blue**(**the_sky**)
b. **beautiful**($\cap$**blue**)

The semantics of our polyadically P-distributive sentence *The team is wearing an orange vest*, then, can be derived according to the following steps:

(11) Let

[[the team]] = **the_team** (type $e$)
[[an orange vest]] = [[orange vest]] = **orange_vest** (type $\langle e,t\rangle$)
[[is wearing]] = $\lambda x\lambda y[(\mathbf{wear}(x))(y)]$ (type $\langle e,et\rangle$)
$\cap$ = a function of type $\langle et,e\rangle$

Then:
(i) $\lambda x\lambda y[(\mathbf{wear}(x))(y)](\mathbf{orange\_vest})$ *(type mismatch)*

Following the common assumption that a type mismatch may trigger a typeshift (if an appropriate typeshift is available in the grammar), we apply $\cap$ and the derivation proceeds as follows:

(12) (ii) $\lambda x\lambda y[(\mathbf{wear}(x))(y)](\cap\mathbf{orange\_vest})$
(iii) $\lambda y[(\mathbf{wear}(\cap\mathbf{orange\_vest}))(y)]$
(iv) $\lambda y[(\mathbf{wear}(\cap\mathbf{orange\_vest}))(y)](\mathbf{the\_team})$
(v) $(\mathbf{wear}(\cap\mathbf{orange\_vest}))(\mathbf{the\_team})$

[4] Or actually type (type $\langle s\langle et\rangle\rangle$) - Chierchia analyses properties as intensional functions. For simplification, I will follow the example of Partee (1987) and McNally (2009) and misrepresent $\cap$ as an extensional typeshift from sets of entities to entities.

Chierchia's $^\cap$ operator is very similar to our impure atom typeshift $\uparrow$ - both turn a set into an entity that, while being semantically singular, has a salient conceptual part-whole structure reflecting its close relationship with its corresponding set. The impure atom **the_team** is semantically singular, but conceptually it still refers to a collection of individuals; similarly, the property $^\cap$**orange_vest** is semantically singular, but conceptually the parts that 'make up' this property entity are individual orange vests. I will refer to this kind of semantically singular but conceptually plural entities as *higher-order entities*. I will not conflate the two different operations that produce them ($\uparrow$ and $^\cap$), however, since completely eliminating the formal difference between impure atoms and properties leads to problems when trying to capture the interpretation of verbs like *wear* using the kind of pseudo-equivalences we have seen at work in chapter 3 (section 3.4.1). In (13), we see how a pseudo-equivalence can be used to interpret a *wear*-relation between an impure atom and a property[5]:

(13) For every impure atom $x$ and property $^\cap y$:
$\mathbf{wear}(x,^\cap y) \leftrightsquigarrow \forall x'[x' \text{ is a part of } x \rightarrow \exists y' \in y[\mathbf{wear}(x', y')]]$

Note that this postulate has nothing to say about the orange vests that are *not* worn by a member of the team; the only thing that is required (with the room for vagueness and context-dependency that is characteristic of these pseudo-equivalences) is that each team member is wearing a vest. But this is not the interpretation that **wear**($x$,$y$) receives if $y$ is a higher-order individual associated with a referential NP like *the orange vests* or *the 2014 summer collection* in (14):

(14) The team is wearing $\left\{ \begin{array}{l} \text{the orange vests} \\ \text{the 2014 summer collection} \end{array} \right\}$.

For this sentence to be true, it is not enough that every team member is wearing an orange vest or an item from the summer collection: it must also be true that each of the orange vests or items from the collection is worn by a member of the team. So, incorporating the pseudo-equivalence in (13) into the lexical

[5] In the rest of this chapter, I will often simply talk about 'properties' as a shorthand for 'individual correlates of properties', not just to save time and space but also because ultimately it does not really matter what implementation we choose. I have chosen to formalise the property-based account of polyadic P-distributivity in terms of entity correlates just to make the semantics more explicit, but if future work should show that there is actually some kind of Semantic Incorporation at work here, the idea behind this analysis would not be invalidated. The important point is that the indefinites in question denote properties, and it is this point that I will stress in the remainder of this chapter.

semantics of **wear** is not enough. We also need the postulate in (15) (cf. Scha 1981):

(15) For all impure atoms $x$ and $y$:
$\mathbf{wear}(x, y) \leftrightsquigarrow \forall x'[x' \text{ is a part of } x \rightarrow (\exists y'[y' \text{ is a part of } y \wedge \mathbf{wear}(x', y')])] \wedge$
$\forall y'[y' \text{ is a part of } y \rightarrow (\exists x'[x' \text{ is a part of } x \wedge \mathbf{wear}(x', y')])]$

To sum up, since higher-order entities corresponding to referential NPs are interpreted differently when it comes to two-place P-distributive relations than higher-order entities corresponding to properties, I will keep the two apart in our notation: $\uparrow$ derives the former, $\cap$ the latter.

### 4.2.1 Additional evidence for a property analysis

#### Co-argumenthood

The polyadic P-distributivity approach predicts that in order to get P-distributivity with both a group and a property, they have to be arguments of the same predicate (see Sauerland 1994; Winter 2000, for a similar point in a different context). This is because P-distributivity is a lexical phenomenon: it is rooted in the relationship between a predicate and its (higher-order) arguments, as captured by pseudo-equivalences like the ones in (14) and (15). And as (16b) shows, sentences with a group subject where the indefinite does not directly compose with the predicate seem to lack a DI (the judgements are admittedly subtle):

(16) a. The children will get upset if a drawing is taken off the wall.
$\Leftarrow$ For every child $x$, there is a drawing $y$ such that $x$ will be upset if $y$ is taken off the wall. *(DI)*
$\Leftarrow$ For every child $x$, $x$ will be upset if there is a drawing $y$ such that $y$ is taken off the wall. *(CI)*

b. The class will get upset if a drawing is taken off the wall.
$\not\Leftarrow$ For every child $x$, there is a drawing $y$ such that $x$ will be upset if $y$ is taken off the wall. *(DI)*
$\Leftarrow$ For every child $x$, $x$ will be upset if there is a drawing $y$ such that $y$ is taken off the wall. *(CI)*

Consider the following situation. Ms Smith, an art teacher, has picked one drawing from each of the pupils in her class to put up on the wall of her classroom. But over time, wall space has become limited and Ms Smith fears

she'll have to remove some of the drawings. Now, imagine that Ms Smith's class is a very close-knit group, and Ms Smith knows that if she removes any of their drawings, the entire class will be upset. In this situation, both (16a) and (16b) are true.

We might also imagine that the children in Ms Smith's class are not so close to each other, but they are quite insecure about their own talents. Ms Smith knows that they will not care much if the drawing of one of their classmates is taken off the wall, but each of them will be quite upset if his or her own drawing gets removed. Now, (16a) is true but (16b) is not.

This is what the polyadic P-distributivity approach predicts: since the indefinite *a drawing* is not an argument of the predicate *get upset*, it cannot be related to *the class* or *the children* by P-distributivity. In the case of (16a), the DI can still be the result of Q-distributivity, but that option is unavailable for (16b), which has a group noun subject. Thus, the contrast between (16a) and (16b) follows.

This coargument requirement is similar in spirit to the way indefinite objects are treated in the semantic incorporation literature, in which predicate and indefinite object are often analysed more like a complex intransitive predicate than like a predicate with one argument saturated. Both the coargument requirement on P-distributivity and the 'incorporation' accounts of property-type objects emphasise the lexical character of this close bond between predicate and object (cf. Carlson 2006).

### Underspecification versus ambiguity[6]

In the present analysis, binary P-distributivity is analysed as a relation between two higher-order entities that is underspecified with respect to the relations that hold between particular members or instantiations of these entities. This also means (as already argued in section 3.1) that the difference between P-distributivity and atom 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 (17) show how VP ellipsis can distinguish underspecification from ambiguity:

(17) a. The floor is clean and John's scalpel is, too.

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

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

Sentence (17a) can be true even if the notion of cleanliness is quite different for a scalpel than it is for a floor: *clean* is underspecified with regard to the level of cleanliness required, and nothing stops both conjuncts from being specified in different ways (the floor is clean because there's no visible dirt on it; the scalpel is clean because it is completely sterile). In (17b), 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. Assuming that VP ellipsis is only possible if the second conjuncts semantically parallels the first, this means that scope ambiguities should be reflected in the logical form of a sentence, while levels of cleanliness should not.

If the distinction between P-distributivity and collectivity is like the distinction between sterile and not visibly dirty, 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 ambiguity, we expect that both conjuncts should receive the same interpretation: either both collective, or both distributive. The example in (18) suggests that the first option is the right one:

(18) 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.

The judgement is a bit subtle here, but I believe that the second sentence in (18) does not contradict the first; most of my English-speaking informants also agreed that there is no contradiction. 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 (Kratzer 2008, makes a very similar point).

A caveat is needed at this point: not all cases of vagueness are well-behaved with respect to the VP-ellipsis test. For example, in sentence (19), it is very hard (if not impossible) to interpret the overt VP as 'start-to-cook' and the elided one as 'start-to-eat':

(19) John started dinner, and Mary did, too. ??Only John started cooking his dinner and Mary started eating hers.

Still, we probably would not want to claim that *start x* should be ambiguous

between 'start to cook $x$' and 'start to eat $x$' (and, presumably, 'start to read $x$', 'start to write $x$', 'start to sing $x$', 'start to smoke $x$' and dozens more).

Similarly, mixed collective/P-distributive interpretations are not always as acceptable as (18) suggests. For example, it is not very easy to get a mixed interpretation in the following case:

(20) The red team carried a piano upstairs and the blue team did, too. ?Only the members of the red team carried a piano together and the members of the blue team each carried one individually.

Thus, it seems that the VP ellipsis test is mainly useful for distinguishing a subset of the vagueness cases from the rest of the vagueness cases plus ambiguity: if different interpretations are possible, we are definitely dealing with underspecification, if they are not, it could be either underspecification or ambiguity. While cases of ambiguity fail the VP-ellipsis test for semantic reasons, the reason that some cases of vagueness fail may be more pragmatic: the use of a VP ellipsis construction implicates that we are talking about very similar situations (if not, we would probably have given more information), and starting to cook and starting to eat (or, carrying a piano singlehandedly and being one of many carriers) may simply not be 'similar' enough to merit this.

Even if mixed collective/P-distributive interpretations of VP ellipsis constructions are not always fully acceptable, the fact that mixed interpretations are possible in at least some cases shows that they are not ruled out by the semantics. They might be marginal for pragmatic reasons, but so are other cases of VP-ellipsis with underspecified predicates (like *start*). All in all, the VP-ellipsis test gives us reason to assume that an account of the distinction between collectivity and P-distributivity in terms of vagueness is on the right track.

## 4.3 Alternatives to the P-distributivity analysis

In this section, I will discuss two alternative analyses of the group distributivity data that do not involve property-type indefinites: group credit and quantification over kinds. I argue that neither of these alternative approaches is able to fully account for the data.

### 4.3.1 Group credit[7]

One might argue that we could analyse group distributivity as a special case of a 'group credit' interpretation, which in turn is a special case of collectivity. Consider the following sentence:

(21) The team is holding up a trophy.

Sentence (21) can be true if only one of the team members (say, the captain) is actually holding a trophy: because the captain represents his team in doing so, the entire team 'takes credit' for the trophy-holding and (21) can be considered true on its collective interpretation. Similarly, we might say that if some representative proportion of the team is wearing a blue shirt, the team as a whole is wearing a blue shirt, and therefore the collective sentence *The team is wearing a blue shirt* can be true in a 'distributive' situation where each individual team member is wearing their own shirt.

If group distributivity is a special case of group credit, it should behave in a similar way. In particular, we expect the group-distributive reading to persist under an existential paraphrase, just as happens with the group credit-reading of our trophy sentence: both (21) and its existential paraphrase in (22a) are verified by a situation in which some representative member of the team (and no one else) is holding up the trophy. However, the same relation does not hold between the group-subject sentences in (22b-c):

(22) a. There is a trophy that the team is holding up.

b. The team is wearing a blue shirt.

c. There is a blue shirt that the team is wearing.

Unlike (22b), sentence (22c) cannot be interpreted distributively - it is false in a situation in which every team member is wearing his or her own blue shirt (unless we read *a blue shirt* as 'a *kind* of blue shirt'). So while group credit interpretations persist under an existential paraphrase, group-distributive interpretations do not. This contrast between group credit and group distributivity cannot be explained under an analysis that treats them as essentially the same phenomenon. I therefore conclude that this kind of analysis cannot fully account for the group distributivity data.

[7]This alternative analysis was suggested to me by Roger Schwarzschild (p.c.)

### 4.3.2 Quantification over kinds

The second alternative analysis is based on the aforementioned observation that sentence (22b) is compatible with every individual team member wearing their own shirt if we interpret *a shirt* as 'a kind of shirt'. From this, we might conclude that the group distributivity effect in *The team is wearing a blue shirt* is a matter of quantification over kinds as well: the noun *shirt* does not denote a set of ordinary objects but a set of kinds (each of them a subkind of *shirt*), and *The team is wearing a blue shirt* is interpreted as the assertion that there is a subkind of shirt (say, the polo shirt) of which the team members are wearing instantiations. Again, this assertion is compatible with a situation in which every team member is wearing their own shirt.

Quantification over kinds may be able to explain part of our group distributivity data - it is hard, if not impossible, to prove that it is not involved - but it does not explain all of it. In particular, there is a contrast between *a*- and *some*-indefinites that would remain quite mysterious under this analysis. Consider the following data:

(23) a. A rare owl was sighted in this forest recently.
b. Some rare owl was sighted in this forest recently.

(24) a. The team is wearing a blue shirt.
b. The team is wearing some blue shirt.

The pair of sentences in (23) shows that *some*-indefinites can quantify over kinds as easily as *a*-indefinites can: (23a) and (23b) are both grammatically correct, and truth-conditionally equivalent. However, this is not the case for the sentences in (24), which are both grammatical but do not have equivalent meanings. Sentence (24b) requires that every team member is wearing the same kind of blue shirt; if half of the team is wearing a polo shirt and the other half a button-down shirt, the sentence is false. This follows when we analyse the sentence in terms of existential quantification over kinds. However, (24a) can be true in such a situation, which cannot be explained under a quantification-over-kinds analysis.

Here is another way to capture the difference between the data with *a* and *some*. While (24a) is truth-conditionally equivalent to its existential paraphrase, this does not hold for (24b), as shown here:

(25) a. The team is wearing some blue shirt
⇔ There is some blue shirt that the team is wearing.

b. The team is wearing a blue shirt
   ⇏⇐ There is a blue shirt that the team is wearing.

Under a fully quantificational analysis, we expect all the sentences in (25) to be equivalent. However, this is only the case for the pair in (25a). The pair of sentences in (25b) is not truth-conditionally equivalent because the first allows for a multiple-kinds-of-shirt interpretation while the second, like its counterpart with *some*, does not. It follows that the truth conditions of the first sentence are not fully captured by a quantificational analysis of the indefinite.

Concludingly, while quantification over kinds is able to account for certain distributivity effects with groups in the case of *some*-indefinites, it fails to fully account for the data involving *a*-indefinites.

Under the P-distributivity analysis, the difference between *a* and *some* can be accounted for in terms of their ability to form property-denoting NPs: while *a*-indefinites can easily be analysed as properties, *some*-indefinites are nearly always quantificational. We find this difference between *a* and *some* with nearly all of the previously-mentioned phenomena that have been argued in the literature to involve property-type indefinites (the judgements below are my own, not the original authors'):

(26) *Be*-predicates:

a. John is a linguist.

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

In (26a), 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, (26b) 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:

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

a. John is looking for a secretary.

b. John is looking for some secretary.

On its opaque reading, (27a) 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 secretary that John is looking for. In contrast, I am unable to get the opaque reading for (27b): it only has the transparent reading (in addition to a 'some kind of'-reading comparable to the one in (27b)). If we claim, with Zimmermann, that opaque readings result when the verb takes a property-type complement, this again suggests that property denotations are unavailable for *some*-indefinites.

(28) Eigenspace semantics (Mador-Haim and Winter 2007):

a. We're far from a gas station.

b. We're far from some gas station.

The same pattern again appears in (28a-b). Sentence (28a), 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* denotes 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 does not seem to be available with the *some*-indefinite in (28b).

Finally, there are light verb constructions like *have a smoke*, *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 smoke*, *to walk*, *to fuss* - without loss of information):

(29) Light verbs (cf. de Hoop 1996):

a. John took a walk.

b. John took some walk.

Unlike the light verb reading of (29a), (29b) cannot be paraphrased as 'John walked' without loss of information, because unlike (29a) it asserts that there exists a *particular* walking route that John took. In contrast, the *a*-indefinite in (29a) shows all the signs of property denotation: it is nonspecific, number

neutral, and scopes with the verb. Again, the *some*-indefinite only seems to have a quantificational interpretation, while the *a*-indefinite can denote either a quantified expression or a property.[8]

All in all, if we take the claims made in the literature about the kind of linguistic phenomena that rely on property-type indefinites at face value, the above contrasts suggest 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 attributes certain group distributivity effects to the involvement of property-type indefinites, it predicts (correctly, as we have seen earlier in this section) that these effects will be easily available with *a*-indefinites, but not with *some*.

## 4.4 Remaining issues

In the next two sections, we take a look at two cases that show that the available interpretations of a predication over an impure atom are not always fully determined by world knowledge or reasoning about parts and wholes. In this section, I argue that P-distributivity also involves the relativisation of number implicatures to individual group members, which puts a limit on the number of interpretations a group-distributive sentence may have. Section 4.4.2 discusses cases where P-distributivity is completely unavailable.

### 4.4.1 P-distributivity and implicature

Consider the following data:

(30) a. #The team is wearing a blue sock.

b. The team is wearing two blue socks / a blue and a green sock.

Sentence (30b) is fine in a situation where every team member is wearing two socks; (30a), though, is very odd. This number sensitivity is unexpected if we analyse (30a) as expressing a relation **wear** between the group **the_team** and the property $^{\cap}$**blue_sock**. World knowledge tells us that socks tend to be worn in pairs, so if the pseudo-equivalences governing our interpretation of predicates like *wear* are really as context-sensitive as I have claimed (following Winter and

[8] With existential *there*-sentences (which (McNally 1992) argues involve property-type NPs), the contrast is less clear - *There is some cat in the garden* is fine, and although a taxonomic kind reading ('some kind of cat') seems the most readily available, it also has a reading on which its meaning is identical to that of *There is a cat in the garden.*

Scha to appear) in sections 3.4.1 and 4.2, there might well be a P-distributive interpretation of such a relation that links single team members with pairs of socks. And yet this interpretation is out. If **wear**(**the_team**,$^{\cap}$**blue_sock**) is vague with respect to the particular relationships that hold between team members and blue socks, why does (30a) only seem to mean that the team members are each wearing just a single sock?

The fact that the statement in (30a) seems more odd than false suggests that the manifested number sensitivity is pragmatic in nature. Compare the oddness of (31) (uttered while I am perfectly aware that I own two guinea pigs):

(31) #I have a guinea pig.

While (31) is strictly speaking true in a world in which I have two guinea pigs, it is infelicitous because the use of a singular indefinite triggers the implicature that I have only one - after all, if I did have more than one guinea pig, I could just as easily have made the stronger claim *I have two guinea pigs*. Similarly, sentence (30a) is infelicitous because it implicates that the team members are wearing just a single sock.

Support for the claim that the number sensitivity in (30a) is an implicature comes from the fact that, like other implicatures, it can be cancelled:

(32) The team is wearing a blue sock. In fact they're wearing two of them.

The number implicature triggered by the use of a singular indefinite - 'not more than one sock' - is relativised to individual group members (the situation as a whole may well involve many more socks than one). From this, we can conclude that P-distributivity does not just link the *semantic* content of a predicate to individual members of a higher-order entity: any implicatures associated with the predicate are carried along to the individuals as well.

### 4.4.2 Stubborn distributivity and *weigh*-predicates

In discussing P-distributivity, I have so far been talking about 'lexical semantics' and 'world knowledge' in a rather loose way, as if the former is merely a way of capturing the latter a bit more formally. But I do not want to suggest that this is the case. Of course, the two are closely related; however, 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. Some predicates do not seem to be vague between a collective and a P-distributive interpretation, even though this might very well be possible according to our knowledge of the

world. For example, according to Schwarzschild (2009), sentence (33a) has no interpretation under which it means the same as (33b), and vice versa:

(33) a. The boxes are large.

b. The collection of boxes is large.

According to Schwarzschild's judgements, sentence (33b) can only mean that the collection itself is large, not that the boxes that make up the collection are. Sentence (33a) 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). World knowledge tells us that largeness can be a property of individuals as well as collections, so why are not both of the sentences in (33) vague between two interpretations? Schwarzschild (2009) suggests that predicates like *large*, which he calls 'stubbornly distributive', can only apply to single-participant events, which rules out a collective interpretation for (33a) (the boxes together are large). In principle, this approach is not incompatible with the current one - stubborn distributivity is still a lexical property of the predicate and could easily be captured in the form of a pseudo-equivalence. Still, cases like these tell us that delegating semantic tasks to 'world knowledge' or 'context-sensitivity' easily leads to overgeneration if we do not carefully define what we mean by this.

In addition to the stubbornly distributive predicates, there are other predicates that seem to lack a distributive interpretation when they occur with a group subject. An example is *weigh*:

(34) a. These athletes weigh 60 kilos.

b. This team of athletes weighs 60 kilos.

*Weigh 60 kilos* is not stubbornly distributive: sentence (34a) is vague between a distributive and a collective interpretation. However, (34b) seems unambiguously collective. Again, it is not clear why the P-distributive interpretation is unavailable in the latter case, as nothing in our world knowledge would rule it out (in fact, it is a much more likely interpretation than the collective one).

I do not see an immediate explanation for these facts, but I would like to leave open the possibility that the 'missing' P-distributive interpretation of *The team is large* and *The group weighs 60 kilos* are not actually blocked, but (for some reason) need to be made extremely salient by context before they become acceptable. (Of course, this would in itself require an explanation.) For

example, I am not so sure that *The group weighs 60 kilos* cannot be interpreted distributively in the following context:

(35) The contestants in this boxing match have been divided into three different weight classes. Watch them enter the arena in groups corresponding to their weight class! The first group weighs up to 80 kilos, the second group weighs 80-100 kilos, and the third group weighs 100 kilos and up.

And similarly for *large*:

(36) A family of four, all renowned hamburger-eating champions, wants to book seats for tonight's performance of *Hamlet*. We'd better bring in some plus-size chairs, because this family is *large*.

If this were true, and we could bring out the 'missing' distributive interpretations in the right context, the only thing that would be left to explain would be the lack of collectivity effects with stubbornly distributive sentences like *The boxes are large*. As this issue is independent of the present analysis, I will leave it for further research (see Schwarzschild 2009 for an event-based analysis of stubborn distributivity).

### 4.4.3 A remark on modified numerals

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

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

(37) is true if every *member* of the battalion received the number of medals mentioned, so under our analysis of group distributivity, the indefinites in (37) should be able to denote properties. Modified numerals may also appear in de dicto readings with opaque predicates (38a), *there*-sentences (38b) and with *be*-predication (38c):

(38) 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,

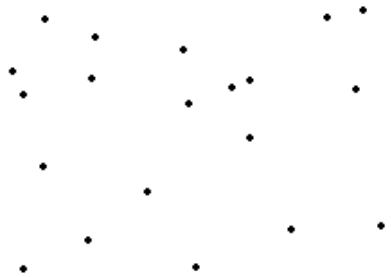


Figure 4.1: An array of dots (cf. sentence (38c))

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: (38a) is incompatible with Lily wanting to adopt more than four orphans, and (38b) 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 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 nonincreasing modified numerals in (37) and (38) could be derived without quantification over the domain of medals, orphans or cats; and yet, their appearance in sentences like (37) and (38) 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:

(39) 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.

Although this analysis technically solves the problem for *at most* and *exactly*, it leaves *less than* unaccounted for - we would not want to claim that *less than* is a propositional modifier. 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.

## 4.5 Conclusions

We started out this chapter 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 chapter 3. 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. Additional evidence for this idea comes from VP ellipsis, which supports the claim that the difference between P-distributivity and collectivity can be a matter of vagueness rather than ambiguity, and the requirement that the subject and the indefinite be co-arguments of the same predicate. Further, I discussed two quantificational alternatives to the polyadic P-distributivity analysis - 'group credit' as a special case of the collective interpretation, and quantification over kinds - and concluded that they can not account for the full range of distributivity data with groups. The chapter ended with a couple of additional and unresolved issues, and suggestions for further research.

The 'moral' of this chapter and the previous one can be summed up as follows: wherever we find higher-order entities with a clear part-whole structure, there will be distributivity - not because of any formal semantic operation, but because of the way we reason about parts, wholes and predicate meanings. Since distributivity is not a unified phenomenon, we should be careful to draw

conclusions about the formal semantic analysis of sentences involving pluralities or higher-order entities 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 and use it to bring out the empirical distinction between P- and Q-distributivity.

# CHAPTER 5

## Q-distributivity and morphosyntactic number: a study of group nouns in British English

In the previous chapters, we have developed the idea that the distinction between P- and Q-distributivity can be used as a diagnostic for semantic number: P-distributivity is available with arguments that have a clear part-whole structure regardless of semantic number, but Q-distributivity is a quantificational mechanism and as such only available with semantically plural arguments. We have used this diagnostic to show that singular group NPs behave like atoms in Dutch and American English: while P-distributivity is available with group subjects, comparing the (a) and (b) sentences in (1) shows that Q-distributivity is not.

(1) a. The baseball players are singing or dancing.
⇐ Every member of the baseball team is singing or dancing.

b. The baseball team is singing or dancing.
⇍ Every member of the baseball team is singing or dancing.

This conclusion may have been a bit too simple, though, because the comparison here is not just between group NPs and definite plurals. The morphosyntactic number of the VP is also different: in the (a) sentences, that feature a plural subject, the VP is plural as well; in the (b) sentences the VP is singular. So

the most we can actually say about the (un)availability of Q-distributivity with plural and group subjects based on the data we have seen so far, is that it is available with the former *if the VP is morphosyntactically plural* and unavailable with the latter *if the VP is morphosyntactically singular*. This raises the question of the role of VP number in the availability of Q-distributivity. Would Q-distributivity still be available with definite plural subjects if the VP were morphosyntactically singular? And, conversely, would it still be unavailable with group subjects if the VP were plural?

In chapter 3 (section 3.5), I have already suggested that the predicate pluralisation operator $*$ might have to be licensed by the presence of plural morphology on the VP. This hypothesis ties in with the questions above, since it suggests that the morphosyntactic number of the VP plays an important role in the availability of Q-distributivity.

Of course, it is difficult to investigate the role of VP number separately from the group/plural contrast, since English has obligatory subject-verb agreement that links NP and VP number. In some varieties of English, however (most notably British English), singular group NPs are allowed to appear with a plural VP: both (2a) and (2b) are grammatical in British English.

(2) a. The cricket team is laughing.

b. The cricket team are laughing.

In this chapter, I will make use of this fact to investigate the availability of Q-distributivity with group subjects with either a singular or a plural VP, by means of a small questionnaire study of six native speakers of British English. As we will see, the study shows that group NPs in British English behave like sets (allowing Q-distributivity) when they occur with a plural VP, but not when they occur with a singular VP. I will argue that the behaviour of British English group NPs is best accounted for by assuming that they underlyingly denote sets, but that they have to be shifted into impure atoms in sentences like (1b) and (2a) to avoid a type mismatch with the morphosyntactically singular VP. While the effect is the same here (a lack of Q-distributivity), this makes the story of group nouns a bit more complicated than we have been assuming so far; it also shows the need for a more in-depth investigation of the link between morphosyntactic number and Q-distributivity, some suggestions for which I will offer in the final sections of this chapter.

Section 5.1 presents the main data of this chapter: the results of the questionnaire study. In section 5.2, I show that the British English facts can be analysed straightforwardly within the formal system I have set up in chapter 2, *if* we assume that group nouns range over sets. This analysis allows us to account for the behaviour of British English group NPs in very general terms, without the need for any language-specific assumptions or special type-shifting mechanisms, which gives it an advantage over earlier analyses (such as Landman 1989; Barker 1992; Schwarzschild 1996; Sauerland 2004). I will compare the proposed analysis with some of these earlier ones in section 5.3; in this section I also present some English data that suggest that the availability of Q-distributivity depends on the number of the VP not just if the subject is a group NP, but also if the subject is an 'ordinary' plural - something that is expected under the advocated analysis but not under the aforementioned alternatives. Once again, section 5.4 is devoted to tying up some loose ends, especially in the formal part of the analysis. Section 5.5 concludes this chapter.

## 5.1 Q-distributivity with British English group NPs

In chapter 3 (section 3.2), I have identified a couple of contexts where the distributive interpretation cannot be reduced to any lexical properties of the main predicate (P-distributivity); I have shown that distributivity in these contexts has to be derived by assuming some kind of covert quantificational mechanism (Q-distributivity). As expected, these contexts all show a contrast between definite plural and group subjects: Q-distributivity is available with the former but not with the latter.

Of the Q-distributivity tests I discussed in chapter 3, the anaphora and proportionality tests were only defined for Dutch, but the remaining three tests - VP disjunction, VP conjunction, and other quantifiers - are suitable for testing for the availability of Q-distributive interpretations in British English. The judgements in this section were obtained from a small group of 6 native speakers of British English; for methodology, a list of test items and a quantitative summary of the results see appendix A.

**VP disjunction.** (For a more elaborate discussion of this Q-distributivity test, see section 3.2.1.)

(3) a. The children are sleeping or drawing.
⇐ The children are sleeping or the children are drawing. *(CI)*
⇐ For every child $x$, $x$ is sleeping or $x$ is drawing. *(DI)*

b. The class is sleeping or drawing. *(only CI)*

As we have seen in chapter 3, the plural-subject sentence in (3a) can be interpreted in two ways, only one of which (the distributive interpretation) is compatible with a 'mixed' situation in which part of the children are drawing and the others are sleeping. So, if a sentence with two disjunctively coordinated VPs can be interpreted as true in the situation depicted in fig. 5.1, Q-distributivity must be available for that sentence. This means that sentence (3a) can be true in the depicted situation; on the other hand, (3b) cannot. Both of these observations hold for British English as well. However, (4), with a group subject

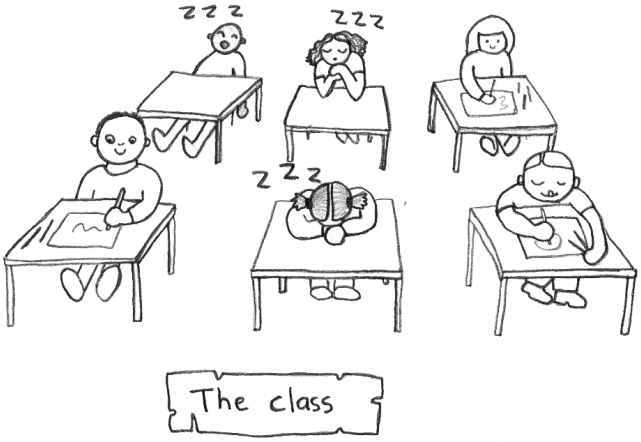



Figure 5.1: "The children / the class is/are sleeping or drawing."

and a plural VP, behaves like (3a) and not like (3b): according to my informants, it can be interpreted as true in the mixed situation.[1]

(4) The class are sleeping or drawing. *(CI/DI)*

[1]This contrast was first pointed out to me by Michelle Sheehan and Hazel Pearson (p.c.), whose observations first motivated me to pursue this particular line of inquiry.

Following our earlier reasoning in chapter 3, this means that the denotation of *the class* in (4) should be analysed as semantically plural.

**VP conjunction.** (For a more elaborate discussion of this Q-distributivity test, see section 3.3.3.) The same pattern appears with conjunctive coordination. As we have seen in chapter 3, this is necessarily interpreted with its strongest possible (Boolean) meaning when the subject is a group noun and the VP is singular, even though a weakened, non-anomalous meaning is readily available when the subject is plural (I have put 'DI' in quotes here, since even though the general entailment pattern is similar, the interpretation itself does not precisely fit our definition of a 'distributive' interpretation):

(5) a. The cricket players are underweight and obese.
⇐ #The cricket players are underweight and the cricket players are obese. *(CI)*
⇐ For every cricket player $x$, $x$ is underweight or $x$ is obese. *('DI')*

b. #The cricket team is underweight and obese. *(only CI)*

This means that (5a) but not (5b) can be interpreted as true in the situation depicted in fig. 5.2; sentence (5b) only has the anomalous interpretation according to which each of the cricket players is both underweight and obese at the same time. Again, British English behaves in the familiar way for plural-subject sentences and group-subject sentences with a singular VP, but the group-subject sentences with a plural VP pattern with the former in allowing a non-Boolean interpretation: (6), like (5a), can be interpreted as true in the situation depicted in fig. 5.2.

(6) The cricket team are underweight and obese. *(CI/'DI')*

If it is only possible to derive the non-Boolean interpretation when the subject is semantically plural - as in the approach of Winter (2001b), which as I argued in chapter 3 is justified by the group/plural contrast in (5) - this means that the group NP *the cricket team* in (6) cannot denote an atomic entity. Again, we see a group NP behaving like a set rather than an atom when it occurs with a plural VP.

**Other quantifiers.** (For a more elaborate discussion of this Q-distributivity test, see section 3.2.2.) Since the pluralisation operator $*$ introduces, in effect, a quantifier over individual members of a plurality, we expect this quantifier to be

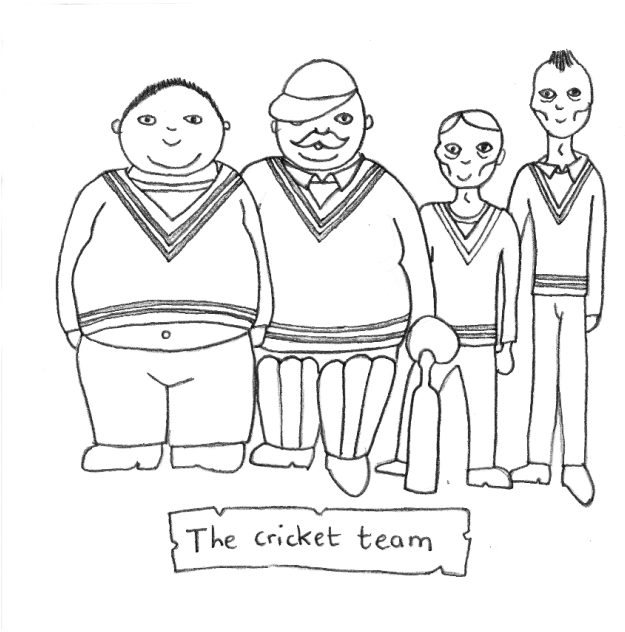



Figure 5.2: "The cricket team / cricket players is/are underweight and obese."

able to take scope over other quantificational elements in the sentence. On the other hand, in the case of singular predication (without $*$), any quantificational elements in the sentence end up scoping over the subject NP. In accordance with this, we see that a quantificational wide-scope interpretation for *the children* is available in (7a), while *the class* in (7b) as an entity that is scopeless with respect to the adverb *somewhere*:

(7) a. The children are hiding somewhere.
⇐ There is a place $x$ such that the children are hiding in $x$. *(CI)*
⇐ For every child $y$, there is a place $x$ such that $y$ is hiding in $x$. *(DI)*

b. The class is hiding somewhere. *(only CI)*

In (7a), the quantificational wide scope interpretation of *the children* results in a distributive interpretation according to which each child is hiding in a potentially different location, which is true in the situation depicted in fig. 5.3. In American as well as British English, the DI is unavailable in the case of (7b), which means that (7b) is false in the depicted situation. But in British English,

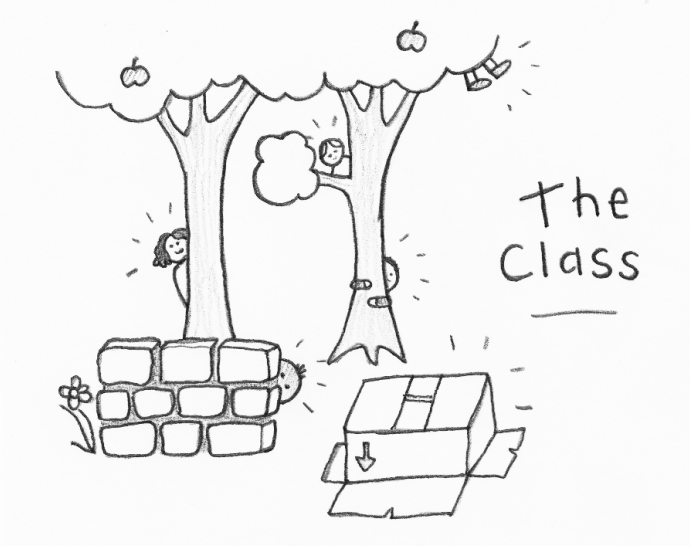



Figure 5.3: ''The children / the class is/are hiding somewhere.''

when the subject is a group NP and the VP is plural, it behaves like (7a) and not like (7b): sentence (8) can be interpreted as true in the situation depicted in fig. 5.3.

(8) The class are hiding somewhere. *(CI/DI)*

The picture that emerges from these observations, then, is that British English group sentences pattern with their American and Dutch counterparts if the VP is singular: they are unable to receive a Q-distributive interpretation. However, if the VP is plural, British English group sentences pattern with plural-subject sentences in generally allowing Q-distributivity.

### 5.1.1 A related contrast: reciprocity

The observed pattern is also found with reciprocal predication in British English, which should not come as a surprise given that reciprocity, like Q-distributivity, is usually analysed as a form of quantification (cf. Dalrymple et al. 1998) and hence requires a semantically plural argument. It has been noted in the literature that reciprocal expressions are fine with plurals, but at best marginal with group nouns (Schwarzschild 1996; Lønning 2011):

(9) a. The cricket players are friends / usually coach each other.

b. *The cricket team is friends / usually coaches each other.

However, Schwarzschild hypothesises that reciprocal predication over a group subject may be grammatical with British English when the VP is plural, a suggestion supported by the data in (10) (from Pearson 2011). Many examples of these sentences 'in the wild' can be found with Google (11a-d)[2]:

(10) The family can't stand each other.

(11) a. The Team are friends on track as well as off track, and are as much family as we are friends.

b. Can a scientific program really change the way the Diaz family love each other?

c. It is puzzling when medical staff disagree with each other.

d. Remember that your group are neighbours who have to get along outside the group as well as within it.

Like the Q-distributivity data, these reciprocity data are in line with the idea that the semantic number of a morphosyntactically singular group NP depends on the number of the VP it agrees with: since Q-distributivity (and by the same reasoning also reciprocity) can function as a diagnostic for semantic number, we can conclude that group NPs behave like atomic entities when the VP is singular, but like sets when the VP is plural.

## 5.2 Analysis

The way I have formulated the above generalisation - group NPs behave like atoms with a singular VP and like sets with a plural VP - already suggests the first part of an analysis: I have stressed throughout this dissertation that Q-distributivity is an automatic consequence of the semantic pluralisation of atom predicates, and also suggested that this semantic pluralisation needs to be licensed by the presence of plural morphology (section 3.5). This suggests that the morphosyntactic difference between singular and plural VPs in our group noun data is also reflected in the semantics: when a group NP occurs with a singular VP, the VP denotes an unstarred predicate (hence, no Q-distributivity),

[2]Search terms used: 'team are friends', 'family love each other', 'staff disagree with each other', 'group are neighbours', respectively.

but when it occurs with a plural VP, the VP denotes a starred predicate and we get a Q-distributive interpretation.

But this is only half of an analysis, since it does not yet account for the observation that group NPs are sometimes interpreted as atoms and sometimes as sets. Are they ambiguous between the two? Is there a typeshift that maps one to the other? Are group NPs interpreted as atoms (sets) because they occur with a singular (plural) VP, or is the VP singular (plural) because the group NP denotes an atom (set)?

In this section I will propose that group nouns, in their basic form, range over sets and that the atomic interpretation is the result of a typeshift to avoid a type mismatch with the morphosyntactically and semantically singular VP. As it turns out, once we assume that group NPs are set-denoting, the rest of the analysis follows almost automatically from the general assumptions about number we made in chapter 2, and we can account for the behaviour of group nouns in both British and American English without any further assumptions or language-specific semantic mechanisms.

With the assumption that group nouns range over sets, we have built a problem into our system that every language will have to solve in some way: because we now have a class of nouns that are semantically plural but syntactically singular, we cannot combine these nouns with a predicate without ending up with either a type or an agreement mismatch. With matching agreement (a syntactically singular VP to match the syntactically singular group NP), we end up with a type mismatch as both the NP and the VP will be of type *et*. With matching typing (a pluralised VP to match the set-denoting NP), we end up with mismatched number inflection, as semantic pluralisation of the predicate needs to be licensed by plural number morphology. So, either a language will have to allow mismatched agreement, or it will have to shift the group to its corresponding impure atom. The plural agreement option in British English exemplifies the first option, while American English exemplifies the second.

Schematically:

(12) $\mathbf{tall}_{[\mathrm{SG}],et}(\mathbf{the\_group}_{[\mathrm{SG}],et})$ : matching agreement but mismatched types

a. *The American strategy (always available):*
$[[\text{The group is tall}]] = \mathbf{tall}_{[\mathrm{SG}],et}(\uparrow \mathbf{the\_group}_{[\mathrm{SG}],e})$

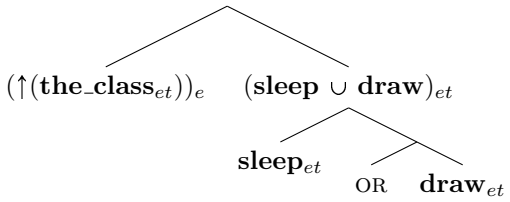
b. *The British strategy (only available if the grammar allows it):*
$[[\text{The group are tall}]] = {*}\mathbf{tall}_{[\mathrm{PL}],(et)t}(\mathbf{the\_group}_{[\mathrm{SG}],et})$

I am assuming that the 'American' strategy is always available because (1) to my knowledge, there are no languages that *require* singular group NPs to take a plural VP[3], and (2) the typeshift involved is the impure atom mapping from chapter 2, which I have been assuming is freely available anyway[4]. The availability of the 'British' strategy, on the other hand, depends on the syntax of the language in question: if the combination of a singular group noun and a plural VP is ungrammatical, it obviously cannot be used as a solution to the mismatch problem.

It follows that group NPs must behave like atoms when they occur with a singular VP, but can behave like sets when they occur with a plural VP: as can be seen in (12), the NP denotes an atomic entity (type $e$) in (12a), and a set (type $et$) in (12b). To illustrate how this accounts for the observed pattern with Q-distributivity, let us look at the derivations of the sentences ''The class is sleeping or drawing'' (in (13)) and ''The class are sleeping or drawing'' (in (14)):

(13)

$$\uparrow(\textbf{the\_class}) \in \textbf{sleep} \cup \textbf{draw}$$
$$\Leftrightarrow \uparrow(\textbf{the\_class}) \in \textbf{sleep} \text{ or } \uparrow(\textbf{the\_class}) \in \textbf{draw}$$

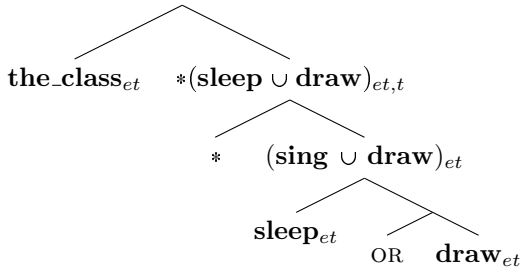



Because the union of **sleep** and **draw** is not pluralised in (13), *is sleeping or drawing* denotes just the set of entities that are either sleeping or drawing. For the sentence *The class is sleeping or drawing* to be true, then, the impure atom corresponding to **the_class** must be one of these entities, which is true if it is either a member of **sleep** or of **draw**. By P-distributivity over this impure atom, we infer that the individual group members are either sleeping or drawing, but a split interpretation is impossible in this derivation.

[3]Corbett (2000) mentions Spanish, Old Church Slavonic, Samoan, the Brazilian language Paumarí and the Caucasian language Kumaxov as other languages that (sometimes) allow group NPs to appear with a plural VP, but he does not mention any languages for which this is obligatory.

[4]But see chapter 6 for a more nuanced version of this claim

(14) $\mathbf{the\_class} \in *(\mathbf{sleep} \cup \mathbf{draw})$
$\Leftrightarrow \forall x \in \mathbf{the\_class}$: $x \in \mathbf{sleep}$ or $x \in \mathbf{draw}$




In (14), on the other hand, *the class* is interpreted as a set, and the pluralised predicate *are sleeping or drawing* denotes the set of all sets whose members are either sleeping or drawing. This means that **the_class** is a member of $*(\mathbf{sleep} \cup \mathbf{draw})$ just in case each of the group's members is either a member of **sleep** or a member of **draw**. This is also true in a split situation where part of the group is sleeping and the rest is drawing.

Because the proposed analysis treats the observed semantic differences between languages as a direct consequence of differences in morphosyntax, it is able to account for the behaviour of group nouns in both British and American English without any language-specific semantic assumptions, and without the need for any semantic machinery that is specifically tailored to group NPs (like the $\downarrow$ typeshift - the opposite of $\uparrow$ - that is used by e.g. Landman 1989; Barker 1992; Sauerland 2004 to handle the semantics of group nouns). In the next section, I will compare the present analysis to several of its possible alternatives, and see whether there are any empirical reasons to favour one over the others.

## 5.3 Comparison with alternative analyses of group NPs

Broadly speaking, there are two possible alternative analyses to the one that I have proposed. The first is to do everything the opposite way around - according to this alternative analysis, group NPs denote atoms but if the VP is plural these atom are broken up by a 'fission' operation $\downarrow$ (see Barker 1992; Schwarzschild 1996; Sauerland 2004, for proposals in this vein). The second is to assume that British English group nouns, unlike their American counterparts, are ambiguous between a predicate that ranges over sets and one that ranges over atoms (cf.

Schwarzschild 1996:9). I will discuss these approaches in section 5.3.2. But first, I want to take a step back and look at the different ways the class of 'group nouns' has been defined in the literature, since the definition I have been using more or less implicitly in this chapter (just those collective nouns that can take a plural VP in British English) is by no means universal and rather narrow by comparison, something which we have to keep in mind when comparing the current approach to 'group nouns' with earlier ones.

### 5.3.1 Defining 'group noun'

The Oxford English Dictionary defines what it calls a *collective noun* as ''a substantive which (in the singular) denotes a collection or number of individuals''. In his *Modern English Grammar on Historical Principles*, Jespersen (1927) adopts this definition, citing nouns like *train* (a collection of carriages), *library* (a collection of books), *forest* (a collection of trees), and *army* (a collection of soldiers) as examples.

The problem with this definition is that it is not always clear what counts as an individual. Is *puzzle* a collective noun because it denotes a collection of individual puzzle pieces? Is *book* a collective noun because it denotes a collection of individual pages? Most entities in the world have parts of some sort, but a semantic theory that classifies every noun that ranges over these entities as a 'group noun' probably would not be very helpful in accounting for the properties that, intuitively, set nouns like *army* and *family* apart from other nouns.

To delimit the relevant class of nouns, Barker (1992) proposes to define them in syntactic terms: a group noun is a noun that can take a plural but not a singular *of*-complement, as in (15):

(15) a. A committee of women / *woman
b. An army of children / *child
c. A stack of cups / *cup

According to this definition, *puzzle*, *book*, and *piece* are not group nouns. They cannot take a plural *of*-complement ((16a-c)), and/or they are grammatical with a singular complement ((16c)):

(16) a. *A puzzle of pieces
b. *A book of pages
c. *A piece of cookie / *cookies

Furthermore, although Barker's definition does not explicitly mention this, his use of examples like (17) makes clear that he also rules out nouns that are compatible with mass noun *of*-complements: *ocean*, although it is compatible with the plural complement *of tears*, does not count as a group noun according to Barker because it can also take a mass noun complement *of water*.

(17) An ocean of tears / water

Barker's definition is also adopted by Schwarzschild (1996) and Champollion (2010), although the latter modifies it a bit: instead of ruling out nouns that can take a mass *of*-complement, Champollion rules out 'container' nouns like *box* by postulating that if a noun $X$ can take a plural *of*-complement, the resulting interpretation must entail the presence of an actual $X$ for $X$ to count as a group noun. So, because we can talk about *a box of sweets* on a measure reading that does not entail the presence of an actual box (for example, if I say *I ate an entire box of sweets* I do not mean to say that I ate a box, just that I ate a certain quantity of sweets), *box* does not count as a group noun under Champollion's modified definition. In practice, both definitions seem to rule out the same nouns, albeit for different reasons: Barker would rule out *box* as a group noun because it can take a mass noun *of*-complement (*box of cardboard*).

However, does Barker's syntactic definition really rule out the nouns that he wants to rule out? If we choose our examples somewhat differently, we see that nouns like *puzzle* or *book*, which Barker claims are not group nouns, are not always incompatible with plural *of*-complements:

(18) a. A book of pictures / poems

b. A puzzle of one hundred (strangely shaped) pieces

It seems that the reason these nouns are incompatible with the plural *of*-complements in (16), is that these complements are redundant or trivial: a book necessarily consists of pages, and a puzzle necessarily consists of pieces. In contrast, (18) shows that *book* and *puzzle* have no problem taking a non-trivial plural *of*-complement. Consider also (19):

(19) A committee of *(six (perpetually arguing)) members

According to Barker, the group noun *committee* should be compatible with a plural *of*-complement; however, if that complement is trivial (*a committee of members*), the result is just as unacceptable as **a book of pages*. Adding a

modifier (like *six* or *perpetually arguing*) results in a construction that is once again grammatical, showing that the problem is not with the noun *members* per se.

It seems that the nouns that Barker classifies as group nouns are not actually distinguished from his non-group nouns by their ability to take plural *of*-complements. What about their compatibility with mass noun complements? Here, too, the line between Barker's group nouns and non-group nouns seems rather blurry upon closer inspection. Consider the following data:

(20) a. A jury of flesh and blood

b. A forest of oak

c. A pile of gold

According to Barker, *jury*, *forest* and *army* are group nouns, but according to his definition, group nouns should not be compatible with mass noun *of*-complements. So not only does it turn out that certain nouns that Barker does not consider group nouns should count as such by his definition, there are also nouns that Barker does consider group nouns that do not count as such by his definition.

With respect to the data in (20), Champollion's more semantic definition fares better: all three nouns in (20) are still considered group nouns under his account. His definition also leads to a classification that seems to be in line with a third, independent attempt to define the notion of 'group noun': that of Pearson (2011), to which we will turn next.

Pearson's definition of group nouns is the narrowest so far: under her account, the relevant class of nouns (which she calls 'committee nouns') include only those nouns that denote groups consisting of humans, like *team* and *committee*. Other 'group nouns', like *bunch* and *pile*, are treated as count nouns like any other (Pearson calls them 'collection nouns', and according to Champollion (2010), they seem to coincide with those nouns whose group noun status is dubious under his definition because they have very salient measure readings).

Pearson's paper includes a number of tests to distinguish committee nouns from collection nouns. Here are a few of them:

(21) *Compatibility with collective predicates:*

a. The couple { is similar. / is a good match. / looks cute together. }

b. *The bunch of flowers { is similar. / is a good match. / looks cute together. }

(22) *Compatibility with plural agreement in British and Canadian English:*

a. The staff are friendly.

b. *The list of party guests are long.

(23) *Number of verifying situations for partitive constructions:*[5]

a. Half of the committee had been painted yellow.
*false if half of every committee member had been painted yellow*

b. Half of the bunch of flowers had been painted yellow.
*true if half of every flower had been painted yellow*

According to Pearson, committee nouns consistently pass all the tests, while collection nouns consistently fail them.

However, just looking at the three tests illustrated above, it is already possible to find exceptions: there are committee nouns that do not pass them all, and there are collection nouns that do not fail them all. For example, some collective predicates (even those that Pearson explicitly argues are only compatible with committee nouns, like *gather* and *come together*) can take arguments that fail the plural agreement test:

(24) a. ??The herd of cows are hungry.

b. The herd of cows piled up near the gate / dispersed.

(25) a. *That pile of dead skin cells are a disgusting sight.

b. A small pile of dead skin cells has gathered in the sink.

And others are marginal even with arguments that pass the plural agreement test:

(26) a. The orchestra are based in London.

b. ??The orchestra is similar / numerous.

[5]For a more elaborate discussion of this particular criterion, see chapter 6, section 6.1.

Throughout this dissertation, the 'group NPs' I have been using in my examples have all been NPs that, in British English, are compatible with a plural VP, which means they correspond to Pearson's committee nouns (albeit based on a single criterion, rather than several). With Pearson, I believe that these nouns should be treated as a separate subclass within the class of 'collective nouns' as defined by the OED. This means that the observations presented in this chapter do not invalidate Barker's and Schwarzschild's insights about the atomic nature of many collective NPs, and that the present analysis of group NPs as set-denoting should be seen as a supplement to rather than a full replacement of the Barker-Schwarzschild-Champollion approach to collective nouns: I do not want to claim that all nouns that are classified as group nouns by these authors should be analysed as ranging over sets.

The obvious disadvantage of using 'the ability to take a plural VP in British English' as the defining criterion for the class of NPs that our analysis applies to, is that it has only limited use beyond English. If we want to know whether an analysis of group NPs as sets is empirically justified for other languages as well, we need a more universal way to delimit the relevant class of nouns. I have argued above that Pearson's other, less language-specific criteria are not always consistent with the plural-VP criterion, even within English itself, so they are not immediately useful for this purpose.

However, the well-known observation (already made in Jespersen 1927) that the ability to take a plural VP in British English is limited to animate (and in particular human) collective nouns provides us with both a universally usable definition, and - together with the analysis of British English group nouns as proposed in this chapter - a hypothetical cross-linguistic generalisation. Following Jespersen's observation on animacy, I will define 'group nouns', as I use the term in this dissertation, as just those collective nouns (as defined by the OED) that refer to collections of animate entities. I have analysed these nouns as ranging over sets based on their behaviour in British English; we can now hypothesise that this property does not just apply to a particular class of British English nouns, but to animate collective nouns in general, regardless of the language. In chapter 6, I will provide some evidence that this hypothetical generalisation is correct, and that animate collective NPs - unlike inanimate ones like Pearson's collection NPs - behave like semantic pluralities in other languages than British English as well.

### 5.3.2 Alternatives to impure atom formation: 'fission' or ambiguity

As mentioned in the introduction to this section, there are two possible alternative analysis to the present impure atom-based approach. The first is to do everything the opposite way around - according to this analysis, group NPs denote atoms but if the VP is plural these atom are broken up by a 'fission' operation (cf. Barker 1992; Schwarzschild 1996; Sauerland 2004). The second is to assume that British English group nouns, unlike their American counterparts, are ambiguous between a predicate that ranges over sets and one that ranges over atoms (cf. Schwarzschild 1996:9).

The fission approach seems logically indistinguishable from the present one, since it only reverses directions: instead of a typeshift from sets to atoms forced by a type mismatch with a singular VP, it assumes a typeshift from atoms to sets forced by a type mismatch with a plural VP. However, there are at least two reasons why I think it fares worse than the present analysis. The first is related to animacy. As I have argued, the class of NPs that behave like sets when they occur with a plural VP are just those NPs that are associated with collections of animate/human entities. Under the present impure atom-based analysis, this requirement follows from the fact that both animacy and semantic type are lexical properties that happen to coincide in the relevant class of nouns[6]: if animacy is a lexical property of all the nominal predicates that range over sets, and singular nouns are compatible with plural agreement only if they denote such predicates, it follows that the only singular NPs compatible with plural agreement are animate NPs. On the other hand, it is unclear how the animacy requirement (and the resulting effects on the interpretation of the NP) might be enforced if group nouns are semantically indistinguishable from other nouns, as they are under a fission-based approach. Such an approach would need to restrict the application of the atom-to-set mapping to just those NPs that refer to animate entities (Barker (1992) acknowledges this, but Sauerland (2004) does not). This means that animacy has to be analysed as not just a lexical property of certain nominal predicates, but as a formal feature, that influences the compositional semantics of the entire NP; furthermore, we have to stipulate that the atom-to-set typeshift is sensitive to the value of this feature

[6]In chapter 6, I will argue that this coincidence is not accidental, and that animacy and semantic plurality are inherently related in the conceptual system.

and formally enforce this sensitivity in some way. An analysis that takes the atomic denotation to be basic and the set denotation to be derived is incomplete without a formally explicit account of the role of animacy, but to my knowledge, no such account has been given.

A second reason to prefer the impure atom-based approach over the fission approach is that the latter is tailored to group nouns in particular, while the former has a much wider use in a theory of plurality. I believe that the more general implications of the impure atom-based analysis are empirically justified: the ability to switch between a set and an atom denotation is a property of plural NPs in general, not just of group nouns (I have provided some evidence for this in section 3.5, and will provide more evidence for it in chapter 6). Impure atom formation captures this because it can apply to all set-denoting NPs. Fission does not, since it only explains the mixed atom/set behaviour of group NPs, and nothing else. The same reasoning applies to the ambiguity approach: while this is hard to rule out as such, it cannot be the whole story because it only captures the mixed behaviour of group nouns and not of set-denoting NPs in general. (An additional, more conceptual problem with the ambiguity account is that it declares a whole class of nouns systematically ambiguous, which is of course technically possible, but not very elegant.)

This second point is related to the double question I started out this chapter with. First, would Q-distributivity still be available with definite plural subjects if the VP were morphosyntactically singular? And, conversely, would it still be unavailable with group subjects if the VP were plural? In this chapter, we have looked only at the second question; I have shown that Q-distributivity is available when the VP is plural regardless of whether the subject is a plural or a group NP. However, the analysis I have proposed in order to account for this also predicts a particular answer to the first question. If the presence of $*$ has to be licensed by plural morphology, so that it is impossible for morphosyntactically singular VPs to denote a pluralised predicate, we expect Q-distributivity to be unavailable with plural subjects if they occur with a singular VP for the same reason that it is unavailable with group subjects under these circumstances. So, if it turns out to be the case that Q-distributivity is unavailable with plural subjects if the VP is singular, the proposed analysis accounts for that straightforwardly, while the fission-based and ambiguity-based approaches would have to find an independent solution for it.

In colloquial English, speakers occasionally allow a plural subject to occur

with a singular VP. For example, Kratzer (2008) notes that conjoined mass nouns are often judged acceptable with a singular VP in some varieties of English and her own dialect of German (see (27), the Dutch equivalent of which sounds fine to me as well):

(27) The moss on the rocks and the moss on the trees *is* blighted.

This observation gives us an opportunity to test the availability of Q-distributivity with such conjoined subjects, depending on the number of the VP (the entailments given in (28) represent my own judgements):

(28) a. Good hygiene and regular exercise *are* more effective than antibiotics.
⇐ A combination of good hygiene and regular exercise is more effective than antibiotics. *(CI)*
⇐ Good hygiene is more effective than antibiotics and regular exercise is more effective than antibiotics. *(DI)*

b. Good hygiene and regular exercise *is* more effective than antibiotics.
⇔ A combination of good hygiene and regular exercise is more effective than antibiotics. *(CI)*
⇍ Good hygiene is more effective than antibiotics and regular exercise is more effective than antibiotics. *(DI)*

This kind of Q-distributivity test is more difficult when the subject involves conjoined count definites, since these sentences are more degraded than their mass noun counterparts. However, when I asked some of my Dutch- and English-speaking informants to compare the sentences in (29), they all felt that (29d) was much worse than (29b):

(29) a. The credit crunch and his company's bankruptcy have evaporated John's savings and given him an ulcer.

b. ??The credit crunch and his company's bankruptcy has evaporated John's savings and given him an ulcer.

c. The credit crunch and the Occupy movement have evaporated John's savings and given him some hope for the future.

d. #??The credit crunch and the Occupy movement has evaporated John's savings and given him some hope for the future.

While neither (29b) nor (29d) are quite grammatical, (29d) is also problematic because it suggests that the credit crunch has given John hope (in addition

to evaporating his savings) and the Occupy movement has evaporated his savings (in addition to giving him hope), both of which are quite contrary to the properties we generally associate with the credit crunch and the Occupy movement. In other words, the non-Boolean interpretation of the VP that allows each of the VP conjuncts to apply to just a part of the subject denotation seems to be unavailable in (29d), which leads to an anomalous interpretation. In (29b), the absence of a non-Boolean interpretation does not result in such an anomaly, since both VP conjuncts can apply naturally to both credit crunches and bankruptcies. The judgements are admittedly subtle because of the interference of grammatical and pragmatic factors, but there does seem to be a real difference between (29b) and (29d), which would follow from the analysis of VP number and Q-distributivity presented in this chapter.

A second example of the influence of VP number on the availability of Q-distributivity can be found with *there*-sentences. In colloquial English, many speakers accept *there*-sentences with mismatched agreement, as in (30b):

(30) a. There are four semanticists singing or dancing in my garden.

b. There's four semanticists singing or dancing in my garden.

Under the proposed analysis, we expect the Q-distributive interpretation (which is compatible with a scenario in which some of the semanticists are singing while the others are dancing) to be present in (30a) but absent in (30b), as the latter features a morphosyntactically singular VP which I have claimed cannot denote a starred predicate. And according to most of my English-speaking informants (not all of them accepted (30b) as grammatical), these sentences do show a contrast similar to the British English Q-distributivity cases: while (30a) can be interpreted as true in the described 'mixed' situation, (30b) cannot.[7] Again, this observation follows straightforwardly from the way I have analysed the mixed atom/set behaviour of group NPs, but would require additional explanation had we adopted either a fission-based or an ambiguity-based approach to the group noun data.

[7]Unfortunately, I have not been able to gather substantial quantificational data on the availability of Q-distributivity in *there*-sentences beyond the handful of judgements regarding (30); I will leave this for further research.

### 5.3.3 A note on Winter's analysis of group nouns as atom predicates

While I have presented the groups-as-sets analysis as a reasonably straightforward extension of the framework in Winter (2002), at one point they seem incompatible: based on the data in (31), Winter categorises group nominal predicates like *team* and *committee* as atom predicates.

(31) a. *All the students are a good team.

b. *Every student is a good team.

Since (31a) and (31b) are equally ungrammatical, *(be a) good team* is classified as an atom predicate (see chapter 2, section 2.2).

I see two possible ways to reconcile Winter's judgement with the analysis presented in this chapter. The first is that there is something special about *be*-predication that blocks the set-of-sets interpretation of *good team*, for example by an obligatory type-shift (this solution is essentially the mirror image of an idea suggested by Schwarzschild (1996:9) to deal with 'mismatched' predication structures like *My guests are a couple*). In addition to its ad hoc nature, this solution is problematic because it predicts that sentences like (31a) are always ungrammatical, which in fact does not seem to be the case. For example, the *all*-sentences in (32) and (33) are judged fine by all native speakers of English and Dutch that I consulted (although some comment that they would be even better with *together*):

(32) *Context: I want to divide my students into three project groups, which I do by telling them the following.* ''All the redheads are a team. All the students over 21 are a team. And the third team consists of everyone else.''

(33) ''Alle roodharigen zijn een groep. Alle brildragers zijn een groep. En de laatste groep bestaat uit iedereen die dan nog over is.'' *(Dutch)*
*'All redheads are a group. All glasses-wearers are a group. And the last group consists of everyone who remains'*

And here are some examples found with Google (emphases mine):[8]

(34) a. Alle moslims zijn een grote familie. *(Dutch)*
*'All muslims are a big family'*

[8]Search terms used: 'alle * zijn een grote familie', 'all the * are one big family', 'all * are a lovely bunch', 'all the * are a close-knit group', 'all * are a hate group', respectively.

b. I enjoy living here at Broadway Plaza, *all the people are one big family.*

c. It's a great way to meet new people and have a real fun day out at the races, *all our members are a lovely bunch of people* who love the sport and the craic of being involved with the horses, trainers and jockeys.

d. *All the seniors are a close-knit group* and a lot of us came in together.

e. I have always gone to pains to differentiate myself from the idea that *all atheists are a hate group.*

So, while the seeming contradiction between the results of Winter's atom/set test and the groups-as-sets analysis presented in this chapter is somewhat troubling, it is hard to tell precisely how contradictory they are because the atom/set test results are not very conclusive. At this point, I do not think that Winter's data provide enough counterevidence to reject an analysis in which group nouns range over sets.

## 5.4 Tying up some loose ends

### 5.4.1 Multiple groups with the same members

In chapter 2, I observed (following Landman 1989 and Barker 1992) that it is possible for two groups to consist of precisely the same members and be distinct nonetheless - for example, even though the same group of people might make up both the Programme Committee and the Committee in Charge of Flower Arrangements, that does not make them the same committee. Under an atomic analysis of group NPs, this is easy to account for: the two NPs are simply associated with different entities, both of which are included in the extension of **committee** (as in (35a)). Under the current analysis however, in which group NPs denote the set of the group's members (say, {**mary**, **sue**, **bill**}), *the Programme Committee* and *the Flower Committee* have the same denotation (as in (35b)). So, under an atomic analysis of group NPs, a predicate like **committee** has as many members as there are different committees; under a set-based analysis, it has as many members as there are different groups of people that form committees:

(35) a. $\mathbf{committee}_{et}$ = { **programme_comm**, **flower_comm** }

b. $\mathbf{committee}_{et,t}$ = { {**mary**, **sue**, **bill**} }

Since the impure atom mapping ↑ was defined as a one-to-one mapping in chapter 2, according to which each set is associated with a unique impure atom, there is no way in the current system in which *the Programme Committee* can be made to refer to a different individual than *the Flower Committee*: they are associated with the same individual at both the set and the impure atom level. As argued in section 2.3.1, however, this is not necessarily problematic as long as we also equip our formal system with a way to distinguish between different 'roles' or functions that a single individual might have (such as the intensional system from Landman 1989). Just as John-as-a-judge can be on strike while John-as-a-hangman is not, it is possible for the plural individual {**mary**, **sue**, **bill**} to habitually meet on Tuesdays in their role as the Programme Committee, while never meeting on Tuesdays in their role as the Committee in Charge of Flower Arrangements. The former does not require us to associate the proper name *John* with several different entities; neither does the latter force us to assume that *the Programme Committee* and *the Flower Committee* have to refer to different sets, or that the result of applying the ↑ mapping to the set {**mary**, **sue**, **bill**} should be different depending on which of the two committees we are talking about.

### 5.4.2 Morphosyntactically plural group NPs

In chapter 2, we have seen that it is possible to analyse the denotation of *the* as the maximum operator regardless of whether it is applied to a singular or a plural noun: if we apply THE to an ordered set, it returns the maximal element in that set; if we apply it to a singleton set it returns the unique member of that set (i.e. it reduces to iota); and if we apply it to a set with no unique maximum (including the empty set), the result will be undefined. Unfortunately, this unified analysis of THE is untenable under the current approach. An example will illustrate this. Imagine a model in which the extension of [[*committee*]] equals the set {{**a**},{**b**},{**a**,**b**}}, so the denotation of *committee* happens to coincide with $*\{\mathbf{a}, \mathbf{b}\}$. Then *the committee* would denote the maximal set {**a**,**b**} in this model, even though we want it to be undefined: because there are three committees in our model, uniqueness is not satisfied and *the committee* should fail to denote.

This means that I will assume after all that *the* is ambiguous between $\text{THE}_{singular}$ and $\text{THE}_{plural}$: the former an untyped function that picks out the

unique member (set or entity) from a singleton set, the latter a function that picks out the maximum from a set of sets. This ambiguity is not necessarily problematic - many languages have different words for $\text{THE}_{singular}$ and $\text{THE}_{plural}$ (and English itself has *this/that* versus *these/those*).

The next question is what exactly a morphosyntactically plural group NP like *the committee**s*** denotes. In chapter 2 we have seen that the denotation of a plural NP like *the girls* is just the denotation of *girl* - that is, the set containing all girls in the model - because of the way $\text{THE}_{plural}$ is defined. In a similar way, we could analyse $[[\textit{the committees}]]$ as equivalent to $[[\textit{committee}]]$, if we take $\text{THE}_{plural}$ to be an untyped function that can operate on sets of sets (type $((et)t)et$) and sets of sets of sets (type $(((et)t)t)((et)t)$) alike. But this results in a classic problem: if we allow NPs of type $(et)t$, we would also need to be able to lift predicates into a type $((et)t)t$. This introduces a lot of ambiguity and complexity into the system for which we do not really have an empirical basis.

Instead, I propose that $\text{THE}_{plural}$ only ever has type $((et)t)et$, and that $[[\textit{committees}]]$ is the result of applying $*$ to the singularised version of **committee**[9]:

(36) $[[\textit{committees}]]_{(et)t} = *(\Uparrow(\mathbf{committee}_{(et)t})_{et})$

So, *the committees* then denotes the maximal set of committee-atoms just as *the girls* denotes the maximal set of girls. In this way, we do not add any unnecessary complexity to the system by adding a third type of referential NP and all the additional type lifting that this would require, while still being able to account for all the relevant data (as far as I can tell).

## 5.5 Conclusions

I have shown that morphologically singular group NPs in British English behave like atoms when they occur with a singular VP, but like sets when they occur with a plural VP: in the former case, they do not allow Q-distributivity and reciprocity, but in the latter case they do. If we assume that group NPs are basically set-denoting, their behaviour with both singular and plural VPs follows from our general assumptions about the semantics of plurality. Either the language allows a mismatch in number agreement so the group NP can

[9]The singularisation operator $\Uparrow$ was introduced in chapter 2, section 2.2.1, and functions to turn predicates over sets into predicates over impure atoms.

participate in semantically plural predication, or the NP has to be shifted into its corresponding impure atom to avoid a type mismatch with the, similarly set-denoting, singular VP.

The advantage of this proposal is that it reduces crosslinguistic variations in interpretation to morphosyntactic differences between languages, allowing us to maintain a uniform semantics for group nouns. It also has the empirical advantage of being applicable to a wider range of semantic phenomena than just group nouns, because it is based on the mapping from sets to impure atoms that I have assumed is generally available to all set-denoting referential NPs. Our next step, therefore, should be to look beyond English and see whether we see the same pattern - set-denoting NPs shifting into impure atoms to resolve a type mismatch - pop up when 'ordinary' plurals occur with a singular VP, as the present analysis predicts it should.

A topic that came up briefly in this chapter is animacy: I have argued that this is the property that sets apart what I have called 'group nouns' (that range over sets according to the proposed analysis) from other collective nouns like *pile* or *bunch* (that the present analysis is not concerned with). In the next chapter, we will take a closer look at the relationship between animacy and semantic number.

# CHAPTER 6

## Animacy and plurality

In the previous chapter, I have developed an analysis of the mixed atom/set behaviour of British English singular definite group NPs by proposing that they denote sets, but have to be shifted into impure atoms because a morphologically singular VP is necessarily also semantically singular. One of the advantages of this approach is its crosslinguistic applicability: it does not explain the behaviour of group NPs in British English as some kind of isolated 'special case', but analyses it as part of a general theory of semantic number from which the behaviour of group NPs in American English and other languages follows just the same. I have suggested that group nouns range over sets not just in British English but in language in general, and placed the burden of their varying behaviour fully on morphosyntax: in a language where group NPs obligatorily take a singular VP they will always be forced into their atomic guise, but in a language that allows them to appear with a plural VP (like British English) they are free to behave according to their underlying set nature. So far, however, we have not seen any empirical evidence for this supposed underlying set nature of group NPs in other languages than British English. One of the aims of this final chapter, therefore, is to investigate whether there are any empirical reasons to analyse group NPs as sets even in languages where they always take a singular VP, or whether it might be more accurate to allow for some variation in the denotation of group nouns across languages.

The second question I want to address in this chapter has to do with my assumption, back in chapter 2, that the ↑ mapping from sets to impure atoms is freely available for all set-denoting referential NPs. Like the assumption that group nouns uniformly range over sets, I have not backed this one up empirically; and in fact, it can be shown that this assumption leads to predictions that are not always borne out. For example, it predicts that referential plural NPs will always be able to receive an impure atom denotation, which means (at least within our current framework) that they should be able to do anything group NPs can do. As it turns out, however, this is not the case: atom predicates like *founded in the 16th century* or *composed of experts*, that denote properties of groups, are compatible with group subjects but not with plurals.

(1) a. The board is composed of experts.

b. # The board members are composed of experts.

If the NP *the board members* were able to receive an impure atom interpretation, we would expect sentence (1b) to be unproblematic: it could receive a semantics equivalent to that of (1a) and be interpreted in precisely the same way. The fact that (1b) is anomalous suggests that such a semantics is unavailable for (1b), which in turn suggests that plural NPs like *the board members* cannot always be shifted into an impure atom. It appears we should constrain our ↑ mapping in some way; the question is how.

At first glance, these two issues appear to be independent; however, I believe that they are actually closely related. Both cases involve (potential) discrepancies between morphosyntactic number on the one hand and semantic number on the other: in the first case, the question is whether or not certain morphosyntactically singular NPs should denote a semantically plural individual, and in the second case, whether or not certain morphosyntactically plural NPs should be able to denote a semantically singular individual. The way I will approach the answer to these questions is very similar, too: I will argue that whether *any* referential NP (whether morphoyntactically singular or plural) is interpreted as atom- or set-denoting is strongly influenced by the animacy of the referent. Based on several kinds of data from Dutch and Afrikaans, I will show that inanimate NPs are much more likely to be interpreted as atomic than animate (and especially human) NPs, regardless of morphosyntactic number; and conversely, that animate (and especially human) NPs are much more likely

to be interpreted as sets than inanimates, again regardless of morphosyntactic number. The latter observation makes it plausible that group nouns range over sets across languages (and not just in British English) because they are by definition animate. The former observation suggests that the impure atom mapping is not completely free, but licensed (or even triggered) by certain properties of the NP including, but perhaps not limited to, a lack of animacy.

The chapter is structured as follows. In section 6.1 I address the question of group noun denotations in other languages than British English, using a test inspired by Pearson (2011) to determine the semantic number of embedded group and plural NPs in Dutch. I will show that according to this test, Dutch group nouns pattern with (animate) plurals rather than with singular inanimate 'collection nouns' such as *pile* or *set*, lending support to the idea that referential group NPs also denote sets in languages (like Dutch) in which they obligatorily appear with a singular VP. Additionally, the test shows that the behaviour of plural NPs is not uniform either: while animate plural NPs show behaviour characteristic of semantically plural individuals, inanimate plural NPs pattern with the singular collection nouns in behaving like atoms.

In section 6.2, I further explore the animacy connection by applying our familiar Q-distributivity tests to Afrikaans, which marks number on the subject NP but not on the VP. As it turns out, in the absence of morphological clues that tell us whether we are dealing with singular or plural predication, there is a correlation between animacy and the availability of Q-distributivity: in Afrikaans, sentences with human subjects are more likely to be interpreted Q-distributively than sentences with a non-human or inanimate subject. Since Q-distributivity is a diagnostic for semantic plurality, this study confirms the relation between animacy and semantic number that we also saw in Dutch.

In section 6.3, I return to Dutch in order to address the question of the impure atom shift. By testing the acceptability of sentences like (1b) with human, animate non-human and inanimate subjects, I show that the contrast between group or collection nouns (like *the board* in (1a)) and plurals (*the board members* in (1b)) is much smaller if these nouns refer to inanimate collections: unlike animate plurals, inanimate plurals are relatively acceptable as the subject of a predicate like *composed of*. This suggests that many speakers are able to get an atomic interpretation of the latter, but not the former.

Section 6.4 interprets and discusses the findings of these three studies. I introduce the so-called 'Animacy Hierarchy' and its relation to morphosyntactic

number and agreement (Corbett 2000), and suggest that this relation might reflect an underlying difference in semantic number between referents high and low on the hierarchy. Finally I use the insights gained from our Dutch and Afrikaans data to reflect on the two main issues from the beginning of this introduction. Section 6.4 concludes the chapter.

This chapter is not an exhaustive investigation of the relationship between animacy and semantic number, nor does it provide a definitive answer to the two questions we started out with. However, the three small case studies I discuss will provide us with both a window into this relationship and a direction in which to look for our answers, and as such may be a good starting point for future research.

## 6.1 Group NPs as sets in other languages than British English: some evidence from Dutch

While the analysis of group NPs presented in chapter 5 allows us to treat them uniformly across languages - i.e. as underlyingly set-denoting, even in languages like Dutch and American English where they are not 'outed' as such by an ability to occur with a plural VP - this is not the only option. In theory, we could account for the behaviour of group nouns in other languages than British English with a much more straightforward atomic analysis and get precisely the same results. The downside of this simplification would be the return of language-specific assumptions (some languages have nouns that range over sets, others do not).

From a theory-driven point of view, the existence of nominal set predicates should be the null hypothesis; after all, verbal and adjectival predicates also come in both atom and set varieties. However, this does not mean that this role should be universally played by group nouns - relational nouns like *sister(s)* and *neighbour(s)* can also be analysed as set predicates (Winter 2002). So the question boils down to an empirical one: is there a way to tell whether singular group NPs underlyingly denote sets, even in languages like Dutch or American English where they obligatorily take a singular VP?

In order to answer this question, we need a semantic environment that distinguishes between set-denoting and atom-denoting NPs, without forcing the

former to shift into the latter for type-matching reasons. In this section I suggest one such 'sethood test' (based on an observation on partitives made in Pearson (2011)) which may be applied to group nouns irrespectively of the agreement rules of the language in question. I show that the '*half of*-test' (as I will call it) diagnoses Dutch singular group NPs as semantically plural; as we will see, the Dutch data also suggest that it is animacy, rather than morphosyntactic number, that primarily determines whether a given NP denotes a set or an atom. This means that the results of the *half of*-test not only lend support to the idea that group nouns range over sets in languages where group NPs obligatorily take a singular VP, but also provide us with the start of an explanation, as we have defined group nouns as precisely those nouns that, in the singular, refer to collections of animate individuals (section 5.3.1).

### 6.1.1 Pearson's 'half of'-test

According to Pearson (2011), proportional expressions like *half of the N* are sensitive to the distinction between atoms and sets. Syntactically, they are compatible with both singular and plural *N*s (as (2) shows), but the sentences in (2a-b) have different truth conditions even if *the wall* refers to exactly the same physical stuff as *the bricks in the wall* does:

(2) a. Half of the wall had been painted yellow.
b. Half of the bricks in the wall had been painted yellow.

According to Pearson, it does not matter for the truth of (2a) whether half of the bricks has been painted completely yellow, half of each brick has been painted yellow, or some bricks have been painted completely and others only partly - (2a) is true as long as half of the stuff that makes up the wall has been painted yellow. However, (2b) is only true in the first situation. Pearson accounts for this contrasts as follows. She assumes (following Barker 1998) that expressions like *half of the N* denote quantifiers over atomic proper parts of $N$. If $N$ denotes a set, as in (2b), those atomic proper parts are precisely the entities that this set consists of (individual bricks in the case of (2b)). On the other hand, if $N$ denotes an atom as in (2a), embedding it in a partitive NP yields a mass interpretation, which is underdetermined with respect to its atomic proper parts (Chierchia 2010). The result is that *any* situation in which half of the 'wall-stuff' has been painted yellow may satisfy the truth conditions of (2a), which means that (2a) can be construed as true in more situations than (2b).

Pearson then goes on to apply this test to group nouns, and concludes that they behave like (2b) rather than like (2a): sentence (3) is false in a situation in which each committee member has been painted yellow up to the waist.

(3) Half of the committee had been painted yellow.

This means that the atomic proper parts of [[*the committee*]] are the individual members of the committee, not just any partition of the committee into bits of 'committee-stuff': *the committee* does not behave like *the wall*, but like *the bricks in the wall*. This means that *the committee*, just like *the bricks in the wall*, denotes a set and not an atom.

Since Pearson is herself a native speaker of (British) English and seems to have based her judgements on introspection, we cannot simply extend the results of her *half of*-test to other languages. But the test itself does extend to other languages: since it features group NPs in embedded positions (where they do not enter into an agreement relation with the VP), it works regardless of the agreement requirements that the particular grammar imposes on group NPs. More concretely, whether or not the partitive NP as a whole is shifted into an impure atom does not make a difference: any interpretational differences resulting from embedding either an atom or a set are preserved. This means that Pearson's *half of*-test provides us with a way to test the hypothesis that group nouns also range over sets in other languages than British English.

### 6.1.2 The 'half of'-test in Dutch

To test whether I could replicate Pearson's results in another language than (British) English, I gathered judgements from 15 native speakers of Dutch (for a full description of the method and results of this small questionnaire, see Appendix B). In Dutch, proportional partitives like *half of the N* always take a singular VP, regardless of the morphosyntactic number of N. This makes Dutch particularly suitable for the purposes of the *half of*-test, since there is nothing in the syntax that might disambiguate between semantically singular and semantically plural partitive NPs. Any interpretational difference between the sentences in (4) must therefore be due to the semantics.

(4) a. Driekwart van de stapel tentamens is al nagekeken.
*Three quarters of the pile exams is already graded*
'Three quarters of the pile of exams has already been graded'

b. De helft van de meisjes is met modder bedekt.
*The half of the girls is with mud covered*
'Half of the girls are covered in mud'

c. De helft van het bestuur staat op de foto.
*The half of the board stands on the photograph*
'Half of the board is pictured'

If Pearson's judgements carry over to Dutch, we expect (4a) to be true in a situation in which three quarters of each exam has been graded, but (4b) and (4c) to be false in situations in which half of each girl is covered in mud and half of each board member appears in the picture, respectively. Assuming that the Barker/Chierchia/Pearson analysis of partitives is correct, this would mean that collection nouns (Pearson's term for inanimate collective nouns like *pile (of exams)*) range over atomic entities, while plurals and group nouns (like *girls* and *board*) range over sets. If, on the other hand, Dutch group NPs pattern with the collection NPs and not with the plurals, we can infer that they denote atoms in Dutch.

According to my informants, there does turn out to be a difference in interpretation between sentences with a partitive subject depending on whether the embedded NP is a collection NP or a group NP: while the former are generally judged true in 'distributive' situations like the ones described above, the latter are mostly judged false. According to the above reasoning, this confirms Pearson's intuitions and provide support for the idea that group NPs denote sets even in languages where they require plural agreement.

However, contrary to Pearson's intuitions for (2), my informants' judgements did not show a similarly large difference between plurals and collection NPs: while sentences with an embedded plural NP were, on average, rated 'less true' than sentences with a collection NP, they were not rated as badly as the sentences with an embedded group NP. We might therefore wonder whether the *half of*-test really works as intended. If it really functions as a diagnostic for semantic plurality, why do plural definites come out as 'less plural' than group NPs?

### 6.1.3 The influence of animacy

In chapter 5, I defined the class of 'group nouns', as I use the term in this dissertation, as those collective nouns (as defined by the OED) that refer to collections of animate individuals. In contrast, Pearson's 'collection nouns'

can be defined as those collective nouns that refer to collections of *in*animate individuals. This means that the only difference between group nouns and collection nouns, from a conceptual point of view, is animacy. As to formal differences between the two classes, I have argued that group nouns range over sets; this claim is supported (for English and Dutch) by the results of the *half of*-test, which also shows that collection nouns range over atoms. In short, the difference between group nouns and collection nouns is that the former are animate and range over sets, while the latter are inanimate and range over atoms. The co-occurrence of animacy and semantic plurality suggests that these properties might be connected. But if this is true, there is no a priori reason why this connection should be limited to singular collective nouns: perhaps animate NPs tend to be interpreted as sets and inanimate NPs tend to be interpreted as atoms regardless of their morphosyntactic number.

As it turns out, closer inspection of my informants' judgements appears to confirm this hypothesis. Of the four sentences with an embedded plural NP that I presented to my informants, two were animate and two were inanimate. Looking at these sentences individually reveals that the two sentences with an animate plural subject (e.g. *half of the girls*) were generally judged false by my informants, just like the sentences that contained a group NP. In contrast, the two sentences with an inanimate plural subject (e.g. *half of the exams*) were generally judged true, just like the sentences with an embedded collection NP. Thus, the test's diagnosis of plural definites both as 'more atomic' than group NPs and as 'less atomic' than collection NPs only holds on average: when we separate them into animates and inanimates, we see that plural definites clearly behave either like atoms (patterning with the collection NPs) or like sets (patterning with the group NPs).

The entailments in (5) and (6) exemplify these results:

(5) a. *Inanimate collective ('collection') NP:* Driekwart van de stapel tentamens is al nagekeken.
'Three quarters of the pile of exams has already been graded'
⇐ Three quarters of each exam has been graded.

b. *Inanimate plural NP:* Driekwart van de tentamens is al nagekeken.
'Three quarters of the exams have already been graded'
⇐ Three quarters of each exam has been graded.

(6) a. *Animate collective ('group') NP:* De helft van de klas is met modder bedekt.

'Half of the class is covered with mud'
⇍ Each of the pupils is half covered with mud.

b. *Animate plural NP:* De helft van de meisjes is met modder bedekt.
'Half of the girls are covered in mud'
⇍ Each of the girls is half covered with mud.

In short, the results of the Dutch *half of*-test, when split up according to animacy, suggest that animate NPs that refer to collections of individuals are interpreted as sets regardless of morphosyntactic number, and inanimate NPs that refer to collections of things are interpreted as atoms regardless of morphosyntactic number. This means that these findings not only support the hypothesis that group nouns range over sets in Dutch, but also provide us with a direction in which to look for an explanation of this: if it is true that sethood is primarily determined by animacy, and group nouns are animate by definition, it becomes plausible to assume that they range over sets universally and not just in British English. In section 6.4 I offer a bit of additional speculation on this issue.

## 6.2 Q-distributivity and animacy in Afrikaans

In this section, I further explore the animacy connection by applying several of our familiar Q-distributivity tests to Afrikaans. Afrikaans is quite similar to Dutch but does not mark any agreement features on the VP, including number:

(7) a. Die kat/katte slaap in die tuin.
*The cat/cats sleep in the garden*
'The cat is / cats are sleeping in the garden'

b. Die koffiekoppie/koffiekoppies is rooi.
*The coffee cup / coffee cups is red*
'The coffee cup is / coffee cups are red'

Since the VP could be either singular or plural and, accordingly, could denote either a starred or an unstarred predicate, it should be compatible with both atomic and set-denoting arguments. Unlike in English and Dutch, there is nothing about the morphosyntax of the VP that could influence whether the subject is interpreted as an atom or a set. We therefore expect the semantic number of the subject NP (and, consequently, the availability of Q-distributivity) to depend completely on the properties of the NP itself - like animacy. This means

that Afrikaans - like the Dutch partitives discussed in the previous section - provides us with a good environment to test the influence of animacy on semantic number without the possible interference of VP morphosyntax.

I asked seven native speakers of Afrikaans for their judgements regarding the Q-distributive interpretation of different sentences with inanimate, non-human animate and human plural subjects, using several of the Q-distributivity tests from chapter 3 (for a full description of the questionnaire and the obtained data, see Appendix C). The results confirm our hypothesis that animacy and semantic plurality are related: even though my informants generally seemed to be able to accept the Q-distributive interpretation regardless of the animacy of the subject, their judgements indicate that they got this interpretation more easily when the subject was animate, and most easily when it was human. These results are exemplified by the entailments in (8), where each arrow indicates how easy it was for my informants to accept that particular entailment:

(8) a. *Inanimate subject:* Die koffiekoppies is rooi of wit.
'The coffee cups are red or white'
$\overset{\text{hardest}}{\Leftarrow}$ For every coffee cup $x$, $x$ is red or $x$ is white.

b. *Animate subject:* Die honde hardloop deur die tuin of slaap.
'The dogs are running through the garden or sleeping'
$\overset{\text{medium}}{\Leftarrow}$ For every dog $x$, $x$ is running through the garden or $x$ is sleeping.

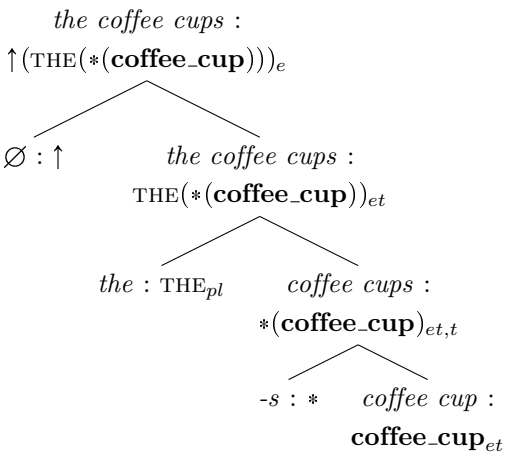
c. *Human subject:* Die meisies sing of dans.
'The girls are singing or dancing'
$\overset{\text{easiest}}{\Leftarrow}$ For every girl $x$, $x$ is singing or $x$ is dancing.

Since the availability of a Q-distributive interpretation reflects the semantic plurality of the subject NP, this means that plural NPs denoting a collection of humans are interpreted as sets more easily than plural NPs denoting nonhuman collections, and non-human animates are in turn more likely to be interpreted as set-denoting than inanimates. This is in line with the results from Dutch described in section 6.1.

## 6.3 More on impure atoms: the ↑ mapping and group-level predicates

In the two previous sections, we have seen evidence suggesting that inanimate NPs tend to be interpreted as atoms even if they are morphosyntactically plural. I should perhaps emphasise that this does not mean that they are interpreted as if they were morphosyntactically singular. The atomic entity denoted by a singular (non-collective) NP like *the coffee cup* corresponds to a conceptually singular individual (a single coffee cup), but the atomic entity denoted by an inanimate plural NP like *the coffee cups* corresponds to a *collection* of individuals. These semantically singular but conceptually plural entities have to be derived from the basic noun denotation in some way. Under our current assumptions, this can be done straightforwardly (and compositionally) by semantically pluralising the noun, applying the maximum operator THE, and then shifting the resulting set of entities into the corresponding impure atom by means of ↑:

(9)




We cannot do without either pluralisation or an impure atom mapping here: the first is needed because we need *the coffee cups* to refer to an entire collection of coffee cups, not to a single coffee cup; the second is needed because the behaviour of inanimate NPs like *the coffee cups* in Dutch and Afrikaans shows that they are often interpreted as semantically singular in spite of referring to multiple coffee cups. Thus, our observations on Dutch and Afrikaans not only suggest that semantic number is related to animacy, they also support the need for a notion of impure atomicity and a way to derive impure atoms from corresponding sets.

The Dutch and Afrikaans data suggest that the impure atom shift is triggered by a lack of animacy (although probably not obligatorily, at least not in Afrikaans, where inanimate plurals are still more likely to be interpreted as sets than collection nouns[1]. Moreover, the Dutch *half of*-data suggest that animates are very unlikely to receive an atomic interpretation even if this could 'save' an otherwise false sentence. Both of these observations could help us deal with a specific problem posed by the assumption of a freely available impure atom mapping: the overgeneration problem already briefly mentioned in the introduction to this chapter. In the following sections, I will introduce the problem in more detail and discuss some new data that I gathered from a large group of Dutch native speakers, which confirm that the overgeneration problem is much less of a problem if we assume an animacy-based restriction on the application of the impure atom shift.

### 6.3.1 A problem with the impure atom mapping

In previous chapters, I have been assuming that the ↑ shift from sets to impure atoms is more or less freely available for the denotation of referential NPs. While it is sometimes required for type-matching reasons - when a group subject occurs with a singular VP (chapter 5), or in the case of VP coordination of a set and an atom predicate (chapter 3, section 3.5) - it is not just a 'last resort' strategy. For example, it is not possible to claim (as I have done) that simple predication structures like ''The girls smiled'' may be analysed in terms of P-distributivity if the impure atom shift only applies as a last resort, since mapping the set denoted by *the girls* into an impure atom is not necessary for type reasons: the sentence can be analysed with a starred predicate and a set denotation for *the girls* just fine.

The assumption that the impure atom mapping is freely available, however, is not unproblematic. It predicts that any predicate that is compatible with a group subject should also be compatible with a plural subject, since the latter is always able to shift into an impure atom. But, as (10) shows, this is not the case: while the group-subject sentences in (10a) are grammatical, their plural-subject counterparts in (10b) are not (see also Schwarzschild 1996; Winter 2001a; Magri 2012).

[1]See the final section of Appendix C. While the Q-distributive interpretation was not easily available for sentences with an inanimate plural subject, my informants were unable to get this interpretation at all when the subject was a collection NP like *stapeltjie* 'stack' or *se"elversameling* 'stamp collection'.

(10) a. The council $\left\{\begin{array}{l}\text{was constituted in 2001}\\ \text{has five members}\\ \text{consists of lawyers and archaeologists}\end{array}\right\}$.

b. *The councillors $\left\{\begin{array}{l}\text{were constituted in 2001}\\ \text{have five members}\\ \text{consist of lawyers and archaeologists}\end{array}\right\}$.

Other predicates are compatible with both plural and group subjects but give rise to a different range of available interpretations with each, as can be seen by comparing (11a) and (11b):

(11) a. The committee is old.
$\Leftarrow$ The committee's members are old.
$\Leftarrow$ The committee is an old institution.

b. The committee members are old.
$\Leftrightarrow$ The committee's members are old.
$\not\Leftarrow$ The committee is an old institution.

In a system that lacks a freely available mapping from sets to impure atoms, the data in (10) and (11) can easily be accounted for. Without such a mapping, the semantics of sentences like those in (10b) and (11b) - which both contain plural atom predicates - must be derived by applying a starred predicate to the set denoted by the subject. As we have seen, this requires that each individual member of the set of councillors or committee members be in the extension of (unstarred) **constituted_in_2001** and **old**, respectively: ''The committee members are old'' is true just in case the individual committee members are old, and ''The councillors were constituted in 2001'' is true just in case the individual councillors were constituted last year. In other words, without a freely available impure atom mapping, these sentences receive an obligatory Q-distributive interpretation. Since this interpretation is anomalous in the case of (10b) and incompatible with the 'old institution' interpretation of (11b), the contrasts between the (a) and (b) sentences above are accounted for.

On the other hand, in a system that allows for an atomic interpretation of NPs like *the committee members*, the differences between the (a) and (b) sentences in (10) and (11) are unexpected, since any semantics that can be derived for the group-subject sentences in (10a) and (11a) should be available for the plural-subject sentences in (10b) and (11b) as well. With a freely available impure atom mapping, there is nothing in our current system that would block the logical forms in (12b) and (13b):

(12) a. **constituted_in_2001**(↑**the_committee**)

b. **constituted_in_2001**(↑**the_committee_members**) *(unavailable)*

(13) a. **old**(↑**the_committee**)

b. **old**(↑**the_committee_members**) *(unavailable)*

Yet, the fact that the 'group-level' interpretations of *old* and *constituted* are incompatible with plural subjects suggests that these logical forms are not available. The assumption that the impure atom mapping is freely available thus leads to an overgeneration problem, in which non-existent interpretations are predicted to exist.[2]

[2]In an observation related to the present one, Pollard and Sag (1994) mention that group-level predicates like *be constituted* are ungrammatical with plural agreement in British English:

(i) *A new committee have been constituted.

Similarly, Barker (1992) notes that (ii.b) (in which the group noun appears with a plural VP) can only mean that the members of the committee are old, unlike (ii.a) which can also mean that the committee is an old institution. (Barker also claims that (ii.a) does not have the 'old members' interpretation, but this appears to be too strong a claim: according to my informants, sentence (ii.a) can have both interpretations, just as it does in other varieties of English.)

(ii) a. The committee is old.

b. The committee are old.

Under the analysis of group NPs as developed in chapter 5, these observations can be accounted for just like the contrasts in (10) and (11): in (i) and (ii.b), the morphosyntactically plural atom predicate is analysed as semantically plural and the subject is analysed as a set, and the sentence is necessarily interpreted Q-distributively. In this case, we might get away with the apparent unavailability of an impure atom interpretation of *the committee* when it occurs with a plural VP by adopting some sort of 'blocking' account: since there is already a more economical way to express a predication over an impure atom using a group subject - namely, by using a singular VP, as in (10a) and (ii.a) - the existence of this possibility would then block the same interpretation for the more marked (cf. Corbett 2000) plural sentences in (i) and (ii.b). While such a blocking mechanism is not implausible, it only solves the overgeneration problem for group subjects, not for plurals: since the latter can only occur with a plural VP, there are no 'competing' forms that can end up with different meanings through a blocking process. This means that the observed contrasts in (10) and (11) still form a challenge for any semantic framework that includes a freely available impure atom shift.

### 6.3.2 Group-level predicates with inanimate, animate and human subjects

The examples above, most of which I adapted from earlier literature, all involve human subjects. Considering the connection between animacy and semantic plurality that we have uncovered in this chapter, it makes sense to wonder whether the humanness of these plural NPs has something to do with their inability to occur with a group-level predicate. If group-level predicates like *constituted* and *consist of* behave the way they do because they are atom predicates whose extension is restricted to impure atoms, and animate NPs are less likely to receive an atomic interpretation than inanimate ones, we might expect group-level predicates to be more acceptable with plural subjects if those subjects are non-human or inanimate. According to my own judgement, the sentences in (14) certainly sound much better than those in (10)b:

(14) a. The stolen items consist of six pearl necklaces and five gold watches.

b. These campaign ideas were compiled by our interns.

Similarly, with predicates like *old* and *new*, that can be interpreted on either an individual or a collective level, we see a contrast between (11)b and (15). The sentence ‘‘The matchboxes are new’’ sounds quite natural to me in the context of (15a), in which the group-level interpretation is made salient; note that (15a) can be true even if Susie’s matchbox collection consists mostly of antiques, as long as the collection itself was put together recently. This suggests that the group-level interpretation of *new* is available in (15b), unlike the group-level interpretation of *old* in (11).

(15) a. Susie has always loved to collect things - mainly Star Wars merchandise and matchboxes. She started her Star Wars collection ten years ago, but the matchboxes are new.

b. The matchboxes are new.
⇐ The matchboxes in the collection are new.
⇐ The matchbox collection is new.

To further test the hypothesis that the less animate a plural NP, the more acceptable it is with a group-level predicate, I asked 41 native speakers of Dutch for their grammaticality/acceptability judgements on 18 different sentences, each featuring a group-level predicate and either an inanimate, non-human animate or human subject. (For a full discussion of the methods and results

of this study, see Appendix D.) On the whole, my informants' judgements confirmed the observations from the literature: while group-level predicates are perfectly grammatical with collective subjects of all levels of animacy, they are at best marginal and at worst extremely degraded with plural subjects. But the judgements also showed a clear animacy distinction: while my informants consistently disapproved of the sentences with plural animate subjects (both human and non-human), they were relatively happy with the inanimate ones (even though these are still not quite as acceptable with group-level predicates as their collection NP equivalents).

The examples in (16) summarise the link between the animacy of an NP and its acceptability as the subject of a group-level predicate in Dutch:

(16) *Inanimate subject:*

a. *Collective:* De tiplijst is door onze eigen dj's samengesteld.
*The tip-list is by our own djs compiled*
'The list of tips was put together by our own djs'

b. *Plural:* ?De tips zijn door onze eigen dj's samengesteld.
*The tips are by our own djs assembled*
'The tips were put together by our own djs'

(17) *Animate subject:*

a. *Collective:* Het nestje bestaat uit twee katertjes en een poesje.
*The litter consists of two male.cats and a female.cat*
'The litter consists of two males and a female'

b. *Plural:* *De kittens bestaan uit twee katertjes en een poesje.
*The kittens consist of two male.cats and a female.cat*
'The kittens consist of two males and a female'

(18) *Human subject:*

a. *Collective:* De onderzoeksgroep is in 2010 in het leven geroepen.
*The research-group is in 2010 into the life called*
'The research group was established in 2010'

b. *Plural:* *De onderzoekers zijn in 2010 in het leven geroepen.
*The researchers are in 2010 into the life called*
'The researchers were established in 2010'

Given that (according to the assumptions of the present theory) an NP should be acceptable with a group-level predicate if it can be interpreted as an impure atom, these data again confirm that the sets associated with inanimate plural NPs can be shifted into impure atoms much more easily than those associated with animate NPs.

### 6.3.3 Intermediate conclusions

All this means that we can no longer claim that the impure atom mapping is freely available - but neither is it true that it only applies as a last resort to resolve type mismatches. Rather, whenever shifting a set into an impure atom is not necessary for type-matching reasons, it may be mapped into an impure atom anyway but only if the NP associated with it has the right properties. This chapter has demonstrated that a lack of animacy is one of these properties, but there might well be more (see section 6.4.1).

Let me give a schematic overview of the picture that has emerged so far.

(19) **Impure atom formation (extended version)**
If $X_{et}$ is the denotation of a referential NP, $(\uparrow X)_e$ is the *impure atom* corresponding to $X$.

$X$ *must* be typeshifted to $\uparrow X$ if $X$ is:

a. the argument of an unstarred atom predicate (cf. sections 3.3.4, 5.2, 5.3.2) or a singularised set predicate (cf. section 3.4.2);

b. the argument of a complex predicate derived by intersecting or unioning the extensions of an unstarred atom and a singularised set predicate (cf. section 3.5).

$X$ *may* be typeshifted to $\uparrow X$ if:

c. the NP corresponding to $X$ is sufficiently inanimate, where what counts as 'sufficiently inanimate' might depend on the language.

In the next section, we will look at (c) in more detail.

## 6.4 Discussion: animacy and semantic number

The relation between animacy and morphosyntactic number has been studied at length in the typological literature, and a great overview can be found in

Corbett (2000). Corbett demonstrates that animate NPs are crosslinguistically more likely to be marked for number and to trigger number agreement on other elements (like adjectives and VPs). In this section, I briefly summarise his main points and discuss how the semantic observations made in this chapter might tie in with Corbett's more morphosyntactic approach. Then, armed with the technical knowledge of Corbett's 'Animacy Hierarchy', we will go back to our three questionnaire studies in more detail to see to what extent we can define the conditions on the impure atom mapping. Even though I will not be able to provide any definitive conclusions, I hope to end this chapter with a better idea of the kind of questions we still have to answer when it comes to atomic interpretations of plural NPs, and the kind of data we have to study in order to answer them.

### 6.4.1 Number agreement and the Animacy Hierarchy

In his typological overview of number and number agreement, Corbett (2000) shows that whether or not a language expresses plural marking on a noun often depends on animacy. For example, in the West Chadic language Miya plural number is obligatorily marked on nouns denoting humans, domesticated animals and large wild animals, but only optionally on inanimates (Schuh 1998):

(20) a. tə̀vam tsə̀r / * 'ám tsə̀r *(Miya)*
*woman*.PL *two* / *woman*.SG *two*
'two women'

b. zə̀kiyáyàw vaatlə/ zə̀kiy vaatlə
*stone*.PL *five* / *stone*.SG *five*
'five stones'

In many other languages, the level of animacy of the NP determines whether it triggers plural agreement. In the Austronesian language Muna, plural human nouns and pronouns obligatorily take plural predicates, plural inanimates obligatorily take singular predicates, and non-human animates may take either (data from van den Berg 1989):

(21) a. ihintu-umu o-kala-amu / *o-kala *(Muna)*
2-PL 2-*go*-PL / 2-*go*.SG
'you (plural) go'

b. bara-hi-no no-hali / *do-hali
*good*-PL-*his* 3.SG.REALIS-*expensive* / 3.PL.REALIS-*expensive*
'his goods are expensive'

c. o kadadi-hi no-rato-mo / do-rato-mo
*the animal*-PL 3.SG.REALIS-*arrive*-PFV / 3.PL.REALIS-*arrive*-PFV
'the animals arrived'

We find many languages like Miya and Muna that distinguish number for animates but not for inanimates, but the opposite pattern is unattested: there are no known languages that express plural number on inanimate nouns but not on animate ones, or languages where plural number agreement between an NP and VP is optional for humans but obligatory for nonhumans. Generally, the 'more animate' a plural noun is, the more likely it is to be marked for number and trigger agreement. By observing where different languages draw the line between nouns that distinguish number and nouns that do not, it is possible to arrive at a universal 'Animacy Hierarchy'; Corbett's eventual proposal (based on an earlier version by Smith-Stark 1974) is given in (22). The constraint in (23) expresses the above generalisation that number distinctions always affect a top segment of the hierarchy: if a language distinguishes number for a particular class of nouns but not for another, the former must rank higher on the Animacy Hierarchy than the latter.

(22) **The Animacy Hierarchy** (Corbett, p. 56)
1st person >> 2nd person >> 3rd person >> kin >> human >> animate >> inanimate

(23) **General constraint of the Animacy Hierarchy on number differentiation** (Corbett, p. 70)
As we move rightwards along the Animacy Hierarchy, the likelihood of number being distinguished will decrease monotonically (that is, with no intervening increase).

Corbett describes the relation between number agreement and the Animacy Hierarchy in purely morphosyntactic terms: the higher on the hierarchy a plural expression is, the higher the chance that other expressions will overtly agree with it in number. The observations in this chapter suggest that we are not just dealing with a purely morphosyntactic phenomenon, though. They show that the Animacy Hierarchy and the associated constraint play a role even in languages in which animacy has no influence on the morphosyntactic expression of number at all: neither Dutch nor Afrikaans has any morphosyntactic phenomena that depend on animacy[3], but animacy still influences semantic number in both

[3]Although according to van Bergen et al. (2011), animacy or at least humanness is relevant in certain nonstandard Dutch pronoun systems.

of these languages. And it does so in a way that, as far as I can tell, obeys the same general constraint that governs morphosyntactic number distinctions: the likelihood that a given NP is interpreted as semantically plural decreases monotonically as we move down the Animacy Hierarchy.

It seems unlikely to me that these two manifestations - morphosyntactic and semantic - of the influence of animacy on number are independent. Rather, the morphosyntactic facts that Corbett reports might be a reflection of the underlying semantics; that is, if a predicate does not show number agreement with its plural subject, this might be not 'just' because the subject carries some syntactic feature [-animate], but because the subject is actually semantically singular. When it comes to number agreement, languages will have to seek a balance between faithfulness to morphosyntax and faithfulness to semantics. In languages like American English or Dutch, VP number is fully determined by the morphosyntactic number of the subject, regardless of whether it is semantically singular or plural; in British English, VP number sometimes reflects semantic rather than morphosyntactic number (resulting in plural agreement with singular group NPs); in languages like Muna, VP agreement mostly reflects the semantic number of the NP.

Another observation from Corbett that is important to mention here is that agreement is influenced by other factors than just animacy - notably, high-cardinality numerical NPs are less likely to trigger plural agreement on the VP than low-cardinality ones, as Corbett demonstrates using data from twelve different Slavic languages (p. 215). He speculates that the influence of animacy is really a special instance of a more general phenomenon, namely individuation: the more we care about the individual members of the collection to which a plural NP refers, the higher the likelihood that the NP will be marked for number and/or trigger plural agreement. We are more likely to individuate humans than inanimate objects; we are also more likely to individuate the members of small collections than the members of large ones. From our semantic perspective, it is precisely the possibility to individuate that distinguishes sets from impure atoms: while both may refer to collections of individuals, only the former preserves those individuals in the semantics.

### 6.4.2 Back to the impure atom mapping

We are now in a position to take a closer look at the influence of animacy on the impure atom mapping, using our knowledge of the way the Animacy Hierarchy

is manifested in morphosyntax to identify some relevant questions and enable an educated guess as to their answers - anything beyond the level of educated guess I will leave for future research.

**Cut-off points.** As we have seen, languages in which animacy influences morphosyntactic number carve up the Animacy Hierarchy in different ways: while number distinctions always affect a top segment of the hierarchy, some languages might only distinguish plural number on first and second person pronouns, while others might distinguish it on everything except inanimates, and so on. We might expect this to be different when it comes to the influence of animacy on semantic number: not only is semantics often taken to be more 'universal' than syntax, but the difference between sets and impure atoms is pretty much invisible in everyday language use (we have to coax it out using carefully designed Q-distributivity and *half of*-tests), so it is hard to see how a cut-off point on the Animacy Hierarchy above which plural NPs denote sets and below which they are likely to denote impure atoms could be learnable if it were a language-specific part of the grammar.

Even so, this does not mean that the relation between animacy and semantic number could not involve such cut-off points, nor that it should manifest itself in the same way across languages. For example, if animacy is morphosyntactically relevant elsewhere in the language's grammar, and this involves carving up the Animacy Hierarchy in some specific way, this same cut-off point might govern the relation between animacy and semantic number. Another option is that languages might have different cut-off points as a reflection of cultural differences - it is likely, for example, that different cultures have different views of non-human animals that may influence their position on the Animacy Hierarchy[4]. In short, further research should determine (1) whether the relation between animacy and semantic number is a gradual one (the less animate the NP, the more likely it is to receive an atomic interpretation) or one that involves sharp distinctions or cut-off points between different animacy classes; (2) whether this is language-specific or universal; and (3) how the cut-off point (if any) is determined.

**Optionality.** In languages where number marking is influenced by animacy, this is not always a matter of marking plurality above a certain point on the

[4]For example, Corbett mentions the Athabaskan language Slave, in which dogs (and only dogs) 'count as' humans for the purposes of number marking.

hierarchy and not marking it below that: as the examples from Miya and Muna show, sometimes the distinction is between obligatory and optional (non-)marking. We have seen that Dutch and Afrikaans inanimate plurals are more likely to receive an atomic interpretation than human/animate plurals, but is there a way to tell from the results if this atomic interpretation is obligatory or merely optional?

The best way to answer this question is to compare the behaviour of inanimate plurals with that of collection nouns; being both morphosyntactically singular and inanimate, collection NPs can only denote atoms (as evidenced by their near-total incompatibility with Q-distributivity in Afrikaans). Thus, they can function as a 'baseline' of atomicity. If inanimate plurals pattern with collection NPs in our various tests, we have to conclude that inanimacy inevitably leads to atomicity. If, on the other hand, the behaviour of inanimate plurals falls somewhere in between that of collection NPs and that of animate plurals, we should conclude that they can denote either a set or an impure atom, even if the latter is more likely.

Unfortunately, the results of our three studies are not consistent when it comes to this question. The first study (the *half of*-test in Dutch) showed no difference between plural and collective inanimates, which suggests that they are equally likely to receive an impure atom interpretation. However, according to both the second and the third study, collection nouns are still much more likely to receive an atomic interpretation than inanimate plurals, suggesting that the latter may still be interpreted as sets. More research is therefore needed before we can answer this question.

**Atomic interpretations of animates.** A question related to the previous point is whether the impure atom mapping is completely unavailable for animates (unless, of course, they are involved in one of the phenomena described in (20a-b)), or merely a bit difficult. The results of the first and third questionnaire studies suggest that it is simply unavailable - in both cases, the animates scored close to zero, where they would have scored quite a bit higher had they been able to receive an atomic interpretation. However, if the relation between animacy and plurality is a special instance of a more general relation between plurality and individuation, we expect animates to be able to shift into impure atoms if there are other factors that reduce individuation, for example if they refer to very large groups. It might also be possible to add contextual factors that downplay the distinction between individual group members and emphasise

the group as a single unit. For example, recall the following example from Mador-Haim and Winter (2012) that was discussed in chapter 2:

(24) The house is exactly 10 meters away from the utility poles.

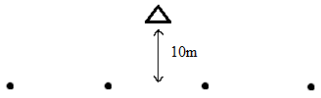



Figure 6.1: A house and a row of utility poles.

Here, the fact that sentence (24) can be interpreted as true in the depicted situation shows that it must be possible to interpret 'the utility poles' as a single, row-shaped unit, rather than a set of points. The impure atom interpretation is natural here because we know that the utility poles are both neatly lined up and part of a single functional system. We can invent a similar situation involving an animate NP, for example:

(25) John is exactly 10 meters away from the ticket inspectors.

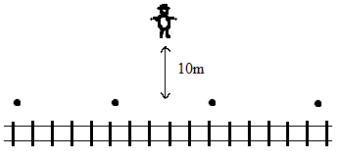



Figure 6.2: John and a row of ticket inspectors.

Here, the ticket inspectors are lined up in such a way that each of them will end up near a door when the train arrives, ready to inspect the tickets of every emerging passenger. If we emphasise their functioning as a single unit in this way, my judgement is that (25) is perfectly true in the depicted situation, which indicates (if we accept Mador-Haim & Winter's reasoning) that I am able to assign an atomic interpretation to *the ticket inspectors* despite the fact that it refers to a collection of humans.[5]

[5]This is reminiscent of a point made in Grimm (2012), who discusses the role of individuation in number systems. Languages like Welsh and Maltese possess a class of nouns that refer to collections of individuals in their morphosyntactically unmarked form, and to single

## 6.5 Conclusions

I started out this chapter with two related questions. First, is the claim that morphosyntactically singular group nouns range over semantically plural individuals crosslinguistically applicable? And second, can morphosyntactically plural NPs freely receive a semantically singular interpretation or is this restricted in some way? I have suggested that the answers to both of these questions lie in the observation that the higher the position of an NP on the Animacy Hierarchy, the more likely it is to be interpreted as a set and the less likely it is to be interpreted as an atom. This makes it plausible that group NPs - which are, by definition, (human) animate - denote sets universally and not just in British English, a hypothesis that was confirmed for Dutch by using the *half of*-test from Pearson (2011), which should be easy to apply to other languages as well. The observed link between animacy and semantic plurality also suggests that the mapping ↑ from sets to impure atoms that was introduced in chapter 2 is restricted rather than completely free in its application: when it is not necessary as a last resort operation to resolve type mismatches, it has to be licensed by inanimacy, or more generally a lack of individuation.

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individuals in their marked form:

(i) a. Ile mae 'r adar? *(Welsh, from Grimm 2012)*
*Where is the bird*
'Where are the birds?'

b. Ile mae 'r ader-yn?
*Where is the bird*-SG
'Where is the bird?'

As is often observed, these 'aggregate nouns' all refer to entities that tend to cluster together in space - small animals that move in swarms or flocks, plants that grow together in patches, or substances like grains of sand or specks of dust. Grimm argues that the unmarked (collective) form should not be analysed on a par with plural count nouns, but as a separate kind of individual that falls somewhere in between count and mass on a countability scale. He also argues that this countability scale directly reflects the degree of individuation of the noun referent: the higher the degree of individuation, the 'more countable' the noun will be. According to this reasoning, languages like Welsh and Maltese show that spatial coherence is much like animacy - both influence the degree of individuation of a noun referent, and this influence may be reflected in a language's number system. And just as animacy influences the interpretation of NPs as semantically singular or plural even in languages without grammaticalised animacy distinctions, examples like (25) suggest that spatial coherence is relevant to the interpretation of NPs also in languages that do not recognise a separate morphosyntactic class of aggregate nouns.

# CHAPTER 7

# Conclusions

The contents of this dissertation may be separated into two distinct but closely related parts. In the first part, consisting of chapters 2 to 4, I investigated the different sources of distributive interpretations. Its central claim is that distributivity effects can occur with both plural and singular predication, but through different mechanisms. In the first case, distributivity is a 'side effect' of semantic pluralisation: the operation that turns a predicate over atomic entities into a predicate over sets results in a predicate that is distributive by definition. In the second case, distributivity is the result of reasoning about the lexical semantics of the predicate in relation to the part-whole structure of the entity it applies to: given the lexical meaning of $P$, and knowing that $P$ holds of an entity $x$ with a salient part-whole structure, what can be concluded about the relation that holds between $P$ and the individual parts of $x$? Following the terminology of Winter (1997), I called the first kind of distributivity *Q-distributivity* and the second kind *P-distributivity*. Q-distributivity is necessarily a property of plural predication, that requires the application of a pluralised predicate to a semantically plural (set-denoting) argument. P-distributivity does not require a semantically plural argument: it can occur with any singular individual with a salient conceptual part-whole structure. The upshot of this is that only the availability of Q-distributivity, and not the presence of distributivity effects in general, can be used as a diagnostic for semantic plurality. To this purpose,

several tests were developed in chapters 3 and 4 to distinguish P- from Q-distributivity.

The second part of the dissertation, consisting of chapters 5 and 6, built on the P/Q-distinction to 'diagnose' the semantic number of group NPs (chapter 5) and plural NPs with varying levels of animacy (chapter 6). The overarching claim of this second part is that the morphosyntactic number of an NP is not a reliable indicator of its semantic number: I argued that some morphosyntactically singular NPs are interpreted as semantically plural (animate group NPs), and some morphosyntactically plural NPs tend to be interpreted as semantically singular (inanimate NPs). In addition to this, type mismatches between a plural subject and a singular predicate can force the former to shift into an atomic entity; I argued that this is what happens to group NPs if they occur with a singular VP, which explains why they behave like atomic entities in most languages.

Taken together, the two parts of this dissertation show that, once we have determined which kind of distributivity effects are indicative of semantically plural predication and which are not (part 1), we can use distributivity judgements to determine whether a given NP denotes a singular or a plural individual (part 2); the latter process both uncovers a clear relationship between semantic plurality and animacy (or, more generally, individuation), and provides support for a 'flexible' system of semantic number in which a typeshifting mechanism systematically relates singular and plural individuals.

The main aim of this dissertation was to investigate the relationship between morphosyntactic and semantic number of both NPs and VPs. Let me give a schematic overview of the answers I have proposed to both parts of this question.

**Morphosyntactic and semantic number of NPs.** I have argued in chapters 3, 5 and 6 that singular group NPs are able to denote sets and plural NPs are able to denote atoms. The picture is not completely symmetrical, however: while singular group nouns originate as predicates over sets, the atomic denotation of plural NPs is derived from their set denotation by a typeshift. This asymmetry - represented schematically in table 7.1 - makes sense from a conceptual point of view: singular group nouns like *team* are conceptually plural by definition, while 'ordinary' nouns like *cat* first need to be pluralised before they can refer to a collection of individuals. It also allows us to maintain

| **basic predicate** | **pure atom** | **set of atoms** | **impure atom** |
|---|---|---|---|
| *team* : $\mathbf{team}_{et,t}$ | n/a | *the team* : $\text{THE}_{pl}(\mathbf{team})$ | *the team* : $\uparrow(\text{THE}_{pl}(\mathbf{team}))$ |
| *cat* : $\mathbf{cat}_{et}$ | *the cat* : $\text{THE}_{sg}(\mathbf{cat})$ | *the cats* : $\text{THE}_{sg}(*(\mathbf{cat}))$ | *the cats* : $\uparrow(\text{THE}_{sg}(*(\mathbf{cat})))$ |

Table 7.1: Reference to singular and plural individuals with group and non-group NPs

a formal system in which it is possible to derive both set and impure atom denotations for singular group NPs as well as plural non-group NPs with only a single typeshifting mechanism. Given this picture, it is possible to account for both 'mixed' predication structures like ''John and Mary are a happy couple'' (the group noun *happy couple* ranges over plural individuals), and for various entailments from group-subject sentences to plural-subject sentences and vice versa (the NPs *the team* and *the team members* are associated with the same set of entities, and the impure atom mapping preserves the set's membership structure as part of the conceptual meaning of the associated impure atom).

I observed in chapter 6 that it is much easier to shift the denotation of an inanimate plural NPs into an impure atom than it is for animate (and in particular human) NPs, which helps to account for the various cases in which group-subject sentences do not entail the corresponding plural-subject sentence. For example, ''The committee is old'' does not entail ''The committee members are old'' because the 'old institution' interpretation requires the subject to denote an impure atom, which it does in the first case because the VP is singular, but not in the second case because the subject is human.

**Morphosyntactic and semantic number of VPs.** The morphosyntactic licensing of Q-distributivity was mainly addressed in chapters 3 and 5. Based on the notion of Q-distributivity as a diagnostic of semantic plurality, and given the observation that British English allows Q-distributive interpretations with group subjects when the VP is plural but not when it is singular, I argued that only morphosyntactically plural VPs are able to denote starred predicates. This is in line with the earlier suggestion (from chapter 3) that the pluralisation operator $*$ does not apply at the level of the predicate itself, but at IP level, the location of plural number morphology. This supports an analysis of $*$ as the semantic correlate of plural number inflection. The question of the precise syntactic or semantic mechanism by which the presence of plural number

| **basic predicate** | **singular VP** | **plural VP** | | |
|---|---|---|---|---|
| *laugh* : $\mathbf{laugh}_{et}$ | *is laughing* : **laugh** | *are laughing* : $*$**laugh** | OR | *are laughing* : **laugh** |
| *gather* : $\mathbf{gather}_{et,t}$ | *is gathering* : $\Uparrow$**gather** | *are gathering* : **gather** | OR | *are gathering* : $\Uparrow$**gather** |

Table 7.2: Reference to predicates over atoms and predicates over sets.

morphology on atom predicates licenses $*$ was left for future research.

The table in 7.2 shows the various relations between the morphosyntactic and semantic number of VPs as proposed in this dissertation. I have argued that plural morphology is required to license semantic pluralisation, but that morphosyntactically plural atom predicates are not obligatorily pluralised. This assumption is a necessary consequence of allowing morphosyntactically plural NPs to be associated with impure atoms in languages with obligatory subject-verb number agreement: the morphosyntactically plural NP requires a morphosyntactically plural VP, while the semantically singular individual associated with it requires a semantically singular predicate.

Further, while the semantic pluralisation of atom predicates has to be licensed by plural morphology, I have assumed that semantic singularisation of set predicates is freely available. This asymmetry enables us to derive a semantics for coordinated atom and set predicates, which have to be of the same type before they can be coordinated. Apart from this technically motivated point, the relation - or lack thereof - between verbal number morphology and the singularisation operator $\Uparrow$ has fallen outside the scope of this dissertation. One of the open questions is whether we should assume that morphosyntactically singular set predicates are obigatorily singularised, or whether it is more empirically accurate to treat $\Uparrow$, like $*$, as optional (i.e., should *is gathering* be able to denote a predicate over sets **gather** despite being morphosyntactically singular?).

# APPENDIX A

## British English Q-distributivity questionnaire[1]

## A.1 Method

The judgements used in investigating the availability of Q-distributive interpretations with British English group nouns were obtained from 6 native speakers of British English (5 from England, 1 from Wales, all with a background in linguistics), by means of a pen-and-paper truth value judgement task. Each test item consisted of a sentence and a picture of a situation that was compatible with a distributive interpretation of that sentence, but incompatible with a collective one; subjects were asked to judge whether or not the sentence could be true in the depicted situation.

There were 18 test items in total: three Q-distributivity tests were used (disjunction, conjunction and other quantifiers), with two different pictures in each test category, and each picture being accompanied by one of three different test sentences. This led to six different 'item clusters' (a pictured situation with its associated test sentences), which are all given at the end of this section.

The test items were supplemented with 8 control items (an example is given in fig. A.1) to check whether subjects accepted group-subject sentences with different kinds of agreement in the first place, and 13 fillers (an example is given

[1]I would like to thank Sophie Chesney, whose native speaker intuitions have been of great help to me in developing this questionnaire.

in fig. A.2). The items were then distributed semi-randomly across two versions


Figure A.1: Control item: ''The Evans family is/are tall.''

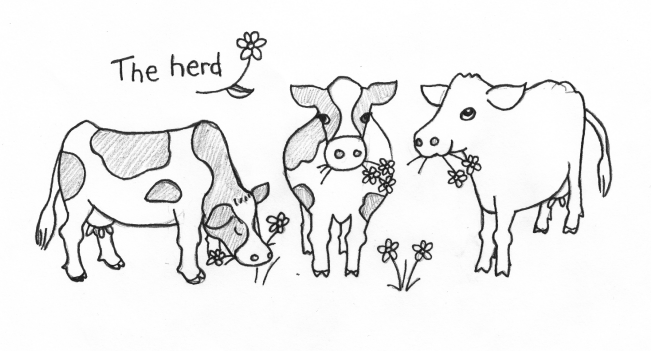


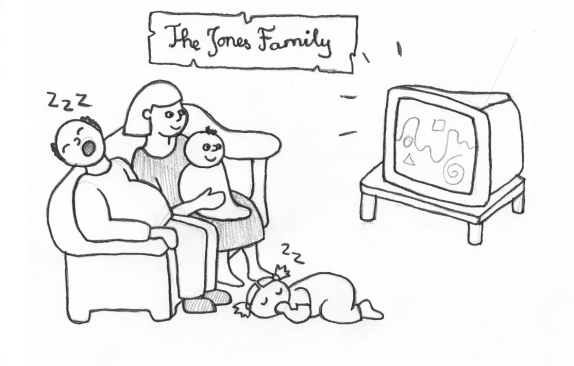

Figure A.2: Filler: ''The cows are chewing on a daisy.''

of the questionnaire. Each of the two versions contained 4 of the control items, all of the 13 fillers, and 2 of the test items from each of the 6 item clusters: the plural-subject item and one of the group-subject items, in such a way that each questionnaire version contained 3 group-subject items with a singular VP and 3 with a plural VP. A few days after filling out the first questionnaire, the informants were asked to fill out the second version, which contained all test and control items missing from the first one, and also had the order of these

items reversed. The goal of all this was to rule out both sloppy answering (from seeing the same picture too many times with near-identical test sentences) and a possible effect of order (people might like the group-subject sentence less when they have already seen the same situation described by a plural-subject sentence earlier).

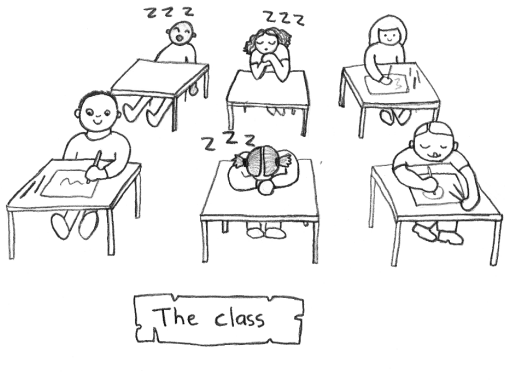
If the availability of Q-distributivity depends only on the number of the subject NP and not on the number of the VP, we expect all British English group noun sentences to behave like their Dutch and American English counterparts, disallowing Q-distributive interpretations regardless of VP number. However, if the availability of Q-distributivity depends on the number of the VP, we expect British English group sentences to disallow Q-distributivity when the VP is singular (like their American and Dutch counterparts), but to pattern with plural-subject sentences when the VP is plural. For all test items, it holds that the given sentence is true in the depicted situation only if it receives a Q-distributive interpretation; thus, the number of 'true' responses directly indicates the availability of a Q-distributive interpretation for every test sentence in the questionnaire.

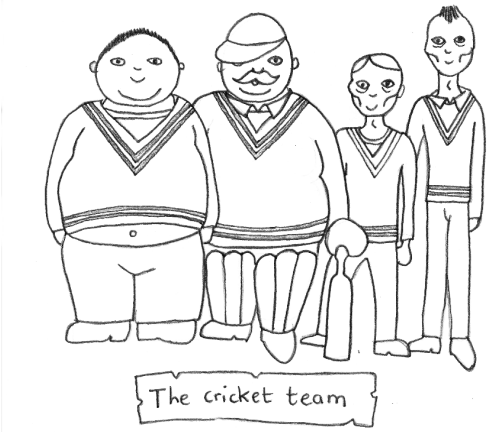
### A.1.1 Test items

| **Subject type & VP number** | **Q-distributivity test / item cluster** |
|---|---|
| | Disjunction 1 |
| Plural; plural | *The Joneses are sleeping or watching TV.* |
| Group; plural | *The Jones family are sleeping or watching TV.* |
| Group; singular | *The Jones family is sleeping or watching TV.* |
| |  |

| **Subject type & VP number** | **Q-distributivity test / item cluster** |
|---|---|
| | Disjunction 2 |
| Plural; plural | *The reading group members are very short or very tall.* |
| Group; plural | *The reading group are very short or very tall.* |
| Group; singular | *The reading group members are very short or very tall.* |
| |  |

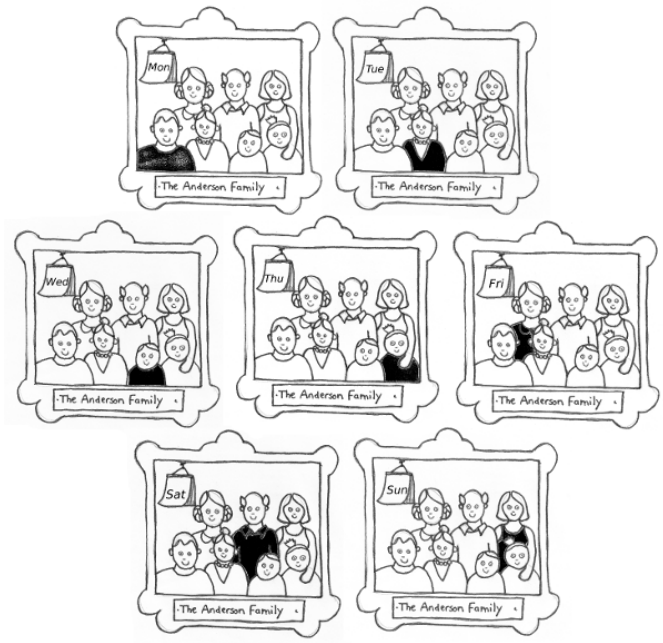


| **Subject type & VP number** | **Q-distributivity test / item cluster** |
|---|---|
| | Conjunction 1 |
| Plural; plural | *The children are drawing and sleeping.* |
| Group; plural | *The class are drawing and sleeping.* |
| Group; singular | *The class is drawing and sleeping.* |
| |  |

| **Subject type & VP number** | **Q-distributivity test / item cluster** |
|---|---|
| | Conjunction 2 |
| Plural; plural | *The cricket players are underweight and obese* |
| Group; plural | *The cricket team are underweight and obese* |
| Group; singular | *The cricket team is underweight and obese* |
| |   |

| **Subject type & VP number** | **Q-distributivity test / item cluster** |
|---|---|
| | Quantifier 1 |
| Plural; plural | *The children are hiding somewhere.* |
| Group; plural | *The class are hiding somewhere.* |
| Group; singular | *The class is hiding somewhere.* |
| |   |

| **Subject type & VP number** | **Q-distributivity test / item cluster** |
|---|---|
| | Quantifier 2 |
| Plural; plural | *The Andersons dress in black once a week.* |
| Group; plural | *The Anderson family dress in black once a week.* |
| Group; singular | *The Anderson family dresses in black once a week.* |




## A.2 Results

All 8 control items were judged to be true by all informants. While this does not strictly indicate that the informants considered both matched and mismatched agreement equally grammatical with group subjects (they were asked for a truth-value judgement, not a grammaticality one), it does indicate that the informants' truth-value judgements are not affected by potential grammaticality differences. This means that we may also expect the judgements on the test items to reflect the semantic differences we are interested in, rather than any differences in grammaticality.

Fig. A.3 shows the percentage of 'true' judgements for each of the 18 test

items (each triplet of bars corresponds to one of the item clusters from section A.1.1). In total, 23% of the singular-VP group-subject sentences was judged true, against 61% of their plural-VP counterparts and 83% of the sentences with a plural subject. As expected, most plural-subject sentences scored close to 100%, with the exception of two particular item clusters (Conjunction 2 and Quantifier 2) where they only scored 10% and 50%, respectively. This might indicate that some unexpected aspect of these sentences interfered with their ability to be interpreted Q-distributively, which means that these sentences are less suitable as Q-distributivity tests. If we remove the test items from those two clusters from our calculation of the total score, the total score becomes 92% 'true' for the plural-subject sentences, 74% for the plural group-subject sentences and 33% for the singular group-subject sentences (see fig. A.4).

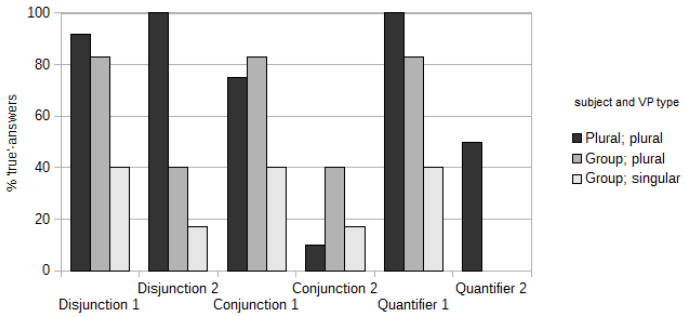



Figure A.3: Percentage of 'true'-judgements for each of the 18 test items.

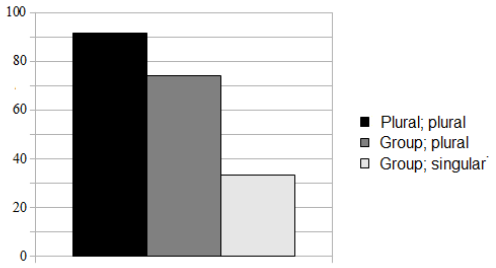



Figure A.4: Total percentage of 'true'-judgements for each sentence type.

# APPENDIX B

## Dutch *half-of* questionnaire

## B.1 Method

I did a small questionnaire study with 15 native speakers of Dutch (recruited from my Facebook friends, and of varying ages, backgrounds and levels of education) to test whether I could replicate the contrast between collection NPs on the one hand and group and plural NPs on the other reported in Pearson (2011) for English. The questionnaire consisted of 10 items, which in turn consisted of a situation description and a sentence pertaining to that situation (all test items are listed at the end of this section; they appeared in the questionnaire in random order). Of the 10 test items, four of the sentences contained a collection noun (Pearson's term for inanimate group-like nouns like *wall* or *pile of exams*), four a plural NP, and two a group NP. Informants were asked to rate the truth of each sentence on a 1-5 scale from clearly false to clearly true.

The situations were designed in such a way that they verified the sentence under an atomic interpretation of the embedded NP, but not under a set interpretation (assuming Pearson's analysis of partitives is correct). So, in theory, we expect high scores for the collection nouns and low scores for the plurals; the group nouns will pattern with the former if they range over atoms

in Dutch, and with the latter if they range over sets.

### B.1.1 Test items

| | **NP type: +plural, +animate** (animate plural definite) |
|---|---|
| **Situation** (translated) | A group of girls has been playing football in the mud. Each of the girls is half covered in mud. |
| **Sentence** | *De helft van de meisjes is met modder bedekt.*<br>'Half of the girls is covered with mud' |
| **Situation** (translated) | A father is not yet sure where he stands on the issue of Black Pete (beloved folk figure or racist caricature?). As a compromise, he has decided to paint only half of himself black this year, an example followed by his wife and seven children. |
| **Sentence** | *De helft van de gezinsleden is zwart geschminkt.*<br>'Half of the family members is painted black' |

| | **NP type: +plural, -animate** (inanimate plural definite) |
|---|---|
| **Situation** (translated) | I used to have a strange chess set whose pieces each consisted of two halves: a 'foot' that was the same for all pieces, and a click-on 'head' that had to be attached to the foot. Unfortunately I lost the box containing the heads, so only the feet are left. |
| **Sentence** | *De helft van mijn schaakstukken is kwijt.*<br>'Half of my chess pieces is lost' |
| **Situation** (translated) | Yesterday, professor Johnson's students made an exam that consisted of 4 questions. Prof. Johnson graded questions 1, 3 and 4 from each exam, but then she didn't feel like doing the rest, so she put the entire pile of exams on her grad student's desk. |
| **Sentence** | *Driekwart van de tentames is al nagekeken.*<br>'Three quarters of the exams has been graded already' |

| | **NP type: -plural, +animate** (group NP) |
|---|---|
| **Situation** (translated) | The board of a fraternity has had portraits made of its individual members for inclusion in the yearbook. When developing the pictures, they discover that the camera had a defect, and the right half of each picture is completely black. |
| **Sentence** | *De helft van het bestuur staat op de foto.*<br>'Half of the board is pictured' |
| **Situation** (translated) | A school class just had a custard fight. Each child is three-quarters covered in custard. |
| **Sentence** | *Driekwart van de klas is met vla bedekt.*<br>'Three quarters of the class is covered with custard' |

| | **NP type: -plural, -animate** (collection NP) |
|---|---|
| **Situation** (translated) | I used to have a strange chess set whose pieces each consisted of two halves: a 'foot' that was the same for all pieces, and a click-on 'head' that had to be attached to the foot. Unfortunately I lost the box containing the heads, so only the feet are left. |
| **Sentence** | *De helft van mijn schaakspel is kwijt.*<br>'Half of my chess set is lost' |
| **Situation** (translated) | The board of a fraternity has had portraits made of its individual members for inclusion in the yearbook. When developing the pictures, they discover that the camera had a defect, and the right half of each picture is completely black. |
| **Sentence** | *De helft van de portretserie is zwart.*<br>'Half of the portrait series is black' |
| **Situation** (translated) | A journalist has obtained a list of members of a local youth gang, but unfortunately he spilled coffee on it, and now either the first or the last name of each of the gang members has become unreadable. |
| **Sentence** | *De helft van de lijst is onleesbaar.*<br>'Half of the list is unreadable' |
| **Situation** (translated) | Yesterday, professor Johnson's students made an exam that consisted of 4 questions. Prof. Johnson graded questions 1, 3 and 4 from each exam, but then she didn't feel like doing the rest, so she put the entire pile of exams on her grad student's desk. |

| | |
|---|---|
| **Sentence** | *Driekwart van de stapel is al nagekeken.*<br>'Three quarters of the pile has been graded already' |

## B.2 Results

As the graph in fig. B.1 shows, the *half of*-test initially does not seem to work entirely like Pearson claims it does: with an average grade of 2.2 for the plurals and 2.8 for the collection nouns, their behaviour when embedded in a proportional NP does not actually seem very different. At an average grade of 1.7, the group nouns even score a bit lower than the plurals. According to the reasoning above, these low scores would confirm our hypothesis that group nouns range over sets in Dutch. However, the general pattern does not really show the large difference between collection NPs and plurals that Pearson claims for English.

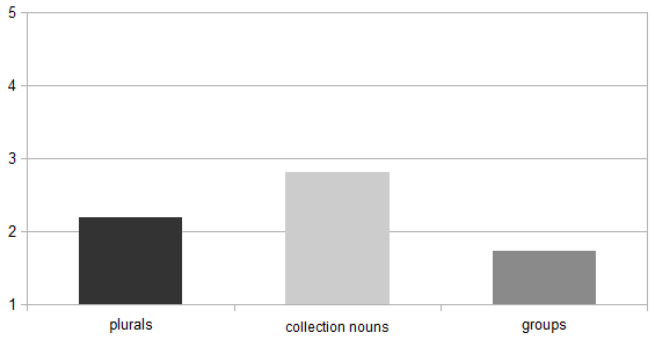



Figure B.1: Average judgements on the Dutch *half of*-sentences, split according to morphosyntactic number.

Something interesting happens, however, when we split up the results according to animacy rather than according to morphosyntactic number, as figure B.2 shows.[1] When we group the inanimate plurals with the collection nouns and the animate plurals with the group nouns, the results clearly fall into two categories: the animates score an 1.6 on average, the inanimates a 2.8. This suggests that

[1]Luckily, the test items with a plural subject happened to be pretty evenly divided among the two animacy categories even though I did not design the questionnaire with animacy in mind.

(1) animates are more likely to denote sets and inanimates are more likely to denote atoms, and (2) this is the case regardless of the morphosyntactic number of the NP.[2]

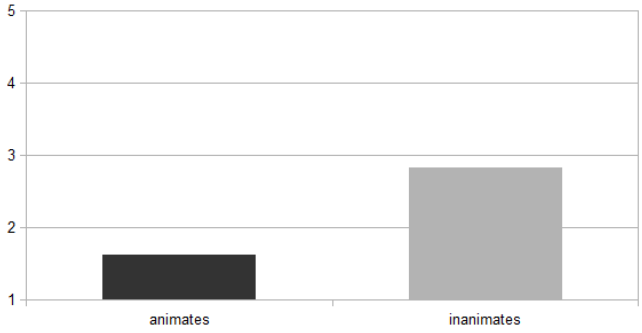



Figure B.2: Average judgements on the Dutch *half of*-sentences, split according to animacy of the NP referent.

[2]One might wonder why, if the singular collection NPs and the inanimate plurals are all interpreted as atomic, they do not score much higher than a 2.8 on an 1-5 scale. Pearson's theory and judgements for English predict that these sentences can all be interpreted as true in the relevant situations, so we might expect them to score much closer to a 5. Looking at the individual results, there is still a relatively large number of informants who reject these sentences in the given contexts. If we accept the theory behind the *half of*-test (according to which mass individuals are underdetermined with regard to their atomic proper parts), this might indicate that many people have a strong preference to construe the atomic proper parts of collection nouns as the things that make up the collection (e.g. the individual exam papers in the case of *the pile* in (25)), rather than anything smaller (e.g. the individual exam questions). The fact that it is not formally determined what the atomic proper parts of a mass individual are does not mean that some possibilities might not be more salient than others. What matters is that on the whole, the results show that many people *are* able to construe the atomic proper parts in a different way for the inanimate nouns when such a partitioning is made salient by the context, while for the animates such alternative partitionings are systematically unavailable.

# APPENDIX C

## Afrikaans Q-distributivity questionnaire[1]

## C.1 Method

For this questionnaire, I used several of the Q-distributivity tests from chapter 3: VP disjunction and three different quantificational constructions. Each test item consisted of a description of a situation (in English) and a sentence (in Afrikaans); informants were asked to rate the truth of the sentence in the given situation on a scale from 0 (clearly false) to 4 (clearly true). All sentences contained a definite plural subject that was either inanimate, non-human animate, or human. A list of all test items is given at the end of this section.

In total, the questionnaire contained 15 test items and 5 fillers, in random order. In order to rule out possible ordering effects, I made a second version that contained all items in reverse order. Seven native speakers of Afrikaans, all with some background in linguistics or language studies and fluent in English, filled out a version of the questionnaire.

[1]I would like to thank Christine Barkhuizen Le Roux for translating all test sentences into Afrikaans for me, and Erin Pretorius for helping me out with some follow-up questions.

| | |
|---|---|
| **Situation** | There are two cows standing in a field: a red one and a black-and-white one. There are two birds sitting on top of the red cow and there's one bird sitting on top of the black-and-white cow. All the birds are taking a nap. |
| **Sentence** | Op al die beeste sit 'n voël en slaap.<br>*On all the cows sit a bird and sleep*<br>'On top of all the cows, a sleeping bird is sitting' |

Table C.1: An example of a filler item.

Similarly to the British English Q-distributivity questionnaire (Appendix A), the test items were all designed in such a way that the sentences could only be true in the given context under a Q-distributive interpretation. So, a high truth value rating reflects easy availability of a Q-distributive interpretation. Given our approach to Q-distributivity as a diagnostic for semantic plurality, this means that the higher the truth value rating of a sentence, the more easily its subject is interpreted as semantically plural. If it is true that semantic number is influenced by animacy, we therefore expect sentences with human subjects to receive higher scores than sentences with non-human or inanimate subjects.

### C.1.1 Test items

| **Subject type** | **Q-distributivity test: VP disjunction** |
|---|---|
| Inanimate 1 | **Situation:** My neighbour has a lot of guests coming over and wants to borrow my coffee cups. I have five red coffee cups and five white ones. Since I'm busy and can't get them myself, I tell my neighbour to just take the ten cups from my cupboard. To make sure she'll get the right ones, I tell her:<br>**Sentence:** *Die koffiekoppies is rooi of wit.*<br>'The coffee cups are red or white' |
| Inanimate 2 | **Situation:** There's a very old and uninhabited house in my street that's slowly falling apart. Half of the house's windows are broken. The other half are still whole but someone has sprayed paint on them.<br>**Sentence:** *Die rame is gebreek of met verf bemors.*<br>'The windows are broken or soiled with paint' |

| | |
|---|---|
| Animate 1 | **Situation:** I'm watching my neighbour's dogs, who are out in the garden. Several of the dogs are asleep under a tree, the others are running around.<br>**Sentence:** *Die honde hardloop deur die tuin of slaap.*<br>'The dogs are running through the garden or sleeping' |
| Animate 2 | **Situation:** I work in an animal rescue. Recently people have been bringing in a lot of seabirds. Currently we are taking care of ten birds. Half of them have broken legs. The other half are covered in oil from an oil spill.<br>**Sentence:** *Die voëls het olie op hulle vere of gebreekte pootjies.*<br>'The birds have oil on their feathers or broken legs' |
| Human 1 | **Situation:** A group of girls is practicing for a musical. Half of them are singing; the others are dancing.<br>**Sentence:** *Die meisies sing of dans.*<br>'The girls are singing or dancing.' |
| Human 2 | **Situation:** During a boring board meeting, several of the managers present are trying to kill time by doodling stick figures in the margins of their paperwork. The rest have simply fallen asleep.<br>**Sentence:** *Die bestuurders slaap of sit en figuurtjies teken.*<br>'The managers are sleeping or doodling' |

| **Subject type** | **Q-distributivity test: Quantificational object** |
|---|---|
| Inanimate | **Situation:** A couple of years ago oil was discovered in a small local desert area. Three different companies each drilled an oil well there. The three wells yielded so much oil that the directors of all companies got incredibly rich.<br>**Sentence:** *Die oliebronne het iemand baie ryk gemaak.*<br>'The oil wells have made someone very rich' |
| Animate | **Situation:** My office is currently home to two mice, a large brown one and a small grey one. This week two unsuspecting visitors foolishly left their lunch lying out in the open. First the brown mouse came out and ate the first visitor's lunch. Then, the grey mouse appeared and ate the second visitor's lunch.<br>**Sentence:** *Die muise het iemand se kos opgeëet.*<br>'The mice have eaten someone's food' |

| | |
|---|---|
| Human | **Situation:** Three criminals escaped from prison recently. They've since split up and are hiding out in different cities; yesterday, each of them mugged someone there.<br>**Sentence:** *Die boewe het iemand beroof.*<br>'The criminals have mugged someone' |

| **Subject type** | **Q-distributivity test: Quantificational adverb** |
|---|---|
| Inanimate | **Situation:** I own three bicycles. One of them is parked in my shed. One of them is parked at the train station in the city where I work. The third, which I use for cycling trips in the national park near where my parents live, is parked at my parents' place.<br>**Sentence:** *My fietse is êrens geparkeer.*<br>'My bicycles are parked somewhere' |
| Animate | **Situation:** My neighbour owns a small number of cows, which he keeps in several different fields a couple of miles apart. One day, in a rather mysterious event, the cows decided to break out simultaneously: despite being miles apart, they broke through the fencing around their fields and wandered off. In total, seven different fences got wrecked.<br>**Sentence:** *Die beeste het êrens deur 'n hek gebreek.*<br>'The cows have broken through a fence somewhere' |
| Human | **Situation:** Three scientists, John, Mary and Sue, each went to a different foreign country to do various kinds of fieldwork. John went to Russia to study a couple of minority languages. Mary went to the Amazon to collect plant samples. Sue went to Japan to do an anthropological study of teenage gamer culture.<br>**Sentence:** *Die wetenskaplikes het êrens veldwerk gedoen.*<br>'The scientists have done fieldwork somewhere' |

| **Subject type** | **Q-distributivity test: Comparative quantification** |
|---|---|
| Inanimate | **Situation:** I'm at a party with a friend. In the span of half an hour, I finish one bottle of beer, while my friend finishes three cocktails. I'm worried that she might not be able to drive home, but my friend tells me not to worry: she has calculated that each of the cocktails contained only 8 ml of alcohol. On the other hand, I might want to worry about my beer, since it's a Belgian triple that contains 20 ml of alcohol! My friend claims:<br>**Sentence:** *Die cocktails bevat minder alkohol as die bier.*<br>'The cocktails contain less alcohol than the beer' |
| Animate | **Situation:** Two cats and one owl went mouse-hunting. The cats each caught three mice. The owl caught five mice.<br>**Sentence:** *Die katte het minder muise as die uil gevang.*<br>'The cats have caught fewer mice than the owl' |
| Human | **Situation:** Last week Mary went to the country fair with her three brothers. They played a lot of games and each of the children won several prizes. Mary won a total of four prizes, and her three brothers won two prizes each.<br>**Sentence:** *Die seuns het minder pryse as Marie gekry.*<br>'The boys have won fewer prizes than Mary' |

## C.2 Results

On average, the sentences with an inanimate subject scored an 1.86 on a 0-4 scale. The nonhuman animates scored slightly higher at 1.97, and the human subjects scored the highest with an average of 2.57. The results can be seen in fig. C.1 and C.2.[2] As fig. C.1 shows, the human-subject sentences receive the highest truth value ratings in each of the four Q-distributivity tests used (although in one case, they tie with the inanimates). In three of the four tests, the inanimates score the lowest. Although the differences are not extremely large, they are mostly consistent, supporting the conclusion that Q-distributive interpretations are more easily available for sentences with human subjects than for sentences with nonhuman subjects, and least easily of all for sentences with

[2]One informant was consistently unable to get the distributive interpretation anywhere, as evidenced by her awarding a score of zero to each of the test items. When her results are discounted, the averages become 2.17, 2.31 and 3.00, respectively; the relative pattern stays the same.

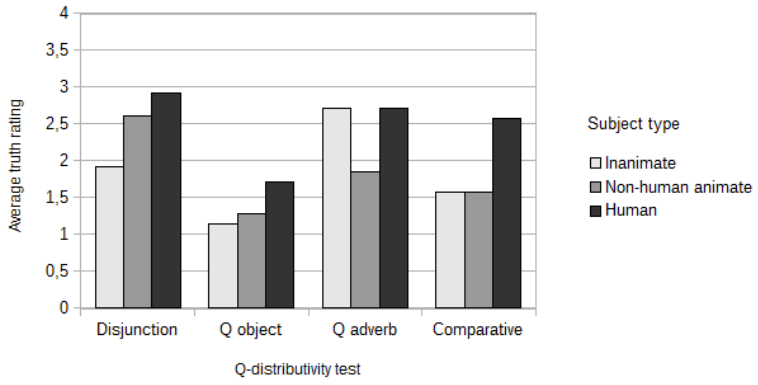



Figure C.1: Mean truth value judgements for each Q-distributivity test, split according to the degree of animacy of the sentence subject. (Each bar corresponds to the average score for a single test item, except the three leftmost ones ('Disjunction'), which each show the average score of two items.)

inanimate subjects. As noted above, since the availability of a Q-distributive interpretation reflects the semantic plurality of the subject NP, this means that plural NPs denoting a collection of humans are interpreted as sets more easily than plural NPs denoting nonhuman or inanimate collections.

## C.3 Group nouns

While this questionnaire did not focus on the interpretation of group nouns, I later sent the participants a small follow-up questionnaire containing four test sentences (along with some fillers): two had a (human) group NP subject, two an (inanimate) collection NP.

| **Subject type** | **Q-distributivity test: VP disjunction** |
|---|---|
| Collection NP | **Situation:** My neighbour has a lot of guests coming over and wants to borrow my coffee cups. I have five red coffee cups and five white ones and they're all stacked up in a single stack in my cupboard. I tell my neighbour to just take the entire stack from my cupboard. To make sure she'll get the right cups, I add:<br>**Sentence:** *Die stapeltjie is rooi of wit.*<br>'The stack is red or white' |

| | |
|---|---|
| Group NP | **Situation:** A local primary school organises a summer camp for the oldest kids every year. It traditionally ends with a big game where the children, divided into a boy team and a girl team, compete against each other on various subchallenges. The children take this event very seriously and, on the day of the match, are seen preparing for it in various ways. The girls are mostly doing stretching exercises. The boys on the boy team have different strategies: half of them are running around to warm up, the other half are taking a last-minute nap.<br>**Sentence:** *Die seunspan hardloop of slaap.*<br>'The boy team is running or sleeping' |

| **Subject type** | **Q-distributivity test: Quantificational adjunct** |
|---|---|
| Collection NP | **Situation:** After my grandfather's death, the family had to decide what to do with his huge and valuable stamp collection. In the end the albums were distributed among many different friends and family members all over the world, so the stamps are now stored in many different places.<br>**Sentence:** *Die seëlversameling is êrens gestoor.*<br>'The stamp collection is stored somewhere' |
| Group NP | **Situation:** Our local chess club mostly consists of amateurs who just play for fun, with the exception of John, Mary and Bill (locally known as 'the trio'): not only are they very close friends who are often seen together, they are also extremely good professional chess players who regularly compete in international tournaments. Last weekend, John played an important chess match in Amsterdam, Mary played a match in Tokyo, and Bill played one in Cape Town.<br>**Sentence:** *Die trio het êrens 'n wedstryd gespeel.*<br>'The trio has played a match somewhere' |

Five informants filled out the follow-up questionnaire, with inconclusive results. The group-subject sentence containing a VP disjunction received an average score of 2.80, which is comparable to the scores the animate plural-subject sentences from the main questionnaire received. This would support the idea that group nouns range over sets in Afrikaans. However, the other group-subject sentence (involving the quantificational adjunct *êrens*) showed a sharp decline in the mean rating compared to the plural-subject sentences:

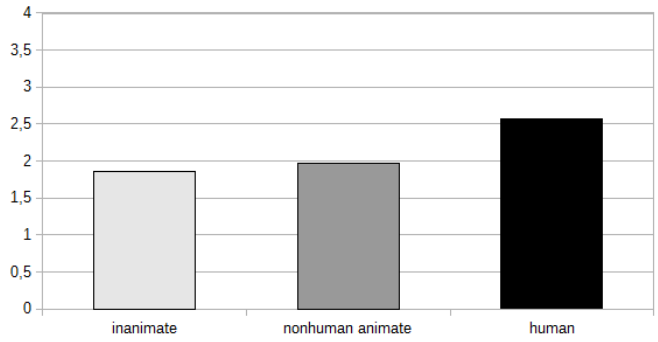



Figure C.2: Mean truth value judgements for all Q-distributivity tests together.

only one of the informants gave it a full score of 4, the others all gave it a zero rating (an average score of only 0.80). This suggests that this particular group NP (*die trio*) is interpreted as an atom by the majority of speakers.

At an average score of 0.70, the two sentences with a collection subject (*stapeltjie* 'stack' and *seëlversameling* 'stamp collection') scored quite a bit lower than their inanimate plural counterparts from the main questionnaire. This would fit with an analysis in which collection NPs are atomic from the start - a set interpretation is just not available to them. In contrast, inanimate plural NPs have to be shifted into atoms from their original set denotation. The contrast between collection NPs and inanimate plurals suggests that while this shift is made more easy or likely by a lack of animacy, it is still optional: unlike inanimate singulars, inanimate plurals can still receive a set interpretation.

Since the results here are based on very little data, and (with regard to the group nouns) inconclusive to boot, it is unfortunately impossible to use them as the basis of anything more than tentative suggestions. I hope to be able to address the interpretation of Afrikaans group NPs in future research.

# APPENDIX D

## Dutch group-level predicates questionnaire

### D.1 Method

Unlike the questionnaire studies described in the previous three appendices, this one involved grammaticality ratings rather than truth-value judgements. I used three different group-level predicates (predicates that, based on my own judgements, were grammatical with collective subjects of all animacy types, but ungrammatical/anomalous with similar plural subjects), and combined each of them in a sentence with collective as well as plural versions of inanimate, non-human animate and human subjects. This resulted in 18 test items (3 predicates × 3 animacy categories × 2 number categories), to which I added 15 fillers. Two example fillers can be seen below; a list of all test items can be found at the end of this section. I added a bit of context to each sentence so the informants wouldn't give them a low grade simply because they did not fully understand what the sentence was 'about'.

To avoid having a very long questionnaire with a lot of near-identical items that might provoke sloppy answering or betray the purpose of the study, I made two questionnaires, each containing 9 of the test items and all 15 fillers in random order. Each questionnaire contained either the plural or the collective version of each test sentence. 41 native speakers of Dutch of varying ages,

| |
|---|
| **Context** (translated): A baby has built a block tower.<br>**Sentence**: *De toren is uit blokken opgestapeld.*<br>'The tower is piled up from blocks' |
| **Context** (translated): The library in our village is so small that over the years I've read all the books in it.<br>**Sentence**: *Ik heb de bibliotheek één voor één gelezen.*<br>'I've read the library one by one' |

Table D.1: Two examples of filler items; most of the fillers contained either a collective predicate or a collective NP, so they would not stand out too much from the test items, but they did not contain group-level predicates and, if they were ungrammatical, they were not ungrammatical in the same way as the test items might be.

backgrounds and levels of education (recruited via Facebook), filled out one of the questionnaires, rating the acceptability of each sentence on a scale from 0 ('you can't say that at all!') through 2 ('I wouldn't say this but someone else might') to 4 ('perfectly fine').

### D.1.1 Test items

| **Subj. type** | **Predicate:** *samengesteld* 'assembled' |
|---|---|
| Inanimate | **Context**: A radio station publishes a list of 'tips' every week, consisting of the station's djs favourite new songs.<br>**Stc.**: { *De lijst is* / *De tips zijn* } *door onze eigen dj's samengesteld.*<br>'The list is / the tips are assembled by our own DJs' |
| Animate | **Context**: A zoo has started a new breeding programme for giraffes and put together a herd with giraffes from all over Europe.<br>**Stc.**: { *De kudde is* / *De giraffes zijn* } *in overleg met een geneticus samengesteld.*<br>'The herd was / the giraffes were assembled in consultation with a geneticist' |

| | |
|---|---|
| Human | **Context**: Two football experts have put together the hypothetical 'best football team of all times'.<br>**Stc.**: { *Het team is* / *De voetballers zijn* } *door twee voetbalexperts samengesteld.*<br>'The team was / the football players were assembled by two experts' |

| **Subj. type** | **Predicate:** *in het leven geroepen* 'established' (lit. 'called into life') |
|---|---|
| Inanimate | **Context**: Ten years ago, my great uncle started collecting and catalogueing all sorts of family memorabilia, for the benefit of future generations.<br>**Stc.**: { *De familieverzameling is* / *De familie-memorabilia zijn* } *door mijn oudoom in het leven geroepen.*<br>'The family collection was / the family memorabilia were established by my great uncle' |
| Animate | **Context**: Since the 80s, geneticists have been carefully breeding the offspring of the genetically modified stallion Kevin in order to study how the altered gene manifests itself throughout the generations.<br>**Stc.**: { *De bloedlijn is* / *De paarden zijn* } *in de jaren '80 in het leven geroepen.*<br>'The bloodline was / the horses were established in the 80s' |
| Human | **Context**: The university established a special interdisciplinary 'Social Media' research group, consisting of several anthropologists, psychologists and computer scientists, among others.<br>**Stc.**: { *De onderzoeksgroep is* / *De onderzoekers zijn* } *in 2010 in het leven geroepen.*<br>'The research group was / the researchers were established in 2010' |

| **Subj. type** | **Predicate:** *bestaan uit* 'consist of' |
|---|---|

| | |
|---|---|
| Inanimate | **Context**: A jewelry shop was robbed.<br>**Stc.**: { *De buit bestaat uit* / *De buitgemaakte voorwerpen bestaan uit* } *vijf parelkettingen en zes horloges.*<br>'The loot consists of / the stolen items consist of 5 pearl necklaces and 6 watches' |
| Animate | **Context**: A litter of three kittens.<br>**Stc.**: { *Het nestje bestaat uit* / *De kittens bestaan uit* } *twee katertjes en één poesje.*<br>'The litter consists of / the kittens consist of two males and one female' |
| Human | **Context**: An advisory committee with five members.<br>**Stc.**: { *De commissie bestaat uit* / *De adviseurs bestaan uit* } *twee juristen en drie bedrijfskundigen.*<br>'The committee consists of / the advisors consist of two lawyers and three business administrators' |

## D.2 Results

As the graph in fig. D.1 shows, the general pattern confirms the observations from Schwarzschild (1996), Winter (2001a) and Magri (2012): while the used predicates are fine with collective nouns[1], they are quite degraded with plurals. While the sentences with a collective subject score a 3.4 on average, those with plural subjects score only a 1.1. This supports an analysis of group-level predicates as predicates over impure atoms, which leads to an anomaly when they are are applied to a set of pure atoms.

The second thing to note about the graph is that plural inanimate NPs, even though they are not quite as acceptable with group-level predicates as their collection NP equivalents, nevertheless receive much higher ratings than plural human and non-human animate NPs. The latter two received an average score of 0.7, while the sentences with an inanimate plural subject scored an 1.7, nearly

[1]The graph also shows that non-human animates score a bit lower than the group nouns and the collection nouns; the average is dragged down by one particular sentence whose subject (*bloedlijn* 'bloodline', intended to refer to a group of related horses) might, in retrospect, be a bit too abstract to qualify as a real collective noun. I think that this relatively low average score reflects this somewhat unfortunate choice of test item, rather than any fundamental property of non-human animate collectives that somehow sets them apart from human and inanimate ones.

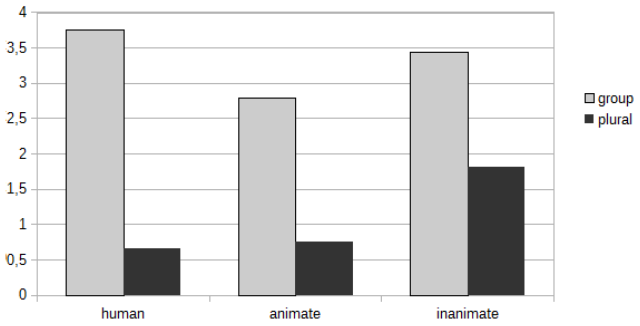



Figure D.1: Mean grammaticality judgements for Dutch sentences with group-level predicates, split according to animacy and morphosyntactic number of the sentence subject.

2.5 times as high. This confirms our hypothesis that the sets associated with inanimate plural NPs can be shifted into impure atoms much more easily than those associated with animate NPs, a result in line with our earlier observations on both Dutch (the *half of*-test, see Appendix B) and Afrikaans (Q-distributivity, see Appendix C).

The third thing the graph suggests is that the relation between animacy and the ability to shift into an impure atom in Dutch seems to involve an abrupt 'cutoff point' rather than a gradual increase in grammaticality as we move down the animacy hierarchy. However, because of the small number of test items involved, we cannot draw anything more than a very tentative conclusion from this at this point.

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# Samenvatting

Deze dissertatie gaat over de formele interpretatie van enkelvoudige en meervoudige naamwoordsgroepen zoals *Marietje* of *mijn cavia's*. De formele semantiek houdt zich niet zo bezig met de betekenis van individuele woorden, maar met de rol die een woord of zinsdeel speelt bij het 'berekenen' van de betekenis van de zin als geheel. Dit betekent dat ik niet zozeer genteresseerd ben in de eigenschappen van Marietje of de vraag wat een cavia tot een cavia maakt, maar in de wiskundige objecten waarmee we kunnen modelleren wat zo'n enkelvoudige of meervoudige naamwoordsgroep bijdraagt aan deze berekening. Een intuïtieve suggestie is om gebruik te maken van de verzamelingenleer, waarbij we de betekenis van een enkelvoudige naamwoordsgroep (zoals *Marietje* of *mijn cavia*) associëren met een entiteit ('atoom'), en de betekenis van een meervoudige naamwoordsgroep (zoals *Marietje en Jantje* of *mijn cavia's*) met een verzameling entiteiten. Met andere woorden: morfosyntactisch getal (of de vorm van het woord of zinsdeel enkelvoudig of meervoudig is) komt overeen met semantisch getal (of het woord of zinsdeel verwijst naar een atoom of naar een verzameling).

Er zijn echter een paar redenen waarom zo'n één-op-één-relatie tussen morfosyntactisch en semantisch getal waarschijnlijk een te simpele voorstelling van zaken is. Er zijn bijvoorbeeld naamwoordsgroepen (vanaf nu 'NP's', voor *noun phrase*) die weliswaar een enkelvoudige vorm hebben, maar waarvan de betekenis meervoudig lijkt: de rol die ze spelen in het grotere geheel van de zin of het discourse lijkt meer op die van *mijn cavia's* dan op die van *Marietje*. Ze kunnen bijvoorbeeld voorkomen met elementen die normaal bij meervouden horen, zoals een meervoudig voornaamwoord (*hun* in (1a)) of een meervoudig werkwoord (zoals in de Brits Engelse zin in (1b)):

(1) Elk gastgezin heeft hun eigen begeleider.[1]

(2) My family are early risers.
'Mijn familie zijn vroege vogels'

En ze zijn vaak grammaticaal in zinnen waar 'normale' enkelvoudige NPs dat niet zijn (maar meervoudige NPs wel):

(3) a. *Marietje verzamelde zich / kwam bijeen / ging uit elkaar
b. De meisjes verzamelden zich / kwamen bijeen / gingen uit elkaar
a. De commissie verzamelde zich / kwam bijeen / ging uit elkaar

(4) a. *Jantje en Marietje zijn een cavia.
b. Jantje en Marietje zijn een cavia en een konijn.
c. Jantje en Marietje zijn een gelukkig echtpaar.

Andersom nemen sommige semantici aan dat morfosyntactisch meervoudige NPs kunnen worden geïnterpreteerd als semantisch enkelvoudig. De motivatie voor deze aanname is vaak nogal technisch, maar hier is een wat meer intuïtieve reden (gebaseerd op data in Mador-Haim & Winter 2012; de pijltjes geven aan of en hoe de verschillende statements uit elkaar volgen):

(5) a. Marietje kuste de jongens.
$\Leftrightarrow$ Marietje kuste jongen$_1$ & Marietje kuste jongen$_2$ &... Marietje kuste jongen$_{zoveel}$.
b. De muis zit in de aardappels.
$\not\Leftrightarrow$ De muis zit in aardappel$_1$ & de muis zit in aardappel$_2$ &... de muis zit in aardappel$_{zoveel}$

De zin in (5a) betekent dat Marietje in een 'kus'-relatie staat tot elk van de jongens (de interpretatie rechts van de pijl). Maar de vergelijkbare zin in (5b) interpreteren we niet op deze manier: (5b) betekent niet dat de muis in een 'in'-relatie staat tot elk van de aardappels (of zelfs maar één van de aardappels), maar dat er sprake is van een 'in'-relatie tussen de muis en zoiets als 'de *berg* aardappels'. Zin (5b) is waar als de muis tussen de aardappels in zit, zolang de aardappels samen maar een samenhangend geheel vormen waardoor we ze als één enkele complexe entiteit kunnen zien. Bovenstaande zinnen suggereren dus dat morfosyntactisch meervoudige NPs onder bepaalde omstandigheden kunnen worden geïnterpreteerd als semantisch enkelvoudig.

[1] Gevonden via Google op adopteereenhond.com.

Het doel van deze dissertatie is om de relatie tussen morfosyntactisch en semantisch getal nader te onderzoeken - met name de vraag of een formele theorie van semantisch getal volledig kan functioneren zonder 'mismatches' tussen morfosyntax en semantiek (zoals bovenstaande) toe te staan. Mijn conclusie is dat dit niet mogelijk is: om alle relevante data uit verschillende talen te kunnen modelleren, moet ons semantisch systeem zowel in staat zijn om enkelvoudige NPs te interpreteren als verzamelingen, als om meervoudige NPs te interpreteren als atomen. Ik stel voor dat deze semantische flexibiliteit gereguleerd wordt door twee verschillende mechanismen. Het eerste is het vermijden van zogenaamde 'type-mismatches' tussen onderwerp en predikaat. Het onderwerp en predikaat dienen hetzelfde semantische getal te hebben, anders loopt de semantische 'berekening' spaak; wanneer een predikaat enkelvoudig is en het onderwerp meervoudig kan het laatste een 'type-verschuiving' (*typeshift*) ondergaan naar een semantisch enkelvoudige interpretatie. De tweede factor die bepaalt of een gegeven NP geassocieerd wordt met een atoom danwel een verzameling is de mate van bezieldheid (*animacy*) van de referent: hoe 'bezielder' het individu (of de individuën) waarnaar de NP verwijst, hoe groter de kans dat deze geïnterpreteerd wordt als een verzameling, en hoe minder bezield, hoe groter de kans dat deze geïnterpreteerd wordt als een atoom - ongeacht het morfosyntactisch getal van de NP. (Bezieldheid is van invloed op grammaticale fenomenen in veel verschillende talen en kent een universele hiërarchie, grofweg: mensen zijn het meest bezield, dieren minder, levenloze voorwerpen het allerminst.) Ik stel voor dat de invloed van bezieling op semantisch getal te maken heeft met 'individuatie' (Corbett 2000, Grimm 2012): hoe meer we geneigd zijn de leden van een groep waarnaar een bepaalde NP verwijst als zelfstandige individuen te zien, hoe groter de kans dat we deze zelfstandige individuen ook terugzien in de verzamelingtheoretische structuur van de NP-semantiek. En andersom: als het onderscheiden van individuele groepsleden van minder belang is (zoals in het geval van de berg aardappels hierboven) is de kans groot dat de NP geïnterpreteerd wordt als een enkelvoudig complex 'groepsatoom'.

In hoofdstuk 2 presenteer ik een basaal theoretisch kader voor de semantiek van getal, met daarin diverse 'formele gereedschappen' die we kunnen gebruiken om de in deze dissertatie besproken taaldata te analyseren.

In hoofdstuk 3 (en voor een deel hoofdstuk 4) ontwikkel ik een serie testjes waarmee we kunnen bepalen of een gegeven NP in de semantiek met een verzameling of met een atoom geassocieerd wordt. De testjes zijn gebaseerd op de

aanwezigheid van een zogenaamde *distributieve* interpretatie in bepaalde contexten. Een predikaat $P$ geldt als distributief als $P$, wanneer het van toepassing is op een groep individuen, daarmee ook van toepassing is op ieder individu in die groep. We kunnen op basis van (6a) bijvoorbeeld afleiden dat (6b) waar moet zijn:

(6) a. De cavia's (Jantje en Marietje) fluiten.

b. Jantje fluit en Marietje fluit.

Er zijn twee manieren waarop we dit soort distributieve interpretaties kunnen benaderen. De eerste benadering (terug te voeren op Link 1983) is om de interpretatie van meervoudige distributieve predikaten zoals *fluiten* te modelleren met behulp van een soort verborgen universele kwantor over leden van de verzameling die geassocieerd is met het zinsonderwerp - de verzameling bestaande uit de entiteiten **jantje** en **marietje** in het geval van (6a). Volgens deze theorie heeft zin (6a) min of meer dezelfde formele structuur als de zin ''Elk van de cavia's fluit'', alleen is de 'elk' niet hoorbaar. Kwantificatie werkt alleen als het onderwerp een verzameling is; een kwantor als 'elk' kan niet worden toegepast op een atoom. Als deze theorie klopt, kan de beschikbaarheid van een distributieve interpretatie dus fungeren als lakmoesproef voor het semantisch getal van het zinsonderwerp, omdat deze interpretatie alleen kan worden afgeleid als het onderwerp semantisch meervoudig is.

Het is echter ook mogelijk om distributiviteit te benaderen op een manier die geen relatie veronderstelt tussen distributiviteit en semantisch getal. Scha (1981) stelt bijvoorbeeld voor dat distributieve gevolgtrekkingen zoals die van (6a) naar (6b) niet-formele gevolgtrekkingen zijn die ontstaan doordat we redeneren over de lexicale betekenis van het betreffende predikaat in een bepaalde context. Als bij bestudering van de data blijkt dat een lexicale theorie zoals die van Scha beter in staat is de relevante data te verklaren, kunnen we distributiviteit dus niet gebruiken om conclusies over semantisch getal op te baseren.

Een derde mogelijkheid is de twee benaderingen te combineren en aan te nemen dat zowel formele als lexicale mechanismen ten grondslag kunnen liggen aan distributiviteit: sommige distributieve gevolgtrekkingen zijn alleen te verklaren als we een kwantificationele operatie aannemen, andere zijn juist alleen te verklaren met behulp van lexicale mechanismen. Voortbouwend op o.m. Dowty 1987; Hoeksema 1988; Winter 1997, 2000; en Champollion 2010 betoog ik dat dit de best werkende benadering is. Het belangrijkste argument voor deze conclusie is het gedrag van groeps-NPs zoals de eerdergenoemde *mijn*

*familie* en *de commissie*. Deze staan niet alle distributieve gevolgtrekkingen toe, zoals het contrast in (7) laat zien:

(7) a. De commissie grinnikte
⇔ Elk van de commissieleden grinnikte.

b. Het dispuut is voor de helft kaalgeschoren.
⇏ Elk van de dispuutsleden is voor de helft kaalgeschoren

Ik laat zien dat alle distributieve gevolgtrekkingen die in principe verklaard kunnen worden in termen van lexicale processen ook beschikbaar zijn als het zinsonderwerp een groeps-NP is (dit geldt bijvoorbeeld voor (7a)). Distributieve gevolgtrekkingen die alleen kunnen worden afgeleid door middel van kwantificatie over individuele groepsleden zijn echter systematisch afwezig als het onderwerp een groeps-NP is: zo kan (7b) alleen betekenen dat de helft van de dispuutsleden helemaal kaalgeschoren is, niet dat ieder van de dispuutsleden half kaalgeschoren is. Het contrast tussen (7a) en (7b) laat twee dingen zien. Ten eerste ondersteunt het een analyse van groeps-NPs als semantisch enkelvoudig (ondanks hun ogenschijnlijke 'meervoudigheid' in zinnen als (1-4)). Ten tweede toont het aan dat we twee verschillende distributiviteitsmechanismen nodig hebben: één die wel beschikbaar is in zinnen met groepsonderwerpen (en dus onafhankelijk is van semantisch getal), en één die niet beschikbaar is in zinnen met groepsonderwerpen (en dus een semantisch meervoudig onderwerp vereist). In navolging van Winter (1997) noem ik deze twee vormen respectievelijk *P-distributiviteit* ('P' van 'predikaat') en *Q-distributiviteit* ('Q' van 'quantification'). Zinnen als (7b) stellen ons in staat de twee vormen van elkaar te onderscheiden: als een dergelijke zin een distributieve interpretatie heeft, kan dat alleen Q-distributiviteit zijn en is het onderwerp dus semantisch meervoudig. In hoofdstuk 3 introduceer ik een hele serie van dit soort 'Q-distributiviteitstestjes', die fungeren als lakmoesproef voor het semantisch getal van het zinsonderwerp.

Hoofdstuk 4 gaat in op een verschijnsel dat een probleem lijkt te vormen voor de claim dat groeps-NPs geen Q-distributiviteit toestaan. In zinnen zoals (8) kan het predikaat *draagt een blauw shirt* distributief geïnterpreteerd worden (iedere voetballer draagt haar eigen blauwe shirt), terwijl we op basis van de theorie in hoofdstuk 3 verwachten dat de zin alleen kan betekenen dat het hele team zich in één en hetzelfde shirt heeft gewrongen.

(8) Het voetbalteam draagt een blauw shirt.

Vanwege zinnen zoals (8) stelt bijvoorbeeld Magri (2012) voor om groeps-NPs wel degelijk te analyseren als semantisch meervoudig, en de distributieve interpretatie van dergelijke zinnen dus als Q-distributiviteit. Dit gaat echter voorbij aan het feit dat de beschikbaarheid van een distributieve interpretatie van dit soort zinnen (met een groeps-NP als onderwerp en een onbepaalde NP als lijdend voorwerp) een uitzondering is op de regel: volgens alle andere Q-distributiviteitstesten uit hoofdstuk 3 gedragen groeps-NPs zich als atomen, niet als verzamelingen. Ik stel daarom voor om de onbepaalde NP *een blauw shirt* in zin (8) niet te analyseren als een existentiële kwantor (waardoor we genoodzaakt zouden zijn om een Q-distributieve analyse aan te nemen voor (8)), maar als een zogenaamd (individueel correlaat van een) *eigenschap*, in navolging van vele vergelijkbare analyses van onbepaalde NPs in de literatuur (e.g. Milsark 1974; McNally 1992; Zimmermann 1996; Mador-Haim & Winter 2007). Een individueel correlaat van een eigenschap lijkt qua structuur op een groeps-atoom: semantisch enkelvoudig, maar met een duidelijke conceptuele deelstructuur die het mogelijk maakt te beredeneren wat het feit dat zo'n complexe entiteit in (bijvoorbeeld) een 'draag'-relatie staat tot een andere complexe entiteit precies betekent voor de betrokkenheid van de delen (individuele voetballers en blauwe shirts) waaruit deze entiteiten conceptueel zijn opgebouwd. We kunnen de distributieve interpretatie van zinnen als (8) dus analyseren in de stijl van Scha, in termen van lexicale distributiviteit over (in dit geval) meerdere argumenten van hetzelfde werkwoord.

Na het uitstapje in hoofdstuk 4 brengt hoofdstuk 5 ons terug bij de hoofdvraag van deze dissertatie: de relatie tussen morfosyntactisch en semantisch getal. Met behulp van de Q-distributiviteitstests uit hoofdstuk 3, die het mogelijk maken om predikatie over verzamelingen te onderscheiden van predikatie over atomen, kunnen we onderzoeken van welke factoren de interpretatie van predikaten en hun argumenten als semantisch enkelvoudig of meervoudig allemaal afhangt. Hoofdstuk 5 neemt de rol van getalsmarkering op het werkwoord onder de loep.

Op basis van data uit het Brits Engels laat ik zien dat kwantificationele distributiviteit (in tegenstelling tot lexicale) 'gelicenseerd' moet worden door meervoudige getalsmarkering op het werkwoord (e.g. de *-en* in ''De cavia's fluiten'') - met andere woorden, alleen zinnen met een morfosyntactisch meervoudig predikaat kunnen Q-distributief worden geïnterpreteerd. In hoofdstuk 3 zagen we dat zinnen met een groeps-NP als onderwerp niet Q-distributief kunnen worden geïnterpreteerd. Dit blijkt iets genuanceerder te liggen: als we

de Q-distributiviteitstests uit hoofdstuk 3 toepassen op het Brits Engels blijkt dat Britse groepszinnen een Q-distributieve interpretatie kunnen krijgen, mits het werkwoord morfosyntactisch meervoudig is (zoals in (9b)).

(9) a. The class is sleeping or drawing.
'De klas zit te slapen of te tekenen'
*Geen Q-distributieve interpretatie mogelijk: de disjunctie 'slapen of tekenen' is van toepassing op de héle klas, alle kinderen doen hetzelfde.*

b. The class are sleeping or drawing.
'De klas zitten te slapen of te tekenen'
*Wel een Q-distributieve interpretatie mogelijk: de disjunctie 'slapen of tekenen' is van toepassing op elk kind afzonderlijk, het is mogelijk dat niet alle kinderen hetzelfde doen.*

Omdat de beschikbaarheid van Q-distributiviteit een lakmoesproef is voor semantisch getal, kunnen we uit bovenstaand contrast concluderen dat morfosyntactisch enkelvoudige groeps-NPs (in elk geval in het Brits Engels) met atomen geassocieerd zijn als het werkwoord morfologisch enkelvoudig is, maar met verzamelingen als het werkwoord meervoudig is.

Om dit dubbele gedrag te verklaren stel ik voor dat groeps-NPs in de semantiek beginnen als verzamelingen, maar dat ze verplicht een type-verschuiving naar een atomaire 'groepsentiteit' ondergaan als het predikaat morfosyntactisch enkelvoudig is. Onderwerp en predikaat moeten 'matchen' qua verzamelingtheoretische structuur: een semantisch meervoudig onderwerp vraagt om semantisch meervoudige predikatie, en een semantisch enkelvoudig onderwerp om semantisch enkelvoudige predikatie. Matchen ze niet, dan kan er geen zinsbetekenis berekend worden. Als we nu aannemen dat alleen morfosyntactisch meervoudige werkwoorden in de semantiek geassocieerd kunnen worden met een meervoudig predikaat, dan leidt de combinatie van een groeps-NP met een enkelvoudig werkwoord dus automatisch tot zo'n mismatch: het onderwerp is semantisch meervoudig, maar het predikaat semantisch enkelvoudig. Om deze mismatch te kunnen oplossen moet de verzameling die geassocieerd is met de groeps-NP als het ware worden aaneengesmeed tot een complex groepsatoom; het resultaat is semantisch enkelvoudig en staat dus geen Q-distributiviteit meer toe. In een taal als het Brits Engels daarentegen, die de combinatie van een groeps-NP met een morfosyntactisch meervoudig werkwoord toestaat, is geen sprake van een mismatch op semantisch niveau; de groeps-NP kan daardoor zijn oorspronkelijke

semantisch meervoudige betekenis behouden, en Q-distributiviteit is mogelijk. Deze analyse verklaart zowel de generalisatie over groeps-NPs uit hoofdstuk 3 als het specifieke gedrag van groeps-NPs in het Brits Engels op een manier die direct volgt uit onze basale aannames over de semantiek van getal.

Hoofdstuk 6, tenslotte, is een verkenning van de relatie tussen bezieldheid en semantisch getal in de vorm van drie verschillende *case studies* van het Nederlands en het Afrikaans. De link met bezieldheid dook voor het eerst impliciet op in hoofdstuk 5: volgens de daarin voorgestelde analyse komt de klasse van morfologisch enkelvoudige NPs die op semantisch niveau geassocieerd zijn met verzamelingen in plaats van atomen precies overeen met de klasse van NPs die in het Brits Engels kunnen voorkomen met een meervoudig werkwoord; een al heel oude observatie is dat dit alleen mogelijk is voor bezielde (en met name menselijke) groeps-NPs, niet voor onbezielde (een zin als **The stack of plates are dirty''* ''de stapel borden zijn vuil'' is ook in het Brits Engels ongrammaticaal). Dit suggereert dat er een verband is tussen semantisch meervoud en bezield-zijn dat min of meer onafhankelijk is van het morfosyntactische getal van een NP. In dit laatste hoofdstuk beweer ik dat het omgekeerde ook het geval is: onbezielde NPs worden eerder geïnterpreteerd als semantisch enkelvoudig, zelfs als ze morfosyntactisch meervoudig zijn.

De eerste studie gaat in op zogenaamde partitieve NPs in het Nederlands (NPs als *de helft van de meisjes* of *driekwart van de groep*). De interpretatie van dergelijke NPs - getest bij moedertaalsprekers met behulp van een vragenlijst - suggereert dat morfosyntactisch enkelvoudige groeps-NPs ook in het Nederlands geassocieerd zijn met semantisch meervoudige individuen (en dat dit dus geen unieke eigenschap van het Brits Engels is). Hiernaast laat dit onderzoek zien dat mensen geneigd zijn om onbezielde NPs te interpreteren als atomen, ongeacht hun morfosyntactisch getal.

In de tweede studie pas ik, wederom met hulp van een groepje moedertaalsprekers, verscheidene van de Q-distributiviteitstests uit hoofdstuk 3 toe op het Afrikaans (dat geen getalsmarkering op het werkwoord kent). De resultaten laten zien dat zinnen met meervoudige menselijke onderwerpen eerder als Q-distributief geïnterpreteerd worden dan zinnen met niet-menselijke en onbezielde onderwerpen. Volgens de inmiddels bekende aanname dat Q-distributiviteit een lakmoesproef is voor semantisch meervoud betekent dit dat menselijke onderwerpen een grotere kans hebben om als verzameling te worden geïnterpreteerd dan niet-menselijke, zelfs als het in alle gevallen gaat om morfosyntactisch

meervoudige NPs.

De derde studie gaat weer over het Nederlands. Zoals regelmatig is opgemerkt in de literatuur zijn predikaten als *samengesteld zijn*, *bestaan uit 5 leden* en *opgericht zijn in 1999* wel grammaticaal als het onderwerp een groeps-NP is, maar niet als het een meervoud is (vergelijk (10a) met (10b)). We kunnen dit verklaren door aan te nemen dat dergelijke predikaten alleen groepsatomen als argument toestaan:

(10) a. De commissie bestaat uit 5 experts.

b. *De commissieleden bestaan uit 5 experts.

Door een heleboel van dergelijke zinnen op te stellen en aan moedertaalsprekers voor te leggen laat ik zien dat de mate waarin sprekers zinnen met een meervoudig onderwerp als ongrammaticaal ervaren sterk afhangt van de mate van bezieldheid van het onderwerp: een zin als (11b), met een onbezield onderwerp, klinkt volgens mijn informanten best OK.

(11) a. De buit bestaat uit 5 horloges en 4 parelkettingen.

b. ?De buitgemaakte voorwerpen bestaan uit 5 horloges en 4 parelkettingen.

Dit suggereert dat bezielde meervoudige NPs in de semantiek niet (of in elk geval niet makkelijk) geassocieerd kunnen worden met het soort atoom dat geschikt is als argument voor een predikaat als *bestaan uit...*, terwijl een dergelijke atomaire interpretatie voor een niet-bezielde NP veel makkelijker is.

Aan het slot van hoofdstuk 6 bespreek ik de gedane ontdekkingen in het licht van de overvloedige taaltypologische literatuur over de relatie tussen bezieldheid en morfosyntactisch getal (zoals samengevat in Corbett 2000), inclusief een lijstje suggesties voor verder onderzoek.

Hoofdstuk 7 vat tot besluit alle conclusies van deze dissertatie nog eens samen.

# Curriculum Vitae

Hanna de Vries was born on December 24, 1984, in Waalwijk in the Netherlands. After obtaining her *gymnasium* diploma in 2002, she obtained a *propedeuse* degree in Psychology and Cultural Anthropology from Leiden University before switching to linguistics. In 2008, she graduated with a BA in Linguistics from Leiden University, and in 2010 she obtained her MA degree from Utrecht University (cum laude). In the same year, she started as a PhD researcher within the NWO-funded project 'Between Logic and Common Sense: the formal semantics of words'. This dissertation is the result of four years of research on this project.

Hanna currently works at Utrecht University as a lecturer in Linguistics and Artificial Intelligence.