Comparative Quantifiers

by

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Abstract

The main goal of the thesis is to present a novel analysis of comparative quantifiers such as *more than three students.* The prevalent view on such expressions advocated in Generalized Quantifier Theory is that they denoted generalized quantifiers ranging over individuals — entirely on a par with expressions like *every student, some student(s),* etc. According to this view, *more than three* is a determiner (like *every*) that is, even though morpho-syntactically complex, semantically a simplex expression that can be viewed as denoting a relation between sets of individuals.

The proposal that will be developed in this thesis on the other hand maintains that expressions like *more than three* are also semantically complex. More specifically, an analysis of comparative quantifiers will be given that is fully compositional down to level of the formation of comparative determiners. The proposal is based on concepts that are independently needed to analyze comparative constructions. Three main pieces will be argued to form the semantic and syntactic core of comparative quantifiers: a degree function expressed by *many*, a degree description given by the numeral (which will be analyzed as measure phrase) and the comparative relation expressed by the comparative morpheme –er. Importantly, each of the three pieces can be empirically shown to interact in predictably (and partially independent) ways with elements inside the quantifier as well as with elements in the matrix clause. These interactions are unexpected unless comparative quantifiers are built in the syntax. Giving a fully compositional analysis is therefore not just conceptually appealing but also required to explain new empirical generalizations. The more general enterprise that this thesis hopes pave the way is giving a uniform and fully compositional analysis of comparative quantificational structures that does not exist so far.

Thesis supervisor: Irene Heim
Title: Professor of Linguistics

Acknowledgments

It has been a great privilege to study at MIT which provided me with an environment to learn that I can't imagine being better suited to engage my ever curious mind. Faculty, students and visitors alike create an intellectual atmosphere of collaborative effort from which I have profited in more ways than can be described in this short note. Among the people I have benefited the most are (in random order) Alec Marantz, Jon Nissenbaum, Gina Rendon, Phoebe Rendon-Nissenbaum, Danny Fox, Morris Halle, Ken Hale, Irene Heim, Elena Guerzoni, Liz Spelke, David Pesetzky, Uli Sauerland, Susi Wurmbrand, Jonathan Bobaljik, Philippe Schlenker, Dave Embick, Sabine Iatridou, Lisa Mathewsson, Orin Percus, Norvin Richards, Kai von Fintel, Calixto Aguerro-Bautista, Meltem Kelepir, Rajesh Bhatt, Roumi Izvorski-Pancheva, Jeanette Schaefer, Karlos Arregi, Noam Chomsky, Francesca Panzeri, Sjef Barbiers, Colin Phillips, Ken Wexler, Kazuhko Yatzushiro, Marie-Claude Boivin, and many others who will hopefully forgive me for not mentioning their names.
It doesn't do much justice to simply list the names of these people, I hope they know how much I appreciate their intellectual as well as personal company.

The danger of living in such a stimulating environment as MIT lies in getting interested in too many things at the same time. When I couldn't ignore the need anymore to settle on a thesis project and concentrate on it, very little time was left. I am deeply grateful to my committee members Irene Heim, Kai von Fintel and Danny Fox for taking me under their wings despite the little time that was left and the much too ambitious project I had in mind. The thesis is a rather premature brainchild and it is very difficult for me to letting go of it. If there is some hope that one or the other idea in it survives in some form or other, it is because of my advisors.
Foremost I want to thank Irene who has been supportive with her time and energy to a much higher degree than I deserved. Her ability to see through often confused ideas the core of something valuable helped me immensely to keep on going. Equally important was her incredibly acute sense for linguistic facts which helped me sort through a notoriously difficult empirical domain. She is in many ways a role model — most importantly though in her Socratic approach to theorizing which puts great value to understanding where we don't understand anymore. Working with Kai has helped me greatly in developing and sharpening ideas that seemed more like foggy impressions before talking to him. Looking back I wish I had had more time discussing things with him. Even though or probably because we were fellow students over three years, Danny is the person I learned most from during the time I spent at MIT. His incredible ability to see through convoluted theories and complicated facts the bare bone structure of a theory is
I also want to thank my parents Johann and Christine Hackl, my siblings and their children and the rest of the family back in Austria. My deepest thanks go to Elena Guerzoni who has been on my side over the last two years supporting me in so many ways that I blush thinking about it — and who has allowed me to be on her side which is the greatest privilege I can imagine. Thank you for being the sunshine of my life.

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Chapter 1

Amount Comparison and Quantification: Basic Questions

1.1 Introduction[1]

The main concern of this thesis is the analysis of expressions such as the ones underlined in (1) which are at an intuitive level comparative as well as quantificational.[2,3]

(1) a. John read more than nine books.
    b. John read more than half of the books.
    c. John read most of the books.
    d. John read more books than papers.
    e. John read more books than Bill (read).
    f. John read more books than there are planets in the solar system.

To a naïve eye it might come as a surprise that these constructions — even though quite similar in appearance — are standardly not treated in a uniform way. In fact as

[1] Unfortunately, it is impossible to provide a comprehensive survey of the literature on generalized quantifiers as well as on comparatives. The discussion is necessarily selective and organized around presenting the issues the way I understand them rather than doing complete justice to previous work.
[2] Nerbonne(1994) uses the label "nominal comparatives" for a similar class of examples. This is however a bit misleading because there are nominal comparative constructions that are not comparing quantities (in the narrow sense) such as *John is more of a syntactician than a semanticist* (cf. Bresnan's(1973)).
[3] The paradigm in (1) is a rather small sample of the empirical domain. Unfortunately, I will not be able to discuss a variety of comparative constructions such as equatives, modal and counterfactual

far as I know, there is at present no uniform analysis of these expressions although they seem to express closely related meanings using overlapping sets of means (comparative and superlative morphology, measure nouns, numerals and plural NPs) to express these meanings so that a uniform analysis seems at least initially very tempting. Contrary to this prejudice, a rather sharp distinction is usually drawn between comparatives quantifiers such as *more than nine students* which are said to denote generalized quantifiers and various kinds of amount comparative constructions such as *more books than Bill, more books than Bill read,* etc. for which regular comparative syntax and semantics is called for. The most salient difference between the analyses of comparative quantifiers and amount comparatives concerns the issue of how the labor should be distributed between means of expressing measurement and comparison of amounts and quantification over entities and how much of it should actually be encoded in the syntax. While the almost unanimously accepted view of Generalized Quantifier Theory on comparative quantifiers maintains that measurement and comparison of amounts is to be confined to the meta-language description of the truth-conditions associated with comparative quantifiers, explicating the semantics and syntax of these pieces seems to be indispensable for any analysis of amount comparatives. In other words, the analysis of the semantics and syntax of elements that express these meaning components — a degree function possibly expressed by *many,* the comparative relation expressed by the comparative morpheme *-er,* etc. — is the beginning and

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comparatives with *enough* and *too.* Instead, I will focus on what I take to be the paradigm case and end point of any analysis of amount comparatives since they provide the skeleton of of comparative constructions.

Granting for the moment, that a unified account of both types of constructions would be desirable, one could imagine that a unification of these different approaches could be achieved in either one of two directions. One could attempt to analyze comparative quantifiers as comparative constructions or — the other way around — one could attempt an analysis of amount comparative constructions as generalized quantifiers maintaining the basic assumptions of Generalized Quantifier Theory. The second approach appears to be much less promising as it is highly unclear how expressions like *more books than Bill* could be insightfully analyzed as generalized quantifiers without the help of comparative syntax. The first approach on the other hand appears to be more promising since nothing in the surface appearance of comparative quantifiers would tell us that something entirely different from amount comparatives is going on. More specifically, the morpho-syntax of comparative quantifiers indicates that the same core elements that are employed in amount comparatives — a comparative morpheme, a *than*-constituent, *many* — are also used in the formation of comparative quantifiers suggesting that the same syntactic and semantic analysis could be applicable.

The thesis is an exploration of what appears to be the more promising route towards a unified analysis of amount comparatives and comparative quantifiers. The goal is

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leave it for future research to extend the results to these constructions.

rather modest however: I will go the first few steps towards a unified analysis by giving an analysis of comparative quantifiers as amount comparative constructions. Unfortunately, it won't be possible to present a fully developed uniform account fo all expressions listed in (1). I will present compelling evidence that a unification in this direction is at least on the right track. However, I will also present quite unexpected data, which supports one of the main conclusions of the thesis: While it is possible and in fact necessary to analyze comparative quantifiers as comparative constructions, it can only be done if we incorporate a core insight of Generalized Quantifier Theory in quantification, namely that natural language quantification is always restricted quantification. In a real sense then I argue for a unification of the two approaches rather than claiming that the analysis of comparative quantifiers can be subsumed under the analysis of amount comparatives.

Before going any deeper into the discussion, it is necessary to establish the basic tenets of both approaches detailed enough to delimit the empirical domain that will have to be accounted for by a uniform analysis. The remainder of this chapter is devoted to doing that by sketching the analysis of comparative quantifiers as given in the Generalized Quantifier Tradition on the one hand, and an analysis in terms of the comparative syntax and semantics of amount comparative constructions on the other hand. Since to my knowledge this has never been explicitly done, I will sketch an analysis based on standard assumptions about comparative constructions and call it "the classical approach" to contrast it with the one that I will be developing in the chapters to come even though hit doesn't have a real defender.

1.2 Comparative Quantifiers in Generalized Quantifier Theory[4]

1.2.1 Terminology and Notational Conventions

Generalized Quantifier Theory (GQT) is primarily concerned with the analysis of quantificational expressions such as *every student, no student, some student, most students,* etc.[5] To distinguish between the expression and its semantic value (denotation) the following labels will be used. I follow common practice in analyzing the syntactic constituent *every student* as maximal projections of a determiner and will therefore be referred to by the label "quantificational DP" (or for short QP).[6] The constituents they are built from, i.e. the determiner *every* and the noun phrase *student* will be referred to as "quantificational determiner" (D_Q) and "common noun phrase" (NP) respectively. The semantic value of the expression *every student* on the other hand will be referred to as the "Generalized Quantifier" (GQ) expressed by *every student.* The most basic occurrence of a QP is in subject position as in (2).

(2) a. Every student is blond.
    b. No student is blond.
    c. Some student is blond.

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[4] It is not possible here to give a thorough overview of Generalized Quantifier Theory. I will for the most part restrict my attention to the comparative quantifiers. There are many very good introductions to and overviews of Generalized Quantifier Theory. Keenan(1996), Keenan&Westerstahl(1994), etc.
[5] This is not to say that GQT is not concerned with the analysis of adverbial and modal quantification, however its origins are in the analysis of determiner (or D-)quantification.
[6] Cf. Szabolcsi(1984), Abney(1987) and many after them.

To give an initial analysis of the syntax and semantics of such sentences the following assumptions will be made without further argument: the denotation of NPs as well as verb phrases (VPs) can be approximated satisfactorily in an extensional setting as the characteristic functions of a set of individuals. I will be using the familiar lambda-notation to describe functions as well as the conventional type labels e (for entities in the domain of discourse) and t ({1,0}) and their combinations as convenient short-hand to refer to the compositional properties of expressions. This makes it possible to give lexical entries as in (4) for nominal and (in this case) adjectival one-place predicates.

(3) a. $[\![\textit{student}]\!] = \lambda x \in D_e.\ x$ is a student.

b. $[\![\textit{blond}]\!] = \lambda x \in D_e.\ x$ is blond.

Sometimes it will be convenient to simply refer to the set rather than its characteristic function. In this case, I will use bold face as notational device. Hence the semantic value of *student* and *blond* can be given alternatively as in (4) following the convention in (5).[7]

(4) a. $[\![\textit{student}]\!] = \textbf{student} := \{x \in D\text{: x is a student}\}$

b. $[\![\textit{blond}]\!] = \textbf{blond} := \{x \in D\text{: x is blond}\}$

[7] For the most part I follow the conventions in Heim&Kratzer(1998).

(5) Notational conventions

a. *italics* are used for expressions of the object language

b. $[\![\alpha]\!]^a$ refers to the interpretation function that assigns an expression α its semantic value relative to an assignment function a, if there is no superscript given, it is assumed that the denotation of α is assignment independent (i.e for all assignments a,a' $[\![\alpha]\!]^a = [\![\alpha]\!]^{a'}$).

c. **bold face** is a short hand to refer to the semantic value of the bold faced expression. No distinction is drawn between a set and its characteristic function if that should be the semantic value of an expression
For instance, the semantic value of *student* can be given as follows
$[\![$*student*$]\!]$ = **student:** = $\{x \in D_e$: x is a student$\}$ or equivalently
$[\![$*student*$]\!]$ = **student:** = $\lambda x \in D_e$. x is a student
Note that set theoretic operations are well-defined when used in conjunction with the bold face notation if the semantic value of the expression is (the characteristic function of) a set

Furthermore, the following rules of semantic composition will be assumed.

(6) Functional Application
If α is of the form $[\beta\ \gamma]$, then $[\![\alpha]\!]^a = [\![\beta]\!]^a([\![\gamma]\!]^a)$ or $[\![\alpha]\!]^a = [\![\gamma]\!]^a([\![\beta]\!]^a)$

(7) Predicate Modification
If α is of the form $[\beta\ \gamma]$ and β as well as γ are of type <e,t> then
$[\![\alpha]\!]^a = \lambda x \in D_e.\ [\![\beta]\!]^a(x) = 1$ and $[\![\gamma]\!]^a(x) = 1$

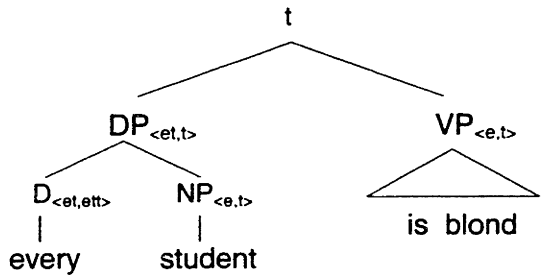
(8) Predicate Abstraction
If α is of the form $[\beta\ \gamma]$ and β a number (index) then $[\![\alpha]\!]^a = \lambda x \in D_e.\ [\![\gamma]\!]^{a[\beta/x]}$
(i.e. the semantic value of γ under the modified assignment $a^{[\beta/x]}$ which is just like a except for the assignment of x as the value of a(β)

1.2.2 Restricted Quantification

Given these basic and entirely standard assumptions, the following structure will be assigned to sentences such as the ones in (2).

(9) a. Every student is blond.

b.



The denotation of the quantificational determiner *every* and the QP *every student* can be given as in (10)a and b respectively or equivalently employing the bold face convention as in (11)a,b.

(10) a. $[\![\textit{every}]\!] = \lambda P_{\langle e,t \rangle}.\lambda Q_{\langle e,t \rangle}.$ for all x st. P(x) =1, Q(x) =1

b. $[\![\textit{every student}]\!] = \lambda Q_{\langle e,t \rangle}.$ for all x st. x is a student, Q(x) =1

(11) a. $[\![\textit{every}]\!] = \lambda P.\lambda Q.\ P \subseteq Q$

b. $[\![\textit{every student}]\!] = \lambda Q.\ \mathbf{student} \subseteq Q$

(11)a,b display more prominently one of the basic insight of GQT into the semantics of natural language quantification namely that QPs denote sets of sets of individuals (type <et,t>). Quantificational determiners in turn can be viewed as denoting relations between sets of individuals. As such, a determiner takes two arguments — the restrictor and the nuclear scope — both of which are sets of individuals. For instance, for a given universe *every student* denotes the set of all sets that have the set of students as subset. This fits well with the truth-conditions associated with a universally quantified sentence (the truth-conditions for (12)a for instance are given in (12)b or equivalently (12)c employing the relational perspective).

(12) a. Every student is blond.

b. $[\![$*Every student is blond*$]\!]$ = 1 iff for all x st. x is a student, x is also blond

c. $[\![$*Every student is blond*$]\!]$ = 1 iff **student** $\subseteq$ **blond**

This treatment can be easily generalized to a variety of quantificational determiners and their Boolean combinations. The short list in (13) will suffice to demonstrate this.

(13) a. $[\![$*some student*$]\!] = \lambda Q.\ \mathbf{student} \cap Q \neq \varnothing$

b. $[\![$*some*$]\!] = \lambda P.\lambda Q.\ P \cap Q \neq \varnothing$

(14) a. $[\![$*no student*$]\!] = \lambda Q.\ \mathbf{student} \cap Q = \varnothing$

b. $[\![$*no*$]\!] = \lambda P.\lambda Q.\ P \cap Q = \varnothing$

(15) a. $[\![$*all students*$]\!] = \lambda Q.\ \mathbf{student} \subseteq Q$

b. $[\![$*all*$]\!] = \lambda P.\lambda Q.\ P \subseteq Q$

(16) a. $[\![$*some but not all students*$]\!] = \lambda Q.\ \mathbf{student} \cap Q \neq \varnothing\ \&\ \mathbf{student} \cap (D - Q)$[8] $\neq \varnothing$

b. $[\![$*some but not all*$]\!] = \lambda.P.\lambda\mathbf{Q}.\ P \cap Q \neq \varnothing\ \&\ P \cap (D - Q) \neq \varnothing$

This rather simple treatment gives an elegant way of describing the truth-conditions associated with *every, some, no* etc. and it fits nicely with the independently given syntax of DP constituents.

1.2.3 Comparative Quantifiers

Extending this treatment to comparative quantifiers such as *most students, more than half of the students, more than three students, between three and nine*

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[8] $\mathbf{A} - \mathbf{B} := \{x: x \in \mathbf{A}\ \&\ x \notin \mathbf{B}\}$

students, exactly three students, at least/at most three students etc.[9] seems straightforward. Here are some examples.

(17) a. $[\![$*most students*$]\!] = \lambda Q.\ |\mathbf{student} \cap Q| > |\mathbf{student} - Q|$
b. $[\![$*most*$]\!] = \lambda P.\lambda Q.\ |P \cap Q| > |P - Q|$

(18) a. $[\![$*more than three students*$]\!] = \lambda Q.\ |\mathbf{student} \cap Q| > 3$
b. $[\![$*more than three*$]\!] = \lambda P.\lambda Q.\ |P \cap Q| > 3$

(19) a. $[\![$*exactly three students*$]\!] = \lambda Q.\ |\mathbf{student} \cap Q| = 3$
b. $[\![$*exactly three*$]\!] = \lambda P.\lambda Q.\ |\mathbf{P} \cap Q| = 3$

(20) a. $[\![$*more than three but less than nine students*$]\!] = \lambda Q.\ 3 < |\mathbf{student} \cap Q| < 9$
b. $[\![$*more than three but less than nine*$]\!] = \lambda P.\lambda Q.\ 3 < |P \cap Q| < 9$

However, some additional complexities arise with comparative quantifiers that are worth pointing out. First notice that in the representation of the truth-conditions more than just Boolean operations over sets is needed. In particular, reference is made to the measure function "the cardinality of" as well as to cardinalities themselves and comparative relations such as "<" and "≤" that are defined for the cardinalities of a set but not the set itself. Even though the representation of the truth-conditions has to be considerably enriched, no specific claim is made as to how the enriched semantics is to be linked to the (typically also enriched) morpho-syntax of comparative quantifiers.

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[9] The label "comparative quantifiers" is used rather inclusively and the examples are not by any means meant to constitute a complete list of what is considered a comparative quantifier in this thesis. Furthermore, it is common practice to employ a more fine-grained classifications of quantifiers see for instance in Beghelli(1994,1995), Keenan(1996) or Keenan&Westerstahl(1998) which would not be useful to employ at this point of the exposition.

We can use these observations as heuristic for delimiting the class of comparative quantificational determiners from the view point of GQT. Comparative quantificational determiners are those that the employment of "the cardinality of" and a comparative relation such as "$\leq$" or "=" in the representation of the truth-conditions import is essential. Since this heuristic makes no reference to the syntax of these determiners, expressions such as *zero, more than zero, one or more, at least one,* etc. are not comparative quantificational simply because the representation of the truth-conditions associated with them can do without any comparative machinery.

The claim that is implicit in this heuristic is that there are no significant semantic generalizations that would carve out comparative quantificational determiners as identified by the syntax as natural class. Accordingly, no attempt is made in GQT to decompose comparative quantifiers any further than identifying the restrictor and nuclear scope of the generalized quantifier against the remainder. In other words, the denotation of (comparative) determiners is mechanically "factored out" from the meaning of (comparative) QPs according to the following recipe: identify the syntactic constituents that denote the restrictor and the scope of the generalized quantifier, the remainder is then called the "quantificational determiner." Attribute to the so found determiner the Boolean and comparative operations necessary to represent the truth-conditions of the generalized comparative quantifier adequately.

Even though the recipe of identifying the determiner of a generalized quantifier can be criticized to be very coarse and in particular insensitive to the internal composition of the determiner, it is important to point out that it is **not** claimed that there couldn't be any further syntactic structure to complex determiners. Nor is it claimed that the parts that are put together to form a complex determiner do not have their own independent meanings. Quite obviously, numerals, measure nouns as well as various kinds of comparative operators have their independent meanings and no GQ-theorist would deny that. The real claim is rather that whatever the basic elements and their composition are that are employed in the formation of complex determiners, these means are irrelevant for semantics. The meaning of complex determiners is not compositional — they are opaque and unpenetrable wholes just like idioms as far as their interaction with the context is concerned.[10]

1.3 Comparative Quantifiers as Comparative Constructions

From a syntactic point of view, the claim that comparative determiners are essentially like idioms is not very attractive. The relation to comparative constructions is too transparent that one wouldn't want to attempt a fully compositional analysis. Furthermore, the formation of comparative determiners is productive at least to the extent that there is a comparative determiner *more than n fewer than n, as many as n, too many n, enough n,* etc. for every number n in which the contribution of the numeral to the meaning of the determiner seems to be the same in every case. It seems quite clear that also "determiners" like *more than half*

[10] Keenan&Westerstahl(1997:17) for instance use the term as "lexical and near lexical determiners"

are transparently formed so that the productivity observation should be generalized to the claim that for every measure phrase MP (numerals, *half*, etc.) there is a set of comparative determiners *more than MP, less/fewer than MP,...* The contribution of the measure phrase is to the meaning of the determiner seems to be the same in every case suggesting that at least for this step of the formation a compositional analysis is called for.

It is worth pointing out, though, that even if a fully compositional analysis of comparative determiners can be given, that does not automatically mean that the GQT treatment has to be abandoned as such. As long as there are no interactions between the pieces that the compositional analysis of comparative determiners postulates and its external environment (e.g. the NP argument), the GQT treatment can be taken as convenient and fair abbreviation of the eventually fully compositional account.[11] Only if it can be shown that properties of the elements that comparative determiners are built from are transparent to the environment will it be necessary to reconsider the GQT position.

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while van Benthem(1986) calls them "tightly knit compounds."

[11] An analogy from physics comes to mind: The gas laws provide a very elegant and satisfactory explanation of the dependencies between pressure, temperature, volume and mol quantities of a gas even though no reference is made to the actual properties of the single molecules the gas is comprised of. A similar state of affairs could be given in the case of comparative quantifiers. Even though we know that comparative determiners are built from more basic pieces, these pieces are not independently detectable when put to the task of forming a determiner.

1.3.1 The Basic Elements of Comparative Constructions

Since it is not immediately obvious where to look for such evidence unless the properties of the pieces a compositional analysis would employ are known, I will sketch in this section how a compositional analysis in terms of the independently needed syntax and semantics of comparative constructions would look like. To get started, it is useful to provide a baseline construction from the domain of comparative constructions and model the account of comparative determiners/ quantifiers as closely as possible after that.[12] For the most part the assumptions I will introduce here follow the exposition in Heim(2000) and are entirely standard — whenever I depart from what Heim(2000) calls the classical analysis it will be noted. Consider to begin with the sentences in (21)a and (22)a and their interpretation as paraphrased in (21)b and (22)b.

(21) a. John is taller than Bill.
b. "John's height exceeds Bill's height"
c. "There is a degree d st. John is tall to that degree and Bill is not that tall"

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[12] The syntax of comparatives provides an intriguingly rich empirical domain that has occupied generative linguists since the 70ies (Selkirk(1970), Bresnan(1973,1975), Hankamer(1973), Chomsky (1977), Jackendoff(1977), Hellan(1981), Pinkham(1982), Napoli(1983), Heim(1985), Grimshaw (1987), Corver(1990, 1997), Hendriks(1995), Kennedy(1997,1999), Lechner(1999) many others). It is impossible to survey all the work that has been done on the syntax. Instead I will present the main questions that will be relevant for this thesis and refer the reader to the rich literature for more detail on questions that are less important.

[13] Cf. Krantz et al. (1971), Klein(1991), Kennedy(1997), etc. and chapter 4 for more discussion of the specific properties of degree/measure functions.

(22) a. John is taller than six feet.
b. "John's height exceeds 6'."
c. "There is a degree d st. John is tall to that degree and d is greater than 6 feet"

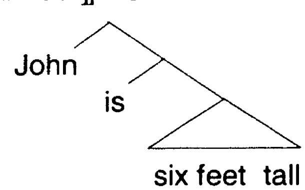
In these comparative constructions John's height is compared with some standard of comparison provided by the *than*-constituent. In the case of (21) the standard of comparison is Bill's height while in (22) it is simply the degree 6'. The claim that is expressed specifically is that John's height is greater than Bill's height and John's height is greater than 6' respectively. Upon reflection, these truth-conditions can also be paraphrased as in (21)c and (22)c which — albeit more cumbersome — have the advantage of being more transparently related to the actual syntax of the original sentences. According to the paraphrase in (22)c, there are three essential pieces to comparative constructions: A gradable predicate or degree function expressed by *tall;* an expression referring to a degree that provides the standard of comparison and a comparative relation. The interplay between these three basic pieces of comparative constructions and their compositional semantics is quite intricate and requires a few introductory remarks.

First, comparative constructions compare two degrees — in the cases above the degree of John's height and the degree of Bill's height or the degree 6 feet — and one of the main tasks of the analysis of comparatives is to explain how the two degrees that are compared are introduced and/or described by the syntactic pieces that comparative constructions are made of. Measure phrase comparatives such as (22) constitute arguable the simplest case of comparative constructions because the standard of comparison is overtly given by a measure phrase which can be taken to refer directly to a degree. I will therefore use the analysis of measure phrase comparatives as starting for developing an analysis of comparative quantifiers as comparative constructions. This is convenient since measure phrase comparatives also provide the closest match for comparative quantifiers as will become clear shortly. The second degree argument in (22) that eventually will "refer" to John's height is introduced by the gradable predicate *tall*. Gradable predicates are typically taken to denote relations between individuals and degrees. In the case of *tall* the relation holds between individuals with physical extent and degrees of height. I will assume specifically that *tall* denotes a characteristic function from degrees to (the characteristic function of) a set of individuals as described in the sample entry in (23)a. Measure phrases such *six feet* on the other hand will be treated as referring directly to a degree cf. (23)b. Given these assumptions, an elementary sentence for instance will be analyzed as indicated in the structure in (23)c and d.

(23) a. $[\![\textit{tall}]\!] = \lambda d.\lambda x.$ x is d-long

b. $[\![\textit{six feet}]\!] = 6'$

c.



d. $[\![\textit{John is six feet tall}]\!] = 1$ iff John is 6'-tall

Back to the measure phrase comparative in (22)a. Note that the matrix degree argument of *tall* is existentially bound in the paraphrase of the measure phrase as apparently no specific degree d to which John is tall is compared to 6 feet. The claim is simply that there is some degree d such that John is d-tall and d is greater than 6 feet. It appears then that an integral part of comparatives is a quantifier that ranges over degrees – for short a degree quantifier. Traditionally, it is assumed that the comparative morpheme –er does double duty. It introduces the (existential) degree quantifier as well as the comparative relation. Specifically, the idea in the classical analysis is that *–er than six feet* denotes a (restricted) degree quantifier as described in (24) which has essentially the same combinatorial properties as a regular individual quantifier in that it denotes as a set of sets.

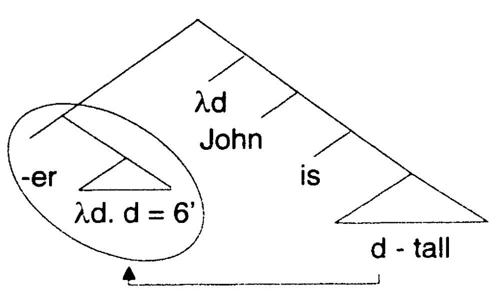
(24) $[\![$*-er than 6 feet*$]\!] = \lambda D \in D_{\langle d,t\rangle}.\ \exists d\ [D(d) = 1\ \&\ d$ is greater than 6'$]$

This degree quantifier is base generated in the degree argument position of tall. Since it is a quantifier, it needs to move to a clausal node to yield an interpretable structure which results in a structure as sketched in (60).

(25) a. John is taller than 6 feet.

b. [-er than 6 feet $]_1$ [John is d_1-tall]

c.



d. $[\![$*John is taller than 6 feet*$]\!] = 1$ iff $\exists$d st. John is d-tall & d is greater than 6'

For simplicity, it is assumed in (60) that there is no clausal node inside the AP. (Nothing in the discussion here depends on this assumption.) Hence the comparative quantifier has to move into the matrix. Movement creates a derived degree predicate with the λ-operator binding the degree trace following Heim&Kratzer(1998).

At this point a question arises: what is the set of degrees d st. John is d-tall? Degrees are elements on a scale, a scale on the other hand is an ordered set of elements. Since degree functions such as *tall* express relations between individuals and degrees (elements of an ordered set), we can think degree functions as expressing measure functions.[13] A characteristic property of measure functions is that they are monotone. I.e. if it is true that John is 6 feet tall then it is also true that he is 5'11" inches tall and so on for every degree smaller than six feet. A definition of the relevant notion of monotonicity that is applicable to degree functions such as *tall* as defined above is give in (26).

(26) **Definition:** Monotonicity[14]

A function μ (type <d,et>) from degrees to sets of individuals A is monotone iff

$$\forall x \in A \text{ and } \forall d, d' \in D_d\ [x \in \mu(d)\ \&\ d' <_D d) \rightarrow x \in \mu(d')]$$

The set of degrees to which John is tall is then the set of all degrees from the bottom element of the height scale to the highest degree d on the height scale for which it is still true that John is tall to that degree.

[14] Cf. Gawron(1995), Heim(2000).

The assumption about the quantificational force of the comparative morpheme *–er* deserves one more comment. Various proposals exist in the literature as to what the exact nature of the quantificational element in comparatives is (existential, universal, or maximal) and depending on the choice of the quantificational element what the comparison operation encoded in the comparative morpheme *–er* has to be. Since the choice is not essential to my purposes here, I will for the moment simply adopt without further discussion the proposal made in Schwarzschild&Wilkinson(1999) and adopted by Heim(2000) which assumes a maximality operator as defined in (27) taken from Heim(2000) as part of the meaning of the comparative operator.[15]

(27) Definition: Maximality$_{\leq}$

$\text{max} = \lambda D_{<d,t>}.$ the unique d st. $D(d) = 1$ & $\forall d'\ [D(d') = 1 \rightarrow d' \leq d]$

The comparative operator can now be viewed as comparing two maximal degrees given by the restrictor and scope argument. The relevant entry is given in (28).[16]

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[15] See also von Stechow(1984), Rullmann(1995) and Schwarzschild&Wilkinson(1999).

[16] As pointed out above, the restrictor of the comparative operator is provided by the *than*-constituent. Given the assumptions about the comparative operator, the restrictor has to denote a set of degrees to fit its requirements. One of the main difficulties in the analysis of comparatives originates from the fact that there is a rich variety of possible *than*-constituents that proves to be difficult to capture under a uniform treatment of deriving a degree-predicate. The sample below gives an illustration of variety.

(i)	a.	John's rod is longer than 12 inches.	measure phrase comparative
	b.	John's rod is longer than Bill's feet.	phrasal comparative
	c.	John bought a longer rod than Bill.	Comparative Ellipsis
	d.	John bought a longer rod than Bill did <~~buy s d-long rod~~>.	Comparative Ellipsis
	e.	John bought a longer rod than Bill sold <~~a d-long rod~~>.	Comparative Deletion
	f.	John's feet are wider than his hands are ~~d~~-long.	Comparative Sub-Deletion

(28) $[\![\textit{-er}]\!] = \lambda D_{<d,t>}.\ \lambda D'_{<d,t>}.\ \max(D) < \max(D')$[17]

In the case of measure phrase comparatives where the standard of comparison is given by a measure phrase these assumptions produce a conflict. Strictly speaking, the restrictor argument of *–er* given by the *than*-constituent has to denote a (characteristic function of a) set of degrees. To arrive at this while maintaining the basic assumption that measure phrases simply denote degrees, I propose a type-shifting operation similar to Partee's(1987) BE operation which maps an individual to its corresponding singleton. Again, the specifics of this type-shifting operation are not relevant here. I simply assume for the moment that there are two interpretations of measure phrases as given in (29)a and b.

(29) a $[\![\textit{six feet}]\!] = 6'$

b. $[\![\textit{six feet}_{BE}]\!] = \lambda d \in D_d.\ d = 6'$

Given these assumptions as well as the structure in (60) the truth-conditions that are derived are now much closer to the more intuitive paraphrases in (22)b.

(30) a. $[\![\textit{John is taller than 6 feet}]\!] = 1$ iff max {d: John is d-tall} > max {d: d = 6'}

b. "John's height exceeds the height of 6 feet"

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[17] Note that the lexical entry of the comparative operator defines it as a non-conservative function. If the restrictor set of *–er* is a subset if the nuclear scope set, then the maximal degree of the intersection of D and D' will be the same as the maximal degree in D.

1.3.2 Comparative Quantifiers as Comparative Constructions – a Traditional Analysis

The "traditional" analysis of comparative quantifiers as comparative constructions follows in the footsteps of the previous development. To keep things as simple as possible and abstract away from irrelevant complications, I will use a comparative quantifier in the coda position of an existential there sentence as depicted in (31) which comes closest to the predicative use of the gradable predicate *tall* as given in (22).

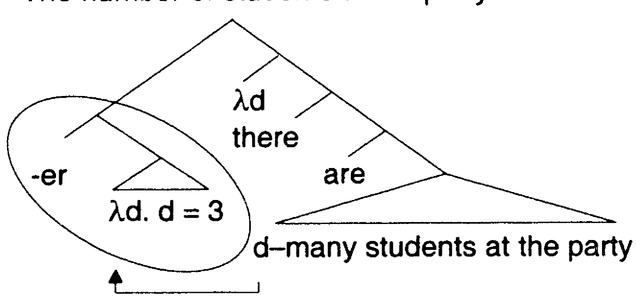
(31) a. There are more than 3 students at the party.

b. [-er than 5]$_1$ [there are d_1-many students at the party]

c. $[\![$*There are more than 3students at the party*$]\!]$ = 1 iff max {d: $\exists$x st. x is d-many students at the party} > max {d: d = 3}

d. "The number of students at the party exceeds/is bigger than 3"

e.



Following Ross(1964), Bresnan(1973) and many subsequent researchers, it is assumed in the treatment sketched in (31) that *more* is the morphological spell-out of *many+er*. *Many* itself is analyzed parallel to other degree predicates/functions such as *tall*. It takes as innermost argument a degree and then denotes (the characteristic function of) a set of individuals that are numerous to degree d.[18]

(32) $[\![many]\!] = \lambda d.\lambda x.$ x is d-many

The degree argument of *many* is given by the degree quantifier *–er than 3* which — as before — has to move to a clausal node to yield an interpretable structure. In the structure in (31) it is assumed for simplicity that the degree quantifier can move into the matrix parallel to the sketch in (60).

1.4 Three Empirical Questions

To be sure, the analysis sketched above leaves many important details of the analysis of comparative quantifiers as comparative constructions open. However, it is sufficiently detailed to contrast it with the approach of GQT to characterize the kind of empirical evidence that might require an analysis of comparative quantifiers along these lines. We have seen that the main difference between the GQT approach and the approach sketched above is how much of the comparative machinery that is essential to the truth-conditional import of comparative quantifiers is syntactically and semantically transparent. While the stance of GQT is that none of this rich machinery is semantically relevant, i.e. comparative determiners are opaque idiom-like units, the analysis of comparative determiners postulates that

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[18] For the purpose of this and the next chapter it is sufficient to think of entities that are numerous to

there are at least three pieces at work in the formation of comparative determiners. There is a degree function expressed by *many*, a measure phrase expressed for instance by a numeral and the comparative relation itself encoded as degree quantifier *–er than n*. The claim that comparative determiners are formed transparently in the syntax yields the expectation that the pieces they are comprised of could in principle interact with constituents outside of the determiner itself and potentially even independent of the other pieces that are put to work in the formation of comparative determiners. Clearly if such evidence can be found, the GQT approach of treating comparative determiners as essentially idiomatic expressions cannot be maintained. On the other hand, if there are no detectable interactions of any of the pieces that comparative determiners are built from, the GQT point of view would be vindicated.

1.4.1 Detecting the Degree Quantifier: Scope Splitting

The clearest case where we should expect to see an element of comparative quantifiers interacting independently of the other pieces with elements outside of the quantifier presents itself in from of the degree quantifier. Recall that GQT only assumes one quantificational element in comparative quantifiers, the fully compositional alternative on the other hand postulates a degree quantifier as well as an individual quantifier. Given the limited assumptions made so far, these two

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some degree as corresponding in some way to be made precise in chapter 4 to a set of individuals.

quantifiers should be able to take scope independently and the presence of could be detected if there is scope bearing intervening operator as schematized in (33).

(33) a. [-er than ... [Op ... [d-many x ...]]]
b. [d-many x ... [Op ... [-er than ...]]

Interestingly, there is well-know evidence from how-many questions that supports the expectation of scope splitting as described in (33)a. Consider the question in (34)a from Rullmann(1995:163) which has two possible interpretations that are paraphrases in (34)b and (34)c respectively.

(34) a. How many books does Chris want to buy?
b. What is the number n such that there are n books that Chris wants to buy?
c. What is the number n such that Chris wants it to be the case that there are n books that he buys?

Of interest for our purposes is the reading paraphrased in (34)c in which a modal operator apparently intervenes between the degree quantifier and the individual quantifier. The reading in question is therefore an instantiation of scope splitting as schematized in (33)a which cannot be explained unless two independent quantifiers are assumed. This observation buy itself is not yet detrimental to the GQT approach to comparative quantifiers simply because one could retreat to the position that how-many questions need not be analyzed as generalized quantifiers to begin with. Furthermore, similar scope splitting data with run of the mill comparative quantifiers have not been discussed to my knowledge and either do not exist or are at least much harder to come by. In will discuss this issue further in chapter 3 and provide clear data that show scope splitting with comparative determiners as well. Since the discussion is quite involved and relies party on results established in chapter 2, I will leave it for the moment at characterizing the different predictions made by the competing approaches.

1.4.2 Detecting the Degree Function

The second set of contrasting expectations turns on the specific properties of the degree function *many* assumed to be an integral part of comparative determiners according to the comparative quantifiers as comparative constructions hypothesis. The property of interest that will be discussed in some detail in chapter 4 is that degree functions are defined only for individuals that can have the gradable property in question to some degree. In the case of *tall* for instance every individual that is said to tall to some degree has to have some physical extent that can be expressed in terms of height. The analogous expectation for amount comparatives is that only individuals that can be said to be numerous to some degree should be in the domain of the degree function *many*. I will argue in chapter 4 that this requirement of *many* is satisfied if the individuals are pluralities. I will argue furthermore, that this reasoning will lead to an insightful account of certain restrictions that comparative quantifiers are subjected to in conjunction with a particular class of collective predicates. The point against the GQT approach to comparative quantifiers is essentially the same as above. Only if it is assumed that *many* is transparently at work in the formation of comparative determiners is it possible to detect its presence via interactions with material outside of the determiner such as the NP. Clearly for the GQT approach none of the properties of the degree function should be detectable while the alternative expects that *many* interacts with its environments just like *tall* does.

1.4.3 Detecting the Measure Phrase

The final class of evidence that potentially distinguishes between the two approaches concerns the detectability of the measure phrase/numeral in comparative quantifiers. The next chapter discusses a variety facts that indicate quite compellingly that the measure phrase is indeed detectable as such independent of the comparative operator and the degree function *many*. These observations are initially equally puzzling for both the GQT approach and the "classical comparatives" approach discussed above. The important point however is that for the analysis of comparative quantifiers as comparative constructions such interactions are in principle within the realm of possibilities since the formation of comparative quantifiers is entirely compositional. The necessary amendments to account for these observations are therefore fairly natural while they would be totally out of character for the GQT approach.

1.5 Overview of the Thesis

To summarize then, the main point of contention between the two approach to comparative quantifiers discussed here is whether the presence of the three essential pieces of comparative quantifiers (degree function, degree quantifier and degree description/measure phrase) can be detected via interactions between them and elements in the DPs as well as the matrix. While the core claim of GQT is that such interactions do not exist, an analysis in terms of the independently needed syntax and semantics of comparative constructions in principle allows for this and in some limited cases even predicts such interactions.

The following chapters of the thesis investigate each of these questions. Chapter 2 is concerned with interactions of the measure phrase with the matrix predicate. Chapter 3 discusses interactions between the degree quantifier and the matrix and chapter 4 discusses effects of the presence of the degree function *many* inside comparative quantifiers. The finding in each case will be that such interactions do exist supporting the main claim of the thesis: Comparative quantifiers are formed entirely compositionally in the syntax. I.e. one has to recognize a syntactically realized module of amount measurement and comparison that can be shown to interact with elements inside the DP as well as the matrix. These interactions are unexpected for the idioms view, which will therefore be argued to be empirically inadequate.

Chapter 2

A Comparative Syntax for Comparative Determiners

2.1 Introduction

In chapter 1 the generalized quantifier approach to comparative quantification was contrasted with an analysis in terms of comparative syntax and semantics. The fundamental difference between the two approaches lies in how much of the comparative machinery is directly and transparently encoded in the syntax. While GQT maintains that none of the pieces that are essential to the truth-conditions of comparative quantifiers are syntactically transparent the analysis in terms of comparative syntax and semantics in principle allows and in limited cases predicts interactions between degree descriptions, measure function and comparative operator on the one hand and elements in the DP as well as the matrix on the other. The present chapter discusses interactions between measure phrases and the matrix (section 2.3). These facts are equally unexpected for both approaches to comparative quantification. I will argue that only the comparatives approach can be suitably amended to give a principled account of these facts. The amendment of the GQT approach to explain the data — although feasible — can be achieved only at the expense of giving up the systematic coverage of comparative quantifiers (cf. the discussion in the appendix). The modification of the comparatives approach on the other hand has to recognize an important insight of GQT, namely that quantification in natural language is essentially sortal. The proposal made in section 2.4 proposes a novel account for amount comparatives that merges the core insights from both approaches in the concept of a "parametrized determiner." This proposal yields surprising predictions for a variety of contexts that will be investigated in the subsequent sections and in chapter 3.

2.2 The Minimal Number of Participants Generalization with Comparative Determiners

Winter (1998) observes that morphological number marking has to be taken into account in order to give an explanation of the contrast in (35).

(35) a. ?? More than one student is meeting.[19]
  b. At least two students are meeting.

Denotationally, *more than one* and *at least two* are equivalent if we restrict our attention to natural numbers and keep explicit or implicit reference to fractions out of the picture.[20] They even share the same set of monotonicity properties – both are

[19] For some speakers, (35)a is not that bad and gets even better with an overt partitive as in (i) below. At this point, I have nothing to offer to explain the judgements of these speakers.

(i) a. More than one of the students are meeting.

[20] D. Fox (p.c.) points out that examples as the following two sentences are not equivalent because *eating more than one apple* leaves the possibility open of eating one apple plus some part of another apple which would be overall less than what is required by *eating at least two apples*.

(i) a. John ate more than one apple
  b. John ate at least two apples

To control for this complication the data discussed in this chapter do not allow an interpretation of *more than n* as equivalent to *at least n + 1/m* (n,m $\in$ **N**) for pragmatic reasons. This is obviously the increasing in both of their arguments. In fact, there is no readily available and independently motivated semantic property that distinguishes these two determiners, hence the difference that accounts for the contrast in (35) cannot be located in the semantics. Winter (1998) proposes therefore that morphological number marking is the essential distinguishing factor. Specifically, plural agreement of the NP associated with the determiner *at least/no fewer than two* triggers the application of a special interpretation rule "dfit" ("determiner fitting") that is required by predicates like *meet* to yield an acceptable interpretation.[21]

Winter's proposal is a natural development of GQT that attempts to incorporate plurality into the GQT-framework.[22] Even though it is a rich and well-worked out proposal it can easily be shown to be not general enough to cover a much more general phenomenon of which the contrast in (35) is just a limiting case.

First, under Winter's account morphological number marking is predicted to effect the grammaticality of sentence pairs contrasting *more than one NP* and *at least two NP* only if the DPs are in positions that enter into number agreement with the VP. For English this means that only the subject position should show the contrast. This is however not correct. Specifically, a similar contrast to the one in (35) between *more than one* and *at least two* can be reproduced in the object position of predicates such as *separate* as shown in (36).

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case in the example in (35) since one student plus some part (smaller than the whole) of another student can't be meeting.

[21] A detailed discussion of the specifics of Winter's proposal is not crucial for the argument I present in this section.

(36) a. ?? John separated more than one animal.
b. John separated at least two animals.

Amending Winter's proposal to these cases would amount to claiming that the VP (possibly including the subject) is semantically plural even though it agrees in number with the singular subject.[23] This move removes of course much of the force of the argument to make morphological number marking responsible for the contrast in (35).

Worse even, the contrasts in (35) and (36) can be replicated with plural marked NPs in connection with predicates that require a higher number of participants than two. To begin with, consider the examples in (37). The judgement, that my informants give on these sentences is very similar to the ones they give for (35)a and (36)a. Importantly, all of these examples involve plural marked NPs agreeing with the predicate in number, yet they are quite awkward. Furthermore, the oddness is independent of the specific particle, i.e. *more than* as well as *at least* are equally awkward with these predicates.

(37) a. ?? More than two/at least three students dispersed
b. ?? More than two/at least two policemen surrounded the bank.

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[22] Cf. e.g. Link(1987), Van der Does(1991,1994,1996), among many others for proposals and discussion of issues that arise in attempting to develop GQT to be able to accommodate plurals.

[23] There is course evidence that plural objects effect the interpretation of the predicate. One widely discussed phenomenon is cumulative interpretations (cf. Scha(1981) and section 3.3 for discussion). The point against Winter's proposal is that these phenomena are too general to be linked to morphological agreement between object and verb or VP.

At an intuitively level, it is rather obvious what goes wrong in these examples: *dispersing, surrounding the bank*, etc. are predicates that require more than just two or three participants to be well-formed. It is infelicitous to use them with subjects that leave the possibility open that smaller sets than required by the VP are involved. A bit more formally, we can say that predicates like *meet, gather, disperse, etc.* have a (lexically specified) minimal number of participants that the number specification of the subject NP conflicts with. *Meeting* involves 2 or more participants, *dispersing* requires some number that is sufficient to represent a crowd, etc. This simple observation suggests that the morphological number marking is not at the heart of the phenomenon under discussion.

A pragmatic account of these facts seems to be attractive at first sight but it can be easily shown to be not sufficient. One could argue that since the lexical meaning of predicates such as *meet, gather, disperse* comes with a minimal number of participants requirement, statements that include the minimal number or even a number below the minimal number as possibility are pragmatically awkward. Since the minimal number is already given by the predicate, such sentences would at best be un-informative in the case where the comparative quantifier ranges over sets of the size of the minimal number requirement or bigger or conflict with the number requirements of the predicate in cases were the quantifier ranges over sets smaller than the number requirements of the predicate. Note however, that this story cannot account for the full paradigm as it would predict *at least n* where n is the minimal number of participants as specified by the predicate to be awkward just as much as *more than n-1* is – contrary to fact. Hence, a purely pragmatic account might cover the cases in (37), however the contrast between *more than n-1* and *at least n/no fewer than n* remains unexplained.

The paradigm in (38) - (40) suggests that it is possible to generalize the contrast between *more than n-1* and *at least n/no fewer than n* systematically for all n >1 ($n \in \mathbf{N}$) as described in (42). (The predicates get increasingly artificial with n increasing and the judgements accordingly difficult, however the contrast subtle as it is remains stable throughout the paradigm.) [24]

(38) a. ?? More than one student is meeting.
b. At least/no fewer than two students are meeting.

(39) a. ?? More than two students were forming a triangle.
b. At least/no fewer than three students were forming a triangle.

(40) a. ?? More than three students were standing in square formation.
b. At least/no fewer than four students were standing in square formation.

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[24] There is some speaker variation as to whether *no fewer than n* is as good as at *least n*. Interestingly, also in German this contrast is observed.

(i) a. ?? Mehr als zwei Studenten haben sich im Dreieck aufgestellt.
'more than two students have REFL in a triangle arranged'
b. ?? Nicht weniger als drei Studenten haben sich im Dreieck aufgestellt.
'no fewer than three have REFL in a triangle arranged'
c. Mindestens drei Studenten haben sich im Dreieck aufgestellt.
'A least three students have REFL in a triangle arranged'

It is suggestive to think of these facts in terms of negation in *nicht weniger als* as having sentential scope rather than *no* in *no fewer than* at least for those speakers of English for which *no fewer than n* is on a par with *at least n* with respect to the Minimal Number of Participants Generalization.

It will suffice for the purpose of the present discussion to assume that the minimal number requirement of predicates like *meet, disperse, form a triangle* etc. is (lexically) encoded as definedness condition. I.e. these predicates — let's call them "minimal number predicates" or P_n where n is the minimal number — are defined only for arguments that correspond to sets of individuals with cardinality n or bigger.[25] Sample entries are given in (41)a-c while the general format is given in (41)d.

(41) a. [[*meet*]] = λx: x corresponds to a set of individuals with at least 2 members. x is meeting

b. [[*gather*]] = λx: x corresponds to a set of individuals with at least 3 members. x is gathering

c. [[*stand in square formation*]] = λx: x corresponds to a set of individuals with at least 4 members. x is standing in square formation[26]

d. [[P_n]] = λx: x corresponds to a set of individuals with at least n members. P(x) =1

[25] The question whether these arguments should be thought of as sets or individual sums is irrelevant for the present discussion. I will use the term "correspondence to a set" as cover term to abstract away from any specific choice.

[26] Assuming that *standing in square formation* has a minimal requirement of 4 is as given in (41)c is glossing over a non-trivial issue. Presumably the minimal number presupposition comes from *square formation* and is inherited by the whole VP *standing in square formation.* The issue is under which circumstances minimal number presuppositions are inherited by larger constituents. For the case of *standing in square formation*, this can probably be subsumed under general principles of presupposition projection. However, cases where a simple numeral in conjunction with a certain predicate generates a minimal number definedness condition such as in (45)a and (46)a are harder to accommodate. Since these questions are not essential to the present purpose I leave it for future research to develop a general account of minimal number presuppositions that arise only as combination of elements that by themselves do not have such a presupposition.

With the help of this notation we can state the first still preliminary generalization about denotationally equivalent comparative quantifiers in conjunction with minimal number predicates.

The Minimal Number of Participants Generalization (preliminary version)

For all VPs with a minimal number of participants requirement n (VP_n), $n > 1$ ($n \in \mathbf{N}$),

(42)a. ?? *More than n-1 NP VP_n.*
b. *At least/no fewer than n NP VP_n.*

The contrast described in generalization (42) can be replicated for object positions although it is increasingly difficult to find good predicates with a minimal number of participants requirement that is bigger than 2. The contrast in (44) represents such a case.

(43) a. ?? John separated more than one animal.
b. John separated at least/no fewer than two animals.

(44) a. ?? John arranged more than two students in triangular formation.
b. John arranged at least/no fewer than three students in triangular formation.

Similar contrasts can be constructed with a variety of predicates, in fact there seem to be few limitations aside from our imagination to finding examples that display the minimal number of participants generalization in one way or other. For instance, any argument slot and even adjuncts can have this property given a suitable choice of the other arguments. (45) displays the contrast with indirect objects and (46) with an instrument adjunct/prepositional argument.

(45) a. ?? To make sure that no one gets more than one candy, John distributed the 10 candies to more than 9 kids.

b. To make sure that no one gets more than one candy, John distributed the 10 candies to at least/no fewer than 10 kids.

(46) a. ?? To make sure that each of the 10 kids got at least one, John paid them with more than 9 candies.

b. To make sure that each of the 10 kids got at least one, John paid them with at least/no fewer than 10 candies.

There are even predicates that seem to distinguish between odd and even number of participants as can be seen in the examples (47) and (48) below.

(47) a. ?? More than 9 people got married to each other at 3 pm last Sunday.

b. At least/at most/no fewer than/no more than 10/8 people got married to each other at 3 pm last Sunday.

(48) a. More/fewer than/at least/most 10 students were grouped into two equal halves/groups.

b. ?? More/fewer than/at least/most 9 students were grouped into two equal halves/groups. [27]

[27] At this point, an alternative take on the Minimal Number of Participants Generalization can be shown to be wrong. Recall from footnote 1 that *more than n-1* and *at least n* are equivalent only as long as fractions are kept out of the picture. All the examples in the text use predicates that control for this. However, one could argue that at the level where the comparative determiner is interpreted the distinction between natural numbers and rational numbers is not yet made. All that the semantics gives us for *more than n-1* is n-1 + 1/m (m>0). Hence, *more than n-1* leaves the possibility open that n-1 + 1/m NP VP_n which would violate the minimal number requirement of the VP and is therefore awkward in contrast to *at least n* which does not violate the minimal number requirements of the VP. If this were correct, however, then (48)c is predicted to be good because 10 + 1/m (m>0) students can be split into unequal groups. Arguing that with respect to the predicate *group into two unequal groups*, 10 is equivalent to 10+1/m (m>0) because only odd numbered sets can satisfy the number requirement of the predicate removes the force of the argument.

For predicates like *get married to each other* the minimal number of participants generalization will in fact surface as contrast between *more than/fewer than n_{even}-1 NP VP_{even}* and *at least/at most/no fewer than/no more than n_{even} NP VP_{even}*. Likewise, for *be grouped into equal halves/groups,* on the other hand, odd numbers are awkward while even numbers will come out fine. Accordingly the oddness is now attested with *at least/at most/no fewer than/no more than n_{even} NP VP_{even}* while *more than/fewer than n_{even}-1 NP VP_{even}* comes out ok.[28]

These examples show that the contrast is independent of the determiner particles *at least, no fewer than, at most, more than, etc.* and their associated semantic properties such as monotonicity. Decreasing as well as increasing quantifiers are equally sensitive to the generalization and — depending on the specific number of participants requirement of the predicate — can be felicitous or infelicitous.

What all these facts suggest is quite surprising: the numeral seems to "projects out" of the DP even though it is deeply embedded in it to clash or match with the predicate. I.e. the oddness of the (a-) examples in these pairs is the same that we would get if we were to interpret *n-1 NP VP_n*.

(49) a. ?? One student is meeting.
b. Two students are meeting.

[28] For "even/odd predicates" a more appropriate statement of the Minimal Number of Participants Generalization would be in terms of "proper number of participants" rather than minimal. Throughout the thesis, I will use minimal to cover also these cases of proper number of participants.

(50) a. ?? Two students were forming a triangle.
b. Three students were forming a triangle.

(51) a. ?? Three students were standing in a square.
b. Four students were standing in a square.

(52) a. ?? 9 people got married to each other at 3 pm last Sunday.
b. 10/8 people got married to each other at 3 pm last Sunday.

The generalization should therefore be stated in terms that reflect this parallelism.[29] In full generality, the Minimal Number of Participants Generalization can be given as in (53).

(53) The Minimal Number of Participants Generalization (general version)

For all m-place predicates with a minimal (proper) number of participants requirement n on the m'-th argument slot (in short $P_n^{m'}$), $n \geq 2$/n even/ etc. ;$1 \leq m' \leq m$; $n,m,m' \in \mathbf{N}$ [30]

(54) a. $P_n{}^{m'}(\textit{more than/etc. } n\text{-}1 \textit{ NP})^{m'} =_{\textit{in status}} P_n{}^{m'}(n\text{-}1 \textit{ NP})^{m'}$
b. $P_n{}^{m'}(\textit{at least/etc. } n \textit{ NP})^{m'} =_{\textit{in status}} P_n{}^{m'}(\ldots, n \textit{ NP}, \ldots)^{m'}$

The notation in (54) is unfortunately not very transparent. Two points are important. First, the contrast between denotationally equivalent comparative quantifiers can in principle be replicated with any number in any argument slot provided a suitable choice of the predicate. Second, the status of the resulting sentences is parallel to the status of the minimally differing sentences that employ instead of the comparative quantifier a bare numeral DP. I.e whatever the awkwardness is that is

[29] Thanks to D. Fox (pc.) for pointing this out to me.

detected with *more than n-1 NP* VP_n the generalization states that it will be the same as the one observed in the corresponding sentence *n-1 NP* VP_n.[31]

The same argument that Winter(1998) makes for the case of *more than one* and *at least two* can be made for all cases covered in generalization (53) as well. I.e. denotationally as well as with respect to semantic properties such as monotonicity that are known to be relevant independently these quantifiers are equivalent. Hence the systematic contrast between them as stated in the Minimal Number of Participants Generalization cannot be due to the semantics. Furthermore, we have seen that morphological number marking is orthogonal to the puzzle as well because the generalization holds for n>1. Almost all instances of the generalization are contrasting sentence pairs employing plural marked NPs in both sentences.[32]

Obviously then, Winter's proposal which makes crucial reference to morphological number marking is not able to account for this generalization. Worse even, there is no readily available fix-up for his theory in sight either. Winter's system cannot account for the fact that the numeral has to be taken into account for principled

[30] $P_n{}^{m'}(NP)^{m'}$ is meant to refer to the predicate P which has a minimal number of participants requirement on the m'-th argument slot applied to NP at the m'-th argument slot.

[31] This means that it is not a genuine responsibility for linguistics to explain exactly what it is that speakers find awkward in these sentences. It is, for instance, conceivable that some "minimal number contrasts" can be detected only by subjects with a certain amount of knowledge of mathematics. The linguistic task is simply to provide a place where comparative quantifiers are parallel to bare numeral DPs.

[32] Number marking might very well have an effect in terms of how clear the contrast is, i.e. the contrast is sharpest between *more than one* and *at least 2*.

reasons, because the numeral – in good old generalized quantifier theory tradition – is treated as part of the complex and un-analyzable determiner *at least n, more than n,* etc in Winter's proposal. What the Minimal Number of Participants Generalization however suggests is that the numeral itself is the culprit. Somehow, the numeral "projects out" of the DP even though it seems deeply embedded in it to clash/match with the number requirements of the predicate. This is a rather surprising state of affairs and constitutes a major challenge not only for the GQ treatment of comparative determiners as syncategorematic quantifiers but for compositional semantics in general.

We can sharpen the puzzle even further. The solution of the puzzle **has** to be a compositional one because denotationally the quantifiers in question are equivalent. That means that the offending clash between the numeral and the predicate has to happen "during" the calculation of the meanings of these sentences. Once the computation of the sentence is completed, they give rise to the same truth-conditions because they employ denotationally equivalent quantifiers. The conclusion, then, to be drawn from the Minimal Number of Participants Generalization is that the computation of the denotationally equivalent quantifiers *more than n-1 NP* and *no fewer than n NP* has to be different. More specifically even, the precise form of the MNPG suggests that the interpretation of the whole sentence *more than/etc. n-1 NP* VP_n involves at some point the interpretation of *n-1 NP* VP_n. Likewise, the interpretation of the whole sentence *no fewer than n NP* VP_n

involves at some point the interpretation of *n NP VP* and the challenge for any theory is to give a principled way of achieving this while maintaining basic structural as well as semantic properties assigned to the constituent *more than/at least/etc. n-1 NP*.

2.3 The Idea in a Nut Shell: A Comparative Syntax

Recall from the previous section that the MNPG would follow if we can show that at some point in the interpretation of the whole sentence the constituents boxed in (55) have to be interpreted.[33]

(55)	a. ?? More than/etc.	n-1 NP VP_n.
	b. At least/no fewer than/etc.	n NP VP_n.

The challenge is to provide this parse in a principled manner while maintaining the basic constituency. The idea to employ comparative syntax and semantics in the explanation of this puzzle comes from the simple fact that we can see comparative morpho-syntax overtly at work inside comparative determiners. The hope is more specifically that if we give a fully compositional analysis of comparative determiners similar to the one sketched in chapter 1, the MNPG could be accounted for as a by-product of the composition of comparative quantifiers. However, in order to achieve that, we have to show that the underlying structure of comparative quantificational statements as in (56)a and (57)b is similar to the paraphrases in (56)b and (57)b.

[33] To keep things readable, (55) sketches only the parse for minimal number requirements associated with the subject position. Parses for other positions for can be given in a straightforward way.

(56) a. ?? More than one student is meeting in the hallway.

b. ?? "More students are meeting in the hallway than how many students there are in $\boxed{\text{a meeting of one student in the hallway}}$."

(57) a. No fewer than two students are meeting in the hallway.

b. "No fewer students are meeting in the hallway than how many students there are in $\boxed{\text{a meeting of two students in the hallway}}$."

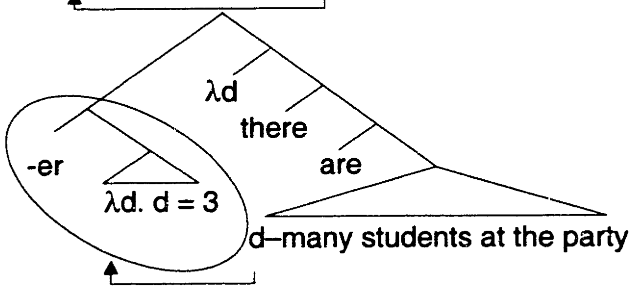
The generalization follows if it can be shown that the interpretation involves an analysis similar to the one suggested in the paraphrases because in the interpretation of the than-clause a clash between the number given in the comparative quantifier and the number requirements if the predicate occurs in (56) but not in (57). Notice that the essential piece in these paraphrases that accounts for the MNPG is the fact that the matrix-VP *meet in the hallway* is interpreted inside the *than*-clause as well as in the matrix.

The analysis that was sketched in chapter 1 does not assume that and therefore cannot account for the MNPG. Recall that the classical analysis maintains that the measure function *many* is syntactically parallel to attributive gradable adjectives like *long.* The numeral on the other hand is on a par with measure phrases denoting a degree. Finally the comparative operator together with the *than*-clause denotes a degree quantifier that has to move to a clausal node to yield an interpretable structure as indicated in the tree in (58) repeated from chapter 1.

(58) a. There are more than three students at the party.

b. [-er than 3 $]_1$ [there are d_1-many students at the party]

c.



d. [[*There are more than 3students at the party*]] = 1 iff max(λd. ∃x st. x is d-many students at the party) > max (λd. d = 3)

e. "The number of students at the party exceeds/is bigger than 3"

Note that the *than*-clause supposed by the classical analysis for measure phrase comparatives is deployed of any lexical material other than the measure phrase. In fact, nothing in the interpretation requires there to be anything else than a type shifting operation that relates a definite degree description in form of the measure phrase (or a proper name a degree) to its corresponding predicate.[34]

In order to account for the MNPG using comparative syntax, we have to find a principled reason why the matrix-VP is interpreted inside the *than*-clause. The classical analysis of measure phrase comparatives as presented in chapter 1 does not offer such a reason. In particular, nothing in the interpretation of measure phrase comparatives requires the matrix-VP to be part of the *than*-clause. This means that if it can be shown that an account of the MNPG in terms of comparative syntax and semantics is correct, the analysis of measure phrase comparatives is more complicated than meets the eye and than the classical analysis assumes.

2.4 *MANY as* Parameterized Determiner

The proposal that I want to develop in this section to address the shortcomings of the classical analysis in accounting for the MNPG relies on two basic assumptions. The first — which I will assume for the moment without any further justification — is that the gradable predicate *many* is interpreted in the *than*-clause as well as the matrix. The second assumption is that *many* is quite unlike gradable adjectives in that it requires for its interpretation in addition to the degree argument two more arguments which are provided by the NP and the VP. I.e. I will suggest that *many,* even though it denotes a gradable function, maintains the characteristics of a determiner — hence the label "parameterized determiner".

2.4.1 Bresnan(1973)

Given the assumption that the gradable function expressed by *many* is interpreted in the *than*-clause as well as the matrix, the task is to find a reason why also the VP has to be interpreted inside the *than*-clause. I would like to suggest that a parallel phenomenon from attributive comparatives first discussed in Bresnan(1973) leads the way an answer to this question. Consider the contrast between (59)a and (59)b from Bresnan(1973). As Bresnan observes the contrast is intuitively due to the fact

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[34] Recall that it was assumed that something like Partee's(1987) type shifter BE could be assumed to do the job. It was also admitted that this seems a technical fix-up more than an insightful treatment.

that the sentences in (59)a,b are interpreted similarly to their respective paraphrases.

(59) a. # I have never seen a taller man than my mother. [35]

?? "I have never see a taller man than my mother is a tall man"

b. I have never seen a man taller than my mother.

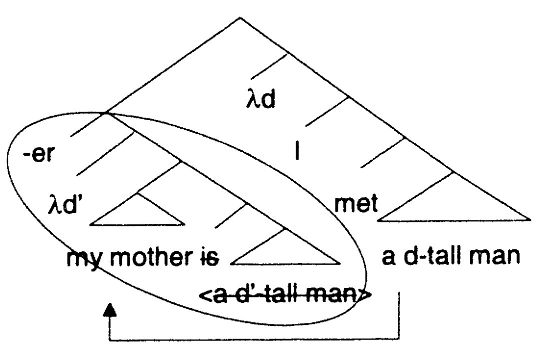
"I have never seen a man who is taller than my mother is tall"

In other words, Bresnan's intuition is that (59)a is awkward because the attributively modified noun *man* has to be interpreted in the *than*-clause while (59)b has an analysis as reduced relative clause where the adjective *tall* is used predicatively. Assuming our classical analysis (which is in many respects a slightly updated version of Bresnan's own (1973) proposal) the situation can be displayed as in (60).[36]

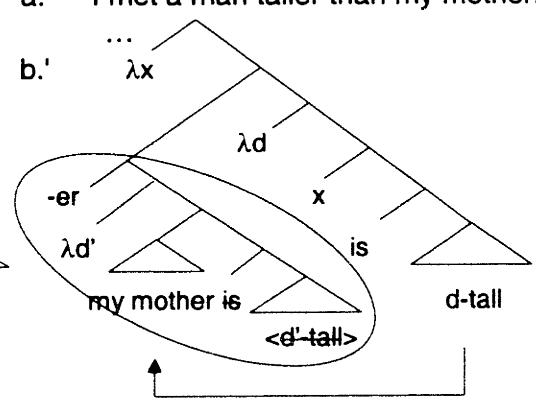
(60) a. ?? I met a taller man than my mother.

a.' I met a man taller than my mother.

b.



b.'



[35] There is of course also another interpretation with a larger elided structure similar to "I have never met a taller man that my mother has met tall men." This interpretation is irrelevant for the discussion.

[36] I abstract away from extrapositon of the *than*-clause here and in the discussion to follow.

As discussed in chapter 1, the classical analysis assumes that *–er than my mother* denotes a degree quantifier that is base-generated in the argument position of *tall*. Since the gradable adjective *tall* needs to be interpreted in the *than*-clause to get an interpretable structure, the base-generated configuration is one of antecedent containment. Antecedent containment is resolved via movement and copying of identical material from the matrix clause into the ellipsis site.[37] In the case of (60)b, the constituent that is copied into the *than*-clause is *a d-tall man* while in the case of (60)b it is *d-tall.*

Importantly, nothing in the semantics of comparatives enforces that the modified noun *man* is interpreted in the *than*-clause in (60)b. I.e. while the structures assigned in (60)b and (60)b' correctly predict the contrast it is not clear what the reason is that the ungrammatical structure in (60)b cannot have an alternative structure identical to the one in (60)b'. Certainly the alternative would be equally interpretable from the perspective of compositional semantics and wouldn't yield the selectional conflict between *my mother* and *man*. A survey of the literature reveals that nobody has identified a deep reason for this effect. Everybody basically has to add a syntactic stipulation to the effect that attributively used adjectives form an inseparable unit with the modified NP with respect to ellipsis resolution.[38]

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[37] I abstract away from the question what the syntactic constituent is that is copied and how it is that the copula *be* is deleted in the *than*-clause in (60)b even though it doesn't have an antecedent in the matrix. See Kennedy&Merchant(2000) for recent discussion.

[38] Bresnan(1973) assumes that the predicates *tall* and *tall man* are different and *tall* is not visible if it is part of *tall man* for CD. Hellan(1981), Pinkham91982), Gawron(1995) and Lechner(1999) all give essentially the same reason. Lechner(1999) for instance encodes it in a phrase structure stipulation according to which *tall man* is an AP containing the NP *man* while Gawron(1995), Hellan(1981)

Presumably the simplest account of this restriction is that a predicative adjective and its attributive twin are not considered identical with respect to ellipsis parallelism even though they are systematically related via type-shifting. (61) summarizes how this idea could be formally executed: (61)a gives the familiar attributive denotation of the gradable adjective *tall* while (61)b presents the predicative version. (61)c and (61)d on the other hand are possible type shifting operation that will systematically map predicative denotations into attributive denotations (TSH_1) or the other way around (TSH_2).[39]

(61) a. $[[tall_{Att}]] = \lambda d.\lambda P_{<e,t>}.\lambda x.\ P(x) = 1\ \&\ x \text{ is d-tall}$

b. $[[tall_{Pred}]] = \lambda d.\lambda x.\ x \text{ is d-tall}$

c. $TSH_1 = \lambda P_{<d,et>}.\lambda d.\lambda Q_{<e,t>}.\lambda x.\ Q(x) = 1\ \&\ P(d)(x) = 1$

d. $TSH_2 = \lambda P_{<det,et>}.\lambda d.\lambda x.\ P(d)(\lambda y.1)(x) = 1$

If parallelism is sensitive to the distinction between the attributive and predicative types of the adjective, then it will require that the elided adjective matches the antecedent adjective in type. This means that the elided adjective in (60)a requires an NP argument to yield an interpretable structure. Hence the whole AP-NP complex *d-tall man* has to be copied into the ellipsis site which explains the awkwardness of (60)a. Notice however that there is a piece missing in this explanation. There is no

Pinkham(1982) stipulate a constraint similar to Bresnan's. Kennedy(1997), Kennedy&Merchant (2000), Zamparelli(1996), Larson(1988), Bierwisch(1987), Klein(1991) Heim(1985), von Stechow (1984) and Schwarzschild&Wilkinson(1999) either admit that they don't have anything to say or don't talk about it.

principled reason why it has to be the NP *man* rather than some other NP that is salient in the discourse that is copied into the argument slot of the elided adjective. I have nothing to offer other than pointing out that ellipsis processes seem to be in general restricted to local antecedents (with the notable exception of VP ellipsis). I am not aware of an explanation for this contrast and simply assume that an independently needed locality constraint is at work.

2.4.2 d-*MANY*

How could we extend this treatment to an account of the MNPG? Prima facie not at all, it seems, because the best we can do is to require the NP to be copied into the ellipsis site parallel to the discussion of Bresnan's cases. This is however not enough. To account for the MNPG we need the VP inside the *than*-clause as well. That means we need to extent the account of Bresnan's facts that refers to an argument slot of the adjective to be filled one step further. In other words, not only do we need an NP argument for the gradable function *many* we also need the VP to be an argument of *many*. Here is a simple lexical entry for *many* that hard-wires a stipulation to this effect into its basic meaning.

(62) $[[\mathit{many}]] = \lambda d.\lambda P_{<e,t>}.\lambda Q_{<e,t>}.$ d-many x are st. $P(x) = 1$ & $Q(x) = 1$

[39] The status of the type-shifting operation is immaterial for the discussion and can simply be thought of as convenient way of expressing a lexical generalization.

While this stipulation does the job, there seems to be something deeply suspicious about this entry for *many.* At an intuitive level, the lexical entry in (62) stipulates that *many* denotes a gradable function that measures VP denotations with respect to how many individuals it contains that satisfy the sortal restriction given by the NP. Notice that *many* has now by stipulation the combinatorial requirements of a determiner quantifier! In fact — abstracting away from the degree part — it is every bit like a determiner that yields together with its restrictor NP a generalized quantifier. Didn't we work so hard to develop an alternative because the GQT seemed to be missing the point? And aren't we basically back at square one with this proposal?

I'd like to argue that we are not and that we have in fact made a lot of progress. Surely the entry in (62) amounts to proposing a hybrid entity. It incorporates on the one hand explicitly the idea that *many* denotes a gradable function submitting it to the principles of comparative syntax. On the other hand, it incorporates also a fundamental insight if GQT, namely that quantification in natural language is always and essentially restricted quantification. Let's first give our brainchild a name before we go and see whether it is a monster or the answer to our problems. I propose the label **parametrized determiner** refer to *many* with the degree argument providing the "cardinality parameter" of the otherwise regular determiner meaning.[40]

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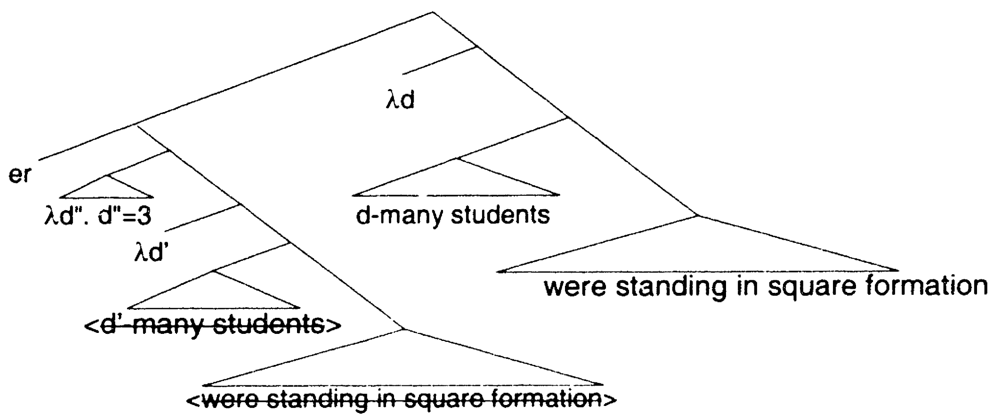
[40] The proposal of *many* being a parameterized determiner is similar in spirit to Nerbonne's(1994) idea of deriving comparative determiner meanings as inverse functions of measure functions. Cf. also the treatment of *more* in the discussion of amount comparatives in von Stechow(1985). Von Stechow

With the help of the parametrized determiner *many* we are almost ready to give an account of the MNPG. Take the by now familiar contrast between *more than three* and *no fewer than four* as in the examples below repeated from section 2.2. Given the assumptions so far the structure that is interpreted is as depicted in (63).

(63) a. ?? More than three students were standing in square formation.

b. [-er λd. d=3 & ~~d-many students were standing in square formation~~] [λd. d-many students were standing in square formation]



As usual, it is assumed that –er plus *than*-clause denotes a degree quantifier that is base generated in the degree argument position of the parameterized determiner *many.* To yield an interpretable structure, the degree quantifier has to move to a clausal node. Given the analysis of *many* as parameterized determiner we have now a principled reason for the assumption that the closest clausal node for the degree quantifier is in the matrix. Hence the comparative operator has to move into the

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assumes that *more* rather than *many* has the properties of a determiner which has the un-welcome property that two entries for the comparative are needed. In the discussion below, it will become apparent that indeed *many* has determiner-like properties.

matrix.[41] There is simply no available clausal node inside the DP. Furthermore, the assumption that *many* has to be interpreted inside the than-clause, a configuration of antecedent containment has to be resolved. Movement of the degree quantifier *–er than...* yields a structure in which the matrix provides identical material to be copied into the ellipsis site. The parameterized determiner *many* with all its arguments can be copied from the matrix into the *than*-clause which gives rise to the MNPG.

The final piece needed in the account sketched in (63) is the assumption that the measure phrase/numeral moves inside the *than*-clause to the left periphery to create a derived degree predicate. It is also type-shifted into a predicative meaning to intersect with the landing site of the movement very much like a free relative.[42] I.e. I propose to extend the technical solution to measure phrase comparatives that was already needed in the classical analysis to the now enriched analysis of measure phrase comparatives with a clausal source for the *than*-constituent.[43] These steps effectively result in an interpretation of the *than*-clause that produces the MNPG. The derivation of the contrasting *than*-clauses is summarized in (64) and (65) with the boxes indicating where the minimal number of participants presupposition of the

[41] Even if there is a clausal node inside the DP, it will be below the determiner and to allow lowering of the degree quantifier would result in a structure that does not allow resolution of antencedent containment — putting aside the severe difficulties such an operation would pose for the assigning an interpretation.

[42] See Pancheva-Izvorski(1999) for interesting work along these lines.

[43] Obviously this is rather unsatisfactory as the proposal cannot claim any deep insight into the phenomenon here. The point is that the revised proposal to account for the MNPG is on a par with the classical analysis. Measure phrases and in particular numerals seem to be leading a double life as proper names/definite descriptions of degrees and as degree-predicate. It seems plausible to me that the special ontological status of degree might be ultimately the source for the relative ease with

VP conflicts or matches with the numeral parameter of the parameterized determiner *many*.

(64) a. ?? More than three students were standing in square formation.

b. [-er [λd. d=3]$_1$ ~~d_1-many students were standing in square formation~~]

c. [[*-er than* 3_1 d_1*-many students were standing in square formation*]] = $\lambda D_{<d,t>}$. max(D) > max(λd. $\boxed{\text{d-many students are standing in square formation \& d = 3}}$)

(65) a. No fewer than four students were standing in square formation.

b. [-er [λd. d = 4]$_1$ ~~d_1-many students were standing in square formation~~]

c. [[*-er than* 4_1 d_1*-many students were standing in square formation*]] = $\lambda D_{<d,t>}$. max(D) $\geq$ max(λd. $\boxed{\text{d-many students are standing in square formation \& d = 4}}$)

The paradigm in (64) and (65) shows that we have succeeded in providing — for principled reasons — a locus in the derivation of comparative quantifiers where the numeral specification of the comparative quantifier is checked against the presuppositional demands of the VP. This explains why we observe the MNPG even though the paired statements are eventually truth-conditionally equivalent.

2.4.3 Measure Phrase Comparatives

In order to account for the MNPG it was crucial to assume that *many* had to be interpreted in the *than*-clause. This is a rather unusual assumption. Recall that the classical analysis of measure phrase comparatives didn't have any measure function

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which they acquire the meaning needed by their environment. Pursuing these questions here would in the *than*-clause. Instead it was assumed that the measure phrase can be mapped via type shifting into predicative meaning that is required by the comparative operator. If this were indeed the correct analysis, there would be no possibility of accounting for the MNPG. We can turn the table around and take the existence of the MNPG as evidence that the composition of measure phrase comparatives is more complex than the classical analysis would have it. In particular, we can take the MNPG to show that even in measure phrase comparatives a measure function and all its arguments are required to yieid an interpretable structure. In other words, the MNPG provides evidence that even the most basic and supposedly clearest cases of phrasal comparatives namely measure phrase comparatives have a clausal source. This is rather surprising and if correct compelling empirical evidence for the claim that all comparatives are semantically clausal comparatives.

What could be the reason that even measure phrase comparatives have a clausal source? I do not have anything insightful to offer other than a rational based on a simply intuition: degrees (as e.g. denoted by measure phrases) are always degrees of something on some scale. The language doesn't seem to allow us to talk about "bare degrees".[44] They have to be licensed by a gradable function expressed by adjectives such as *tall,* which in turn is predicated of an individual. A bit more formally the speculation is this. Assume that measure phrases are definite descriptions or proper names (as in the case of numerals) of degrees. As such they

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lead me too far afield. I have to leave it for future research.

[44] Potential exceptions are identity statements over degrees such as *1 yard is more than 90 centimeters.*

cannot provide the restrictor for the degree quantifier *–er*. Hence they cannot directly compose with the comparative operator and therefore cannot be (Θ-)licensed by the matrix measure function. The only other possibility for a measure phrase under a comparative operator to be licensed (get a theta-role) is then to be base generated as the argument of a separate measure function. Hence the requirement for a measure function inside the *than*-constituent of measure phrase comparatives. While this rational is at best a place-holder for a component in the proposal that is not yet understood, the expectation is that all measure phrase comparatives should display effects similar to the MNPG observed with amount comparatives. More specifically, since the gradable function needs to be interpreted in both arguments of the degree quantifier, we should be able to detect its presence in the *than*-clause. Consider in this vein the contrast between measure phrase comparatives with *rich* and *tall* as displayed in (66).

(66) a. * Bill Gates is richer than 5 billion dollars.
b. Bill Gates is taller than 5 feet.

While measure phrase comparatives with adjectives such as *tall* are perfectly acceptable, the comparable construction employing *rich* instead of *tall* is ungrammatical.[45] Interestingly, to account for this difference it is not sufficient to

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[45] Bierwisch(1987) points out that only dimensional adjectives are associated with numerical scales.
[46] Schwarzschild&Wilkinson(1999) observe that differentials have syntactic properties that are typical of mass terms indicating that degrees are mass-like. Hence they model degrees as dense intervals.
[47] For the point I would like to make in this section, it is irrelevant whether the paraphrase in (69)a or

simply stipulate that degrees of wealth/richness cannot be expressed by dollar amounts. If that were so, the sentence in (67)a in which the measure phrase refers to the difference between two degrees of wealth would be equally ungrammatical.

(67) a. Bill Gates is (more than) 5 billion dollars richer than Michael Jordan.
"Bill Gates is richer than Michael Jordan and the difference is 5 billion dollars."
b. Bill Gates is taller (more than) 5 inches taller than Michael Jordan.
"Bill Gates is taller than Michael Jordan and the difference is 5 inches."

The interesting observation is then that a measure phrase such as *5 billion dollars* can be used to refer to degrees of wealth/richness, however only if it is used to refer to a differential. Differential degrees are somehow less selective than standard of comparison degrees as to how they are expressed. [46] How should we account for this difference? I would like to suggest that the selectivity is due to the idiosyncratic properties of *rich*. Note that even the positive form of *rich* cannot take a measure phrase argument unlike dimensional adjectives like *tall*.

(68) a. * Bill Gates is 5 billion dollars rich.
b. Bill Gates is 5 feet tall.

Obviously, we would like to relate the fact that *rich* cannot form a measure phrase comparative to the seemingly more basic fact, that it also cannot take a measure phrase argument in the positive. As pointed out above, the problem is not that dollar amounts couldn't be used to refer to degrees of richness. A rather immediate way of relating these tow observations is to assume that *rich* is interpreted in the *than*-clause as well as in the matrix clause as indicated in either one of the paraphrases in (69).

(69) a. * Bill Gates is richer than 5 billion dollars.
b. * "Bill Gates is richer than how rich 5 billion dollars are."
c. * "Bill Gates is richer than how rich somebody is who is 5 billion dollars rich." [47]

Exactly in this respect *tall* is different from *rich. Tall* can take measure phrases in the positive as arguments and it can also form measure phrase comparatives. The corresponding paraphrases in (70)b and (70)c seem acceptable as well compared to the paraphrases in (69).

(70) a. Bill Gates is taller than 5 feet.
b. ? "Bill Gates is taller than how tall 5 feet are."
c. "Bill Gates is taller than how tall somebody is who is 5 feet tall."

These observations lead us to expect a correlation between the possibility of adjectives allowing measure phrase arguments in the positive and the possibility of forming measure phrase comparatives as described in the Measure Phrase Positive-Comparative Correlation (71).

(71) **Measure Phrase (Positive-Comparative) Correlation**[48]

1. Gradable predicates that can take measure phrases as arguments in the positive can also have a phrasal comparative with a measure phrase.
2. Gradable predicates that can NOT take measure phrases as arguments in the positive also can't have a phrasal comparative with a measure phrase.

By and large this correlation is borne out as the data in (72) to (76) show. The data in (72) present a variety of degree functions that can take measure phrases as arguments in the positive.

(72) a. John weighs 155 pounds.
b. That book costs 5 dollars.
c. That artillery carries/shoots 10 kilometers
d. John is 6 feet tall.
e. John is 21 years old.
f. This book is 1 inch thick.
g. The serenade is 10 minutes long.
h. John drove 65 miles per hour (*fast).
i. This well is 50 meters deep.
j. This water is 30 degrees Celsius (*warm).
k. The sun is about 8 light minutes away from earth.
l. The drive way extends 2 feet into the neighbor's garden.

As the correlation in (71) leads us to expect, measure phrase comparatives based on these degree functions are equally grammatical cf. (73).

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[48] The negative twin in a pair of adjectives in polar opposition (tall-short, long-short, etc.) is a systematic exception to this correlation. I.e. even though (i)a is ungrammatical many speakers find the measure phrase comparative acceptable. See Bierwisch (1987/89), Kennedy(1997), etc. for discussion.

(i) a. * John is 5 feet short.
b. John is shorter than 6'8.

(73) a. John weighs more than 80 kilos
b. That book costs more than 5 dollars.
c. That artillery carries/shoots farther than 10 kilometers
d. John is taller than 6 feet.
e. John is more than 21 years old.
f. This book is thicker than 1 inch.
g. The serenade is longer than 10 minutes.
h. John drove faster than 65 miles per hour.
i. This well is deeper than 50 meters.
j. This water is warmer than 30 degrees Celsius.
k. The sun is farther than 8 light minutes (away from earth).

The data in (74) on the other hand show a variety of degree functions that cannot take measure phrases as arguments in the positive.

(74) a. * John is 125 pounds heavy.
b. * This book is 5 dollars expensive/cheap/costly/pricy.
c. * The sun is about 8 light minutes distant from earth.
e. * John is 2 marriages and divorces mature.
m. * John is 2 points good/dumb.

Again, as expected from the measure phrase correlation, these predicates cannot form measure phrase comparatives (cf. (75)) even though these measure phrases can be used to refer to the differential degree in regular comparatives as shown in (76).

(75) a. * John is heavier than 125 pounds.
b. * This books is more than 5 dollars expensive/cheap/costly/pricy.
c. * The sun is more than 8 light minutes distant from the earth.
e. * John is more than 2 marriages and divorces mature.
m. * John is better/dumber than 2 points.

(76) a. John is 125 pounds heavier than Bill.
b. This books is 5 dollars more expensive/cheap/costly/pricey than that book.
c. The sun is 8 light minutes more distant from the earth than the moon.
e. John is 2 marriages and divorces more mature than Mary.
m. John was 2 points better/dumber than Mary.

The measure phrase correlation points towards a close relationship between the positive and the comparative. The account of the correlation that I want to suggest hypothesizes that the presence of the degree function in both the matrix clause and the *than*-clause is responsible. [49] I.e. the ungrammaticality of (77)a repeated from above is due to the fact that there is no grammatical parse for *than*-clause that includes the degree function *rich* as the attempts in (77)b and c show.

(77) a. * Bill Gates is richer than 5 billion dollars.
b. * "Bill Gates is richer than how rich 5 billion dollars are."
c. * "Bill Gates is richer than how rich somebody is who is 5 billion dollars rich."

The grammaticality of (78)a and (79)a on the other hand follows from the parallel observation that it is possible to construct a grammatical *than*-clause that includes the degree function *tall/long* as the paraphrases in (78)b and (79)b respectively indicate.

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[49] This entails also that the grammaticality of (76) where the measure phrases are used as differentials, it is not the same degree function that licenses the measure phrase. E.g in the case of (67) it is not *rich* which licenses the differential instead, I suggest, it is the degree function *much* that licenses differentials. Hence a fuller paraphrase of (67) could be given as below.

(67)a. Bill Gates is (more than) 5 billion dollars richer than Michael Jordan.
b. "Bill Gates is richer than Michael Jordan by an amount that is (more than) 5 billion dollars much."

(78) a. Bill Gates is taller than 5 feet.
b. "Bill Gates is taller than somebody who is 5 feet tall."

(79) a. This rope is longer than 5 feet.
b. "This rope is longer than how long 5 feet are."

While the fact that the degree function has to be included in the *than*-clause is not understood it is comforting to observe that it is general property of comparatives and not just a quirk of amount comparatives. All measure phrase comparatives are clausal in nature. For some reason, the *than*-clause has to contain a degree function. This is enough to justify the stipulation that *many* is part of the *than*-clause in amount comparatives.

2.4.4 Summary

Let me summarize quickly the proposal before looking into some of the predictions that are made by this account. Comparative quantifiers such as *more than three students* are analyzed as measure phrase comparatives. The measure function *many* that the comparative syntax is based on has special properties that make it appear rather unlike gradable adjectives and much closer to regular quantificational determiners. In particular, the analysis proposes to treat *many* as **parameterized determiner** which is — to be sure — a hybrid entity that combines insights on quantification from comparative syntax and semantics as well as GQT. Intuitively *many* can be though of as degree function that measures the cardinality of the VP denotation with respect to how many individuals it contains that satisfy the sortal restriction given by NP. It is furthermore assumed that measure phrase comparatives are superficially in an antecedent containment configuration that has to be resolved via movement of the degree quantifier denoted by [-er than-XP]. Interpretability restrictions demand that the degree quantifier moves into the matrix to a clausal node where the usual principles of semantic composition apply. After movement to resolve antecedent containment, the ellipsis site can be restored via copying of the antecedent in the matrix into the *than*-clause. For the case of comparative quantifiers this means effectively that the degree function *many* with all its arguments has to be copied into the *than*-clause. Together with the measure phrase given by the numeral we arrive at a constituent inside the *than*-clause (cf. (81) and (82)) that corresponds to the boxed material in (80) repeated from above.

(80)	a. ?? More than/etc.	n-1 NP VP_n.
	b. At least/no fewer than/etc.	n NP VP_n.

I have argued furthermore that this not only accounts for the MNPG but it also accounts for it in the right way because the parallelism between bare numeral NPs and comparative quantifiers as stated in the MNPG follows directly from the structures derived in the *than*-clause as paraphrased in (81) and (82).

(81) a. ?? More than one student was meeting in the hallway.
b. ?? "More students are meeting in the hallway than how many students there are in a meeting of one student in the hallway."

(82) a. No fewer than two students were meeting in the hallway.

b. "No fewer students are meeting in the hallway than how many students there are in $\boxed{\text{a meeting of two students in the hallway}}$."

2.5 Predicative Uses of *MANY* – Are there any?

The proposal of *many* as "parametrized determiner", i.e. as degree function with the properties of a determiner makes the immediate predictions that *many* is quite unlike adjectival degree functions such as *tall* which have the syntax of modifiers. One specific prediction in this respect is that there should not be any be predicative uses of *many*. Recall from the discussion above that there is a systematic and meaning preserving mapping via type-shifting operations between predicative and attributive denotations gradable adjectives like *tall*. It is easily verified that these type shifters cannot be applied to *many*. *Many* as proposed in (62) is simply not of the right type. For convenience the relevant entries are repeated in (83)a and (83)b below.

(83) a $[[\mathit{many}]] = \lambda d.\lambda P_{<e,t>}.\lambda Q_{<e,t>}.$ d-many x st. P(x) = 1 are st. Q(x) = 1

b. $TSH_2 = \lambda P_{<det,et>}.\lambda d.\lambda x.\ P(d)(\lambda y.1)(x) = 1$

c. $TSH_3 = \lambda P_{<det,ett>}.\lambda d.\lambda x.\ P(d)(\lambda y.1)(x) = 1$[50]

[50] It is only fair to ask whether there could be a closely related type shifting operation that takes into account that parameterized determiners take two arguments instead of one. Certainly, it seems that a type-shifting operation that maps the parameterized determiner $many_{Det}$ to a one place predicate of type <d,et> parallel to the predicative meaning of *tall* is far-fetched. A more sensible result could be achieved if we were to demand that NP argument is required in the predicative use of *many* as well. That means the supposed type shifting operation gets only ride of the VP argument of the determiner meaning. (i) sketches how this would work.

(i) a $[[\mathit{many}_{Det}]] = \lambda d.\lambda P_{<e,t>}.\lambda Q_{<e,t>}.$ d-many x st. P(x) = 1 are st. Q(x) = 1

b. $TSH_4 = \lambda D_{<det,ett>}.\lambda d.\lambda P_{<e,t>}.\lambda x.\ D(d)(P)(\lambda y.1)(x)$

c. $TSH_4\ (many_{Det}) = \lambda d.\lambda x.$ d-many x are st. P(x) = 1

At first sight, this seems to be an unwelcome prediction given the grammaticality of sentences such as (84) which feature comparative as well as positive forms of *many* in post-copula position.

(84) a The Red Sox fans were more than enough to intimidate the Yankees fans.
b. While the Red Sox fans sent a large contingent, the Yankees fans were fewer/less than 200.
c. The guests were many women.

Note however that the post-copula environment does not provide the best test environment to establish that these comparatives are indeed interpreted as predicates because it is also an environment in which Null Complement Anaphora (NCA) is licensed. Predicates such as *look* which don't license NCA provide therefore a more solid testing area predicate status. Interestingly, amount comparatives based on *many* are not grammatical in the complement position of *look* as the examples in (85) and (86) show.

(85) a. John looks tall.
b. * The guests look many.

(86) a. The Red Sox fans looked more numerous than the Yankees fans.
b. * The Red Sox fans looked more than the Yankees fans.
c. * While the Red Sox fans sent a large contingent, the Yankees fans looked fewer/less than 200.

The ungrammaticality of (86)b is especially surprising since its intended meaning is clearly expressible in the complement position of *look* — albeit only if a gradable adjective such as *numerous* is employed. Similar contrasts can be observed in the predicate position of small-clauses as shown in (87) and (88).

(87) a. Mary considers John tall.
b. *Mary considers the guests many.

(88) a. Mary considered the Red Sox fans more numerous than the Yankees fans.
b. *Mary considered the Red Sox fans more than the Yankees fans.

These facts are surprising for the classical treatment of amount comparatives which maintains that *many* is to be analyzed as adjective.[51] Minimally these facts show that *many* cannot be analyzed completely parallel to *tall*. Otherwise we would expect a predicative use to be available in these contexts. For the present proposal that treats *many* as parameterized determiner on the other hand, these facts are expected. To firmly establish this conclusion, an in-depth investigation of comparatives in copula-sentences has to be conducted. Pending further data, the conclusion of this section is that the facts concerning predicative uses of amount comparatives surprisingly vindicated rather than challenged the proposal of *many* as parameterized determiner because it is expected under this approach that *many* will not display a parallel distribution to gradable adjectives like *tall*.

[51] Note also that proponents of the "adjectival theory of indefinites" (cf. Landmann(2000) for a recent defense) will have difficulties accounting for the fact that *many* does not have genuine predicative uses.

2.6 Intensionalizing *Maximality*

While these observations seem in general rather promising, it might not have escaped the reader that the proposed analysis of comparative quantifiers faces a serious problem: Given the fact that the *than*-clause in comparative quantifiers analyzed as amount comparatives is clausal, it is not clear how the correct truth-conditions can be derived.

2.6.1 Two Problems for Getting the Truth-Conditions Right

The problem is illustrated most clearly with downward monotone quantifiers such as *fewer/less than 3 students* but an analogous problem arises with increasing quantifiers. Consider again the derivation of comparative quantifiers as proposed above which predicts truth-conditions as exemplified in (89)a and (89)b.

(89) a. ⟦*More students than three students were at my party*⟧ = 1 iff
max (λd. d-many students were at my party) > max (λd. d-many students were at my party & d = 3)

b. ⟦*Fewer students than three students were at my party*⟧ = 1 iff
max (λd. d-many students were at my party) < max (λd. d-many students were at my party & d = 3)

(89)a is predicted to be true only if the maximal number of students that are at my party is bigger than the maximal number of students that are at my party such that that maximal number equals 3. Likewise, (89)b is predicted to be true only if the maximal number of students that are at my party is smaller than the maximal number of students who are at my party such that that maximal number equals three. It turns out that the statement of these truth-conditions isn't just cumbersome, worse the predicted truth-conditions are radically incorrect. Specifically, in the case of decreasing quantifiers, the predicted truth-conditions can never be satisfied while in the case of increasing quantifiers, they are much too weak.

It is easier to see the problem of the predicted truth-conditions in the case of decreasing quantifiers as (89)b. Let's walk through some cases. Surely, if there are more than 3 students at my party, the sentence is predicted to be false which fits well with our intuitions. The crucial question is however what the predicted truth-conditions are if there are less than three students at my party. The intuitions are of course solid. These are exactly the situations under which the sentence is judged to be true. The problem is that the truth-conditions that are predicted by the current proposal are radically different. If there are less than three students at the party, the degree predicate in the *than*-cause will be empty because the intersection of {d: d-many students at my party} and {d: d=3} is empty. Presumably, maximality is not defined for the empty set; hence we would expect presupposition failure. But even if it were defined, it would return the degree 0. Since no degree can be smaller than 0, the sentence is predicted to be false rather than true. The third case to consider is when there are exactly three students at the party. That means that the sentence is true only if 3 < 3. But this is of course false. The conclusion then is that (89)b and in fact all monotone decreasing comparative quantifiers have truth-conditions that can never be satisfied according to the proposed analysis.

A similar, though somewhat less dramatic problem arises with increasing comparative determiners as in (89)a. In this case the predicted truth-conditions are too weak. Consider again various circumstances: If there are more than three students at the party, the sentence is predicted to be true because the maximal degree that satisfies the matrix clause will be bigger than the maximal degree that satisfies the *than*-clause. If there are exactly three students at the party, the sentence is predicted to be false for the same reason its decreasing counterpart was false under these circumstances. Finally, if there are less than three but at least one student at the party, the sentence is predicted to be either undefined or true contrary to our intuitions. The reason for this unwelcome prediction is the same that we have observed in the previous section: if there are less than three students at the party, then the maximal degree satisfying the *than*-clause is either undefined or 0. If we assume that maximality is defined for the empty set, then the derived truth-conditions is that the maximal degree of students at the party has to be bigger than 0. This is satisfied as long is there is at least one student at the party. The last case to consider is if there are no students at the party. In this case, we either get undefinedness or again the prediction that the sentence is false because $0 > 0$ is necessarily false. We can summarize the curious set of truth-conditions predicted for

(89)a and in fact every monotone increasing comparative quantifier as summarized in (90).

(90) A sentence employing an increasing comparative quantifier of the form *more than n NP VP* is predicted to be

- <u>true</u> if there is at least 1 x st. **NP**(x) = **VP**(x) = 1 unless[52]
- there are exactly n x st. **NP**(x) = **VP**(x)=1, in which case it is <u>false</u>, and
- undefined or false if there are zero x st. **NP**(x) = **VP**(x)=1.

The fact that we predict these truth-conditions is as disturbing as the obviously incorrect truth-conditions that were predicted for decreasing comparative quantifiers.

2.6.2 Diagnosing the Source of Problems

Even though the problems appear on the surface to be quite different — while decreasing comparative quantifiers are predicted to give rise contradictory truth-conditions, increasing comparative quantifiers have in general too weak truth-conditions according to the proposed analysis — they have the same origin: as soon as we put the VP as well as the NP together with the numeral in the calculation of the standard of comparison argument, the calculation is too sensitive to the actual state of affairs to give appropriate truth-conditions. For instance, if the number of students at the party is smaller than 3 in the case of (89), the maximal degree/cardinality assigned to the second term in the calculations in (89) will be 0

[52] For simplicity the statement is given only for comparative quantifiers in subject position. The observation naturally generalizes for comparative quantifiers in any argument position.

and any comparison operation based on a 0 standard of comparison will be trivial or undefined. Obviously, what is missing in this treatment is that we can make reference to numerosities without committing ourselves to a claim that there exists an entity/a set of individuals that is numerous to the degree specified by the numeral in the *than*-clause. In other words, it seems that including the VP in the calculation of the standard of comparison argument does not automatically entail an existence claim to the effect that there are 3-many students at the party. This seems paradoxical at first sight. After all, we had to go out of our way to find a reason why the VP had to be part of the computation of the *than*-clause only to find ourselves forced to assume that it doesn't have any truth-conditional import in the *than*-clause. How can we reconcile this paradoxical state of affairs?

2.6.3 The Remedy: Intensional Maximality

The remedy that I would like to suggest to resolve the paradox, is to optionally calculate the cardinality in the *than*-clause on the basis of the intension of *three students be at my party* rather than its extension. To give a first impression of the proposal, consider the two possible paraphrases for (91)a in (91)b and c.

(91) a. More than three students were at my party

b. "More students were at my party than how many students there are st. 3 students **were** at my party."

c. "More students were at my party than how many students there are st. 3 students **would be** at my party."

The salient difference between (91)b and (91)c is that only in the first case is the standard of comparison calculated based on the actual state of affairs. The import of the difference is not as obvious in the case of increasing comparative quantifiers as it is for decreasing comparative quantifiers cf. (92). (92)c employs a paraphrase that is less faithful to the actual syntax but displays more prominently what the basic insight behind the idea of calculating the standard of comparison based on the intension of *three students be at the party* rather than its extension is.

(92) a. Fewer than three students were at my party
b. "Fewer students were at my party than how many students there are st. 3 students **were** at my party."
c. "Fewer students were at my party than how many students there are **had there been** 3 students at my party."

If structures for the *than*-clause similar to the paraphrases in (91)c and (92)c could be derived, the problem of decreasing as well as increasing comparative quantifiers would be solved in a straightforward manner as the commitment to the existence of a set of students at the party with cardinality 3 in the actual world is suspended. In the paraphrases in (91)c and (92)c this is achieved by employing a modal operator in the *than*-clause. Rather than stipulation a separate covert modal operator inside the *than*-clause in comparative quantifiers for which there is no evidence other than it be necessary to derive contingent truth-conditions, I suggest that the maximality operator inside the degree quantifier can do the job. The intuition is rather simple. The maximality operator inside the degree quantifier as defined in chapter 1 and repeated in (93) for convenience takes a set of degrees as argument and returns the biggest element in that set. A natural extension of this semantics is to allow the maximality operator to find the biggest degree across worlds. The relevant definition is given in (94).

(93) Definition: Maximality

$max = \lambda D_{\langle d,t\rangle}.\iota d \text{ st. } D(d) = 1 \ \& \ \forall d' [D(d') = 1 \rightarrow d' \leq d]$

(94) Definition: Intensional Maximality

$max = \lambda D_{\langle d,st\rangle} \iota d. \exists w \ D(d)(w) = 1 \ \& \ \forall d' [D(d')(w) = 1 \rightarrow d' \leq d]$

To make use of the intensional version of the maximality operator, the *than*-clause has to denote a set of degree-world pairs rather than a set of degrees. To achieve this on principled grounds I would like to advance the following proposal.

We begin by recognizing that lexical entries for predicates are more complicated than we pretended so far. Intuitively, their extension depends on the particular properties of the situation or world in which it is used. For instance the extension of *students at MIT* depends on the time at which this predicate is evaluated. To encode this dependency formally it will be assumed that predicates take as innermost argument a world/situation pronoun.[53] Even though this pronoun is phonetically not realized its syntactic and semantic properties are very much those of the more

[53] For convenience, I assume the situation semantic extension of possible world semantics as developed in Berman(1987), Kratzer(1989), Heim(1991), von Fintei(1994) etc. Situations are simply

familiar personal pronouns. In particular, their semantic value depends on the assignment function relative to which the sentence is interpreted. Of course world/ situation pronouns can also be bound by a local antecedent such as a modal or temporal quantifier. It will be assumed that for the purpose of this thesis tense can sufficiently approximated as existential quantifier ranging over situations. Tense is like any other quantificational element in natural language a restricted quantifier. Its restrictor – a set of situations – is given by a sparse relation "in" or "part of" introducing again a situation pronoun that can be bound from a higher quantifier over situations. If there is no higher situation binder and the situation variable remains unbound, it will be assumed that the assignment function assigns by default the utterance world/situation to this pronoun symbolized by s_0. For convenience, these pieces will be simply packed into the tense operator. We get sample entries for predicates as in (95)a while the basic format of the tense operator gets a semantics as in (95)b.[54]

(95) a. $[\![sick]\!] = \lambda s.\lambda x.$ x is sick in s

b. $[\![T(ense)]\!] = \lambda P_{<s,t>}.\ \exists s$ in s_0 st $P(s)=1$

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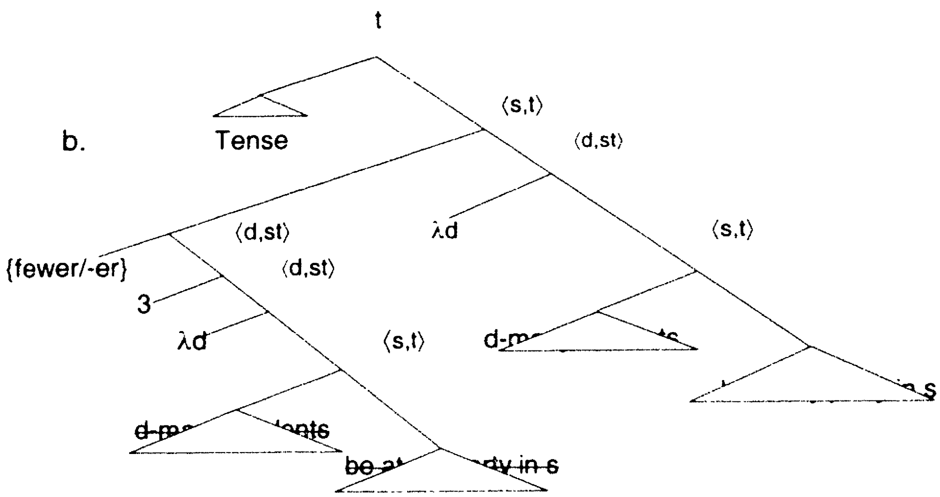
parts of possible worlds or equivalently, a world is a maximal situation in the sense that it is not a proper part of any other situation.

[54] I will not be concerned at all with the differences among tense. Instead, I assume that the entry in (95)b can be suitably adjusted for each specific tense by specifying the "in" relation. PAST could for instance be approximated as $\exists s$ preceding s_0. Of course it will be necessary to specify what precedence for situations means.

The scope argument of Tense is given by the VP. According to the definition of the Tense operator in (95), the VP has to denote a function from situations to truth-values. I would like to suggest that this is exactly the node that is copied into the ellipsis site in the *than*-clause in comparative quantifiers. The tense operator will take scope over both arguments of the comparative operator. Crucially, the situation pronoun inside the *than*-clause can be optionally quantified over by intensional maximality. The situation is summarized in the tree in (96)b.

(96) a. Fewer/more than three students were at my party.[55]

b.



c. $\exists$s in s_0 st. max(λd st. d-many students were at my party in s) {<,>} max(λd. $\exists$s' st. d-many students were at my party in s' & d=3)

In the case of monotone decreasing comparative quantifier the situation pronoun inside the *than*-clause has to be quantified over by the intensional maximality

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[55] Again there is a technical amendment to be noted regarding the interpretation of the numeral inside the *than*-clause. Strictly speaking the predicates "λd.d=3" and "λd.λs.d-many … in s" cannot be intersected. The easiest way to solve this problem is to assume that the measure phrase can be optionally of type ⟨d,st⟩.

operator to derive contingent truth-conditions. Notice that the truth-conditions do not anymore demand from the evaluation situation that it contains 3 students that are at my party. All that is required is that there is **some** possible situation that contains 3 students at my party. In the case of monotone increasing comparative quantifiers the situation pronoun inside the *than*-clause can be quantified over by the matrix tense operator at least if there are three or more students at the party in the actual world. The assumption that the bare VP is copied into the *than*-clause together with claim that maximality can optionally scan across worlds/situations to find the biggest degree satisfying the *than*-clause gives the system enough flexibility to predict the right truth-conditions. Before looking for independent support for the rather unusual claim that the *than*-clause in at least some comparative constructions is an intensional domain, it is worth addressing the potential worry that assuming intensional maximality might undermine the account of the MNPG. Recall from section 2.2 that the minimal number requirement of predicates such as *meet* was assumed to be encoded as definedness condition. Since the *than*-clause at least in some cases is an intensional environment, it is conceivable that the minimal number presupposition is filtered out by the intensional maximality operator similar to existence presuppositions and would therefore predicted to be not detectable. Note however, that the minimal number presuppositions of predicates such as *meet* have to be satisfied in all worlds. It is part of the very meaning of minimal number predicates that they require a certain minimal number of participants. Any meeting event no matter which world is considered will have to have at least 2 participants.

Suspending the commitment to the existence of a set of meeting individuals in the evaluation world as required by monotone decreasing comparative quantifiers does not entail that the meaning of *meet* itself changes. Embedding minimal number predicates under a modal operator will therefore not affect the minimal number presupposition. The account of the MNPG therefore is not undermined by the move of intensionalizing the maximality operator.

Since the proposal that some *than*-clauses are intensional environments is to my knowledge novel it would be important to find independent evidence in support of this idea. There are two essential features — a semantic and a corresponding syntactic — to the proposed solution. On the semantic side, we have seen that even though measure phrase comparatives have a clausal source, the *than*-clause has to be a "pure degree description." The basic intuition is that pure degree descriptions are intensional objects (type $\langle d,st \rangle$) that are interpreted by the intensional version of the maximality operator. Two expectation can be derived from these claims: First it is expected that we find other cases where the *than*-clause needs to denote an intensional degree description without there being an overt modal operator. Second, in cases where there are pure degree descriptions without the presence of an intensional maximality operator, an overt modal operator will be required in the interpretation of the degree description.

The corresponding syntactic claim was that the intensionality of the *than*-clause has its source in the fact that the bare VP is copied into the *than*-clause. I will argue in the second section to follow that a variety of diagnostics for phrasal comparatives that have been discussed in the literature can be naturally captured under the perspective that the *than*-clause in phrasal comparatives is indeed a (very small) small clause — essentially a bare VP.

2.6.4 Semantic Correlates

On closer examination, the seemingly simple account of the MNPG proposed in 2.4, turned out to have non-trivial implications such as the need for the *than*-clause to span an intensional domain. The need to suspend any existence claims in the *than*-clause makes the MNPG even more puzzling. To account for the generalization the VP had to be part of the *than*-clause but at the same time we had to ensure that the VP is not detectable in any way other than through the definedness conditions. Interestingly this peculiar combination of affairs is not unique to amount comparatives. First of all we can extend that observation from comparative quantifiers to all measure phrase comparatives. Recall that all measure phrase comparatives have a clausal source as evidenced by the measure phrase (positive-comparative) correlation. The same reasoning that forced us to allow the *than*-clause to be intensional also provides the support for an intensional *than*-clause in cases such as (97).

(97) a. John is shorter/less tall than 6'8.
b. This cable is thinner/less thick than 2 feet.

It is clearly not required that there is somebody in the evaluation world who is 6'8 tall or that there is a cable that is 2 feet thick in order for (97)a and b respectively to be felicitous. Quite similar observations can be made also outside of the limited range of measure phrase comparatives. Consider the sentence in (98)a due to I. Heim (p.c.).

(98) a. They treated me worse than a slave.
b. "They treated me worse than they/one would treat a slave if they had one."

Again as the clausal paraphrase indicates, for (98)a to be felicitous (or even true) it is not required that they have/there is a slave in the evaluation world.[56] The need to abstain from any existence claim is exactly the same as the one we have observed with measure phrase comparatives. Since the interpretation of this comparative minimally requires the interpretation of a *than*-clause of the form "than how badly one/they treat a slave," the same solution that I have proposed for measure phrase comparatives suggests itself also for these cases. Specifically, if it is assumed that the bare VP is copied into the *than*-clause its interpretation assuming intensional maximality would be as in (99).

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[56] It seems possible to turn this observation into a (weak) argument against so-called direct analyses of phrasal comparatives (cf. e.g. Hoeksema(1983,1984), Hendricks(1995) among many others). The general format of direct analyses is most clearly discussed in Heim(1985). The proposal is essentially that the same gradable function is successively applied to the two arguments that are compared under the scope of the relevant comparative operator. The format can be schematized as -er(x)(y)(f) = 1 iff f(x) > f(y). The relevant observation in (98) is that it that the degree function has to be intensional when applied to the standard of comparison argument (*a slave*) but extensional when applied to the matrix argument. Hence the degree functions are not identical and the format of the direct analysis is not applicable all structures that fit its structural description.

(99) $[\![$*They treated me worse than a slave*$]\!]$ = 1 iff max {d:∃s they/one treats a slave d-badly in s} < max {d: they treat me d-badly in s_0}

These facts show then that the idea of intensional maximality finds applications in comparatives that are independent of measure phrase comparatives. The second piece of evidence that I would like to discuss as providing support for the analysis comes from a curious and ill-understood observation about amount relatives (cf. Carlson(1977), Heim(1987), Grosu&Landman (1998)). Recall that the flip side of the proposal advocated here is that pure amount descriptions/predicates are claimed to be intensional objects of type ⟨d,st⟩. I.e. specifically they provide a situation/world variable for a modal operator to quantify over. Evidence form amount relatives seems to corroborate this claim since this is exactly what is needed in certain cases of amount relatives where only the amount but not the substance is under discussion.

Intuitively, amount relatives are relative clauses that seem to modify the amount of stuff denoted by the head noun rather than the individuals in its extension. Consider the data in (100) from Carlson (1977) and Heim(1987) respectively.

(100) a. I put everything I could in my pocket.

b. It will take us the rest of our lives to drink the champagne that they spilled last night.

The unmarked reading of Carlson's example in (100)a is not that I put everything in the pocket for which there is a possibility that I put it in my pocket. Assume that there are 50 rocks all of which by themselves fit in my pocket. (100)a — in its unmarked, so called "identity of amounts" reading (as opposed to the "identity of substance" reading) — doesn't mean that I put all of them in due succession in my pocket. Instead it says that I put as many of them as could fit together in my pocket. (100)b from Heim(1987) illustrates this effect more dramatically since the identity of substance reading is clearly not available. It would mean that it would take us the rest of our lives to collect all the champagne that they spilled last night and then drink it. Interestingly, as Grosu&Landman(1998) observe — without offering an explanation — following similar claims in Carlson(1977) pure amount relatives that do not license an identity of substance reading for pragmatic reasons require embedding under a modal operator. Consider the contrast in (101)b adapting Heim's(1987) example.

(101) a. It will take us the rest of our lives to drink the champagne that they spilled last night.

b. ?? It took me two weeks to drink the champagne that they spilled last night.

(101)b is rather awkward because it suggests that they drank last night the same champagne that it took me two weeks to drink. I.e. the relative clause in (101)b talks both about the amount and the substance. Embedding under a modal operator on the other hand as in (101)a makes it possible to suspend the substance reading of the amount relative clause and refer only the amount of champagne. The puzzle is why the pure amount reading of the amount relative is possible only if there is a suitable modal operator. I would like to suggest that this fact can be understood along the lines of the proposal made for than *than*-clause of measure phrase comparatives. The idea is simply that pure amount relatives arise just like pure degree descriptions when any existence claims are suspended about an individual/a substance that has the relevant amount/degree in the actual world. Just like pure degree descriptions pure amount descriptions (which are simply a special case of a pure degree description) are so to speak parasitic on a description of an entity. Unless the commitment to the existence of an entity in the actual world is suspended as achieved by a modal operator binding the situation/world pronoun inside the NP, the amount as well as the substance reading is generated.[57] Comparatives and amount relatives differ in one essential respect. While the comparative operator itself (in form of the intensional maximality operator) can suspend existence claims, amount relatives require a modal operator to do that. This supposed difference is corroborated by the contrast in (102)[58].

(102) a. ?? This year I earned the money that the basketball coach earned last year.
b. This year I earned twice the money that the basketball coach earned last year. "This year I earned twice as much money as the basketball coach earned last year."

(102)a is quite awkward for the same reason that (101)b is awkward. It entails that I earned the same money that was already handed out to the basketball coach last year. Once again this shows that unless there is a suitable modal operator, the pure

[57] Unfortunately the syntax of amount relatives is not too well understood (cf. Grosu&Landman(1998) for discussion) so that I have confine myself to sketching the basic insight and leave it for future research to work out a concrete proposal.

amount reading is not available even if it is pragmatically they only sensible reading. Interestingly, the awkwardness disappears as soon as a comparative structure is superimposed. As the paraphrase of (102)b indicates, adding the (multiplicative) differential *twice* enforces a comparative structure — in this particular case it is an equative construction which by the same token that allowed us to derive contingent truth-conditions in the case of decreasing comparative quantifiers generates a "pure amount" reading in (102)b.

2.6.5 Syntactic Correlates

The second claim essential to the account of measure phrase comparatives advanced in the present chapter concerns the claim that the intensionality of the *than*-clause is syntactically tied to the absence of tense in the *than*-clause. Recall that the structure given in (96)b assumes that syntactically, the *than*-clause is similar to a small clause or rather a bare VP (assuming the VP internal subject hypothesis). Intuitively, even though the *than*-clause is clausal in meaning in the sense that a complete theta-complex is utilized, it lacks the functional categories like tense that locate it relative to the utterance situation.[59]

I'd like to suggest that the lack of tense in the *than*-clause of measure phrase comparatives correlates with the syntactic properties that distinguish so called

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[58] Thanks to Colin Phillips (pc) for the data.

[59] This is the reason for the somewhat peculiar paraphrases — "More students were meeting than there are in a meeting of one student" — that I have given to comparative quantifiers if analyzed in terms of comparative syntax.

phrasal comparatives from clausal comparatives. The evidence that distinguishes phrasal comparatives from clausal comparatives is entirely syntactic in nature.[60] Interestingly, it seems that the common characterization of the various syntactic differences is in terms of the "size" of the *than*-clause. I.e. even though these syntactic differences appear to be quite heterogeneous, they can be thought of as manifestations of the same basic syntactic property that distinguishes phrasal comparatives from clausal comparatives — while clausal comparatives have a fully specified (tensed) *than*-clause, the size of the *than*-clause in phrasal comparatives is that of a bare VP lacking any tense. The correlation between the presence of tense and size of the clausal domain as well as the syntactic difference that result from the specific size of the clause are well established.[61] I.e. more concretely, I would like to argue that the evidence that distinguishes phrasal comparatives from clausal comparatives consists of a variety of syntactic phenomena indicating transparency of the *than*-constituent with respect to which the matrix in the case of phrasal comparatives while their clausal counterparts are opaque. I will refrain in the following discussion from providing a detailed syntactic analysis of the phenomena since the important point is only to show that the *than*-clause of phrasal

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[60] To my knowledge nobody has provided convincing evidence that the semantics of phrasal comparatives is different from clausal comparatives. Hoeksema(1983,1984) makes the strongest pitch for such a position taking NPI licensing as indicator for a different semantics. See von Stechow(1984b), Heim(1985) for critical remarks on his semantics and Hendriks(1995) remarks on the empirical facts concerning NPI licensing in Dutch which are more complicated actually not predicted by Hoeksema's proposal.

[61] See especially Wurmbrand(1998) for recent.

comparatives is in a variety of ways more transparent than the *than*-clause of clausal comparatives.

Bresnan(1973) first pointed out that some phrasal comparatives and in particular measure phrase comparatives such as the one given in (103)a cannot support the presence of a finite copula. This is predicted under the current proposal that only a bare VP is copied into the *than*-clause of measure phrase comparatives. There is simply no space for a tense operator. We can add to Bresnan's observation the parallel fact from comparative quantifiers that receive an analysis as measure phrase comparatives under the present proposal.

(103) a. This rope is longer than 6 feet (*are)[62]
"This rope is longer than how long 6 feet are"
b. There are more than 3 books (*are) on the table.
"There are more books on the table than how many books three books are "

As the paraphrases suggest, there is nothing semantically wrong with a copula in the *than*-clause. It is rather a purely syntactic property of measure phrase comparatives that they do not support functional categories. I do not have anything to offer that would explain this peculiarity. Given the assumptions from above, the observation is

[62] An open question is why you can't even have the non-finite form of the copula in measure phrase comparatives.

(i) a. * This sope is longer than 6 feet (*be)
b. * There are more than three books (*be) on the table.

This doesn't follow from the present proposal. Alec Marantz (p.c.) suggests that it might be that the VP that is copied into the *than*-clause is too small to support the spell-out of any functional categories. I will have to leave this as an open problem here.

nevertheless important as it provides a principled reason why the *than*-clause in measure phrase comparatives spans an intensional domain.

The second set of contrasting observations are due to Hankamer(1973) and concern transparency with respect to Binding Theory. Specifcally, Hankamer(1973) observes that phrasal comparatives seem to form a binding domain with the matrix while clausal comparatives do not. The contrast in (104) illustrates this difference.

(104) a. No man is stronger than himself.[63]

b. * No man is stronger than himself is.

c. No man is stronger than he himself is.

While the contrast is clear, the correct account is much less so. In particular, the ungrammaticality of (104)b might well be due to the anaphor being in position that nominative case is assigned to.[64] What the grammaticality of (104)a shows then is that if there is a clausal source, it cannot be finite. This is of course compatible with the claim that the *than*-clause in (104)a is a bare VP and need to be taken to show that the *than*-constituent is a PP as Hankamer and Hoeksema did.

The third piece of evidence — "extraction transparency" — has been first observed again by Hankamer(1973) who pointed out that phrasal comparatives are

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[63] The English examples are actually due to Hoeksema(1984). Hankamer(1973) used Greek. Cf. also Hendriks(1995) for similar examples from Dutch.

[64] Cf. the nominative island condition (NIC).

transparent for wh-extraction while clausal comparatives are not as the contrast in (105) indicates.

(105) a. ? You finally met somebody you're taller than.

b. * You finally met somebody you're taller than is.

Again the fact that phrasal comparatives are transparent for wh-extraction does not prove that the *than*-constituent is a PP. The contrast can be equally well accommodated under the assumption that the *than*-clause in phrasal comparatives is a small clause, which are known to permit wh-extraction more freely than finite clauses.

The final set of facts that will be briefly discussed here goes back to Heim(1985) and could be properly called "case transparency" vs. "case opacity" effects.[65] The idea is that the case of the constituent following the comparative particle *than* either mimics the case of its correlate in the matrix or is fixed seemingly assigned by the comparative particle *than* itself. German provides examples of both kinds with superficially phrasal comparatives. The examples in (106) to (108) taken from Heim(1985) show that the DPs that are compared — indicated with capitals — are matched in case. I.e. if the DP in the matrix that provides the first pair of the comparison has nominative then the DP after the *than*–particle bear nominative as well and so on for every morphological case.

[65] See also Stassen(1984) for relevant cross-linguistic perspective.

(106) a. ICH habe dir bessere Schlagzeuger als DER KARLHEINZ vorgestellt.
I$_{Nom}$ have you$_{Dat}$ better drummers$_{Acc}$ than the Karlheinz$_{Nom}$ introduced
"I have introduced better drummers to you than Karlheinz (has)"

b. Ich habe DIR bessere Schlagzeuger als DEM KARLHEINZ vorgestellt.
I$_{Nom}$ have you$_{Dat}$ better drummers$_{Acc}$ than the Karlheinz$_{Dat}$ introduced
"I have introduced better drummers to you than to Karlheinz"

c. Ich habe dir bessere SCHLAGZEUGER als BASSISTEN vorgestellt.
I$_{Nom}$ have you$_{Dat}$ better drummers$_{Acc}$ than base-players$_{Acc}$ introduced
"I have introduced better drummers than base-players to you"

Certainly the most natural account of these case-matching effects can be given in terms of a clausal analysis. In particular, if the clause has to be identical to the matrix (with the exception of focused material) for ellipsis to apply, we expect exactly these effects. To give an example, consider again example (106)c and its underlying clausal analysis in (107)b.

(107) a. Ich habe dir bessere SCHLAGZEUGER als BASSISTEN vorgestellt.
I$_{Nom}$ have you$_{Dat}$ better drummers$_{Acc}$ than base-players$_{Acc}$ introduced
"I have introduced better drummers than base-players to you"

b. Ich habe dir bessere SCHLAGZEUGER vorgestellt als <~~ich dir gute~~>
I$_{Nom}$ have you$_{Dat}$ better drummers$_{Acc}$ introduced than <~~I you$_{Dat}$ good~~>

BASSISTEN <~~vorgestellt habe~~>.
base-players <~~introduced have~~>
"I have introduced better drummers to you than I have introduced good base-players to you"

Interestingly, as Heim(1985) observes, there is a minimally different case to the one in (106)c that cannot be submitted to the same treatment. Consider (108)a and the attempt to give a clausal analysis parallel to the so successful strategy in (107) in

(108)b. In particular, under a full blown clausal analysis one would expect nominative case on DP following *than* — contrary to fact. These facts seem to provide again evidence that there are syntactically two kinds of "phrasal comparatives" and one of them has the properties of s small clause which is know to be transparent for case assignment from outside.

(108) a. Ich habe dir BESSERE SCHLAGZEUGER als DEN SHELLY MANNE
I$_{Nom}$ have you$_{Dat}$ better drummers$_{Acc}$ than the Shelly Manne$_{Acc}$
vorgestellt.
Introduce
"I have introduced better drummers to than Shelly Manne"

b. Ich habe dir bessere SCHLAGZEUGER vorgestellt als
I$_{Nom}$ have you$_{Dat}$ better drummers$_{Acc}$ introduced than
der/*den Shelly Manne <~~ein guter Schlagzeuger ist~~>.
the$_{Nom}$/the$_{Acc}$ Shelly Manne <~~a good drummer is~~>.
"I have introduced better drummers to you than Shelly Manne$_{Nom/*Acc}$ is a good drummer"

To summarize, there are four empirical domains that seem to suggest that at least some phrasal comparatives should be analyzed differently from supposing a full-blown clausal source. First, it has been observed that measure phrase comparatives cannot support a finite *than*-clause. Second, evidence from binding theory ("BT-transparency") suggested that phrasal comparatives cannot have a finite clausal source that would assign nominative case to the anaphor in subject position. Instead, the *than*-constituent seemed to form a binding domain with the matrix. Thirdly, phrasal comparatives can be transparent for wh-extraction ("extraction transparency") and finally, some phrasal comparatives are apparently transparent for case assignment ("case transparency"). A unified characterization of these facts presents itself in terms of the size of the *than*-constituent. In particular, the discussed contrasts are very similar to well-known contrast between small clauses and finite clauses. A "small clause" or "bare VP" analysis for phrasal comparatives not only has the important advantage of getting away with one meaning for comparative operator it also seems to provide the syntactic basis of accounting for the observed differences in a principled manner.

While these correlating observations provide encouraging support for the proposal that phrasal comparatives sometimes have a *than*-clause consisting essentially of a bare VP, they do not constitute a proof. Nor should these unfortunately rather sketchy remarks about the syntactic difference between so-called phrasal and clausal comparatives be seen as explanation. All that was attempted in this section is to argue that the assumption of a *than*-clause that consists of a bare VP is syntactically not entirely unreasonable — supporting the prima facie attractive position that all comparatives have are clausal source for the *than*-constituent Furthermore, we have seen that there is potentially corroborating evidence in support of this position. However, much work has to be done still to provide a real account of the syntax of phrasal comparatives.

2.7 Summary

The salient difference between the GQT approach to comparative determiners — which maintains that comparative determiners are at least for the purpose of semantic composition opaque domains — and an analysis of comparative determiners as comparative constructions is that only the latter expects interactions of the building blocks of comparative determiners (comparative operator, measure phrase and degree function) with the environment. The present chapter discussed one particular set of interactions that compellingly document that the measure phrase inside comparative quantifiers (given by the numeral) interacts with the matrix VP. The observations were summarized in the general version of the MNPG with comparative determiners and are equally unexpected for both the GQT approach and the classical comparatives approach sketched in chapter 1 as they show that the numeral even though deeply embedded in the DP "sees" the presuppositional requirements of the matrix predicate.

The analysis of the MNPG that was developed in the subsequent sections had to amend the classical comparatives analysis in a variety of non-trivial ways. The most significant concerns the semantics of the degree function *many*. Unlike adjectival degree functions such as *tall* which have the syntactic properties of modifiers, *many* was shown to have the syntax of a determiner (after the innermost degree argument was absorbed). I e. the proposal of the MNPG relied on insights of both GQT and the comparative quantifiers as comparatives approach. These two sets of properties were unified in the concept of a "parameterized" determiner meaning for *many*. On the one hand, *many* takes a degree argument ("the parameter") which subjects it to the syntax and semantics of comparative constructions. On the other hand *many* was shown to maintain the properties of a determiner. Independent evidence for this assumption came from the fact that amount comparatives based on *many* cannot appear in genuine predicative positions.

The second significant amendment to the classical analysis of comparatives had to be set in place to derive the correct truth-conditions. Specifically it was shown that the *than*-clause in measure phrase comparatives constitutes (at least in the case of decreasing quantifiers) an intensional domain. This unusual assumption was shown to have independent support in regular comparative constructions as well as in amount relatives. Finally, it was argued that there is a corresponding syntax to the observation that the *than*-clause is sometimes an intensional domain. Specifically, it was suggested that the intensionality arises because the *than*-clause does not contain any extended functional structure such as tense dominating the bare VP. It was suggested that this corresponds quite well with syntactic differences that have been discussed in the literature as distinguishing phrasal from clausal comparatives.

2.8 Appendix: A GQT-Analysis of the MNPG

This section discusses how the GQT could be amended to provide an account of the MNPG in terms of the syntax and semantics of multiply-headed noun phrases as argued for in Keenan&Moss(1984), Keenan(1987), Beghelli(1994), Keenan& Westerstahl(1998), Smaessart(1996) etc. The point that I want to make is that it is not impossible to find a suitable amendment of GQT to account for the MNPG, however the needed amendments do not come for free. In fact these amendments seem to undermine the generality of the GQT approach to quantification.

2.8.1 Multiply-Headed Noun Phrases

We have seen that the interpretation of comparative quantificational structures such as *more than n-1 NP* VP_n requires the interpretation of *n-1 NP* VP_n at some point in the derivation. This is rather reminiscent of the interpretation of more complicated amount comparatives such as the multiply-headed ones in (109) below.

(109) a. More students than professors came to the party.
b. Fewer children than adults knew the answer.
c. As many doctors as lawyers attended the congregation.

The Generalized Quantifier approach represented by Keenan&Moss(1984) and Keenan(1987) among many others, analyses *more ... than ...* as discontinuous determiner that takes two NP arguments to yield a generalized quantifier.

(110) a. $[[\textit{more} \ldots \textit{than}\ldots]] = \lambda \mathbf{P}_{et}.\lambda \mathbf{Q}_{et}.\lambda \mathbf{R}_{et}.\ |\mathbf{P} \cap \mathbf{R}| > |\mathbf{Q} \cap \mathbf{R}|$

b. $[[\textit{no fewer} \ldots \textit{than}\ldots]] = \lambda \mathbf{P}_{et}.\lambda \mathbf{Q}_{et}.\lambda \mathbf{R}_{et}.\ |\mathbf{P} \cap \mathbf{R}| > |\mathbf{Q} \cap \mathbf{R}|$

An immediate and well-come consequence of this analysis is that both NP arguments have to satisfy the selectional restrictions of the VP. This explains the oddness of sentences as in (111) where one of the two NPs — *planets of our solar system* — doesn't satisfy the selectional restrictions of the VP *come to the party.*[66]

(111) a. # More students than planets of our solar system came to the party.

b. # More planets of our solar system than students came to the party.

To capture the Minimal Number of Participants Generalization in this approach even simpler comparative quantifiers have to be analyzed as multiply-headed NPs. Specifically, the sentences in (112)a and (113)a would have a parse similar to the one indicated in (112)b and (113)b respectively.

(112) a. ?? More than three students were standing in square formation.

b. *More students than three students were standing in square formation.*

(113) a. No fewer than four students were standing in square formation.

b. *No fewer students than four students were standing in square formation.*

To be able to interpret these sentences assuming a lexical entry for *more ... than ...* as in (110), the numeral has to receive a different treatment than commonly assumed in generalized quantifier theory where they are treated as quantificational determiners. A natural proposal would be to treat numerals as modifiers of the NP as in (114).

(114) $[[\textit{three}]] = \lambda P_{et}.\lambda X.\ |X| = 3\ \&\ P(X) = 1$[67]

Given these assumptions, the sentences in (112) and (113) will be ultimately interpreted as follows.

(115) a. [[*More students than three students were standing in square formation*]] = 1 iff **|students ∩ standing in square formation| > | three students ∩ standing in square formation|**

b. [[*No fewer students than four students were standing in square formation*]] = 1 iff **|students ∩ standing in square formation| ≥ | four students ∩ standing in square formation|**

The Minimal Number of Participants Generalization can now be explained by observing that the awkward sentences that violate the minimal number requirement have very weak truth-conditions maybe are even trivial ones because they involve as part of the calculation of the truth-conditions the term **|n-1 NP ∩ $\mathbf{VP_n}$|** which is either necessarily zero or undefined if it is assumed that the minimal number of participants requirement is encoded as presupposition.

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[66] Keenan(1987) presents this arguments in support of a symmetric treatment of the two NPs, hence against the idea that the complex NP *more NP_1 than NP_2* has one head NP only.

[67] For simplicity, it is assumed here that plural NPs simply range over sets of sets of individuals rather than Linkean i-sums. Nothing depends on the specific though.

2.8.2 Getting the Truth-Conditions Right

The analysis presented above — minimal as it is in its assumptions — faces the same challenge of getting the truth-conditions right that the proposal in section 2.4 had to overcome. Again, the problem is most readily apparent with monotone decreasing comparative quantifiers which are predicted to yield structures that are necessarily false. To see this, consider the lexical entry for the discontinuous determiner *fewer ... than ...* which parallels the entry for *more ... than ...* as in (116).

(116) a. $[\![$*more ... than...*$]\!] = \lambda P_{et}.\lambda Q_{et}.\lambda R_{et}.\ |P \cap R| > |Q \cap R|$

b. $[\![$*fewer ... than...*$]\!] = \lambda P_{et}.\lambda Q_{et}.\lambda R_{et}.\ |P \cap R| < |Q \cap R|$

Assuming these entries, we derive a representation of the truth-condtions associated with the sentences as in (117)b that are analogous to the representation associated with multi-headed quantifiers as in (117)a.

(117) a. $[\![$*Fewer students than teachers were at my party*$]\!] = 1$ iff
$|\textbf{students} \cap \textbf{be\_at\_my\_party}| < |\textbf{professors} \cap \textbf{be\_at\_my\_party}|$

b. $[\![$*Fewer students than three students were at my party*$]\!] = 1$ iff
$|\textbf{students} \cap \textbf{be\_at\_my\_party}| < |\textbf{three students} \cap \textbf{be\_at\_my\_party}|$

c. $[\![$*More students than three students were at my party*$]\!] = 1$ iff
$|\textbf{students} \cap \textbf{be\_at\_my\_party}| > |\textbf{three students} \cap \textbf{be\_at\_my\_party}|$

The problem is that sentences employing monotone decreasing determiners are predicted to be trivial because |**three students** $\cap$ **be_at_my_party**| = 0 if there are fewer than three students at the party or else |**three students** $\cap$ **be_at_my_party**| $\geq$ 3 in which case |**students** $\cap$ **be_at_my_party**| $\geq$ 3 as well. Hence the sentence can never be true.

The corresponding problem with increasing determiners arises as well. In this case the predicted truth-conditions are too weak. (117)c will be true as long as there is at least one student at the party. This is so, because |**three students** $\cap$ **be_at_my_party**| = 0 if there are fewer than three students at the party and |**students** $\cap$ **be_at_my_party**| > |**three students** $\cap$ **be_at_my_party**| will be true as long as there is at least one student at the party.

The diagnostic as well as the remedy are essentially the same as the ones proposed in section 2.6. Since the VP is intersected with the numeral as well as the NP, the calculation of the comparison is too sensitive to the actual state of affairs to give appropriate truth-conditions. To avoid the problem, we have to calculate the cardinality on the basis of the intension of *three students be at my party* rather than its extension. This solves both problems in a straightforward manner as the commitment to the existence of a set with cardinality 3 in the actual world is suspended.

(118) a. $[\![$*Fewer students than three students were at my party*$]\!]$ = 1 iff |**students** $\cap$ **be_at_my_party**| < |λw. **three students** in w $\cap$ λw. **be_at_my_party** in w|

b. $[\![$*More students than three students were at my party*$]\!]$ = 1 iff |**students** $\cap$ **be_at_my_party**| > |λw. **three students** in w $\cap$ λw. **be_at_my_party** in w|

The additional piece that has to be provided here is a semantics for the measure function "| |" so that it optionally calculates the cardinality of a property rather than of a predicate. If we were to give lexical entries to the measure functions, then entries along the lines of (119)a,b for the extensional and intensional versions respectively would be adequate.

(119) a. $[\![/ /]\!] = \lambda P_{<et>}$. the maximal number n st. there n-many x st. P(x) = 1

b. $[\![/ /]\!] = \lambda P_{<s,et>}$. the maximal number n st. there is a world w st. for n-many x P(x)(w)=1

We should note in passing that giving a lexical entry for the measure function "the cardinality of" is incompatible with the main stance of GQT, which is to deny the fact there is a linguistically encoded measure function inside comparative quantifiers.

2.8.3 Some Critical Remarks

At this point it is worth stepping back and taking stock of what is being claimed. We have seen empirical evidence in form of the Minimal Number of Participants Generalization to the effect that comparative determiners such as *more than n* are always bi-clausal similar to multiply-headed NPs at some level of interpretation. Extending the analysis of multiply-headed NPs to simplex comparative determiners leaves us with the question why there don't seem to be simple (mono-clausal) comparative quantificational structures. Recall that the semantics of comparative quantificational structures in a GQ setting is simply given as in (120)a rather than (120)b.

(120) a. $[\![\textit{more than n NP VP}]\!] = 1$ iff $|NP \cap VP| > n$

b. $[\![\textit{more than n NP VP}]\!] = 1$ iff $|NP \cap VP| > |n\ NP \cap VP|'$

The claim hidden in (120)a which seems to be disputed by the facts presented by the Minimal Number of Participants Generalization is that the cardinality *n* can simply be read off the structure by looking at the numeral inside the complex determiner.

Importantly, nothing in the semantics of comparative quantifiers requires the more complicated calculation in (120)b. For the GQ treatment of comparative determiners, the Minimal Number of Participants Generalization is entirely unexpected. This became most obvious when we noted that in order to predict adequate truth-conditions assuming the bi-clausal analysis, we had to apply an intensional measure function. Intensionalizing the measure functions allows us to do in an important respect exactly what is claimed in (120)a namely make reference to "pure" cardinality without existential commitment. Given this, the bi-clausal analysis is even more surprising and the conclusion that is suggested quite compellingly is that the syntax of comparative quantificational structures is responsible for the Minimal Number of Participants Generalization. The GQ treatment of comparative determiners on the other hand can be rightfully criticized to be not faithful to the syntax to the extent that important mechanisms underlying the generation of quantificational structures are covered up. In other words, while it is possible to amend the GQ treatment so that it can provide an adequate description of the truth-conditions associated with comparative determiners, it is not close enough to the actual underlying mechanisms to count as explanation.

A potentially more worrying remark concerns the claims of GQT regarding the inventory of quantifiers. What the MNPG shows is that there are no comparative determiners that have the simple syntax of determiners such as *every*.[68] This by itself is just one more place where GQT helps us to discover gaps in the pandemonium of possible determiner quantifiers and not yet problematic. The problem is that the class of comparative determiners was delimited in chapter 1 as being comprised of those determiners that require the measure function "the cardinality of" as essential piece in the description of their truth-conditional import. We noted in passing that according to this definition, determiners such as *zero or more* are not comparative determiners since their truth-conditional import is identical to *some*. There is no need to make reference to a measure function. The implicit but important claim behind this seemingly idle terminological hairsplitting is that there is

[68] In the notation of Beghelli(1994), Keenan&Westerstahl(1994) these quantifiers are called $\langle 1,1\rangle$ quantifiers as opposed to the discontinuous determiner that give rise to multiply headed DPs which are of type $\langle\langle 1,1\rangle 1\rangle$.

nothing in the semantics of comparative determiners as identified by their syntax that would unify them into a natural class. In other words, since the syntax is assumed to be irrelevant for the semantics of comparative determiners, it is predicted that there are no significant semantic generalizations to be stated in terms of comparative determiners as defined by the syntax. The MNPG and its account in an amended GQT of comparative quantification are however in direct conflict with this claim. To make this observation more concrete consider what the amended GQT approach would say about the data in (121).

(121) a. ?? No fewer than/at least two students were split into two unequal groups.
b. Some students were split into two unequal groups.

Assuming that plurality of the NP in *some students* comes with a presupposition that that there are at least two individuals in the extension of *students*, one would expect that the awkwardness that is detectable in (121)a should also be detectable in (121)b. After all *some students* has the same truth-conditional import as *no fewer than/at least two students* according to GQT. Since there is a clear contrast between (121)a and (121)b (however weak the minimal number effect with predicates like *split into two unequal groups* might be), GQT has to recognize the different syntactic form of the determiners in order to account different behavior with respect to minimal number predicates. Reference to plurality in the spirit of Winter is obviously not helpful as both DPs are morphologically plural. But if we have to recognize the syntactic form and plurality is not at stake to delimit the determiner that give rise to the MNPG, it is at least good practice to do that in a way the uses independently needed assumptions about the differing syntax. What we know independently about the particles *-re than,* etc. is that they provide the core of comparative constructions. An analysis of comparative determiners as comparative construction becomes therefore the null-hypothesis also for the semantics and GQT at least as amended in this appendix fails to recognize this.

Chapter 3

On the Syntax of Amount Comparatives

3.1 Introduction

The present chapter discusses in some detail a couple of non-trivial predictions that the proposal of *many* as parameterized determiner as developed in the previous chapter makes. The first section is devoted to showing that the specific expectations about scope splitting with comparative quantifiers are borne out in exactly the manner predicted. The fact that scope splitting as discussed briefly in chapter 1 is possible also with comparative quantifiers provides evidence for the presence of a degree quantifier inside comparative quantifiers that is syntactically independent from the individual quantifier.

Section 3.3 on the other hand discusses apparently problematic interactions between comparative quantifiers and the definite determiner within the same DP. More specifically, since the *many* itself is claimed to be a determiner (after the degree argument is absorbed), it shouldn't be possible to stack another determiner on top of comparative determiner. This is in apparent conflict with the data. On closer examination, it turns out that the apparent counterexamples have an alternative analysis that makes them behave entirely in concordance with the proposed theory so that these data do not challenge but even support the proposal that *many* is a determiner. Both sections will therefore lend further support to the claim that comparative quantifiers have both properties of determiners as well as amount comparatives.

3.2 Scope Splitting with Comparative Quantifiers

Recall from chapter one that a clear difference between the GQT approach to comparative quantifiers and any approach based on the independently needed syntax and semantics of comparatives was that the latter but not the former predicts the possibility of scope splitting. Specifically, any analysis of comparative determiners as comparative construction assumes that there are two in principle independent quantificational elements inside comparative quantifiers. On the one hand there is a degree quantifier and on the other there is an individual quantifier. In principle these two quantifiers are independent and either scopal order of the two quantifiers should be possible. It turns out that the specific semantics of the degree quantifier and the individual quantifier make it a difficult task to find proof this independence. Examining the resulting truth-conditions for either of the two scope orders for instance yields detectable differences only in a limited set of cases which might be accounted for in an alternative way that doesn't need two separate quantifiers. Compelling evidence for the predicted independence would come from the phenomenon of "scope splitting" in either one of the two possible ways sketched in (122).

(122) a. [-er than ... [Op ... [$\exists$**X** st. **X** is d-many ...]]][69]
b. [$\exists$**X** ... [Op ... [-er than ...] & **X** is d-many]]

The present section examines in some detail whether each of the two configurations is empirically attested. In the first part, I will present data to support the existence of scope splitting as schematized in (122)a. This constitutes one more argument against the GQT approach to comparative quantifiers, which clearly does not allow for this possibility. The data however do not distinguish between the specific proposal made in chapter 2 and a more traditional analysis of comparative quantifiers, which would take *many* to be a modifier as sketched in chapter 1. The second part discusses the schema in (122)b. This time, the proposal made in chapter 2 makes different predictions from a more traditional analysis. I will argue that the configuration in (122)b does in fact not occur just as predicted by the proposal in chapter 2. If this is true, then we a the theory of comparative quantifiers to predict this asymmetry. Since the proposal of *many* as parameterized determiner as does that, the asymmetry is further support for that proposal which furthermore is independent from the MNPG.

3.2.1 Scope Splitting over Intensional Operators

In chapter 1, well-known data from *how-many* questions were briefly discussed that show quite compellingly that quantification over degrees is independent of

[69] Note that *many* is treated here as adjectival modifier instead of a determiner. The existential

quantification over individuals. One piece of evidence comes from the possible readings *how-many* questions in conjunction with modal operators. The data in (123)-(125) taken from Rullman(1995) illustrate the phenomenon.

(123) a. How many books does Chris want to buy?

b. "What is the number n such that there are n books that Chris wants to buy?"

c. "What is the number n such that Chris wants it to be the case that there are n books that he buys?"

The first observation is that the question in (123)a has two possible interpretations as paraphrased in (123)b and c. The reading in (123)c is an instantiation of a scope bearing operator, in this case the modal verb *want,* separating the degree quantifier which seems to take scope over the modal from the individual quantifier which takes scope under the modal.

Interestingly, the second reading disappears under certain circumstances. For instance if there is an intervening negative- or wh-island, only the de re reading survives as the data in (124) and (125) show.

(124) a. How many books did no student want to buy?

b. "What is the number n such that there are n books that no student wants to buy?"

c. * "What is the number n such that no student wants it to be the case that there are n books that he buys?"

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individual quantifier is assumed to quantify over entities that correspond to sets of individuals.

(125) a. How many books do you wonder whether Chris wants to buy?

b. "What is the number n such that there are n books that you wonder whether Chris wants to buy?"

c. * "What is the number n such that you wonder whether Chris wants it to be the case that there are n books that he buys?"

This syntactic dependency of the reading under question indicates that scope splitting in *how-many* questions is subjected to classical locality constraints on movement dependencies — which in turn suggests that there is degree operator movement that is responsible for the generation of scope splitting reading.

Applying the same rational to comparative quantifiers does not immediately yield similar results. Consider for instance the sentences in (126)a and possible paraphrases along the lines of the corresponding *how-many* question.

(126) a. Chris wants to buy more than five brooks.

b. "The number n st. there are n-many books that Chris wants to buy is bigger than 5."

c. "The number n st. Chris wants it to be the case that he buys n-many books is bigger than 5."

A few moments of reflection reveal that the two paraphrases have identical truth-conditions. As Heim(2000) has discussed in detail, this is just an instance of a general difficulty in detecting degree operator scope via truth-conditions: given the semantics of the degree operator, only very few environments are predicted to yield different truth-conditions and would therefore allow detection of scope splitting. One kind of situation that does yield different truth-conditions is given by certain modal operators such as *require, need,* etc. in conjunction with *less/fewer* comparatives. Consider now the sentence in (127)a in which exactly this kind of environment that is employed. (127)a seems to have three different readings as paraphrased in (127)b-d.

(127) a. John is required/needs to read fewer than 5 books.
b. "There are fewer than 5 books st. John is required/needs to read them."
c. "John is required/needs to read no more than 5 books."
d. "The number of books that John is required/needs to read is smaller than 5."

The readings paraphrased in (127)b and c are the familiar de re and de dicto readings. Under the de re reading, there is a set of books that John needs to read and the cardinality of that set of books is smaller than 5. It is of course possible for him to read 5 or more books. But these additional books are not on the required list. The de dicto reading on the other hand, requires that John reads fewer than books whichever they are. I.e. there is no particular set of books that he needs to read, he is just not allowed to read more than 4. Neither one of them requires an analysis in which the modal operator separates the degree quantifier from the individual quantifier. The reading that is of particular interest to us is the one that is paraphrased in (127)d. Under this reading, there is no particular set of books that John needs to read nor is there an upper limit as to how many books he is allowed to read. All that is said under this reading is that John needs to read a number of books and that number is below 5. We can represent the three readings as in (128) b-d.

(128) a. John needs to read fewer than 5 books.

b. max {d: d-many books are st. $\forall$w [John is complying with the requirements in w $\rightarrow$ Jon reads these books]} < max {d: d=5}.[70]

c. $\forall$w [John is complying with the requirements in w $\rightarrow$ max{d: John reads d-many books in w} < max {d: d = 5}]

d. max {d: $\forall$w [John is complying with the requirements in w $\rightarrow$ John reads d-many books in w]} < max {d: d =5}

In the following examples the split reading might be more salient.

(129) a. At MIT one needs to publish fewer than 3 books in order to get tenure.

b. At MIT one needs to come up with fewer than 5 brilliant ideas to get tenure.

The sentences in (129) have an interpretation — which also seems to be the most salient one — under which the possibility of publishing more than 2 books/having more than 4 brilliant ideas isn't precluded. I.e. anybody is more productive than what the sentences in (129) require won't be excluded from getting tenure. Clearly then this reading is different from the de dicto reading represented in (128)c which would claim too much productivity will hurt your aspirations of getting tenure. An important question is though whether the split reading is really different from the de re reading. Again the sentences in (129) seem to support an affirmative answer. The achievement that is required to get tenure certainly is not that there is a set of books whose cardinality is smaller than three such that one has to publish these books.

[70] The de re reading is sometimes analyzed in terms of the whole DP moving higher than the modal operator (cf. Cresswell&von Stechow 1981). However there are equally valid analyses of de re readings, that do not assign the DP syntactic scope over the modal operator. The particular choice is irrelevant for my purposes.

More clearly even, it would be a rather strange demand to have some brilliant ideas that "already exist" and one has to come up with them during the pre-tenure time. In other words, the salient split reading of the sentences in (129) is not about any already existing set of books fewer than 3/ideas fewer than 5 such that one has to publish/ come up with. An adequate representation of the split reading requires then that the NP has be in the scope of the modal operator while the degree quantifier takes scope over the modal. Note that this does not immediately mean that mean also the individual quantifier is below the modal? That conclusion depends on the specific assumptions about the compositional properties of the individual quantifier. Under the current assumptions according to which the individual quantifier is denoted by *many* which works essentially like any other determiner in that it takes an NP argument and a VP argument, the individual quantifier and the NP are inseparable. Therefore, splitting off the degree quantifier from the NP as required to represent the salient reading of the sentences in (129) entails that the degree quantifier is separated from the degree quantifier.[71]

The fact that split readings do exist seems to constitute an insurmountable obstacle for the GQT approach to comparative quantifiers. To represent that reading, we need the degree quantifier take scope higher than the modal operator while the individual quantifier takes scope below the modal operator. Obviously, this means

[71] At the end of the next chapter, a proposal is sketched according to which *many* can be split of from the NP. If this turns out to be correct, then, split readings discussed here do not provide support for the claim that there are two independent quantifiers in comparative quantifiers. Note however that there would be still an argument against GQT which does not allow for a separation of a determiner from its NP argument.

that there have to be two different quantificational elements inside comparative quantifiers. I.e. even if one would want to maintain an GQT account of the MNPG as discussed in the appendix of chapter 2, one would have to do so at the expense of leaving the scope splitting facts unaccounted for because GQT maintains that only the individual quantifier is syntactically active.[72] For the classical as well as the theory proposed in chapter 2 which analyze comparative quantifiers as comparative constructions on the other hand, these data are expected.[73]

3.2.2 Van Benthem's problem

Scope splitting as discussed above does not distinguish between the classical analysis and the particular proposal made in chapter 2. All that is required to explain the scope splitting data discussed in the previous section is that comparative

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[72] In unpublished work, Krifka(1998) develops an analysis of modified and non-modified numeral quantifiers (*at least three NP*, *more than three NP*, three NP, etc.) that — if suitably amended could account for the MNPG. The (amended) proposal would essentially deny the traditional constituency of [[*more than n NP*] *VP*] and propose instead the following constituency [[*more than*] [*n NP VP*]. The observations about scope splitting discussed in the text constitute a major challenge for this approach because Krifka does not assume that the particles *more than, etc.* are actually degree operators. Instead, they are analyzed as focus particles. This means that Krifka doesn't assume that there is a degree quantifier independent of the individual quantifier which is however exactly what is required to account for the scope splitting observations.

[73] This is not to say that any analysis of comparative quantifiers as comparative constructions would be able to explain scope splitting. For instance, an analysis along the lines of Kennedy's(1997) approach which denies that [–er than ...] is a degree quantifier, these data are problematic. Kennedy (1997) maintains that the comparative operator is an integral and inseparable part of the AP and can take scope only to the extent that the AP can take scope. To represent scope splitting it is required that the AP takes scope over the modal operator. Hence a structure of the form [AP_1 ... Op ... [$_{DP}\exists X\ t_1$ NP(X) ...]] has to be interpreted which seems given Kennedy's semantics for the comparative operator not clear to me how it could be done.

quantifiers contain a degree quantifier as well as an individual quantifier and that these two are syntactically independent of each other. The two lines of thinking about comparative quantifiers make however different predictions when it comes to the possibility of scope splitting where the individual quantifier out-scopes the degree quantifier. More specifically, in analyses using classic al assumptions according to which *many* is a modifier, in principle both scope orderings are possible while according the proposal developed in chapter 2 the degree quantifier always out-scopes the individual quantifier for principled reasons.

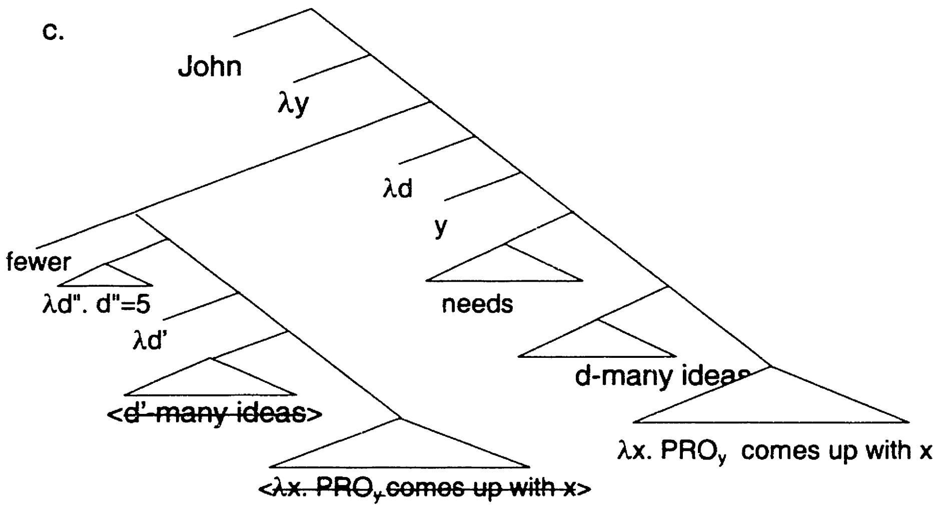
Recall that the degree quantifier was assumed to be base generated in the degree argument position of the parameterized determiner *many* and had to be moved to a clause node note only to satisfy its interpretational requirements as generalized (degree) quantifier but also to allow resolution of antecedent containment. Since the individual quantifier in comparative quantifiers is expressed by *many* itself, the claim about antecedent containment immediately predicts that the degree quantifier always has to be higher than the individual quantifier. The structure that would for instance be assigned to generate the scope splitting reading discussed in the previous section is sketched in (63).

(130) a. John needs to come up with fewer than 5 ideas.

b. [-er λd. d=5 & ~~PRO_1 comes up with d-many ideas~~] [λd. $John_1$ needs PRO_1 to come up with d-many ideas [74]

[74] The LF, unlike the tree in c, sketched in b abstracts away from *John* moving to an appropriately high position to c-command the *than*-clause as well as the matrix clause.

c.



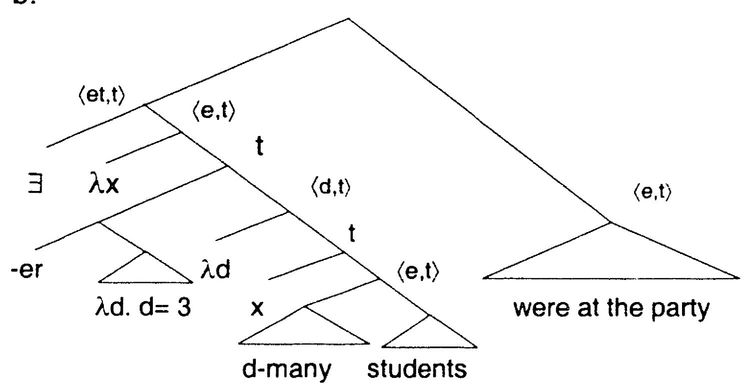
It is assumed in the tree in (63)c, that the comparative quantifier *d-many clubs* moves to a clausal node before comparative syntax is resolved. The degree quantifier [*-er than …*] then moves higher than the matrix modal verb (which is to not copied into the *than*-clause) and the subject *John* binds both instances of PRO. For principled reasons then it is impossible that the individual quantifier out-scopes the degree quantifier and the predictions of this proposal with respect to scope splitting are as schematized in (131).

(131) a. [-er than … [Op … [d-many x …]]]
b. * [d-many x … [Op … [-er than …]]

An account in the spirit of the classical analysis as sketched in chapter 1 would not necessarily make these predictions. Since *many* is treated as modifier parallel to gradable adjectives rather than a determiner, the classical analysis predicts also the possibility that the individual quantifier takes scope over the degree quantifier – if it is assumed that there is a clausal node inside the DP (or AP) that provides the relevant environment to support comparative syntax. Since *many* would be treated as modifier parallel to *tall* rather than as determiner, some other determiner has to do the work of combining the DP with the rest of the clause. A standardly held assumption[75] is that there is a phonetically empty determiner with the semantics of an existential quantifier ("∃") which closes the whole DP [*more than three students*]. The structure that would result using these assumptions is sketched in the type-annotated tree in (132)b.

(132) a. Fewer than three students were at the party.

b.



As long as the DP (as assumed here for convenience) or the AP provides a clausal node so that the degree quantifier can be interpreted, the individual quantifier can out-scope the degree quantifier. The specific assumption made in the tree in (132) is that DPs have a subject position (possibly filled by PRO) that is later on abstracted over to satisfy the semantic needs of the determiner. However nothing in the present discussion will distinguish this particular stipulation from the one were the clausal

[75] E.g. Link(1987), etc.

node is provided by the AP (or both).[76] Under these assumptions, it is possible that the individual quantifier out-scopes the degree quantifier. In fact the basic order reflects this particular scope relation.

Allowing for this possibility introduces however a well-known problem — often referred to as van Benthem's problem — that in fact any adjectival theory of indefinites faces with decreasing quantifiers.[77] Consider the truth-conditions that are derived assuming a structure similar to (132) as given (133)b and paraphrased in (133)c.

(133) a. Fewer than three students came to the party.

b. ⟦*Fewer than three students came to the party*⟧ = 1 iff $\exists X$ [max {d: X is a d-numerous set of students} < max {d: d=3} & X came to the party]

c. "There is a set of students whose cardinality is smaller than three and that came to the party"

Van Benthem's problem is that the truth-conditions given in (133)b are decidedly too weak. Since it is always possible to find a smaller subset satisfying the cardinality requirement of the comparative determiner, the sentence would be predicted to be true even if there is a set of students with cardinality bigger than three that came to the party.

The general solution to van Benthem's problem is to have the maximality operator that is part of the semantics of the comparative morpheme take scope over the

[76] We note in passing that this structure does not predict the MNPG. The VP is not an argument of *many* and will therefore not be interpreted inside the *than*-clause. This is however exactly what is required to account for the MNPG.

[77] Cf. Winter(1998), Landman(200o) for recent discussion.

existential individual quantifier. Compare the LF-sketch and its associated truth-conditions in (133) with the one in (134) which assumes that the comparative operator out-scopes the individual quantifier.

(134) a. ⟦*Fewer than three students came to the party*⟧ = 1 iff [max {d: ∃X st. X is a d-numerous set of students & X came to the party} < max {d: d=3}

b. "The maximal degree to which there is a set of students that came to the party is smaller than the degree 3"

The analysis proposed in chapter 2 automatically and only generates an LF as sketched in (134) and avoids therefore van Benthem's problem for principled reasons.[78] The alternative sketched above however has to provide an additional reason why the narrow scope for the degree-quantifier never occurs with monotone decreasing determiners.

It is conceivable that such a reason could come "for free". Since the scopal relation that give rise to van Benthem's problem essentially result in trivial truth-conditions (as long as the NP restrictor is not empty) one could simply appeal to the fact such a sentence would be essentially useless. I.e. one could appeal to one of the Gricean rules of proper conversation (e.g. "make the strongest statement supported by your knowledge") to exclude the narrow scope structure. I'd like to argue that such a pragmatic solution is insufficient.

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[78] Note that the GQT approach provides exactly the same solution to van Benthem's problem as the proposal in chapter 2 albeit everything is happening in the meta-language. Recall from chapter 1 that the sematnics for *fewer than three* would be as in (i). "| |" corresponds to "the maximal degree d st. ...

(i) ⟦*more than three*⟧ = $\lambda \mathbf{P}.\lambda \mathbf{Q}.\ |\mathbf{P} \cap \mathbf{Q}| < 3$

Let's take a closer look at this pragmatic solution of van Benthem's problem. The account is that the wide scope reading is chosen because it is the stronger of two possible statements. Not only that, the structure that gives rise to van Benthem's problem actually has trivial truth-conditions because any number of students at the party – even if there are zero students – will verify the sentence. Therefore, the structure that gives rise to van Benthem's problem should always lose out over the competing structure that assigns wide scope to the degree quantifier.

Note however, that it is possible to make a sentence under the van Benthem scope relation have non-trivial truth-conditions. We simply need to add another condition. For instance the sentence in (135)a does not have trivial truth-conditions anymore – even if the individual quantifier out-scopes the degree quantifier.

(135) a. Fewer than 10 but more than three students came to the party.
b. More than three students came to the party.

As a matter of fact, the truth-conditions of (135)a are exactly the same as the truth-conditions of (135)b if (135)a has a parse in which the individual quantifier out-scopes the degree quantifier. The reading seems to be however not available, i.e. the two sentences in (135) are judged to have different truth-conditions. Notice however that this does not show that the reading in question is structurally not available for (135)a. We can appeal to the Gricean maxim of brevity to explain why the reading in question is not detectable for (135). A sketch is given in (136).

(136) a. The speaker uttered "Fewer than 10 but more than three students came to the party."

b. If the speaker wanted to convey the meaning that more than three students came to the party, she could have done so in a different/shorter manner. Specifically, the speaker could have uttered "More than three students came to the party."

c. Since the speaker didn't use the form that would be preferred by brevity, there must have been a reason to use the longer form.

d. The reason is that the longer form has also a stronger meaning than the shorter form.

e. Therefore, the speaker intended to convey the stronger meaning.

This reasoning then will explain why the weaker reading is not detectably for sentences like (135)a. By the same token, we might suspect that the stronger reading of (135)a is not a structural property of the sentence but arises as quantity implicature. I.e. the Gricean reasoning opens up the possibility that the sentence in (135)a actually has only the structure in which the individual quantifier takes scope over the degree quantifier. The interpretation is simply strengthened via quantity implicature based on brevity.

(137) a. Fewer than 10 but more than three students came to the party.

b. Truth-conditions supported by the structure:

"There is a set of students whose cardinality is bigger than three and smaller than 10 st. that set of students came to the party."

c. Implicature:

"There is no set of students with cardinality 10 or bigger that came to the party."

If this were the case, we would expect to be able to cancel the quantity implicature which seems to be unexpectedly difficult as the failed attempt in (138) indicates.

(138) a. I was really disappointed because fewer than 10 students came to the party.

b. # In fact 11 students came to the party.

We can sharpen this test even further Consider the sentence in (139)a.

(139) a. ?? Fewer than 10 but more than 9 students came to the party.

b. More than 9 students came to the party.

(139)a is decidedly awkward. It is either interpreted as contradiction or one is forced to consider an amount of students at the party that is between 9 and 10. I.e. one is forced to interpret the sentence as saying something like 9 ½ students came to the party. But this interpretation is awkward given world knowledge. If the stronger meaning would simply arise as an implicature, surely we would expect that the implicature is suspended given the fact that the stronger meaning is contradictory and therefore entirely unfit to communicate information. I take these observations to show then that the reading generated by the structure that has the degree quantifier take scope over the individual quantifier is a true property of the structure itself and does not simply arise as quantity implicature.

The next question to ask is why it appears to be impossible to interpret the sentence in (139)a as its truth-conditional twin given in (139)b? I.e. why are we forced to assign a contradictory meaning to that sentence which should be just as unusable as a sentence with trivial truth-conditions. Note that the unavailability of a non-contradictory reading for (139)a is predicted if the only structure that is available for the sentence is the one in which the degree quantifier takes scope over the individual quantifier.

A defender of a pragmatic approach on the other hand will of course not fail to point out that these facts can be explained again by appealing to brevity. Since the missing reading would have exactly the same truth-conditions as the sentence in (139)b which is much less prolific than its competitor in (139)a that reading is blocked. That means, the fact that (139)a is judged to be contradictory does not show that the reading generated with narrow scope for the degree operator isn't structurally supported. It simply shows that the reading isn't available because it is blocked by the briefer competitor.

Intuitively this stance is not very appealing because the effect seems rather striking to me and uncharacteristically strong to be explained by a pragmatic rule that prefers a shorter way of conveying the same information over a longer one. This is of course not a knockdown argument against a pragmatic account. Can we show that appealing to blocking by brevity is not sufficient to explain the effect in (139)?

Notice first of all that the availability of *more than n-1* does not block the use of *no fewer than n* even though the latter is arguably longer than the former. Appealing to brevity then has to be supplemented by a theory that tells us when exactly one form counts as more prolific than its competitor. For the contrast in (139), a natural guess for why brevity matters in this case would be to notice that the longer form is a conjunction of two determiners[79] while the competitor has no conjunction. It is easy to see that this is not sufficient though. That the brevity condition has to be more sensitive still because in this general form it would also predict that (140)a would be blocked by (140)b contrary to fact since *fewer than n but at least n-1* yields the same truth-conditions as *exactly n-1* (keeping fractions out of the picture).

(140) a. Fewer than 10 but at least 9 students came to the party.
b. Exactly 9 students came to the party.

A more sensitive condition for brevity is therefore required and a promising candidate seems to be something like this: the longer version of expressing the same meaning is blocked by the shorter expression if the longer is a conjunction of the shorter and an expression that doesn't contribute any additional information. However, at least on a cursory inspection of the dat,a this seems to be not a correct generalization either. Consider for instance the examples in (141).

(141) a. Between 9 and 10 or 11 students came to the party
b. Between 9 and 11 students came to the party

(141)a has exactly the same truth-conditions as (141)b. It also fits the structural description of the most recent version of the brevity condition and should therefore be blocked contrary to fact.[80]

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[79] It is not essential to the argument whether the determiner s are conjoined or some other constituent.

[80] (141)a might sound slightly odd however it is clearly not on par with (139)a.

I will leave it at these cursory remarks and tentatively conclude, that van Benthem's reading for decreasing comparative quantifiers is — if available at all — confined to meta-linguistic discourse. If this is correct, then scope splitting as schematized in (122)b and repeated below does not occur either simply because the structure in which the individual quantifier takes scope over the degree quantifier does not occur.

(142) a. [-er than ... [Op ... [∃**X** st. **X** is d-many ...]]]
b. *[∃**X** ... [Op ... [-er than ...] & **X** is d-many]]

Under classical assumptions, which generate the reading and attempt to exclude it on pragmatic grounds, this is unexpected. The proposal in chapter 2 however predicts this asymmetry and is therefore empirically better supported.

3.3 The many problems with *MANY*: Amount Relatives in Disguise

There is another set of phenomena concerning interactions with other determiners in the DP where the classical analysis and the proposal defended in chapter 2 make radically different predictions. While the former treats *many* as modifier similar to other gradable adjectives and therefore requires a determiner on top of the comparative, the latter maintains that *many* itself is a determiner. Hence it shouldn't be possible to stack another determiner on top of comparative determiners. The second prediction seems to be false given well-known facts as in (143).

(143) a. The many guests all brought presents.
b. ? The more than three guests all brought presents.

While the sentences in (143) aren't quite unobjectionably grammatical they are certainly not crushingly bad as one would expect if there were no determiner position available on top of *many*. This seems to be a real challenge for the proposal of *many* as parameterized determiner while it speaks in favor of the classical treatment. Fortunately, things are more complicated. First, if it were really the case that there is a freely available determiner slot on top of *many*, we would expect all kinds of determiners to be grammatical in that position. This is however clearly not the case as already the few data in (144)-(145) show.

(144) a. * Several/most/... many guests brought presents.
b. * Several/most/... more than three guests brought presents.

(145) a. * Some many guests brought presents.
b. * Some more than three guests brought presents.

The data in (145) are particularly interesting as there is no obvious reason why these sentences should be ungrammatical since they have grammatical counterparts. I.e. sentences in (145) simply use the overt version of the alleged covert existential quantifier that closes the DP according to the classical analysis. That is to say, both the classical approach and the proposal of *many* being a determiner have some explaining to do here. The former have to explain why it is that only a covert existential operator or an overt definite can head the DP embedding an amount comparative structure while the latter has to explain how it is possible to stack a determiner on top of a determiner and why this can only be done if a restricted set of determiners.

It is quite obvious that the proposal of *many* as parameterized determiner is forced to give a radically different analysis to the sentences in (143) than the classical approach. Specifically, since it is not possible to stack two determiners on top of each other, it has to be the case that each of these determiners heads their own DP. Even more radically, since *many* is a determiner that needs a clausal environment to be interpretable, the conclusion we are forced to is that there is a clause hidden inside the DP headed by the definite determiner. I would like to suggest specifically that these DPs contain a disguised amount relative clause that provides the right environment for the comparative quantifier. I.e. I submit that the sentences in (143) should be analyzed similarly to the sentences in (146) which are taken to contain amount relatives as briefly discussed in chapter 2.

(146) a. The many guests <u>that there were</u> all brought presents.
b. The more than three guests <u>that there were</u> all brought presents.

The true syntax of amount relatives has to my knowledge not yet been discovered.[81] Since I will have nothing insightful to contribute to this debate here, I will simply assume that at least for the purpose of this discussion, amount relatives can be thought of as appositive relative clauses and hope that the observations to be

[81] cf. Carlson(1977a), Heim(1987), Grosu&Landman(1998), Sauerland(1998) for discussion..

discussed below will also be explainable by the ultimately correct analysis of amount relatives.

There are two advantages to the claim that the sentences in (143) are amount relatives in disguise. First it is known that amount relatives have specific requirements on the external determiner. Carlson(1977a) observes that only universal determiners (*every,* free choice *any, all*), definites and partitives based on definites can head a DP containing an amount relative.[82] The set of determiners that can embed a comparative determiner appears to be a subset of those as the data in show.

(147) a. * Several/most many/more than three guests brought presents.
b. * Every many/more than three guests brought presents.
c. * All/any many/more than three guests brought presents.

(148) a. Most of the many/more than 20 guests brought presents.
b. All/every one of the many/more than 20 guests brought presents.

The generalization that emerges here is that only definites and partitives based on definites can license an amount comparative inside the DP.[83]

The second advantage of to the analysis of sentences as in (143) as disguised amount relatives is that *many* is provided with a different scope argument than the matrix VP (which is the scope argument of the higher definite determiner). D-*many* is

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[8282] Grosu&Landman(1998) propose that the unifying property of these determiner is that they preserve maximality which they assume to be an essential component of the semantics of amount relatives.

computed inside the DP and does not have access to the matrix anymore. This predicts that the minimal number effect should disappear in those cases. Interestingly, this is exactly what happens as the contrasts in (149) and (150) show.

(149) a. ?? More than three students were standing in square formation.
b. The more than three students that there were were all standing in square formation.

(150) a. ?? More than two students were forming a triangle.
b. The more than two students that there were were all forming a triangle.

The contrast in (148) and (149) are exactly as predicted under the assumption that comparatives under the definite determiner are disguised amount relatives. Since the conclusion that these structures are amount relatives was virtually forced upon us given the proposal that *many* is a determiner, these data lend further support to the proposal developed in chapter 2.

3.4 Summary

In the present chapter, two sets of non-trivial predictions of the proposal that *many* is a parameterized determiner were discussed. Both predictions were argued to be essentially correct and provide therefore further support for the theory developed in this thesis. The first set of predictions concerned the phenomenon of "scope splitting." The term refers to facts that seem to indicate that there are two

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[83] An important question is, why it is only a subset of the determiners that license amount relatives. I

independent quantifiers inside the comparative quantifiers — one quantifier encoded by [*–er than* ...] ranges over degrees and the other ranges over individuals. The evidence that was discussed (based on work by Heim(2000)) in support of this position were cases in which the degree quantifier seemed to take scope over an intervening operator while the individual quantifier had to take scope under the intervener. This facts showed that there are two syntactically independent quantifiers inside comparative quantifiers which is an immediate an seemingly insurmountable argument against the GQT approach to comparative quantifiers for which it is virtually a defining characteristic that none of the degree semantics is assumed to be syntactically active.

The predictions that proposal developed in chapter 2 makes with respect to scope splitting are however more specific. In particular, scope splitting is predicted to be possible only in the form of a higher degree quantifier being separated from the lower individual quantifier by an intervening operator as schematized again in (151)

(151)a. [-er than ... [Op ... [d-many x ...]]]
b. * [d-many x ... [Op ... [-er than ...]]

The reason for this specific set of predictions is that for principled reasons the degree quantifier always has to take scope over individual quantifier. In this respect, the proposal developed in chapter 2 is different from an analysis of comparative quantifiers as comparative constructions based on classical assumptions. An

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will have to leave addressing this question for future research.

argument in favor of the first position was presented based on the fact that it automatically provides the general solution to van Benthem's problem with decreasing quantifiers while analysis based on classical assumptions has to add an additional stipulation to the effect that the degree quantifier always out-scopes the individual quantifier in case of decreasing comparative quantifiers.

The second set of facts concerned apparent counter examples to the claim that *many* is a parameterized determiner. The expectation that is seemingly in conflict with the facts is that it shouldn't be possible to stack another determiner on top of *many* and comparative determiners in general. It turned out however that these alleged counterexamples had an alternative analysis as disguised amount relatives. This predicted that the minimal number effects would disappear in exactly these cases of comparative quantifiers. This prediction was shown to be borne out and therefore lend further support for the proposal that *many* is a parameterized determiner.

Chapter 4

Amount Comparatives and Plural Predication

4.1 Introduction

The analysis of amount comparatives proposed in chapter 2 was developed in order to account for facts that showed that the numeral/measure phrase in amount comparatives interacts with material seemingly outside of its reach. The discovery of these facts and their analysis in terms of a comparative syntax for comparative quantifiers concluded the first argument against the GQT treatment of comparative quantifiers as idiomatic expressions. In chapter 3, it was argued that also the degree quantifier that is assumed to be part of the structure of comparative quantifiers according to the proposal developed in chapter 2 is syntactically active. Specifically, it was argued that the degree quantifier can be detected via scope interactions with other scope bearing elements in the DP as well as in the matrix clause. Both chapters provide compelling arguments against the Generalized Quantifier Theory approach to comparative quantification according to which none of the semantically essential components of comparative quantifiers (comparative operator, measure phrase and degree function) is syntactically transparently realized.

The present chapter develops a similar argument showing that the degree or measure function denoted by the parameterized determiner *many* interacts with the matrix. Again, this is unexpected for the idioms-approach as it not only shows that the pieces that comparative quantifiers are built from retain their independent properties in comparative quantifiers but in addition these properties are transparent to their environment.

The argument for the presence of a syntactically realized measure function in the form of *many* inside comparative quantifiers that is presented in this chapter relies on the one hand on a specific property that measure functions in general have — they are defined only for those individuals that can in principle have the property in question to some degree — and on the other hand on assumptions about how plural morphology and semantics interact to express reference to pluralities which will be assumed to be the entities in the domain of *many*.

4.2 Gradable Predicates as Measure Functions[84]

Fundamental to any comparative construction is a gradable predicate (that I have referred to in a somewhat lose way of talking using the label "degree function") Gradable predicates as expressed for instance by adjectives such as *tall, long* or *old* that can be true of individuals to a smaller or larger degree.[85] They contrast with non-gradable ones such as the ones expressed by the adjectives *rectangular* or

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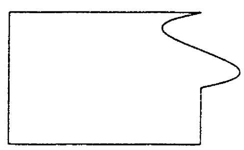
[84] There is excellent literature — see e.g. von Stechow(1984), Bierwisch(1987,1989), Klein (1991) and Kennedy (1997) — that discusses the issues that will be simply introduced here as needed thoroughly and insightfully so that I can limit myself here to the minimum that is needed to develop these basics for the special case of amount comparison (the specifics of which on the other hand haven't been much discussed.) The assumptions used in this thesis are for the most part entirely standard; non-standard assumptions will be introduced and justified only as needed.

[85] I will use adjectives to introduce the basics of the analysis of comparatives. In English, gradable expressions can also be nouns, NPs, adverbials and VPs.

dead. The intuition is that an object is either rectangular/dead etc. or it is not. There is no sense in which an object could be rectangular/dead to some degree.[86] For instance the figure in (152) is not 75% rectangular even though it satisfies a seemingly reasonable definition of rectangularity to 75% (i.e. it has three out of the required four angles with 90 degrees and it is closed.)

(152) ?? The figure below is 75% rectangular.



In the previous chapters, we have encoded the difference between expressions denoting gradable functions and expressions that denote non-gradable functions simply by stipulating that the former but not the latter have an additional argument slot that is to be filled by a degree description. Sample entries that display the contrasting assumptions are given in (153) and (154).

(153) a. $[\![tall]\!] = \lambda d \in D_d.\lambda x \in D_e.$ x is d-tall

b. $[\![warm]\!] = \lambda d \in D_d.\lambda x \in D_e.$ x is d-warm

(154) a. $[\![rectangular]\!] = \lambda x \in D_e.$ x is rectangular

b. $[\![dead]\!] = \lambda x \in D_e.$ x is dead

[86] There are closely related predicates like *satisfies the criteria for rectangularity, is similar to a rectangular object*, etc. that are gradable. Some contexts force initially non-gradable properties to be interpreted as gradable property.

The lack of a degree argument explains the awkwardness of constructions such as comparatives with non-gradable adjectives that require a degree argument.

(155) a. ?? The figure above is very rectangular.
b. ?? The figure above is more rectangular than a pentagon.

The assumption that gradable predicates are expressed by elements with a degree argument while non-gradable ones are not is however not sufficient to explain even very basic observations about degree predicates. Consider the awkwardness of sentences such as the ones in (156).

(156) a. ?? The Atlantic Ocean is (on average) 6 feet tall.
b. ?? John is 2 feet long/longer than Bill.
c. ?? Newton's theory of gravitation is wealthier than Einstein's.

Even though both *tall* and *long* are degree functions as evidenced by the fact that they occur in comparative constructions or by the even more elementary observation that they can take measure phrases as arguments, they cannot be predicated of any run of the mill individual. It appears that degree predicates also have specific requirements on the individuals they can be applied to. Minimally, what seems to be required is that the individuals can have the property to some degree. Theories for instance aren't wealthier than others simply because they cannot own anything. Hence they are also not wealthy to some degree which explains the awkwardness of (156). Analogous observations can be made with respect to the degrees that gradable predicates can take. Consider (157).

(157) a. ?? John is 98 degrees Fahrenheit tall.

b. ?? The Atlantic Ocean is 10 kilometers square deep.

It appears then that each gradable predicate has its own domain of individuals for which it is defined and is associated with a specific scale (temperature, various physical extents, etc.) that their degree arguments have to be belong to. In the lexical entries of expressions that express degree function we have to add requirements to that effect. To find a proper format of adding these conditions, it is important to clarify what it means to be tall or to have some height — in general to have a property to some degree. The answer that is typically given to that question and that I will adopt as well is that the individuals in the domain of a degree functions "can be ordered according to the predicate expressing the degree function." Here are the same entries slightly update with definedness conditions on both the degree argument and the individual argument.

(158) a. $[\![\textit{tall}]\!] = \lambda d \in D_{Height}.\lambda x$: $x \in D_e$ & x can be ordered wrt. height. x is d-tall

b. $[\![\textit{warm}]\!] = \lambda d \in D_{Temperature}.\lambda x$: $x \in D_e$ & x can be ordered wrt. temperature. x is d-warm

Of course we still need to clarify what it means to be orderable with respect to property P. The theory of measurement provides the tools to do that in form of the notion of a "measure function." Following Krantz et. al. (1971) and abstracting away for the moment from any linguistic applications, a measure function can be seen as function that maps individuals to degrees. Obviously, not any mapping between individuals and degrees should be viewed as measure function. Only those mappings are considered measure functions that perform the mapping in an order-preserving manner. The notion of order preservation, presupposes that the domain of measure functions is already an ordered set. Following Krantz et.al. (1971) I will assume that the partially ordered domain required by measure functions has to at least satisfy the condition for a weak order as defined in (159). Based on that the notion of an ordinal measure function can be defined as in (160).[87]

(159) Definition: Weak Order

Let A be a set of individuals and $\leq_A$ a binary ordering relation on A. The relational structure $<A,\leq_A>$ is said be a weak order iff

i. $\forall x,y \in A$ either $x \leq_A y$ or $y \leq_A x$ (connectedness)
ii. $\forall x,y,z \in A$ if $x \leq_A y$ and $y \leq_A z$ then $x \leq_A z$ (transitivity)
iii. $\forall x \in A$ $x \leq_A x$ (reflexivity)

(160) Definition: Ordinal Measure Function

Let A be a weakly ordered set with $\leq_A$ representing the ordering relation. A function μ from A to degrees D is an ordinal measure function iff

$\forall x,y \in A$, if $x \leq_A y$, then $\mu(x) \leq_D \mu(y)$ (order preservation)

Returning to linguistic applications of these notions, we note that the lexical entries given in (158) bear close resemblance to the notion of measure function as characterized in (160). In fact we can view gradable predicates essentially as expressing measure functions, albeit with a somewhat different hierarchical structure. While measure functions as defined in (160) are functions from individuals

[87] Lateron, we will assume that the measur functions needs to be additive.

to degrees, the lexical entries for adjectives such as *tall* stipulates that they denote functions from degrees to functions from individuals to truth-values. A bit more sloppily[88], we could say that a gradable adjective denotes a function from a degree to a set of individuals such that all of the members of the set have the gradable property to the degree specified by the innermost argument.[89]

Before moving on to apply these ideas to *many* which was argued to be a degree function like *tall* albeit with the syntax of a determiner, let's consider how the attributive version of a gradable adjective can be given. Recall from chapter 2 that attributive and predicative adjectives are assumed to have closely related meanings with the former requiring one more argument. It seems plain that the ordering requirement of the attributive measure function extends to its NP argument. Otherwise, the NP of a gradable adjective wouldn't have to range over individuals that are in the domain of the measure function and sentences as in (161) should be acceptable.

(161) a. ?? The Atlantic Ocean is a tall body of water.
b. ?? John is a longer guy than Bill.

These facts show that the NP argument of gradable attributive adjectives needs to range over individuals that can be *tall, long,* etc. In other words the NP inherits the

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[88] Strictly speaking, the move from functions to sets is only valid between characteristic functions and their corresponding set. Degree functions however are partial functions as argued above and can therefore not be represented by the set of individuals that get the value one assigned.

[89] Cf. Kenndy(1997) for a proposal for the meaning for gradable adjectives that mimics the abstract definition of a measure function closer than the proposal made here.

definedness condition from the adjective. A lexical entry for the attributive version of *tall* that encodes this explicitly is given in (162) — although presumably it is more appropriate to think of the definedness condition on the NP argument as an instance of presupposition projection rather than a lexically encoded condition.

(162) a. $[\![tall_{Pred}]\!] = \lambda d \in D_{Height}.\lambda x$: $x \in D_e$ & x can be ordered wrt. height. x is d-tall

b. $[\![tall_{Attr}]\!] = \lambda d \in D_{Height}.\lambda f$: $f \in D_{\langle e,t \rangle}$ & $\forall y\ [f(y)=1 \rightarrow$ y can be ordered wrt. height.λx: $x \in D_e$ & x can be ordered wrt. height. $f(x) = 1$ & x is d-tall

4.3 Measuring Quantity: Amounts and Cardinalities[90]

To see how the ideas discussed in the previous section can be extended to *many*, it is convenient to think of *many* in a first step as modifier rather than as parameterized determiner. The strategy is clear: since *many* expresses as degree or measure function, it will return after absorbing the degree argument a function that is defined only for individuals that can have the property that *many* measures to some degree. Since *many* measures the cardinality of entities that in some sense correspond to sets of individuals, the value of *many* will be a function that is only defined for individuals that can be ordered with respect to cardinality. That means that we can give (163) as first approximation of a lexical entry for *many.*

[90] I use in this section "quantity" as a cover term for both measurements of sets (cardinalities) and of masses (amounts). In the rest of the thesis "amount" and "quantity" are used interchangeably.

[91] Strictly speaking, the domain of *many* as given in (163) is the set of natural numbers while its range

(163) $[\![many_{Attr}]\!] = \lambda d \in D_{Cardinality}.\lambda f: f \in D_{\langle e,t\rangle}$ & $\forall y$ [f(y)=1 $\rightarrow$ y can be ordered wrt. cardinality.λx: $x \in D_e$ & x can be ordered wrt. cardinality. f(x) =1 & x is d-many

The next step is to consider how the entities in the domain of *many* are linguistically referred to. In other words, the question is what the domain of the function is that *many* returns after absorbing the degree argument. I'd like to propose that these entities are pluralities as for instance denoted by plural marked common nouns. Even though this is a natural hypothesis, it is worth seeing just how pluralities could be the kind of entities that fit exactly the structure described above. (Notice that I will sometimes use a shorthand and somewhat sloppy way of referring to the definedness condition of *many* by saying that its domain is the set of pluralities.[91])

Excursus: The Denotation of (Plural) Count Nouns

While singular count nouns were assumed to denote characteristic functions of sets of individuals, a plural marked count noun intuitively denotes the set of all non-empty subsets (i.e. the power set formed over the set of individuals - $\varnothing$) of the set denoted by the singular noun. Every since Link(1983) this simple notion of plural reference has been assumed to be insufficient. Instead a mereological approach is commonly assumed according to which pluralities are mereological sums of individuals. I will

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is a function from individuals to truth-values (in the case of the predicative version). The domain of that function is a set of entities that can be measured by the cardinality of function encoded by *many*.

essentially follow this tradition (although little depends in the coming discussion on the specific choice) and adopt the following assumptions.

The domain of individuals D is closed under mereological summation symbolized by the familiar $\oplus$ - symbol which is an instantiation of the Boolean join operation and can be defined as in (164) based on the notion of individual part $\leq_i$ defined in (165).[92]

(164) Definition: individual sum $\oplus$

For any $x,y \in D$, $x \oplus y$ is the unique $z \in D$ such that

(i) $\forall u\, [u \leq_i x \text{ or } u \leq_i y \rightarrow u \leq_i z]$ and
(ii) $\forall z'[\forall u[u \leq_i x \text{ or } u \leq_i y \rightarrow u \leq_i z'] \rightarrow z \leq_i z']$

(165) Definition: individual part $\leq_i$

For any $x,y \in D$,

(i) $x \leq_i x$
(ii) $x = y \text{ iff } \forall z\, [z \leq_i x \rightarrow z \leq y \;\&\; z \leq_i y \rightarrow z \leq_i x]$
(iii) $x \leq_i y \text{ iff } \forall z\, [z \leq_i x \rightarrow z \leq_i y]$

That is the domain of individuals contains atomic as well as non-atomic individuals where atomic individuals can be defined as those that do not have any proper individual parts. Given these definitions the lexical entry for the plural morpheme *PL* can be given with the help of the familiar *- operator as in (167).

(166) Definition: *-operator

Let x be a set. Then *X is the smallest set that satisfies the following two conditions:

(i) $X \subseteq {}^*X$
(ii) $\forall y \forall z[[y \in {}^*X \;\&\; z \in {}^*X \rightarrow y \oplus z \in {}^*X]$

[92] The definitions are adopted from Heim(2000) lecture notes.

(167) $[\![PL]\!] = \lambda f \in D_{\langle e,t\rangle}.\ \lambda x \in D_e.\ x \in {}^*\{y: f(y) = 1\}$[93]

The important point for our purposes here is that according to the lexical entry for the plural morpheme, plural marked NPs denote a set of pluralities or individual-sums that can be ordered. I will argue that it is possible to do that in the way required by the measure function *many.* The ordering relation that will be exploited is the individual part of relation ($\leq_i$).

For much of the discussion to follow, a simpler and more intuitive notation according to which the individual sum operator can be viewed as set union is adopted creating a complete join semi-lattice. This leads to a more intuitive way of stating the semantics of *many.* Consider the structure $<\wp(\mathbf{A})\backslash\varnothing, \subseteq>$ where $\wp(\mathbf{A})$ is the power set over **A** satisfies the axioms of a complete join semi-lattice with set union "$\cup$" representing the join operation as can be easily verified. If the extension of *student* is for instance the set A = {a,b,c}, then $\wp(\mathbf{student})\backslash\varnothing$ = {{a},{b},{c},{a,b},{a,c},{b,c},{a,b,c}}. This set of sets can be ordered with respect to the subset relation. A familiar way of representing the inherent order in this structure is in terms of a Hasse-diagram as in (171). Assuming that the system doesn't distinguish between

[93] This lexical entry of the plural morpheme does not exclude atomic parts of pluralities which is controversial assumption. See e.g. Ojeda(1993) for a similar position and below for arguments in favor of it.

[94] The structures are isomorphic to Link's individual sums, however — assuming Quine's innovation — more intuitive.

[95] Additivity is required to be able to analyze differential comparatives such as "John read two more books than Bill."

singletons and their element — Schwarzschild(1996) calls this "Quine's innovation" — then the structure can be presented equivalently as in (168)b.[94]

(168)

As before, atomic individuals in the lattice are those that do not have any proper parts. The relevant definition is given in (169).

(169) Definition: <u>Atomic individuals</u>

Let $<\mathbf{A},\leq_{\mathbf{A}}>$ be a complete join semi-lattice under $\sqcup_{\mathbf{A}}$. $\forall x \in \mathbf{A}$

x is an <u>atomic individual</u> in $\mathbf{A}$ ($At(x) = 1$) iff $\neg \exists y \in \mathbf{A}\ [y \leq_{\mathbf{A}} x]$

Based on this ordering, we can think of the measure function "the cardinality of" along the lines discussed above. Specifically, the "cardinality of" is a function that maps elements of the structure $\langle \wp(\mathbf{A})\backslash\varnothing, \subseteq\rangle$ (or equivalently individual sums) in an order preserving way to natural numbers as follows:

(170) Definition: <u>Additive Measure Function ("the cardinality of") for (complete) join semi-lattice</u>

Let $<\mathbf{A},\leq_{\mathbf{A}},\sqcup_{\mathbf{A}}>$ be a relational structure with $<\mathbf{A},\leq_{\mathbf{A}}>$ a complete join semi-lattice closed under $\sqcup_{\mathbf{A}}$. A function μ from $\mathbf{A}$ to degrees $\mathbf{D}$ is an <u>additive measure function for</u> $<\mathbf{A},\leq_{\mathbf{A}}>$ iff

i. $\forall x,y \in \mathbf{A}$ if $x \leq_{\mathbf{A}} y$ then $\mu(x) \leq \mu(y)$ (order preservation)

ii. $\forall x,y \in \mathbf{A}$ if $\neg\exists z\ [z \leq_{\mathbf{A}} x$ and $z \leq_{\mathbf{A}} y]$ then $\mu(x \sqcup_{\mathbf{A}} y) = \mu(x) + \mu(y)$ (additivity)[95]

Notice that the definition in (170) is sufficient to allow only mappings into the natural numbers; which corresponds to counting. To see how this is made sure, consider the additivity condition which requires that for any non-overlapping pair of elements in an ordered structure the degree assigned to the join (concatenation) of the two elements is equivalent to the addition of the degrees that the measure function assigns to them independently. If we were to measure the lattice in (171) only the assignment given in the first column (or multiples of it) is well-formed.

(171) a.

{a,b,c,d}	→	4	#2
{a,b,c} {a,b,d} {a,c,d} {b,c,d}	→	3	#??
{a,b} {a,c} {a,d} {b,c} {b,d} {c,d}	→	2	#1

In particular, it is not possible to take the lowest element as providing the unit or measurement (i.e. cardinality "1"). This is the case because the supremum is the join of two sets which would have cardinality 1 and by the axiom of additivity, the supremum would have to have cardinality 1+1 =2. But this leaves the three membered sets un-measurable with respect to cardinality. I.e. these would have to be mapped to a natural number between 1 and 2 which doesn't exist.

Back to the linguistic applications. Assuming that it is possible to define a measure function that intuitively counts the elements of a set in the way given in (170) which maps pluralities to numbers in an orderly fashion, the next question is how we can make use of this in the analysis of *many.* Recall from before the excursus that the assumed syntax of *many* as modifier in analogy with gradable adjectives prompted the question what the domain of the function is that *many* yields after absorbing the degree argument. The suggestion was that it is a function from pluralities to truth-values. Now we are in the position to see the intuition behind this suggestion. We know from the discussion about the definedness condition of degree functions, that the NP argument of a gradable attributive modifier has to range over individuals that satisfy the definedness condition of the degree function. In the case of *tall* for instance, it had to be possible to place the individuals in an partial order according their height. The analogous reasoning for *many* requires that the NP argument of the modifier *many* denotes a function whose domain is a set of individuals that can be ordered with respect to their cardinality. In other words, the domain of the NP has to be a set of individuals that correspond to sets (i.e. entities that have non-trivial cardinality). A singular count noun for is instance – assuming as is commonly done that it would range over atomic individuals – would have a domain that could only be trivially ordered with respect to cardinality. I.e. every element in the domain would be assigned the same rank on the numerosity scale. This is arguably not sufficient to license the application of a degree function that measures the cardinality of individuals.

Notice that in the discussion above, it was assumed contrary to the proposal made in chapter 2, that *many* is a modifier. How can we combine the insights gained in the previous section with the claim that *many* actually has the properties of a determiner rather than those of a modifier? I'd like to proceed in two steps.

First, recall that according to the treatment of *many* as parameterized determiner argued for in chapter 2 and 3, both the NP and the VP are arguments of the *many*. In analogy to the previous section, we might expect that the definedness condition of the measure function expressed by *many* should extend not only to the NP but also to the VP since both are arguments of *many*. Assuming for the moment that the definedness condition does indeed require the arguments of *many* to denote functions from pluralities to truth-values it is predicted that both VP and NP argument should display similar "presupposition failure" effects as discussed in conjunction with *tall*. Section 4.4 is devoted to discussing evidence that seems to support this prediction.

The second step consists of inspecting a bit closer the proposal according to which *many* denotes a paramterized determiner. The relevant lexical entry now with all its presuppositions explicitly stated is given in (172).[96]

(172) $[\![many]\!] = \lambda d \in D_{Cardinality}.\lambda f$: $f \in D_{\langle e,t\rangle}$ & $\forall y\ [f(y)=1 \rightarrow$ y can be ordered wrt. cardinality. λg: $g \in D_{\langle e,t\rangle}$ & $\forall y\ [g(y)=1 \rightarrow$ y can be ordered wrt. cardinality.λx:$x \in D_e$ & x can be ordered wrt. cardinality. d -many x are such that $f(x) = g(x)=1$

It seems that at least some of the presuppositions together with the suggestion that only pluralities satisfy them are in conflict with the basic syntax and semantics of a

[96] Recall that it is not necessary to assume that all these presuppositions are lexically encoded. It might very well be that there is just one that is inherited by all other arguments of *many*.

determiner quantifier. In other words, "d-many x are st. f(x) = g(x)=1" would be a sensible way of describing the truth-conditions if d-many would bind a variable that ranges over the units of counting (atomic individuals) but not if it ranges over pluralities. So it seems that there is a true incompatibility. I would like to suggest however that it is only an apparent problem. I.e. there is a way of stating the truth-conditions of *many* that is consistent with the idea that *many* is a determiner in the sense that it takes two arguments of the same type to yield a truth-value on the one hand and on the other that it requires its arguments to range over pluralities that are not the units of counting. The proposal that I would like to make is that we have to exploit the fact that the truth-conditions are essentially those of an intersective determiner. The condition of non-empty intersection is of course the core definition of the existential quantifier. In other words, hidden in the statement of the truth-conditions associated with *many* as given in (172) is an existential condition and a cardinality condition. Therefore, so the suggestion, the lexical entry should actually be given as in (173) rather than as in (172) which does not contain conflicting requirements anymore.

(173) $[\![many]\!] = \lambda d \in D_{Card}.\lambda f: f_{Card} \in D_{\langle e,t\rangle}.\lambda g_{Card}.\lambda x: x \in D_e$ & x can be ordered wrt. cardinality. $\exists$ x st. x has d-many atomic elements & f(x) = g(x)=1

4.4 "Genuine Collective Predicates" and Comparative Quantifiers

This section discusses empirical evidence that supports on the one hand the claim that comparative quantifiers extend their definedness conditions to the VP just as one would expect if *many* were essentially like determiner taking two arguments. On the other hand it will be shown that *many* should not be analyzed completely on par with true quantificational determiners with respect to the effects discussed in this chapter since comparative can be shown to display different selectiveness than "true" quantifiers. Taking both pieces together will form yet another argument in favor of the proposal that analyzed *many* as parameterized determiner that has both properties of quantificational determiners and degree functions.

4.4.1 A preview of the argument

The argument that will be develc ɔed here can be abstractly .sketched as follows: Following Dowty(1986) it is assumed that there is an irreducible difference between genuine "collective predicates" like *be a good team, be numerous*, etc. and "essentially plural" predicates like *meet, gather,* etc. This difference manifests itself in a determiner restriction most extensively discussed in Winter(1998) according to which genuine collective predicates are incompatible with quantificational determiners. Comparative quantifiers side with regular quantifiers in this respect while bare numeral DPs like *three students* are compatible with genuine collective predicates. The reason why comparative quantifiers are incompatible with genuine collective predicates is argued to come from the fact that genuine collective predicates do not meet the requirements for the measure function *many* to apply. More intuitively, genuine collective individuals like teams, committees, etc. are not transparent for *many* to measure them in terms of how many members they have. This fact can already be seen when nouns such as *team* provide the restrictor of comparative quantifiers where the units of measurement/counting are not the individuals making up the team. Instead the units of measurement/counting are teams. It is argued that essentially the same effect can be observed when comparative quantifiers are observed to be incompatible with genuine collective VP-predicates like *be a good team.* This argues then for the main point of the thesis namely that we have to recognize the measure function inside comparative quantifiers interacting with the matrix.

Since the present account models the difference between genuine collective predicates and essentially plural predicates in terms of "countability" or "measurability" the reason for comparative quantifiers to be bad with genuine collective predicates is different from the reason why quantifiers are bad. This in turn predicts that there could be environments where regular quantificational determiners like *every, all, both,* etc. and comparative quantifiers are not parallel with respect to genuine collective predicates. In the final part of this section, such environments are discussed and argued to fit nicely into the present account stated in terms of countability while the competing account of Winter(1998) doesn't seem to be able to offer an insightful explanation.

4.4.2 Morphological and Semantic Number

One of the basic tasks of the theory of plurality is to explain which DPs that "correspond" in some way to a plurality of individuals can function as argument of predicates that are intuitively true of a plurality of individuals and — vice versa — which predicates can take such DPs as arguments. Clearly (in languages such as English) this task involves clarifying the relation between plural morphology and semantic plurality. Following Link(1983), it was proposed that morphological plural marking reflects semantic plurality in that it expresses the *-operator which can be viewed as mapping a set of individuals to the set of all its subsets (excluding $\varnothing$). Semantic plurality was simply assumed to be characteristic of *-ed predicates whose extension is a set of sets which can be ordered with respect to the sub-set relation. Unfortunately — as is well known — a straightforward 1-to-1 mapping between morphological number and semantic number is not feasible. The picture has to be complicated and refined in a number of ways allowing for mismatches in both directions. I.e. there are morphologically plural marked DPs that are intuitively semantically not plural and there are intuitively "plurality denoting" DPs that are morphologically singular. The examples in (174) illustrate both classes.

(174) a. John is using the scissors to trim the trousers.
  b. The committee gathered in the hallway.

Despite the fact that both DPs *the scissors* and *the trousers* are morphologically plural, it is not necessary for (174)a to be true that John is using more than one pair of scissors to trim the pants nor is it required that he is trimming more than one pair of pants. This shows that plural marked DPs like *the scissors* can denote simple individuals completely parallel to singular definite DPs like *the hammer.* (174)b on the other hand illustrates that a predicate like *gather* which intuitively can be true only of a multitude or "plurality" of individuals can be predicated of a morphologically singular DP. This goes to show that singular marked DPs can apparently denote "plurality"-individuals.

Similar mismatches between morphological and semantic plurality can be observed with comparative quantifiers as in the cases in (175) and (176).

(175) a. ?? More than one student was meeting in the hallway.
b. At least two students were meeting in the hallway.

(176) a. (More than) one apple is in this salad.
b. * (More than) 1.0 apple is in this salad.
c. (More than) 1.0 apples are in this salad.

Even though *more than one student* and *at least two students* are denotationally equivalent (if reference to fractions is excluded as is the case in (175) for pragmatic reasons) morphological number marking is distinct which is apparently reflected in the compatibility with collective predicates such as *meet.* In chapter 2, in was argued however that the difference in morphological number marking was orthogonal to the contrast between (175)a and (175)b. Instead, the numeral in conjunction with presuppositions of the VP was shown to be the culprit — seemingly dismissing any effect of morphological number marking. The examples in (176) indicate once more that the difference between morphological singular and plural marking cannot be directly tied to a difference in denotation – even if reference to fractions is allowed. Clearly (*more than) one apple* and (*more than) 1.0 apples* are denotationally equivalent, yet one is morphologically singular and the other is plural. Similar observations have led many researchers in the field (e.g. Krifka(1987,1989), Ojeda(1991)) to conclude that plural morphology is the unmarked/default value while singular morphology is the marked option. I will adopt this position, assuming in addition that singular morphology in cases as in (176)a does not reflect semantic singularity of the NP extension. More precisely, I suggest that even in cases of morphologically singular NPs as in *more than one student*, the NP *student* does not denote a set of atomic individuals. Instead, the NP is semantically plural just like (176)c and denotes a set of sets ordered with respect to the subset relation as required by the measure function *many.* The appearance of singular morphology is in these cases rather superficial being a reflection of morphological agreement.[97]

The notion "semantic plurality" requires at least an equal amount of caution — better yet clarification. Intuitively, "semantic plurality" is used to characterize the semantic difference between DPs such as *the student* and *the students* where the first seems to denote a single individual while its plural counterpart denotes a "multitude" of

[97]I leave it for future research to show how this position can be accommodated in a morphological

students.[98] This difference has linguistic import as certain predicates (often referred to as "essentially plural" or "collective predicates") like *meet, gather, be numerous, be a good team,* etc. are defined only for a multitude of individuals. These predicates differ from so called "distributive" predicates like *sleep* or *smile* which are intuitively true only of individuals. The first complication for an overly simplistic approach to semantic plurality that relies exclusively on morphology comes from the simple fact that distributive predicates can take plural marked and plurality denoting arguments as shown in the examples in (177).

(177) a. The professors were smiling at the student.
b. The committee was smiling at the student.

There is a third class of predicates — traditionally called "mixed" predicates — such as *lift the piano* which can be used either collectively or distributively supporting the idea that there is a distributive operator that can be optionally inserted. Assuming a distributive operator, the task is to explain which DPs and which predicates allow and/or require the presence of the distributive operator.[99] It seems clear enough that one factor is the lexical/encyclopedic meaning component of predicates. Take the contrast in (178) as an example. While *smile at the student* is a predicate that is true

theory.

[98] Unfortunately the more common terms "group", "bunch", "collection", "set", etc. all have acquired a technical use. "Multitude" is intended to evoke the naïve intuition about the difference between a single individual and a collection, group, etc. of individuals.

[99] The text is purposefully vague here. One of the main debates in the plurality literature is whether the distributive operator is a VP level operator or whether it is part of the NP. It is not important for the current discussion to take a position on this issue. See below for some remarks.

only of individuals it seems to be able to be true also of a bunch of people as denoted by *the committee* in some derived way. *Have blue eyes* on the other hand cannot be (as easily) interpreted in such a way.

(178) a. The committee was smiling at the student.
b. ?? The committee has blue eyes.[100]

Interestingly, plural DPs like *all students, no students, the students,* etc. like singular DPs (quantificational or not) have apparently no difficulty in taking such predicates as *have blue eyes.* (cf. (179)).

(179) a. All the/no/many/etc. students have blue eyes.
b. The students/John and Mary have blue eyes.
c. Every student/John has blue eyes.

It seems then that we have to distinguish between bunch denoting DPs like *the committee* and all other plurality denoting DPs in their potential to license distributive readings. This seems unfortunate because it is not entirely obvious that *the committee* and e.g. *the members of the committee* denote different entities. Furthermore, collective predicates like *gather in the hallway* not only distinguish singular quantificational DPs (*every student, no student*) from plural quantificational DPs (*all students, no students,* etc.). They are also compatible with definite plural DPs and singular bunch denoting DPs and conjoined proper names – lending

[100] The example is from Landmann(2000).

credence to the intuition that *the committee* and *the members of the committee* (in some sense) denote the same entity.

(180) a. * Every student/no student/John is gathering in the hallway.
b. All the students/no students are gathering in the hallway.
c. The members of the committee/John, Bill and Mary are gathering in the hallway.
d. The committee is gathering in the hallway.

We can summarize these observations as in table 1.

Table 1: Distributive, Collective and Mixed Predicates

	Every student	**All the students**	**The students**	**The committee**	**John and Mary**
Distributive	Every student smiled/has blue eyes.	All the students smiled/have blue eyes.	The students smiled/have blue eyes.	The committee smiled/#has blue eyes.	John and Mary smiled/have blue eyes.
Collective	*Every student gathered in the hallway.	All the students gathered in the hallway.	The students gathered in the hallway.	The committee gathered in the hallway.	John, Mary and Bill gathered in the hallway.
Mixed	#Every student lifted the piano.	All the students lifted the piano.	The students lifted the piano.	The committee lifted the piano.	John, Mary and Bill lifted the piano.

The traditional classification of plural predicates distinguishes at least "distributive" predicates like *smile* that are true of atomic individuals, "collective" predicates like *gather* that are defined only for a plurality of individuals and "mixed" predicates like *lift the piano* that can be interpreted either way leading to ambiguity in case of plural subjects.[101] On the DP end of the picture at least the following can be distinguished

[101] Since "mixed" predicates give rise to a semantic ambiguity only plural subjects, the '#' in table one is meant to indicate that there is no ambiguity between a collective and a distributive reading in these

with respect to compatibility with plural predicates: singular quantificational DPs like *everyone of the students* that range over (atomic) individuals, plural quantificational DPs like *all the students,*[102] definite plural DPs like *the students*, singular "bunch-denoting" DPs like *the committee* and conjoined DPs such as *John and Mary.*

There is a considerable variety of theories that have been developed over the years to account for these facts. The proposals vary with respect to ontological assumptions (what do bunch denoting DPs refer to, what definite plural DPs refer to, what to plural quantifiers quantify over, etc.) as well as what the linguistically realized means to refer to these entities are.[103] Rather than surveying these proposals here, I follow Winter(1998) who points out that it has been notoriously difficulty to pin down the intuitively satisfying classification of distributive, collective and mixed predication to their corresponding linguistic means of expressing them. Winter(1998) in fact goes so far as to reject any linguistic significance of this typology. He develops an alternative typology instead that is based on observations first pointed out in Dowty(1987) and presented briefly in the following section.

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cases. *Every student lifted the piano* has only a distributive reading while *The committee lifted the piano* seems to only have a collective reading.

[102] I will use *all the students* instead of *all students* to avoid complications resulting from generic readings.

[103] Scha(1981), Link(1983,1987,1991), Dowty(1987), Roberts(1987), Landman(1989a,b), Verkuyl (1993), van der Does(1992,1994), Kamp&Reyle(1993), Schwarzschild(1992,1996), Lasersohn (1994), Brisson(1998), Winter(1998), are just the beginning of a rather lengthy list of work in this fieio.

4.4.3 The Dowty-Winter Generalization

Dowty(1987) discusses a particular difficulty for the traditional classification that comes from the observation that there are two classes of collective predicates exemplified by *meet* on the one hand and *be a good team* on the other. Interestingly, the difference between these two classes of collective predicates seems to be related to the notion of distributivity. I.e. in some sense, collective predicates like *meet* are distributive while predicates like *be a good team* aren't. This difference is indicated by a surprising selectivity of these predicates for quantificational arguments. Consider to begin with the contrast in (181) and (182).

(181) a. The students were gathering in the hallway.
b. All the students were gathering in the hallway.

(182) a. The students are a good team.
b. * All the students are a good team.
c. * Every student is a good team

Both predicates *gather in the hallway* and *be a good team* are "collective" in the sense that they can be true only of a multitude of individuals. Nevertheless, the plural quantificational DP *all students* is ungrammatical as subject of the latter kind of predicate just like its singular counterpart *every student* is. Dowty(1987) observes that the difficulties in (182)b and (182)c are intuitively very similar in nature. Both sentences suggest in some sense that every member of the set of students is a good team. More precisely, the presence of the quantificational phrase seems to impose the validity of — using Dowty's term — "distributive sub-entailments" which are not licensed by the predicate.

How is this different from predicates like *meet* and *gather* so that *every student* is ungrammatical with these predicates as well while *all students* is not? Dowty's insight is that *meet* and *gather* do in fact license "distributive sub-entailments" albeit only down to the minimal number requirement discussed in chapter 2. To illustrate this fact, consider the intuitively valid inferences sketched in (183).

(183) Assume there are 10 students. If it is true that ...

... The students are (all) meeting in front in the hallway.

a. $\Rightarrow$ There is a group of 9 students meeting in the hallway.

b. $\Rightarrow$ There is a group of 8 students meeting in the hallway.

$\Rightarrow$ ...

I.e. if it is true that the 10 students are meeting in the hallway then it is also true that 9 students are meeting in the hallway and so on down to the minimal number required to have a meeting.

The difference in compatibility with *every student* and *all students* can be attributed to a difference in morphology. While *every student* is singular quantifying over atomic entities and therefore requiring distributive sub-entailments down to atomic individuals, *all students* is plural. It quantifies over plural entities and requires distributive sub-entailments only down to plural individuals. Collective predicates like *be a good team* on the other hand do not license any sub-entailments. It certainly doesn't follow from the fact that the 10 students are a good team that there is a group of 9 students that is also a good team. What we observe then in the contrast in (182) is that there are DPs that — for some reason to be made explicit — require their scope argument to license distributive sub-entailments down to the units they range over. Even though this requirement seems related to the fact that these DPs are quantificational in nature as Dowty(1987) notes, he leaves it open what exactly it is in the meaning of *all students, etc.* that imposes the licensing of distributive sub-entailments.

Winter(1998) develops the idea that the DPs that are sensitive to the presence of distributive sub-entailments are all quantificational DPs within a larger account of DP syntax and semantics. Consider the examples in (184) to (186) built after examples from Winter(1998) showing that indeed the generalization is broader than a systematic contrast between *every* and *all.*

(184) a. The girls are numerous.
 b. The committee is numerous.
 c. * All the/several/no/etc. girls are numerous.
 d. * Every/no girl is numerous

(185) a. The girls constitute a majority.
 b. The committee constitutes a majority.
 b. * All the/several/no etc. girls constitute a majority.
 c. * Every/no girl constitutes a majority.

(186) a. The girls outnumber the boys.
 b. The foreign affairs committee outnumbers the welfare committee.
 b. * All/several/no etc. girls outnumber all the boys.
 c. * Every/no girl outnumbers every boy.

The data in (187) and (188) built after examples from Winter(1998) — originally however due to Dowty(1987) — illustrate the fact that the difference between quantificational DPs and non-quantificational DPs can also be observed with mixed predicates.

(187) a. The students voted to accept the proposal
b. The committee voted to accept the proposal
c. Every student voted to accept the proposal
d. All the students voted to accept the proposal

(188) a. The students weigh 200 lbs.
b. The committee weighs 200 lbs.
c. Every student weighs 200 lbs.
d. All the students weigh 200 lbs.

This time the observation is not one of a difference in grammaticality rather it is a difference in interpretation. Consider the difference in interpretation between (187)a,b and (187)c,d. While for the a,b-cases to be true it is required that the students as a group/the committee as such voted in favor of the proposal, which allows for individual students/committee members to abstain or even disapprove the cases in (187)c and (187)d make a stronger claim: all students have to have approved in order for to be true. Analogous observations can be made for the examples in (188).

This difference in interpretation is indeed rather reminiscent of the contrast in grammaticality in the examples in (184) to (186) and should fall under the same explanation. In each of these cases the inference from the sum-total of individuals making up the group to the individuals themselves is not warranted. These facts taken together constitute then a significant generalization that needs to be accounted for.[104]

The essence of Winter's proposal to account for this generalization is rather simple and elegant: Quantificational DPs are sensitive to the presence of distributive sub-entailments because distributivity is — so to speak — built into the definition of generalized quantifiers. Recall that generalized quantifiers denote relations between sets. Relations between sets however are defined in terms of quantification over the elements of these sets. Consider for instance the lexical entries of the quantificational determiners *every, some* and *no* in (189) in terms of the sub-set relation, non-empty and empty intersection repeated from chapter 1.

(189) a. $[[every]] = \lambda \mathbf{P}.\lambda \mathbf{Q}.\ \mathbf{B} \subseteq \mathbf{Q}$ (every member of **B** is also a member of **Q**)

b. $[[some]] = \lambda \mathbf{P}.\lambda \mathbf{Q}.\ \mathbf{B} \subseteq \mathbf{Q}$ (there is at least one member of **B** that is also a member of **Q**)

c. $[[no]] = \lambda \mathbf{P}.\lambda \mathbf{Q}.\ \mathbf{B} \subsetneq \mathbf{Q}$ (there is no member of **B** that is also a member of **Q**)

While this is simple enough and old news for singular quantificational determiners like *every*, *each* and no_{Sg} the real question is how this observation can be extended to the plural quantifiers *all*, no_{Pl}, *etc.* Note that it is not sufficient to simply say that

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[104] Winter in fact elevates these observations to a criterion for establishing a new typology of predicates — "atom predicates" and "set predicates." (Winter(1998:214))

The Every/All-Criterion:

An English predicate is called an *atom predicate* if and only if the status (acceptability/ truth-conditions) of the sentence obtained by combining it with an *every* noun phrase is indistinguishable from the status of the sentence we get when it is combined with an *all* noun phrase. Predicates that lead to distinguishable plural quantificational determiners quantify over pluralities/ plural individuals because it wouldn't distinguish between genuine collective predicates and set-predicates. Clearly the extension of both kinds of collective predicates is a set of plural individuals. What is needed instead to execute this idea is that plural quantifiers like *all students* can be reduced essentially to quantification over atomic individuals. This is exactly what Winter(1998) proposes. The specific of his proposal are less important at this point (see the appendix for a description). It is more important to see that this move however justified it may be cannot be adopted for comparative quantifiers if the proposal defended in this thesis is to be maintained.

First, we need to see whether comparative quantifiers behave like quantifiers in the way *all, both, every* etc. pattern in conjunction with set and atom predicates or more like definite plural determiners. Winter observes an interesting difference between two classes of comparative quantifiers in this respect. On the one hand there are the so-called "modified numeral determiners" like *more than three students,* which behave like determiner quantifiers. They are incompatible with genuine collective predicates. On the other hand, bare numeral DPs like *three students* behave like definite plural DPs with respect to genuine collectivity. Witness the contrast in (190) adopted from Winter (1998).

(190) a. * More than three students were the team that won the cup.
b. Three students I know were the team that won the cup.

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sentences are referred to as *set predicates*

Unfortunately, Winter has very little to say about the analysis of modified numeral determiners as employed in sentences as in (190)a. He simply follows the GQ tradition in analyzing these comparative quantifiers as employing idiomatic determiners like *more than three*. The ungrammaticality of (190)a is therefore accounted for in a completely parallel fashion as the ungrammaticality of *all students*.

Note that if the points that were made against the idioms approach in chapter 2 are accepted, Winter's treatment of modified numerals cannot be maintained and it is not immediately clear how his approach could be extended into the analysis of comparative quantifiers as comparative constructions.[105] We can take the acceptability of (190)b as starting point to see why Winter's proposal is not compatible with the analysis of comparative quantifiers as comparative constructions. Recall that the analysis of comparative quantifiers assumed the presence of a measure function expressed by *many* together with a measure phrase expressed by the numeral and the a comparative operator. *Many* was furthermore analyzed not quite parallel to gradable adjectives. Rather it was assumed to have the combinatorial properties of a determiner. Specifically, it was assumed that *many* (after absorbing the degree argument) takes two arguments. The NP provides the

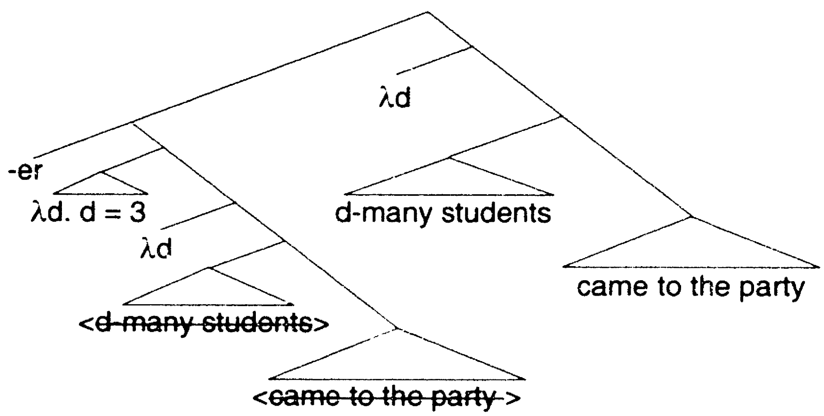
[105] Winter is not really concerned with the analysis of modified numerals, though. His main interest is in giving an account of a correlation that holds of bare numeral DPs as in (190)b. He observes that the same set of DPs that are compatible with genuine collective predicates also give rise to the "wide scope indefinite phenomenology" first discussed in Fodor&Sag(1983), and much subsequent work.[105] Since this is not the focus of the present work I will limit myself to a few remarks on that connection when they are appropriate. What is of interest to the present purposes is the observation that modified numerals behave differently from bare numeral DPs.

terms/units by which the VP extension is measured with respect to the number of individuals there are that satisfy the VP. For convenience, these ideas are summarized in the lexical entry given in (62) and the sample treatment in (192) repeated from chapter 2.

(191) $[[\mathit{many}]] = \lambda d.\lambda P_{<e,t>}.\lambda Q_{<e,t>}.\ \exists x \text{ st. } P(x) = 1\ \&\ Q(x) = 1\ \&\ x \text{ has d-many atoms}$

(192) a. More than three students came to the party.

b. [-er λd. d=3 & ~~d-many students came to the party~~] [λd. d-many students came to the party]

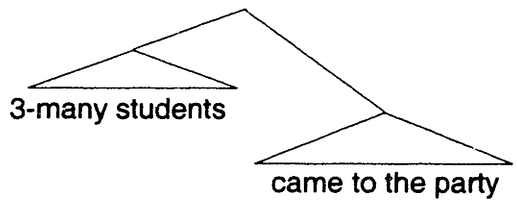


In chapter 2, the question what the proper analysis of "bare numeral" DPs such as *three students* is has not been addressed specifically. In fact I have studiously avoided making any precise claims about the proper analysis of these DPs as the facts are quite intricate. Certainly, the simplest picture given the basic assumptions about comparative quantifiers would be to give a treatment that assumes the presence of *many* also in bare numeral DPs as indicated in (193).

(193) a. [[*three-many students*]] = $\lambda Q_{<e,t>}$. $\exists x$ [students(x) = 1 & Q(x) = 1 & x has 3 atoms]

b. Three students came to the party.

c.



d. [[*three-many students*]] = 1 iff $\exists x$ [x has three atoms & x came to the party]

Let's assume for the moment that this is all we have to say. Then it is quite obvious that there is no essential difference between modified and bare numeral DPs in this treatment that could give rise to the different behavior with genuine collective predicates. The only potential source of a difference between modified and non-modified numerals is the presence of the maximality operator inside the comparative operator in the former case. However, it is far from clear that the incompatibility of modified numerals can be blamed on the maximality operator hidden inside the comparative. Recall that the maximality operator simply returns the biggest element in a set. If there is only one element, it will return that element. Only if there is no biggest element could the contrast between modified and bare numeral DPs be blamed on the presence of the maximality operator because the maximality operator would be undefined in that case. Whether there is a biggest degree depends however on the [illegible]ings of the measure function expressed by *many*. In this respect the structures in (192) and (193) are however equivalent. Therefore, the difference remains unaccounted and problematic for the proposed theory of comparative quantifiers.

To rescue the situation, let's first attempt an answer to the question why modified numerals are bad and assume for the moment that bare numerals have an interpretation that assimilates them to definite plurals. Indeed there is quite a bit of evidence for that as discussed in Winter(1998) and many other places.

The problem now is to account for the incompatibility of modified numerals with genuine collective predicates. Let's assume also that the alternative interpretation that is available for bare numerals is for some reason not available for modified numerals just as Winter(1998) stipulates. What is it then in comparative quantifiers that makes them incompatible with genuine collective predicates? Notice, that it can't be blamed on the quantificational part hidden inside the definition of the measure function *many*. The existential quantifier ranges necessarily over entities that correspond to sets, given the assumptions about the definedness conditions of *many*. It cannot be assumed to range over atomic individuals simply because atomic individuals cannot be counted as argued above. So Winter's move to derive the incompatibility from the essentially distributive nature of quantificational determiners is indeed not available to us. However something closely related to his intuition is. We can appeal to the definedness condition of *many*, i.e. the presupposition that the individuals *many* measures can be ordered isomorphic to the natural numbers. If it can be shown that elements in the extension of genuine collective predicates do not satisfy these requirements, the incompatibility can be explained.

4.4.4 A proposal for Comparative Quantifiers

Form the discussion in the previous sections it is clear that we have to model a seemingly irreducible difference between genuine collective predicates and distributively sub-entailing collective predicates like *meet*. In particular, it was argued that the difference is whether the individuals that make up the plurality are linguistically "accessible" as well. While genuine collective predicates seem to range over pluralities without such a relation i.e. ("impure" atoms which group-individuals that do not make a relation to the members the group linguistically available), predicates like *meet* range over pluralities that do provide a transparent relation to their individuals as evidenced for instance by the validity of sub-entailments. There are of course a number of possibilities to model this difference. I will refrain from proposing a specific way of modeling and simply assume that the informal characterization of the difference is clear enough to support the argumentation. I will however discuss empirical evidence that supports the claim that the relation between bunches and the individuals they are composed of is indeed linguistically less transparent than it is in the case of e.g. definite plurals. One consequence of this difference should be that bunches cannot be counted. We see this difference already in nominal restrictors of (comparative) quantifiers. Quantifiers that are restricted by bunch-denoting nouns range over bunches and not over individuals that constitute these bunches. Essentially the same restriction can be observed with genuine collective predicates providing the nuclear scope of quantifiers. The analysis of comparative quantifiers developed as developed in chapter 2 pinpoints the difficulty these quantifiers have with genuine collective predicates in a conflict between the requirements of the measure function expressed by *many* and the elements in the extension of genuine collective predicates.

A closely related property that is characteristic of predicates such as *meet* and minimal number predicates in general is that they refer cumulatively in the way starred predicates in general were argued to do. The relevant definition is given in (194) below for convenience.

(194) Definition: Cumulativity

A function P of type <e,t> is cumulative with respect to its argument iff
$\forall x \in D_e\ \forall y \in D_e\ [(P(x) = 1\ \&\ P(y) = 1) \rightarrow P(x \cup y) = 1]$

For instance, if it is true that a group of 5 students and a group of 10 students were gathering in front of the Dean's office then it is also true that a group of 15 students is gathering in front of the Dean's office. The fact that *meet, gather,* etc. refer cumulatively is related to the intuitive validity of the inference from the fact that a group of 15 students gathering in front of the Dean's office that there is also a group of 14, 13, etc. students gathering in front of the Dean's office — up to the minimal number of students needed for a gathering as indicated in the paradigm in (195).

(195) Assume: A group of 5 students is gathering in front of the Dean's office.
A group of 10 students is gathering in front of the Dean's office.

a. ⇒ There is a group of 15 students gathering in front of the Dean's office.
b. ⇒ There is a group of 14 students gathering in front of the Dean's office.
   ⇒ ...
c. # There is a group of 2 students gathering in front of the Dean's office.

Notice however that the inference from the claim that there are 15 gathering students to the claim that there are sets of 14, 13 etc. gathering students seem to come about in an interesting way. Take the case of 11 gathering students. The inference from 15 to 11 could come about in a variety of ways, e.g. one could find a subgroup of the 10 gathering students say 8 and a subgroup of the 5 gathering students consisting of 3 students that together give a group of 11 gathering students. Other possibilities would be 7 and 4 and 6 and 5. On reflection, it seems that the ratios 9 and 2 or 10 and 1 wouldn't work because a subgroup of 2 students cannot be a gathering group anymore being too few to gather. In other words, the inferences given in (195) are valid because *gather* refers cumulatively up to the minimal number requirement. To illustrate this observation once more, observe that the inference suggested in (196)b does not seem to go through even though the inferences in (196)a and c seem valid.[106]

[106] The facts in general are not very sharp. The examples in the text exploit the fact that meetings easier to differentiate if they happen at the same time at roughly the same place than gatherings.

(196) Assume: A group of 2 students is meeting in front of the Dean's office.
A group of 10 students is meeting in front of the Dean's office.

a. ⇒ There is a group of 12 students meeting in front of the Dean's office.
b. # There is a group of 11 students meeting in front of the Dean's office.
c. ⇒ There is a group of 10/9/...2 students meeting in front of the Dean's office.

In other words, minimal number predicates like *meet* and *gather* are "essentially plural." They are plural even without the star operator applying to them. This seems to square well with the truth-conditions we get in cases as in (197) where the subject DP denotes a quantifier over bunches.

(197) a. The two/All committees were meeting in front of the Dean's office.
b. Every committee was meeting in front of the Dean's office.

While (197)a allows for one big meeting in which all committees are participating as well as every committee meeting independently, (197)b allows only the latter reading.

The crucial piece is in the account is that many — as defined in chapter 2 — was assumed to measure the VP-extension with respect to how many individuals it contains that satisfy the NP predicate. This means that the VP-extension as well as the NP-extension has to be a measurable domain. More specifically, the elements in the NP and VP extension have to be ordered with respect to the sub-set (individual part of) relation in a way that allows an order preserving mapping of these elements into the natural numbers. There are a couple of non-trivial predictions that the approach sketched above makes.

Prediction 1: Generic Readings

From the sketch of the idea given above it is evident that the reason that "true" quantifiers like *all, every, no* etc. are incompatible with genuine collective predicates is quite different in nature from the reason why comparative quantifiers are incompatible. While in the case of comparative quantifiers, the requirements of the measure function *many* are responsible, it is the built in distributivity of true quantifiers (for the moment adopting Winter's story for true quantifiers[107]) that accounts for their difficulty to take on genuine collective predicates. It is therefore prima facie expected that there could be environments where comparative quantifiers differ from true quantifiers in their compatibility with genuine collective predicates. Indeed these environments exist and therefore support an account that distinguishes these two quantificational expressions. Consider first the data in (199) built after a remark in footnote (??) in Winter(1998).

(198) a. # More than three students are a good team.
b. * More than 3 students were a team that participated in the race.

Winter notes in passing in this footnote that for some speakers (198)a is marginally grammatical albeit under a special, generic interpretation. I completely agree with this observation. Even more, I found that my informants accepted comparative quantifiers in conjunction with "genuine collective predicates" quite easily in generic contexts. Interestingly, this effect cannot be observed with true quantifiers such as *all, both, no, most*. The paradigms in (199) and (200) give an initial taste of the effect.

(199) a. More than 3 students can be/*were a team that participated in the race.
b. Exactly four students can be/*were a good team.
c. Between four and ten students can be/*were a good team.
d. More/less than eleven students can be/*were a good team.
e. At least/most twelve students can be/*were a good team.
f. Few/many students can be/*were a good team.

(200) a. * All the students can be a good team.
b. * None of the students can be a good team.
c. * Most of the/most students can be a good team.

This shows then that there are independent reasons to account for the incompatibility of "true" quantifiers on the one hand and comparative quantifiers on the other with genuine collective predicates. Before going into the details of these data and their account, let me summarize the discussion so far by giving a more complete table representing the data that need to be accounted. Table two is a more complete version of table 1. As before there are a variety of DPs that intuitively range over pluralities. Two columns are added: comparative quantifiers represented by *more than three students* and bare numeral DPs represented by *three students.* On the other hand, Winter's terminology is used to distinguish between various

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[107] Which is actually problematic given the overall picture developed here. See the next section for discussion.

predicates. According to the "every/all test" predicates are classified into atom and set predicates. To make the special status of genuine collective predicates more salient they are called "impure" atom predicates, where impure atoms are groups/collections/bunches of individuals where the relation to the members is not linguistically transparent (as it is e.g. in the case of bunches denotes by definite plurals).[108] The observation most interesting for the purpose of the thesis is encoded by shading, which shows that comparative quantifiers are really ambivalent with respect to genuine collective predicates. If these predicates are episodic, comparative quantifiers are incompatible with them just like "true" quantifiers. In generic contexts however, comparative quantifiers side with bare numerals, definite plurals, etc.

To summarize the important facts: There seems to be an irreducible difference between two classes of collective predicates. Genuine collective predicates like *be a good team* intuitively can be true only of groups/bunches/teams etc. of individuals. Interestingly, what is characteristic about expressions that denote groups/bunches/ teams etc. is that — unlike in the case of definite plurals — the relation between the group and the members of the group is linguistically not transparent. The Dowty-Winter observation is that quantificational determiners seem to require that the relation is transparent. Therefore, quantifiers built from these determiners are incompatible with genuine collective predicates.

[108] Recall that Winter at the end has to appeal to some notion of "impure" atom too.

Table 2: Atom Predicates and Set Predicates

	Every student	**All the students**	**More than three students**	**Three students**	**The students**	**The committee**	**John and Mary**
Atom Predicate	Every student smiled/has blue eyes.	All the students smiled/ have blue eyes.	More than three students smiled/ have blue eyes.	Three students smiled/ have blue eyes.	The students smiled/ have blue eyes.	The committee smiled/??has blue eyes.	John and Mary smiled/ have blue eyes.
Set Predicate	*Every student gathered in the hallway.	All the students gathered in the hallway.	More than three students gathered in the hallway.	Three students gathered in the hallway.	The students gathered in the hallway.	The committee gathered in the hallway.	John, Mary and Bill gathered in the hallway.
Set Predicate	#Every student lifted the piano.	All the students lifted the piano.	More than three students lifted the piano.	Three students lifted the piano.	The students lifted the piano.	The committee lifted the piano.	John, Mary and Bill lifted the piano.
"Impure" Atom Predicate 1	*Every student is a good team.	*All the students are a good team.	*More than three students are a good team.	Three students gathered are a good team.	The students are a good team.	The committee is a good team.	John and Mary are a good team.
"Impure" Atom Predicate 2	#Every student voted to accept the proposal.	#All the students voted to accept the proposal.	#More than three students voted to accept the proposal.	Three students voted to accept the proposal.	The students voted to accept the proposal.	The committee voted to accept the proposal.	John and Mary voted to accept the proposal.
"Impure" generic Atom Predicates 1	*Every student can be a good team.	*All the students can be a good team.	More than three students can be a good team.	Three students can be a good team.	The students can be a good team.	The committee can be a good team.	John and Mary can be a good team.
"Impure" generic Atom Predicates 2	#Every student can vote to accept the proposal.	#All the students can vote to accept the proposal	More than three students can vote to accept the proposal.	Three students can vote to accept the proposal.	The students can vote to accept the proposal.	The committee can vote to accept the proposal.	John and Mary can vote to accept the proposal.

Comparative quantifiers turn out to be ambivalent with respect to genuine collective predicates, which is not expected under Winter's proposal. In particular, if comparative quantifiers in conjunction with genuine collective predicates are interpreted generically, then no conflict arises. Note that the account of this effect cannot be to say that the genuine collective predicates are not "genuine collective" anymore since true quantifiers are still incompatible. This is prima facie evidence that supports a different treatment of comparative quantifiers on the one hand and "true" quantifiers on the other. However, if such a treatment is required, much of the original appeal of Winter's proposal is lost as no uniform treatment of determiner quantifiers (in the sense of GQT) is possible. Now some features of Winter's story that seemed initially not too compelling reasons to be skeptical of become more prominent. For the purpose of the present discussion, the asymmetric facts discussed in chapter 1 noticed with a variety of comparative quantifiers traditionally covered by the label "weak/strong" are important. Notice in particular, that Winter's idea that comparative quantifiers are like "true" quantifiers seems to close the door to any treatment of the observed asymmetries along the lines proposed in "the adjectival theory of indefinites" approach. (I will return to this aspect of the discussion in chapter 4.) Winter's account of the incompatibility relies on the fact that quantification of plural individuals does not exist with true quantifies or is at least not transparent to the environment. This is of course one of the core insights of the adjectival theory of indefinites. If we eventually have to allow quantification over sets of individuals as argued for in the adjectival theory of indefinites and also in chapter

2 of this thesis, then the significance of the every/all test is challenged. It is not clear anymore that it indicates something that goes beyond Dowty's original generalization, which leaves us with the foul smell that we don't even really understand anymore why "true" quantifiers are incompatible with genuine collective predicates. In other words, if there is no uniform treatment of all quantificational determiners as functions of type <et,ett>, then we face the problem of explaining why "true" quantifiers are of that type but e.g. comparative quantifiers are not. This however gets us right back to one of the basic questions that Winter's proposal was supposed to help us with namely, why is it that *all* requires plural marked arguments and whether there is any semantic effect of plural marking. I.e. is there "true" quantification over plural individuals. Since the account of comparative quantifiers seems to require this, certainly the simplest position seems to be that there is quantification over plural individuals after all.

Prediction 2: Embedding under the Definite Determiner

From the discussion in chapter 3, we know that embedding comparative quantifiers under a definite determiner imposes an alternative analysis as disguised amount relatives according to which the comparative syntax is resolved inside the DP. We can extend this prediction to the phenomena at hand as follows: The account sketched in this chapter relied on the claim that the presupposition of the measure function *many* is inherited by both its arguments. This was shown to predict that VPs that are not functions from pluralities to truth-values yield awkwardness with comparative determiners. Extending an analysis as disguised amount relatives as enforce by stacking a definite determiner on top of a comparative quantifier predicts that the definedness condition of many need be satisfied by the matrix VP anymore since the clausal environment is provided by the amount relative. We predict then that in these circumstances the incompatibility of comparative quantifiers with genuine collective predicates disappears. This prediction seems to be borne out as the data in show (201).

(201) a. The more than three students that there were were the team that won the cup.
b. ?? More than three students were the team that won the cup.

Prediction 3: Genuine Collectivity in the Restrictor

Another prediction that is made by the claim that the definedness conditions of *many* are responsible for the incompatibility of comparative quantifiers with genuine collective predicates is that it should extend straightforwardly to all NP restrictors of a comparative determiner. In regular cases this is of course expected also under Winter's approach. It is however less clear to me how he would account for the fact that also (202)b is awkward.

(202) a. ?? More than three students that were the team good team that won the cup came to the party.
b. ?? More students than professors that were the team that won the cup came to the party.

4.5 Appendix: Winter(1998)

Recall from the discussion in 4.4.2 that Winter attempts an account of the determiner restriction with genuine collective predicates that reduces all cases to be the case that disqualifies *every student* form being the subject of a genuine collective predicate. The first step in this reduction consists of a "brute force stipulation" to the effect that there is no semantic difference between the singular and plural determiner quantifiers (*all, every,* no_{Sg}, no_{Pl}, *etc.*). All of them are of type <et,ett>. Plural morphology plays however an important role in the interpretation of the NP and the VP argument of the determiner quantifier. Winter assumes that there is a strict correspondence between singular and plural predicates and the type of their denotation. Specifically, singular marked predicates range over atomic individuals, hence are of type <e,t>, plural marked predicates range over sets of atomic individuals (type <et,t>). Given these assumptions, plural marked arguments of a quantificational determiner yield a type mismatch and should yield prima facie uninterpretability. The situation is rescued, so Winter's proposal, via a special interpretation rule called "determiner-fitting" (dfit) triggered by the presence of morphological plurality. (203) summarizes the proposal (cf. Winter 1998: 230).

Determiner Fitting

(203) Let D be a standard determiner (<et,ett>)

$dfit(D) =_{def} \lambda A_{ett}.\lambda B_{ett}.D(\cup A)(\cup (A \cap B))$

Step 1: (intersection): The verb denotation is modified by intersecting it with the plural noun denotation. (cf. conservativity)

Step 2: (union) The two sets of sets are then "unioned" before they serve as arguments for the determiner.

Effect of number marking:

Singular marked constituents range over atomic individuals (e.g. NP_{Sg}, VP_{Sg} are type <e,t>

Plural marked constituents range over sets of individuals (NP_{Pl}, VP_{Pl} are type <et,t>.

The application of this rule resolves the type mismatch between the quantificational determiners like *all* (<et,ett>) and the plural marked NP which denotes a set of sets (<et,t>). To see how this works, consider the computation of the meaning of sentences as in (204).

(204) a. All students met in the hallway.

b. Several/no/etc. students met in the hallway.

The rule proceeds in two steps: first a complex predicate *students are meeting* is formed by intersecting ⟦*students*⟧ and ⟦*are meeting*⟧. Both constituents are morphologically plural marked, therefore denote a set of sets.[109] After set

[109] In Winter's proposal morphological number marking of the VP has a semantic consequence just as much as it changes the denotation of NPs — singular predicates range over individuals while plural marked predicates range over sets of individuals.

intersection, grand union returns a set of individuals, which is of the right type to be the scope argument of a regular quantificational determiner. The second part of "determiner fitting" involves unionizing the plural NP in the restrictor position of the quantificational determiner to a set of individuals.

Winter motivates step 1 of the determiner-fitting rule as a possible derivational account of the conservativity property of natural language determiners. Importantly, in his system step 1 is also required to get the truth-conditions right. To see this, consider example (205)a and its truth-conditional content described in (205)b.

(205) a. At least 5 students met.
b. 'For at least 5 students it is the case that there is at least one other person out of this group of at least 5 that he/she met with.'

The crucial point is that for (205) to be true, it is not sufficient that at least 5 students participated in some meeting, say with a professor. There has to be a meeting for each of the at least 5 students with at least one member of that same group. Determiner fitting insures that this will be the case because it demands that the intersection of $[\![$*students*$]\!]$ and $[\![$*are meeting*$]\!]$ contains at least 5 students. Crucially, for a set of individuals to be in the extension of the predicate *are meeting* it has to contain at least 2 members. This means, that in the extension of $[\![$*students*$]\!] \cap [\![$*are meeting*$]\!]$ are sets of meeting students of cardinality 2 or greater. The sentence will be true, if the total number of students in the extension of *are meeting* (after grand union) is 5 or bigger, which is a faithful representation of the truth-conditions associated with (205)a.[110]

To see how the problem that "plural" quantificational determiners have with genuine collective predicates like *be a good team* can be reduced to the ungrammatically of *every student is a good team* it is helpful to work with an example. Assume that there are 10 students (1,2,...,10) and 2 professors (a,b) which form the following good teams: $T_1 = \{1,2,3\}$, $T_2 = \{4,5\}$ and $T_3 = \{6,7,8,9,10\}$ $T_4 = \{a,b\}$.[111] The extensions of various predicates relevant for the computation of the sentence in (206)a are given in (207) assuming the usual definition of the plural and singular operator ($pl(X) = \{A \subseteq X: A \neq \emptyset\}$, $sg(X) = \{x \in E: \{x\} \in X\}$).

(206) * All students are a good team.

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[110] There is a complication in this account that is not central to my concerns but should be mentioned. Strictly speaking, Winter's account works only if all the modifiers of the NP are intersected with the main verb as well. Otherwise, it would be possible that (205) is true in a situation in which there are 5 students who met some other student, say a first-year student, that is not part of the group of 5.

[111] For simplicity a team will be represented as set of individuals here which is sufficient for the discussion. If that assumption is not held, the problem of quantificational determiners becomes formally more evident however the underlying intuition is more obscured.

(207) a. [[*student*]] = {1,2,3,4,5,6,7,8,9,10}

b. [[*students*]] = {1,...,{1,2}, ...,{1,2,3}, ...,{1,2,3,4,5,6,7,8,9,10}}

c. [[*is a good team*]] = {{1,2,3},{4,5},{6,7,8,9,10},{a,b}}

d. [[*are a good team*]] = {{1,2,3},{4,5},{6,7,8,9,10}, {a,b},{{1,2,3},{4,5}}, {{1,2,3}, {6,7,8,9,10}},...,{{1,2,3},{4,5},{6,7,8,9,10}.{a,b}}}[112][113]

e. **students** $\cap$ **are a good team** = {{1,2,3},{4,5},{6,7,8,9,10}}

f. $\cup$(**students** $\cap$ **are a good team**) = {1,2,3,4,5,6,7,8,9,10}

As mentioned above, the denotation of *good team* is a set of "impure atoms" – represented here again as sets of individuals. Plural marking of the VP *be a good team* creates a set of sets impure atomic individuals ("the set of sets of good teams") as given in (207)d for the assumed model. Step one of determiner-fitting requires that the intersection of *students* and *are a good team* is computed. This results in the case of (207) in the same denotation that *students* has which after unionizing it to fit the type requirements is a set of individuals all of which are students and **a member of a good team**. The problematic step happens exactly in forming the grand union of the intersection, which involves the move from sets of individuals to their members. While this step is considered unproblematic in the case of *students* it is precisely here where the nature of genuine collective predicates causes problems. As Dowty(1987) already observed, the distinguishing property of genuine collective predicates is exactly that they do not license distributive sub-entailments. Unionizing a set of sets however seems to presuppose that the relation of the set to its

[112] Quines innovation is assumed again here although it is not required to make the point.

[113] It is not immediately obvious that plural marking of the VP has any interpretational consequences. For the discussion here it is not relevant to take a position. Therefore both singular and plural denotations of the VP are given in the example.

members is transparent so that "no information is lost" in the mapping from the set to its members or the other way around. In this manner, Winter gives a formal account of Dowty's fundamental intuition. His actual proposal is however more ambitious than this. It is embedded in larger theory of DP syntax and semantics that is too far-reaching for me to discuss here. I will focus instead on the question how comparative quantifiers behave with respect to genuine collective predicates and how they are treated in Winter's proposal.

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