Sigrid Beck
Universität Tübingen
English Department
Wilhelmstr. 50
72074 Tübingen
Germany
+49 7071 2978461
sigrid.beck@uni-tuebingen.de

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58. Comparison Constructions

Content

Abstract:

The article introduces a version of von Stechow's (1984) theory of comparatives as the most farreaching and widely adopted foundation of semantic analyses of comparison constructions. It illustrates the range covered by this theory by applying it to other constructions like superlatives, equatives and so on. Various kinds of negation are pointed out as an area for further research. The theory serves as the starting point of two research projects that the field is currently engaged in: on the one hand, the interaction of comparison with quantification, and on the other hand, the range of crosslinguistic variation that comparison constructions are subject to. The present state of affairs is sketched for both domains.

1. Introduction

The goal of this article is to answer the following question: what is the semantics of comparatives and how is it compositionally derived? There are some desiderata for that answer, beyond the obvious ones of getting the semantics right, covering a decent range of data on comparatives, and providing a theoretically plausible syntax/semantics interface. They include in particular extendability of the analysis to other comparison constructions like superlatives, equatives and so on, and extendability of the analysis from the standard application to English to comparison constructions in other languages.

My starting point for this enterprise will be von Stechow (1984). The paper discusses and incorporates the earlier literature on the subject to such an extent that I will only make very specific reference to older papers where necessary. I present a modernized version of this influential work in section 2, including comments on obvious extensions and problems solved. I then turn to questions left unanswered by this theory in section 3. That section serves to present much of the subsequent literature on comparison constructions, and the important issues that occupy the discussion. Section 4 summarizes the main results as well as the remaining problems in the theory of comparison today.

The discussion is presented in the general framework of the Heim & Kratzer (1998) textbook. I assume that syntactic structures of the level of Logical Form are compositionally interpreted by a few general principles of composition: function application, predicate abstraction and predicate modification. Truth conditions are presented in a semi-formal metalanguage using among other things Heim & Kratzer's version of the Lambda-notation.

2. The Standard Theory: Von Stechow 1984

Section 2.1. introduces the standard degree semantics and compositional analysis of the comparative construction. The analysis is designed to be extended to other comparison constructions, which is demonstrated in section 2.2. Its generality is one of the strengths of the standard analysis, as are some other properties concerning interaction with scope bearing elements and negative polarity; this is discussed in section 2.3. We will note at certain points in the discussion that the theory, though highly successful, leaves particular questions unaddressed. This motivates the research presented in section 3.

2.1. Comparatives

2.1.1. The basic idea

The apparently simplest types of comparative construction are data like (1). It is tempting to view the comparative form of the adjective in (1a) as an expression denoting a relation between two individuals, cf. (2) (e.g. Larson 1988).

(1) a. **Caroline is taller than Georgiana.**
b. **Caroline is taller than 6'.**

(2) [[**taller**]] = $\lambda x.\lambda y.$ y's height > x's height

(1b) on the other hand suggests that a comparison is made to a height, i.e. a degree of tallness (see e.g. Klein 1991 for a thorough definition of degrees and measurement). Cases of so-called comparative subdeletion, also known as subcomparatives, like (3) (Bresnan 1973) show that this must be so: through changing the adjective, we compare Caroline and the sofa according to different dimensions. Each dimension must provide a degree. The degrees are what is ultimately related by the 'larger than' relation '>'.

(3) **Caroline is taller than the sofa is long.**
'Caroline's height exceeds the length of the sofa.'

It seems natural therefore to suppose that the comparative is a relation between two degrees - the '>' relation; it acts separately semantically from the adjective it morphologically combines with. The subcomparative shows us furthermore that both the main clause and the *than*-clause must make available those degrees. Degrees are introduced by adjectives. This subsection develops this idea.

(4) a. [[**-er**]] : the degree matrix clause > the degree *than*-clause
b. [[**tall**]] : x is tall to degree d

Before we proceed, I should note that these proposals (while widespread and influential) are not uncontested in the literature on comparatives. Some authors reject the idea that the comparative operator acts separately semantically from the adjective it combines with morphologically (e.g.

Pinkal 1989a,b. Similar suggestions can be found in Kennedy 1997; see also section 3). Klein (1980) among others takes the unmarked, positive form of the adjective as basic, not the abstract underlying entry in (4b). The precise semantics of the comparative operator is of course the object of much debate (see e.g. Seuren 1978, Heim 2007, Schwarzschild 2008 for a different view). In recent work, Moltmann (2005) doubts that comparatives necessarily use a degree semantics (compare section 3.2). A careful discussion of a number of choices that go into the theory introduced here can be found in Klein (1991). My own discussion begins with these choices made.

2.1.2. Degrees, Scales and Adjective Meanings

We introduce a new semantic type for degrees, <d>. The set D_d, the denotation domain for d, consists of mutually disjoint sets (heights, distances, weights,...) each of which comes with an ordering relation. For example (from von Stechow 2005):

(5) SD := the set of all spatial distances
$>_{SD}$:= $\{<x,y> \in SD \times SD$: x is a greater spatial distance than y$\}$

(6) TD := the set of all temporal distances
$>_{TD}$:= $\{<x,y> \in TD \times TD$: x is a greater temporal distance than y$\}$

(7) Call each such pair $(X, >_X)$ a scale.
Properties of orders: $>_X$ is total on X, asymmetric, transitive, irreflexive.

The denotation domain of degrees D_d is the union of all of these sets. The members of SD are things like *15cm* or *3 miles*, the members of TD are *3 minutes*, *2 hours* and the like. Note that the degree *3 minutes* is not ordered relative to *15cm*.
Measure functions are partial functions that assign a unique degree to individuals. Height(x) is the maximal degree to which x is tall etc.

(8) Measure functions (type <e,d>):
Height = λx: $x \in D_e$.x's height
Intelligence = λx: $x \in D_e$.x's intelligence
Weight = λx: $x \in D_e$.x's weight

Kennedy (1997) takes this to be the adjective meaning. We follow von Stechow, in whose framework gradable adjectives are relations between individuals and degrees (compare also Demonte this volume for discussion). Adjectives relate individuals with *sets* of degrees, for example the degrees of height that they reach. We use the monotonicity property in (10).

(9) Gradable adjectives (type <d,<e,t>>; von Stechow):
[[**tall**]] = $\lambda d: d \in D_d.\lambda x: x \in D_e$. Height(x) $\geq$ d
[[**intelligent**]] = $\lambda d: d \in D_d.\lambda x: x \in D_e$. Intelligence(x) $\geq$ d

(10) $\forall x \forall d \forall d'[f(d)(x)=1 \ \& \ d'<d \rightarrow f(d')(x)=1]$

More accurately, the degree arguments of adjectives must be restricted to particular sorts: [[**tall**]] is restricted to spatial distances measured in the vertical dimension, (11a). We will mostly assume this tacitly and not represent it, cf. (11b). We also frequently write (11c) for (11b).

(11) a. [[**tall**]] = $\lambda d{:}d{\in} D_d$ & d is a vertical distance in SD.$\lambda x{:}x{\in} D_e$.Height(x) $\geq$ d
b. [[**tall**]] = $\lambda d: d \in D_d.\lambda x: x \in D_e$. Height (x) $\geq$ d
c. [[**tall**]] = $\lambda d.\lambda x$. x is d-tall

We proceed with the simplest imaginable semantics for measure constructions (more discussion is to follow below, in sections 2.2.4. and 3.2.): the measure phrase refers to a degree and occupies the degree argument slot of the adjective. The measure construction will be true if the individual reaches the degree measured. While there is usually an implicature to the effect that this is the maximal degree reached, (13) shows that she can exceed that degree without contradiction in a context in which the implicature does not arise.

(12) a. **Caroline is 6' tall.**
b. **Caroline is [$_{AP}$ 6' [$_{A'}$ tall]]**
c. [[**tall**]] (6')(C)=1 iff Height(C) $\geq$6'

(13) a. Context: There is a discussion about whether Caroline can join the school basketball team. The rules state that one has to be at least 6' tall in order to do so.
b. **Caroline is 6' tall. In fact I think she is even 6'2".**

2.1.3. Comparison with a degree - composition in the main clause

This understanding of adjective meaning equips us to consider the composition of the comparative construction. We concentrate on the main clause and compare with a degree as in (14). The semantics of (14a) adopted in Heim (2001) is (14b). The maximality operator used in (14b) is defined in (15). An appropriate meaning for the comparative morpheme is (16). The comparative relates a degree and a property of degrees - the degree being 6' in our example and the property being the degrees of height that Caroline reaches. Remember (17) in order to connect the semantic representation in (14) with the intuitive paraphrase.

(14) a. **Caroline is taller than 6'.**
b. max(λd.C is d-tall)>6'
'Caroline's height exceeds 6'.'

(15) max(P) = ιd:P(d)=1 & ∀d'[P(d')=1 → d'≤d]

(16) comparative morpheme (comparison to a degree, type <d,<<d,t>,t>):
[[**-er**]] = λd.λP.max(P)>d

(17) a. λd.C is d-tall = λd. Height(C)≥d
b. max(λd.C is d-tall) = max(λd. Height(C)≥d) = C's height

The underlying syntactic structure of our example (14a) is taken to be (18a), where the degree expression '**more/-er than 6'**' occupies the specifier position of AP (Heim 2001; she calls this constituent a DegP). In order to derive the surface (14a) above, one assumes movement of the adjectival head to join the comparative morpheme (Bresnan 1973); alternatively, insertion of dummy 'much' would yield 'Caroline is more than 6' tall'. (This is a sketch of a 'classical' derivation; see Bhatt & Pancheva 2004 for a modern analysis.)

Of more interest to us is the Logical Form, the input to compositional interpretation, given in (18b). The DegP is not of a suitable type to fill the degree argument slot of the adjective and is raised (QRed) to a sentence adjoined position. (18b) is straightforwardly interpretable to yield (14b), with the intermediate step in (19) and predicate abstraction in (20) (following Heim &

Kratzer 1998). Note that the DegP is of type <<d,t>,t>, a quantifier over degrees, and thus an excellent candidate to undergo QR (as Heim 2001 points out).

(18) a. **Caroline is [$_{AP}$ [$_{DegP}$ more/-er than 6'] tall]** (underlying structure)
b. **[$_{DegP}$ more/-er than 6'] [1 [Caroline is [t1 tall]]]** (Logical Form)

(19) [[**[-er than 6']**]] = λP. max(P)>6'

(20) [[**[1 [Caroline is [t1 tall]]**]] = λd.C is d-tall

Next, we consider difference degrees and example (21a). An accurate description of the example's truth conditions is (21b), which says that Caroline's height is at least the degree denoted by the *than*-phrase plus the difference degree.

(21) a. **(Georgiana is 6' tall.) Caroline is 2" taller than that.**
b max(λd.C is d-tall)≥6'+2"
'Caroline's height is at least 6'2".'

We must integrate the difference degree into the semantics. (22) gives the comparative another argument position for the difference degree and (23) interprets our example. If there is no difference degree given, as in (24), we assume that the difference degree slot is existentially quantified over, as indicated in (25a), (26a); (25a) is the same as (25b) and (26a) is the same as (26b), our original semantics from (16).

(22) comparison to a degree with difference degree (type <d,<d,<<d,t>,t>>>):
[[**-er**$_{diff}$]] = [λd.λd'.λP.max(P)≥d+d']

(23) a. **[2" [-er$_{diff}$ than 6']] [1 [Caroline is t1 tall]]**
b. [[**-er**$_{diff}$]] (6')(2")(λd.C is d-tall) =1 iff
max(λd.C is d-tall)≥6'+2" iff
C's height is at least 6'2".

(24) **Caroline is taller than 6'.**

(25) a. $\exists d'[d'>0 \ \& \ \max(\lambda d.\text{C is d-tall}) \geq 6'+d']$

b. $\max(\lambda d.\text{C is d-tall}) > 6'$

(26) simple comparison to a degree (type <d,<<d,t>,t>):

a. $[[\textbf{-er}_{\text{simple}}]] = \lambda d.\lambda P.\ \exists d'[d'>0 \ \& \ \max(P) \geq d+d']$

b. $[[\textbf{-er}_{\text{simple}}]] = \lambda d.\lambda P.\ \max(P) > d$

2.1.4. Descriptions of the item of comparison - the *than*-clause

We now consider data in which the item of comparison is not in an obvious way a degree. It has been assumed since Bresnan (1973) that the semantically most transparent case is the subcomparative. Note: in order to get an acceptable subcomparative, choose your example in such a way that the two adjectives operate on the same scale. As we saw above, IQ points stand in no ordering relation to spatial distances, for instance. The desired semantics for example (27b) is given in (28).

(27) a. **Caroline is taller than the sofa is long.**

'Caroline's height exceeds the length of the sofa.'

b. **The desk is higher than the door is wide.**

'The height of the desk exceeds the width of the door.'

(28) $\max(\lambda d.\text{the desk is d-high}) > \max(\lambda d'.\text{the door is d'-wide})$

We are led to assume that the subordinate clause, just like the main clause, provides us with a set of degrees. The comparative operator uses the maximum of the degrees described to make the comparison. Thus we use a meaning for the comparative morpheme (simple version) given in (29). A Logical Form like (30) will serve as an appropriate input to derive the meaning described.

(29) comparative morpheme for clausal comparatives (type <<d,t>,<<d,t>,t>>):

$[[\textbf{-er}_{\text{simple}}]] = \lambda D1.\lambda D2.\ \max(D2) > \max(D1)$

(30) **[-er$_{\text{simple}}$ than [2 [the door is t2 wide]]] [1 [the desk is t1 high]]**

[[**[2 [the door is t2 wide]]**]] = $\lambda d'.\text{the door is d'-wide}$

[[**[1 [the desk is t1 high]**]] = λd.the desk is d-high

Note that if we suppose that we can derive particular degrees from sets of degrees by some other method (like maximality in free relatives, Jacobson 1995), the contribution of *-er* is simply the 'larger than' relation in (31). The contribution of the max operator is represented in the LF (30'). This would achieve uniformity with the 'comparison to a degree' examples in the last subsection. We will work with (29) (the most common semantics for the comparative morpheme) and come back to (31) later.

(31) possible generalization - comparative morpheme of type <d,<d,t>>:
[[**-er**$_{\text{simple}}$]] = λd.λd'.d'>d

(30') **[-er$_{\text{simple}}$ than [max [2[the door is t2 wide]]]] [max [1[the desk is t1 high]]]**

These are the important features of the analysis: The *than*-clause is a wh-clause with a degree gap. The degree-gap is the trace of a wh-moved operator interpreted via predicate abstraction. The comparative morpheme and the *than*-clause form a constituent at LF - a quantifier over degrees according to the semantics in (29). LF movement of this quantifier creates another predicate abstraction over a degree variable in the matrix clause. At the surface structure, the *than*-clause must be extraposed, and once more we have either movement of the adjective to support *-er* or we insert dummy *much*. An argument for predicate abstraction over degree variables can be drawn from degree questions: As the LF in (32b) shows, *how* spells out the wh-operator that creates abstraction over the degree argument (compare e.g. Beck 1996 for this kind of compositional semantics of degree questions).

(32) a. **How high is the desk?**
b. **[Q [how1 [the desk is t1 high]]]**
c. [[**Q**]] (λd.the desk is d-high)
d. For which d: the desk is d-high

The interpretation of examples with difference degrees once more requires us to use a version of *-er* with an extra argument slot for the difference degree:

(33) **Caroline is 3" taller than the sofa is long.**

'Caroline's height exceeds the length of the sofa by at least three inches.'

(34) **[[3" [-er [than [2[the sofa is t2 long]]]]] [1[Caroline is t1 tall]]]**

(35) a. [[-**er**$_{diff}$]] $= \lambda D1.\lambda d.\lambda D2.max(D2) \geq max(D1)+d$

b. [[-**er**$_{simple}$]] $= \lambda D1.\lambda D2.\exists d[d>0 \ \& \ max(D2) \geq max(D1)+d$

$= \lambda D1.\lambda D2.\ max(D2)>max(D1)$

The subcomparative is special in that there is no genuine deletion process. Most comparatives are less obvious in that various parts of the degree description we need semantically in the *than*-clause have been elided. Below is a simple example involving comparative deletion (an elided AP; Bresnan 1973). Ellipsis is indicated by strike-through. We assume that there is no semantic difference to the cases discussed.

(36) a. **Caroline is taller than Georgiana is.**

b. **[[-er [than [2[Georgiana is [~~AP~~ t2 tall]]]]] [2[Caroline is [AP t2 tall]]]]**

We have concentrated so far on examples in which the adjective is used predicatively. The analysis can be straightforwardly extended to the data below (with the comparative adjective used attributively, and an adverbial comparative). What distinguishes such examples from the one discussed is a matter of syntax: the size, kind and position of the ellipsis. See in particular Lechner (2004) for comprehensive discussion of the syntax of comparison, as well as further references.

(37) a. **Mr Bingley keeps more servants than Mr Bennet does.**

b. **[[-er [than [2[Mr Bennet does [~~VP~~ keep t2 many servants]]]]]**
[2[Mr Bingley keeps t2 many servants]]]

(38) a. **Colonel Fitzwilliam behaved more amiably than his cousin did.**

b. **[[-er [than [2[his cousin did [~~VP~~ behave t2 amiably]]]]]**
[2[Colonel Fitzwilliam behaved t2 amiably]]]

(39) a. **Colonel Fitzwilliam behaved more amiably than Lizzy had expected.**

b. **[[-er [than [2[Lizzy had expected [~~XP~~ C.F. behave t2 amiably]]]]]**

[2[Colonel Fitzwilliam behaved t2 amiably]]]

We will return to (1a) - the phrasal comparative - below. This concludes the description of the basic theory. The important aspects of the theory of comparatives introduced here are:

- comparison is between degrees;
- matrix and *than*-clause provide sets of degrees via abstraction over a degree variable;
- the comparative morpheme relates their maxima;
- adjectives denote relations between degrees and individuals.

With these features of the theory in place, it is straightforward to extend data coverage in many ways.

2.2. Extensions

2.2.1. Phrasal comparatives

Heim (1985) spells out a semantic analysis of phrasal comparatives that does not take them to be elliptical clausal comparatives - a 'direct' analysis. A semantic interpretation is proposed for the comparative as in (41). The Logical Form of (40a)=(1a) is as in (42a). This is interpreted to yield the same semantics as the clausal equivalent, as demonstrated in (42b).

(40) a. **Caroline is taller than Georgiana.**

b. $\max(\lambda d.\text{C is d-tall}) > \max(\lambda d'.\text{G is d'-tall})$

(41) phrasal comparative morpheme (type $\langle e,\langle\langle d,\langle e,t\rangle\rangle,\langle e,t\rangle\rangle\rangle$):

$[[\textbf{-er}_{\text{phrasal}}]] = \lambda y.\lambda R.\lambda x.\max(\lambda d.R(d)(x)) > \max(\lambda d'.R(d')(y))$

(42) a. **[Caroline [[-er$_{\text{phrasal}}$ than Georgiana] [1[2[t2 is t1 tall]]]**

b. $[[\textbf{-er}_{\text{phrasal}}]]$ (G) ($\lambda d.\lambda x.$x is d-tall) (C) =1 iff

$\max(\lambda d.\text{C is d-tall}) > \max(\lambda d'.\text{G is d'-tall})$

In contrast to the clausal comparative, there is no syntactic ellipsis in phrasal comparatives on this analysis. A conceivable alternative would be to reduce the phrasal comparative to the elliptical clausal comparative (42').

(42') **[-er$_{simple}$ than [2[Georgiana [~~XP~~ is t2 tall]]]] [2[Caroline is t2 tall]]**

Heim also argues that it is unclear whether this analysis is to be preferred to an ellipsis analysis. Phrasal and clausal comparatives in English show a very similar behaviour. A recent analysis that reduces the phrasal comparative to the clausal one, and much interesting discussion, is found in Lechner (2004). Thus, while a direct semantic analysis is possible, it is not certain that this is desirable for English phrasal comparatives. One ought to keep in mind that the discussion has been largely based on English (and German; but see Pancheva to appear, Merchant ms.), and be open to the idea that a given language might or might not have a phrasal comparative. Turkish, for example, appears to have only *than*-phrases, not *than*-clauses (Hofstetter to appear), and so does Hindi-Urdu (Bhatt & Takahashi 2008). This makes an analysis along the lines of (42') unappealing and one along the lines of (42) rather appealing for this language. The crosslinguistic variation regarding phrasal vs. clausal comparatives is the subject of Bhatt & Takahashi (2008) and Kennedy (to appear).

2.2.2. Other comparison operators: Equatives, Superlatives and Intensional Comparisons

- Equatives

Von Stechow (1984) observes that the equative seems to be a close relative to the comparative; just the relation expressed is slightly different. Examples and an analysis are given below. The semantics derived corresponds to 'at least as Adj as'.

(43) a. **Mary is as tall as Kitty is.**
b. **Mr Darcy is as rich as Mr Bingley is, if not richer.**

(44) [[**as**]] = λD1.λD2. max(D2) $\geq$ max(D1)

(45) **[[as [1[Kitty is t1 tall]]] [1[Mary is t1 tall]]]**
'The height degree reached by Mary is at least as big as the one reached by Kitty.'

Equatives permit differentials that express multiplication. The meaning of (46b) is given in (47). A semantics for equatives that provides a slot for the differential is given in (48) and a compositional analysis of the example is sketched in (49).

(46) a. **"He could not help seeing that you were about five times as pretty as every other woman in the room."** ('Pride and Prejudice', Jane Austen; available at Gutenberg archives: http://www.gutenberg.org)

b. **The curtain is twice as wide as the window.**

c. **Das Pflanzloch muss doppelt so tief sein, wie die Zwiebel dick ist.**
the hole should doubly as deep be as the bulb thick is
'The hole should be twice as deep as the body of the bulb is thick.'
(from DasErste.de - Ratgeber - Heim+Garten - Gärtnertipps für den Monat September at www.wdr.de/tv/ardheim/sendungen/2007/september/070916-5phtml)

(47) The curtain's width $\geq$ 2$*$ the window's width

(48) [[$\mathbf{as}_{\text{diff}}$]] = λd.λD1.λD2. max(D2) $\geq$ d $*$ max(D1)

(49) a. **[[twice as][1[the window is t1 wide]][1[the curtain is t1 wide]]]**

b. max (λd.the curtain is d-wide) $\geq$ 2 $*$ max(λd.the window is d-wide)

See Bhatt & Pancheva (2004) and Rett (2007) for some recent discussion of the equative.

<u>- Superlatives</u>

There is an intuitively obvious connection between comparative and superlative in that (50a) means (50b):

(50) a. **Caroline is the tallest.**

b. **Caroline is taller than anyone else.**

The superlative differs from the comparative in its surface appearance - it does not necessarily come with an indication of the intended item of comparison. Heim (1985, 2001) spells out the following semantics (meaning of *-est* in (51), example, Logical Form and truth conditions in (52)):

(51) $[[\textbf{-est}]] = \lambda R_{<d,<e,t>>}.\lambda x.\max(\lambda d.R(d)(x)) > \max(\lambda d.\exists y[y \neq x \ \&\ R(d)(y)])$

(52) a. **Caroline is the tallest.**

b. **Caroline [-est [tall]]**

c. $[[\textbf{-est}]]\ (\lambda d.\lambda z.z \text{ is d-tall})(C) = 1$ iff
C's height > $\max(\lambda d.\exists y[y \neq C \ \&\ y \text{ is d-tall}])$

(53) is an example of the well-known absolute vs. relative ambiguity (Ross 1964, Szabolcsi 1986). It has been suggested that the readings correspond to two different possible syntactic scopes of the superlative morpheme, as spelled out below.

(53) a. **Sally climbed the highest mountain.**

b. Sally climbed a higher mountain than anyone else did. (relative)

c. Sally climbed a mountain higher than any other mountain. (absolute)

(54) a. **Sally [-est [1[climbed a t1 high mountain]]]** (relative)

b. $[[\textbf{-est}]]\ (\lambda d.\lambda z.z$ climbed a d-high mountain)(Sally)

(55) a. **Sally [climbed the [-est [1[t1 high mountain]]]]** (absolute)

b. Sally climbed the $(\lambda x.\ [[\textbf{-est}]]\ (\lambda d.\lambda z.z$ is a d-high mountain)(x))

But, one ought to relativize the superlative to a set of contextually relevant entities one is comparing with. Reading (53b) for instance must be about other relevant mountain climbers. We give the superlative a resource domain variable for the quantification in the item of comparison:

(56) $[[\textbf{-est}]] = \lambda C.\lambda R_{<d,<e,t>>}.\lambda x.\max(\lambda d.R(d)(x)) > \max(\lambda d.\exists y[y \neq x \ \&\ C(y)\ \&\ R(d)(y)])$

It has been argued (Heim 1999) that this step makes the first LF (54) superfluous, because C could be the set of mountains total, or the mountains climbed by some relevant person. See Stateva (2002) for more discussion of this and further issues relating to the status and scope possibilities of the superlative operator, as well as for further references.

<u>- Intensional Comparisons</u>

In most examples considered so far, one individual was compared to another (or several others) according to some dimension. The following intensional comparisons are different in that we must consider one and the same individual under different circumstances - in the actual situation vs. in other hypothetical situations. The examples can be paraphrased by more familiar comparison constructions employing intensional verbs (*have to, require*).

(57) a. **Caroline is too tall to sleep on the sofa.**
'Caroline would have to be less tall than she is to sleep on the sofa.'

b. "**[...] I have had the pleasure of your acquaintance long enough to know, that you find great enjoyment in occasionally professing opinions which in fact are not your own."** ('Pride and Prejudice', Jane Austen)
'I have had the pleasure of your acquaintance as long as is required to know that you find great enjoyment in occasionally professing opinions which in fact are not your own.'

c. **"[...] they both of them frequently staid so long, that even Bingley's good humour was overcome, [...]"**('Pride and Prejudice', Jane Austen)
'... they would have had to stay less long than they did for Bingley's good humour not to be overcome, ...'

That means that they relate the here and now to other conceivable situations. We see from the paraphrases that the comparison made by the *too*, *enough* and *so that* constructions relate e.g. Caroline's actual height to her height in hypothetical situations/worlds. As a first step towards a semantics of these constructions, consider Heim (2001) on *too* below. In the presentation of the example, I write '@' for the actual world and 'R' for the accessibility relation (compare e.g. Kratzer 1991 for a standard semantics of modality; see also Bhatt this volume).

(58) $[[\textbf{too}]] = \lambda w.\lambda P_{<d,<s,t>>}.\max(\lambda d.P(d)(w)) > \max(\lambda d.\exists w'[R(w,w') \,\&\, P(d)(w')])$

(59) a. **Caroline is too tall.**

b. $\max(\lambda d.\text{Height}(C)(@) \geq d) > \max(\lambda d.\exists w'[R(@,w') \,\&\, \text{Height}(C)(w') \geq d])$

c. Caroline's actual height exceeds the maximal height she reaches in any relevant alternative world
(where relevant other worlds are ones where C sleeps on the sofa).

d. **[too [1[Caroline is t1 tall]]]**

e. [[**tall**]] = $\lambda d{:}d\in D_d.\lambda x{:}x\in D_e.\lambda w.\text{Height}(x)(w) \geq d$

See in particular Meier (2003) for a discussion of intensional comparison operators. Note that we need to change from the extensional semantics used so far for simplicity to an intensional semantics. As an example, the proper intensional lexical entry for 'tall' is given in (59e). We will use an intensional semantics in this article where it is relevant and an extensional one where it is not.

2.2.3. Positive, Antonyms and *Less*

- Positive and Antonyms

The gradable predicates that we are investigating do not always occur in an explicit comparison. Rather, a frequent use of adjectives is one that does not immediately suggest that a comparison is made at all - the positive form of the adjective.

(60) a. **Caroline is tall.**

b. **Mr Darcy is rich.**

The positive will make us aware of antonyms, or scalar opposites. The pertinent points are: the positive polar and the negative polar adjective in the antonym pair operate on the same scale (cf. (61)). There is a neutral area on the scale of things that have the property expressed by neither of the antonyms; the positive says that an individual is beyond the neutral area on the scale (in the right direction) - cf. (62) (see Bierwisch 1989, Kennedy 2001 and von Stechow 1984, 2006 for discussion).

(61) **Mr Darcy is taller than Mr Bingley.**

<=> **Mr Bingley is shorter than Mr Darcy.**

(62) a. **Mr Darcy is tall.** ==> **Mr Darcy is not short.**

b. **Mr Bingley is not tall.** =/=> **Mr Bingley is short.**

c. **Mr Bingley is neither tall nor short.**

We adopt here the negation theory of antonymy (e.g. Heim 2007), illustrated below. The negative polar adjective is a lexically negated version of the positive polar one.

(63) a. [[**tall**]] = $\lambda d.\lambda x.\text{Height}(x) \geq d$

b. [[**short**]] = $\lambda d.\lambda x.\sim\text{Height}(x) \geq d$

= $\lambda d.\lambda x.\text{Height}(x) < d$

(64) ---> SD

//////////////////////////////////\\\

Darcy is d-tall Darcy is not d-tall = Darcy is d-short

Here is von Stechow's (2006) proposal on the semantics of the positive. He assumes a contextually given delineation interval L_C between polar opposites; L_C is a dense interval of degrees with s_C- as lower bound and approaching s_C+ as an upper bound, i.e., $L_C = [s_C-, s_C+)$. The positive can be defined as a universal quantifier stating that the degree predicate is true of every d in L_C, as in (65) below. Some examples from von Stechow's paper follow.

(65) [[$\mathbf{Pos_C}$ <<d,t>,t>]] = $\lambda D.\forall d[d \in L_C \rightarrow D(d)]$

(66) a. **Ede is tall.**

b. **Pos** (λd.Ede is d-tall) iff $\forall d[d \in L_C \rightarrow \text{Height}(E) \geq d]$

c. |..........)s-.................(s+......Height(E)..................> ∞

(67) a. **Ede is not tall.**

b. ~**Pos** (λd.Ede is d-tall) iff $\sim\forall d[d \in L_C \rightarrow \text{Height}(E) \geq d]$

c. |..........)s-......Height(E).........(s+............................> ∞

or

|.......Height(E).......)s-..........(s+............................> ∞

(68) a. **Ede is short.**

b. **Pos** (λd.Ede is d-short) iff $\forall d[d \in L_C \rightarrow \text{Height}(E) < d]$

c. |.......Height(E).......)s-..........(s+............................> ∞

(69) a. **Ede is not short.**

b. ~**Pos** (λd.Ede is d-short) iff ~$\forall$d[d $\in$ L_C $\rightarrow$ Height(E) < d]

c. |......................)s-.......Height(E)...........(s+.............> ∞

or

|......................)s-...............(s+.......Height(E).........> ∞

Von Stechow' positive operator provides a unified semantics for the positive, i.e. it combines with both pairs of a polar opposition, and is compatible with the negation theory of antonymy. The interpretation of the positive is context dependent. In contrast to earlier analyses of the positive (e.g. Lewis 1970, Kamp 1975, Klein 1980), this semantics takes the relational adjective meaning of type <d,<e,t>> we need for comparative semantics as its starting point and derives the positive from that. Rett (2007) presents a further development of such a view; she decomposes the contribution of the positive into a modifier and a quantifier part (the modifier relating the degree argument of the adjective to the contextual standard). The quantifier occurs in the positive, but the modifier occurs in other constructions that imply comparison to a contextual standard (e.g. **John is as short as Mary is** => **John is short**). Also, see Kennedy (to appear a), Rett (2007) and Demonte (this volume) for further interesting issues regarding the distinction between relative and absolute gradable adjectives and the positive.

We ought to reconsider the contribution of the comparative morpheme when we take into account comparatives with antonyms. The degrees of which the *than*-clause is true does not have a maximum, see (70d). We would get the right result if we compared the minima of the two sets that syntax allows us to derive - as can be brought about by the alternative lexical entry for the comparative morpheme in (71). While this works as an immediate remedy of the problem at hand, it is unattractive to have to assume a second meaning for the comparative when it combines with negative polar adjectives.

(70) a. **Mr Bingley is shorter than Mr Darcy is.**

b. **[[-er [than [2 [Mr Darcy is ~~t2 short~~] [2 [Mr Bingley is t2 short]]**

c. [[**short**]] = λd.λx.Height(x)<d

d. [[**2 than Mr Darcy is t2 short**]] = λd.Height(D)<d no max!

e. [[**2 Mr Bingley is t2 short**]] = λd.Height(B)<d

(71) a. clausal comparative morpheme for negative polar adjectives:

[[**-er$_{anto}$**]] = λD1.λD2.min(D2) < min(D1)

b. $\min(\lambda d.\mathrm{Height}(B)<d) < \min(\lambda d.\mathrm{Height}(D)<d)$

Heim proposes instead a subset semantics (e.g. in Heim 2007) for *-er* given in (72) below. This subset semantics is applied to (70) in (73), and to a regular positive polar adjective in (74). We see that the truth conditions of (74) are the same as before - the sentence is true iff Mr Darcy's height is above Mr Bingley's Height on the Height scale.

(72) [[**-er**]] = $\lambda D1.\lambda D2.D1 \subset D2$

(73) a. **Mr Bingley is shorter than Mr Darcy is.**

b. $[\lambda d.\mathrm{Height}(D)<d] \subset [\lambda d.\mathrm{Height}(B)<d]$

c. The degrees of height that lie above Darcy's height are a subset of the degrees of height that lie above Bingley's height.

(74) a. **Mr Darcy is taller than Mr Bingley is.**

b. $[\lambda d.\mathrm{Height}(B)\geq d] \subset [\lambda d.\mathrm{Height}(D)\geq d]$

c. The degrees of height that lie below Bingley's height are a subset of the degrees of height that lie below Darcy's height.

The subset semantics has the advantage that it works for the antonym case as well. We will keep it in mind as a viable alternative to the max interpretation of the comparative (see also subsection 2.3.4.). Note, however, that since the *than*-clause no longer refers to a degree, the standard theory's analysis of differentials (e.g. **Mr Darcy is 2" taller/shorter than Mr Bingley is**) is lost. (See Schwarzschild 2008, and informally already Klein 1991, for a semantics for differentials within this analysis of the comparative, which however becomes rather more complex.)

<u>- Less</u>

It is tempting to analyse *less* as making a parallel but reversed contribution to *-er*:

(75) a. "**Wickham's a fool, if he takes her with a farthing less than ten thousand pounds."** ('Pride and Prejudice', Jane Austen)

b. **Mr Bingley has five thousand a year. Mr Bennet has less than that.**

(76) a. [[$\textbf{less}_{diff}$]] = λD1.λd.λD2.max(D1) $\geq$ max(D2)+d

b. [[$\textbf{less}_{simple}$]] = λD1.λD2.max(D2) < max(D1)

On the other hand, one could be guided by the idea that "less tall" means "shorter", and "short" in turn means "not tall", and try to compose "less tall" out of the meaningful components *-er* plus negation plus *tall*. An important motivation for the researchers that have contemplated this step is the ambiguity in (78) (Seuren 1973, Rullmann 1995, Heim 2007).

(77) a. **less tall = -er + little + tall**

b. **little** is degree predicate negation (type <d,<<d,t>,t>>):

[[**little**]] = λd.λP.P(d)=0

(78) a. **Lucinda was driving less fast than was allowed.**

b. Lucinda was driving (legally) below the speed limit.

c. Lucinda was driving (illegally) below the minimum speed permitted.

Below is a derivation of the unproblematic 'legal' reading (in the max version, using (79b) as an assumption about the context: the legal speed is between 30mph and 50mph).

(79) a. [[**[than [2[was allowed [Lucinda drive t2 fast]**]] =

λd.Lucinda was allowed to drive d-fast =

b. [30mph , 50mph]

c. L's actual speed < max(λd.Lucinda was allowed to drive d-fast)

= L's actual speed < 50mph

But what about the second, 'illegal' reading? There seems to be no principled derivation of it using (76) (but see Meier 2002 for a different view and an analysis based on a more elaborate semantics for modals). One could employ a minimum operator instead of a maximum operator for the embedded clause, but what would be the motivation? On the other hand, (77) can help here. Heim's (2007) analysis of the ambiguity is given in (80)-(82). The underlying structure in (80), which decomposes *less fast* into *-er* + *little* + *fast*, can lead to two different LFs, (81a) and (81b). They differ with respect to the scope of *little*=negation in the *than*-clause.

(80) **Lucinda drive [[-er than allowed Lucinda drive t little fast] little] fast**

(81) a. **[[-er than [1[allowed [t1 little] [2[L drive t2 fast]]]**
[1[L drive t1 little fast]]]

b. **[[-er than [1[[t1 little] [2[allowed L drive t2 fast]]]**
[1[L drive t1 little fast]]]

(82) [[**[1[L drive t1 little fast]]]**]] = λd.Lucinda drove d-slow
= degrees of speed that Lucinda did not reach

The two LFs provide us with two different intervals for the meaning of the *than*-clause, (83) and (84) respectively. This allows us to account for the ambiguity, as demonstrated in (85a) and (85b) (with Heim's subset semantics), and (85a'), (85b') (with the min semantics from (71)). Crucially, decomposition is used in both versions.

(83) [[**[1[allowed [t1 little] [2[L drive t2 fast]]]]**]] =
λd.Lucinda was allowed to drive d-slow =
[30mph, ∞)

(84) [[**[1[[t1 little] [2[allowed L drive t2 fast]]]]**]] =
λd.Lucinda was not allowed to drive d-fast =
[50mph, ∞)

(85) a. [λd.Lu was allowed to drive d-slow] ⊂ [λd.Lu drove d-slow]
= Lucinda was illegally slow

a'. min(λd.Lu drove d-slow)<min(λd.Lu was allowed to drive d-slow)
= Lucinda was illegally slow

b. [λd.Lu was not allowed to drive d-fast] ⊂ [λd.Lu drove d-slow]
= Lucinda was below the speed limit

b'. min(λd.Lu drove d-slow)<min(λd.Lu was not allowed to drive d-fast)
= Lucinda was below the speed limit

See Heim (2007, 2008) and Büring (2007a,b) for a thorough discussion of the consequences of such an approach to *little* and *less*, and once more subsection 2.3.4. for a related remark. It seems to me that the outcome of this lively debate is yet to be fully determined.

2.2.4. Measure Phrases

Analysing adjectives as denoting a relation between a degree and an individual leads us to expect that they can combine directly with a degree denoting expression (see also once more Demonte this volume). This appears to be verified by measure constructions like (86), and this is how we sketched the contribution of measure phrases at the beginning of section 2.

(86) "**I hope you saw her petticoat, six inches deep in mud."**
('Pride and Prejudice', Jane Austen)

(87) a. [[**deep**]] = λd.λx. Depth(x) ≥d
b. [[**six inches deep**]] = [[**deep**]] (6")
= λx. Depth(x) ≥6"

The property in (87b) will be true of objects whose depth is greater than or equal to six inches (e.g. the mud covering of Lizzy's petticoat). This corresponds to an interpretation 'at least six inches deep'. We can make explicit whether we have an 'at least' or an 'exactly' interpretation in mind:

(88) **Caroline is at least/exactly/at most 6' tall.**

This suggests that a more precise analysis of measure phrases should take them to be quantifiers over degrees, type <<d,t>,t>, as in von Stechow (2005). The three versions of the LF in (90) below mean: Height(C) ≥ 6'; Height(C) = 6' and Height(C) ≤ 6'.

(89) a. [[**at least**]] = λd.λD.max(D) ≥ d
b. [[**exactly**]] = λd.λD.max(D) = d
c. [[**at most**]] = λd.λD.max(D) ≤ d

(90) **[[at least/exactly/at most 6'] [1[Caroline is t1 tall]]]** =

[[**at least/exactly/at most**]] (6') (λd.C is d-tall)

(91) max(λd.C is d-tall) = max(λd.Height(C) $\geq$ d) = Height(C)

The same slightly refined understanding of measures as quantified measure phrases should go into difference degrees - an example is given in (92).

(92) a. **Caroline is 6' tall.**
Mr Darcy is exactly 3" taller than that.
b. max(λd. max(λd'.D is d'-tall) $\geq$ d+6') = 3"
c. **[exactly 3"] [2 [[t2 -er than that] [1 [Mr Darcy is t1 tall]]]]**
The largest degree d such that Darcy is d-much taller than 6' is exactly 3".

It is odd under this analysis, however, that not all adjectives in English permit such measure phrases to fill their degree argument slot, as seen e.g. in (93). See section 3.2. below for a discussion of Schwarzschild's (2005) objections.

(93) * **five dollars expensive**

2.3. Issues Addressed

The generality of this theory of comparison speaks for itself; but let us make some of its strengths more explicit.

2.3.1. Inference Relations among Comparison Constructions

The extendability of the standard analysis of comparatives to other constructions that we observed in the last subsection is a desideratum of a successful theory of comparison, as demonstrated by some sample inferences between the various comparison constructions. It should be clear from the analyses discussed in this section that the theory predicts all of these facts.

(94) a. **Mr Darcy is taller than 6'.**
Caroline is exactly 6' tall.
==> **Mr Darcy is taller than Caroline is.**

b. **Georgiana is not as tall as Caroline is.**
==> **Caroline is taller than Georgiana is.**

c. **Mary is not taller than Kitty.**
==> **Kitty is at least as tall as Mary.**

d. **Kitty is the tallest (among the younger Miss Bennets).**
The younger Miss Bennets are Mary, Kitty and Lydia.
==> **Kitty is taller than Mary and Kitty is taller than Lydia.**

e. **The rules require that nobody taller than 1.5m enter the bouncy castle.**
Joe is 1.6m tall.
==> **Joe is too tall (to enter the bouncy castle).**

f. **Mary is taller than (as tall as) Kitty is**
=/=> Mary is tall.

2.3.2. NPIs and disjunctions: semantics, inferences, licensing

The combination of predicate abstraction and subsequent maximalization gives the comparison scope in a non-trivial sense. This can be seen in the interaction with other operators. Let us first consider disjunction and NPIs. The data in (95a) and (96a) intuitively have the readings paraphrased in (95b) and (96b), which can be derived by giving the comparison scope over the disjunction and the existential quantifier associated with NPI *any*.

(95) a. **Caroline is taller than Elizabeth or Georgiana is.**
b. Caroline is taller than Elizabeth is and Caroline is taller than Georgiana is.
c. Height(C)>max(λd.E is d-tall or G is d-tall)

(96) a. **Caroline is taller than anyone in Derbyshire.**
b. Everybody in Derbyshire is shorter than Caroline.
c. Height(C)>max(λd.$\exists$x[person_in_Derby(x) & x is d-tall])

It is interesting that NPI *any* is licensed in *than*-clauses. Adopting Ladusaw's (1979) analysis of NPI distribution as licensing in downward monotonic contexts, this follows from von Stechow's (1984) analysis. Examples (97) and (98) illustrate inferences from supersets to subsets in *than*-clauses, and (99) provides a few more examples of acceptable NPIs.

(97) **Caroline is taller than anyone in Derbyshire.**
Lambton is in Derbyshire.
==> **Caroline is taller than anyone in Lambton.**
λd.$\exists$x[person_in_Lam(x) & x is d-tall] $\subseteq$ λd.$\exists$x[person_in_Derby(x) & x is d-tall]

(98) **Thilo ran faster than I skied or biked.**
==> **Thilo ran faster than I skied**
λd.I skied d-fast $\subseteq$ λd.I skied d-fast or I biked d-fast

(99) a. **Thilo ran faster than I <u>ever</u> could.**
b. **Es waren mehr Leute da, als da zu sein <u>brauchten</u>.**
It were more people there than there to be needed
'There were more people there than needed to be.'

The meaning that the standard theory provides can thus explain the interpretation and acceptability of NPIs in these *than*-clauses.

<u>2.3.3. Scope</u>

The motivation for von Stechow's proposals comes to a considerable extent from the interaction of the comparative with other operators. The scope bearing maximality operator is argued for for instance with an example involving modal possibility.

(100) a. **A polar bear can be larger than a grizzly bear can be.**
b. The largest possible height for a polar bear exceeds
the largest possible height for a grizzly.
c. max(λd.$\exists$w'[R(@,w') & a polar bear is d-large in w']) >
max(λd.$\exists$w'[R(@,w') & a grizzly bear is d-large in w'])

(101) a. **I can write this paragraph faster than someone else could.**
b. The largest possible speed with which I write this paragraph
exceeds the largest possible speed with which some other
relevant person writes this paragraph.

Von Stechow discusses other intensional operators (propositional attitude verbs and counterfactuals), with respect to which comparative degrees can be described de re or de dicto. I will not enter into this discussion because it seems to me that today one would favour a different solution for plain de re/de dicto readings, namely choice of world variable (Heim 2001, Percus 2000). But it is instructive to recapitulate von Stechow's discussion of the comparative's interaction with nominal quantifiers. The following concerns nominal scope bearing elements in the *than*-clause. Consider first (102) which is unacceptable. Giving the nominal quantifier in the *than*-clause narrow scope relative to the comparison (like we did with the disjunction, NPIs, modals and indefinites above) allows us to predict this. The set of degrees denoted by the *than*-clause can be argued not to have a maximum, making the meaning of the whole undefined and hence unacceptable (von Stechow 1984, Rullmann 1995). This phenomenon has been termed the Negative Island effect in comparatives - perhaps somewhat misleadingly, since syntactic islands are not the issue here, but I will follow the terminology.

(102) a. * **Lydia is taller than none of her sisters is.**
b. # max(λd.~$\exists$x[x is a sister of Lydia's and x is d-tall])

However, quantifiers do not appear to always take narrow scope relative to the comparison. The only reading intuitively available for (103) is one in which the nominal appears to outscope the comparison. A narrow scope reading of 'everyone else' seems to be unavailable.

(103) **Caroline is taller than everyone else is.**
'Everyone else is shorter than Caroline.'

(103') a. For every x, x$\neq$C: C is taller than x
b. # C's height > max(λd.$\forall$x[x$\neq$C $\rightarrow$ x is d-tall])
= C's height exceeds the height of the shortest other person

The puzzle that emerges here is this: what scope possibilities does a quantificational element in the *than*-clause have? When does it take narrow scope relative to the comparative, and when does it take wide scope? I.e.: Why doesn't (102) have an acceptable wide scope negation reading (amounting to: 'No one is shorter than Lydia'), and why doesn't (103) have an additional narrow scope universal reading? And what happens with operators in the main clause? These questions will be discussed in section 3 below.

2.3.4. Negation

Example (102) poses a second problem (besides illustrating the scope question). There seems to be a difference between the negation that features as part of a negative polar adjective ('lexical' negation, if you will), and 'syntactic' negation as it shows up in (102) (terminology inspired by Heim 2008): lexical negation in a *than*-clause seems to yield a well-formed and interpretable sentence while syntactic negation yields a negative island effect (according to the explanation above, an uninterpretable structure). The contrast is illustrated by (104) and (105).

(104) a. **... than Mr Darcy is short.**
b. **... than Mr Darcy isn't tall.**

(105) a. **Mr Bingley is shorter than Mr Darcy is (short).**
b. * **Mr Bingley is shorter/taller than Mr Darcy isn't (tall).**

This difference does not emerge from the semantics set up here. The maxima of the two *than*-clauses in (104) are equally undefined. We have seen in section 2.2. two ways of providing a well-defined semantics for comparatives containing (104a): the min-semantics in (71) and the subset semantics in (72). Both would be able to apply to (104b) in the same way. As far as I can see, we expect in particular that (106a) can have the interpretation in (106b/c). Examples (107a) as well as (102) above are less problematic since they could be ruled out as a case of cross-polar anomaly (Kennedy 2001, Heim 2007); but (107b) could also be expected to be ok.

(106) a. * **Mr Bingley is shorter than Mr Darcy isn't tall.**
b. $\min(\lambda d.\text{Height}(B)<d) < \min(\lambda d.\sim D \text{ is d-tall}])$
$= \min((\lambda d.\text{Height}(B)<d) < \min(\lambda d\text{Height}(D)<d])$
c. $(\lambda d\text{Height}(D)<d) \subset (\lambda d.\text{Height}(B)<d)$

(107) a. * **Mr Bingley is taller than Mr Darcy isn't (tall).**
b. * **Mr Bingley is taller than Mr Darcy isn't short.**

While (104), (105) distinguish lexical from syntactic negation, there is, perhaps, some reason to regard lexical negation as related to structural negation from the ambiguity in (107'a), which is analogous to the ambiguity in (78). To see this, take *few* to be the antonym of *many*; the lexical negation contained in *few* seems to be able to take variable scope within the *than*-clause, just like *little*. But at the same time (as Heim 2008 observes) (107'b) with *fast*'s antonym *slow* does not share the ambiguity we get with *less*.

(107') a. **There are fewer employees in the room than is allowed.**
'The number of employees is below the permitted minimum.'
'The number of employees is below the permitted maximum.'

b. **Lucinda was slower than is allowed.**
'Lucinda was illegally slow.'
#'Lucinda stayed below the speed limit.'

It is not clear to me how best to account for the different effects of lexically vs. syntactically negated degree predicates, and where within this spectrum we have to locate the negation with *little* and *less*, which might be called 'morphological'. While I consider this an important topic, I have nothing more to say about it and must leave this issue unresolved.

3. Open Questions for the Standard Theory and New Developments

Two important questions arose above: in section 2.2. we noted that measure phrases are not as universally acceptable as one would expect under the present analysis. And in section 2.3. we observed that the interaction of the comparison operator with other scope bearing elements is unclear. I will discuss these issues below. In doing so, I extend the measure phrase question to a larger issue: the substantial crosslinguistic variation that the expression of comparison is subject to. These topics are grouped together here because unlike the facts discussed above, which lead to natural extensions of the standard theory, they have the potential to substantially enrich or change our picture of the semantics of comparison, as will become clear shortly.

3.1. Scope: Quantifiers in the Matrix Clause and in the *than*-Clause

A substantial body of literature on comparison in the 1990s and the first decade of this century has been concerned with the behaviour of scope bearing elements in comparison constructions (e.g. Heim 2001, 2006; Kennedy 1997; Schwarzschild & Wilkinson 2002; Sharvit & Stateva 2002; Stateva 2000). This subsection provides an overview of its main results.

3.1.1. Degree Operators and the Matrix Clause

When one considers scope bearing elements in the matrix clause, the impression can arise that there is no scope interaction at all. This is indeed Kennedy's (1997) position. For illustration, consider (1) (Heim 2001).

(1) **John is 6' tall.**
Every girl is exactly 1" taller than that.

Example (1) has the reading in (1'a), which I abbreviate as in (1'a'), simplifying the semantics of the *exactly*-differential (I will use this simplification frequently in this section).

(1') a. For every girl x: max(λd.Height(x)≥6'+d)=1
a'. For every girl x: x's height = 6'+1"
b. # max(λd.for every girl x: x's height ≥d)=6'+1"
'The height of the shortest girl is 6'1".'

If the sentence could have the reading in (1'b), it would express that the largest degree of height reached by every girl exceeds John's height by one inch - i.e. the height of the shortest girl is one inch above John's height. The sentence would then truthfully describe the situation depicted below, where x marks the height of the shortest girl and J marks John's height on the height scale. Intuitively, the sentence cannot be used to describe this situation. Thus it appears that the quantifier 'every girl' must take scope over the comparison. (3) below is parallel.

```
(2)   |------------------------J--x------------------------------------------>   Height scale
      |------------------------------------------>|          girl1
      |---------------------------------->|                  girl2
      |--------------------------->|                         girl3
```

(3) **John is 6' tall.**
Every girl is at most 1" taller than that.
a. For every girl x: x's height ≤ 6'1"
b. # the height of the shortest girl ≤ 6'1"

The only available reading is the one in which the quantifier takes scope over the comparison. Note that the differential is added to truth conditionally distinguish the two readings; the plain 'every girl is taller than that' would not allow one to distinguish them, because if the shortest girl is taller than 6', they all are.
Other types of data that show this pattern of scopal behaviour, identified by Heim (2001), are exemplified by (4) and (6) below.

(4) **John is 6' tall.**
Every girl is less tall than that.

(5) a. For every girl x: x's height < 6'
b. # max(λd.for every girl x: x's height ≥d)<6'
'The height of the shortest girl is less than 6'.'

(6) **John is 6' tall.**
Exactly three girls are taller than that.

(7) a. For exactly 3 girls x: x is taller than 6'
b. # max(λd.for exactly 3 girls x: x's height≥d)>6'
'At least 3 girls are taller than 6'.'

Given such observations, Kennedy (1997) proposes that comparison operators do not take scope - say: DegPs do not cross quantified DPs at LF.
On the other hand, Heim (2001) claims that contrary to first impressions, DegPs do take scope. This is visible truthconditionally with some intensional verbs (for example *need*, *allow*, *require*) in interaction with *less than* and differential comparatives. It is also visible in some cases of syntactic or semantic ellipsis (where a property of degrees shows up as the argument of a comparison operator that includes an intensional verb) with ordinary comparatives, superlatives and *too*-comparisons. We begin with the truth conditional argument, which is inspired by Stateva (2000). Note first that von Stechow already used a variant of (8) to support an analysis in which the comparative takes non-trivial scope.

(8) **John is 6' tall.**

A panda bear can be at most 1" taller than that.

(9) $\max(\lambda d.\exists w'[R(@,w') \,\&\,$ a panda bear is d-tall in $w'])\leq 6'+1''$
= the largest possible height for a panda bear is 6'1"

Below are the relevant data from Heim's paper. The relevant reading of (10a) is (11a), in which the comparison takes scope over the modal verb. Similarly for (10b). The reader may verify that the same point could have been made with the data in (13).

(10) **This draft is 10 pages long.**
a. **The paper is required to be exactly 5 pages longer than that.**
b. **The paper is allowed to be exactly 5 pages longer than that.**

(11) a. $\max(\lambda d.\forall w'[R(@,w') \rightarrow$ the paper is d-long in $w']) = 10pp + 5pp$
= the minimum length required for the paper is 15 pages
b. $\forall w'[R(@,w') \rightarrow \max(\lambda d.$the paper is d-long in $w') = 10pp + 5pp]$
= the paper must have the length of 15 pages

(12) a. $\max(\lambda d.\exists w'[R(@,w') \,\&\,$ the paper is d-long in $w']) = 10pp + 5pp$
= the maximum length allowed for the paper is 15 pages
b. $\exists w'[R(@,w') \,\&\, \max(\lambda d.$the paper is d-long in $w') = 10pp + 5pp]$
= the paper is permitted to have the length of 15 pages

(13) a. **The paper is required to be less long than that.**
b. **The paper is allowed to be less long than that.**

Not all intensional verbs pattern with *allowed* and *required*, though. For example, *might* does not like to take narrow scope relative to comparison. Compare Heim (2001) for more discussion. The question raised by these data for the standard theory is: why are there so few quantifiers that the comparison can outscope? Given that the comparison is an operator that can be (indeed, must be) raised at LF, we would expect it to be able to outscope other quantifiers besides the *required/allowed* type. Heim (2001) considers a syntactic explanation for this that would rule out LF configurations such as (14) (termed 'Kennedy's generalization'). (14) in effect rules out raising of a DegP across a problematic intervener, the QP. What counts as a problematic intervener can be diagnosed independently by looking at intervention effects in wh-constructions (Beck 1996) and distinguishes modals like *require* from quantifiers like *every girl*. The question remains why such a constraint should be operative in the domain of comparison constructions (compare the generalization in Beck 2007 on intervention effects).

(14) * [DegP <<d,t>,t> ... [QP[... t_{DegP} ...]] ...]

Oda (2008) offers a reinterpretation of some of the facts discussed in Heim (2001). She observes that for the cases with *exactly*-differentials, the truth conditions of the minimum requirement reading can be derived by giving only the differential scope over the modal, not the comparative. This would leave the *less*-comparatives as the sole evidence for the comparative being a syntactically mobile quantifier.

(11') a. max(λd.∀w'[R(@,w') → the length of the paper in w' ≥ d+10pp]) = 5pp
= the minimum length required for the paper is 15 pages
b. **[exactly 5pp [1[required [[t1 -er than that] [2[the paper be t2 long]]]]**

It should be stressed that the data in (8), (10) and (13) and their interpretation in Heim (2001) support crucial aspects of the standard theory of comparison. That theory analyses the comparative as a quantificational element taking independent scope at the level of LF. Heim's scope data lend some support to this view, provided that we reach a comfortable understanding of the limitations on scope interaction that (14) describes. Oda's observation weakens that point, however. We should therefore consider the second kind of evidence that Heim provides, ellipsis. Example (15) is an instance of VP ellipsis in the *than*-clause. Importantly, the ellipsis includes the subordinate intensional verb *want*. In order to derive (15)'s interpretation, we need to create (for syntactic as well as interpretive purposes) a constituent that includes *want*, but not *5cm -er*. The LF (15'b) provides such a constituent; it does so by QRing the DegP to a position above *want*.

(15) **John wants to be (exactly) 5cm taller than Bill does.**
'The height John wants to reach is 5cm above the height that Bill wants to reach.'

(15') a. max(λd.∀w'[R(@,w') → John is d-tall in w]) =
5cm + max(λd.∀w'[R(@,w') → John is d-tall in w])
b. **[5cm -er than [1 Bill does ~~want to be t1 tall~~]]**

[1[John -s want to be t1 tall]]

Ellipsis thus provides a second kind of evidence in favour of a quantifier analysis of the comparative. Compare Heim (2001) for further considerations and more discussion. See Sharvit & Stateva for a different view of the semantic side.

3.1.2. Degree Operators and the *than*-clause: Facts

We have already come across the problem of quantifiers in *than*-clauses in section 2.3. Remember the data below, where we observed that the quantifier, surprisingly, seemed to take obligatory wide scope over the comparison.

(16) **Caroline is taller than everyone else is.**
'Everyone else is shorter than Caroline.'

(16') a. $\forall x[x \neq C \rightarrow$ C is taller than x]
b. # C's height > max($\lambda d.\forall x[x \neq C \rightarrow$ x is d-tall])
= C's height exceeds the height of the shortest other person

When we consider the Logical Forms that would correspond to the two potential readings, it becomes obvious why the facts are unexpected. Constraints on QR (i.e. its clauseboundness) would lead one to expect that LF (17a) is impossible while LF (17b) is fine. The facts appear to indicate the opposite. Many other quantifiers (below: 'exactly n') are parallel.

(17) a. **[everyone else [1[[$_{DegP}$ -er [$_{CP}$ than [2[t1 is t2 tall]] [2[C is t2 tall]]]]]**
b. **[[-er [$_{CP}$ than [2[everyone else is t2 tall]]]] [2[C is t2 tall]]]**

(18) **John is taller than exactly three girls are.**
'There are exactly three girls who are shorter than John is.'

The puzzle here is in a sense larger than our question about quantifiers in the matrix clause. A normal expectation would be that a quantifier in a *than*-clause is contained inside a scope island, and must take scope there. That we get only an apparent wide scope reading of quantifiers like nominal 'every N' is very surprising. Even worse, Schwarzschild & Wilkinson (2002) observe that intensional verbs and other expressions which cannot undergo QR also give rise to readings that look like wide scope:

(19) **John is taller than I had predicted (that he would be).**

a. $\forall$w[R(w,@) $\rightarrow$ max(λd.John is d-tall in @)>max(λd.John is d-tall in w)
For every world compatible with my predictions:
John's actual height exceeds John's height in that world.

b. # John's height exceeds the height that he reaches in all worlds compatible with my predictions.
= John's actual height exceeds the minimum I predicted.

For the standard theory, these facts raise the question of why so many quantifiers take scope out of the embedded clause, and for some of them, how this is possible at all.

Once more, it depends on the choice of quantificational element what scope effects we observe. Our modals of the *required/allowed* type can take narrow scope relative to the comparison here as well as in the matrix clause.

(20) **The paper is longer than is required.**

a. The paper's length > max(λd.$\forall$w'[R(w',@) $\rightarrow$ the paper is d-long in w')
The length of the paper exceeds the required minimum.

b. # $\forall$w'[R(w',@) $\rightarrow$ the paper is longer in @ than in w'
The paper is illegally long.

(21) **The paper is longer than is allowed.**

a. The paper's length > max(λd.$\exists$w'[R(@,w') & the paper is d-long in w'])
The paper is illegally long.

b. # $\exists$w'[R(@,w') & the paper is longer in @ than in w']
It is possible for the paper to be shorter than it actually is.

Remember from section 2.3. that some indefinites (for example NPIs) in the embedded clause can also take narrow scope relative to the comparison.

(22) a. **Caroline is taller than anyone in Derbyshire.**

b. $\text{Height}(C) > \max(\lambda d.\exists x[\text{person\_in\_Derby}(x) \ \& \ x \text{ is } d\text{-tall}])$

Regarding negative quantifiers, they certainly lack a wide scope reading of the quantifier, and are claimed to be ungrammatical because the narrow scope reading makes no sense (cf. section 2.3).

(23) ***Lydia is taller than none of her sisters is.**

(24) a. * $\text{Lydia's height} > \max(\lambda d.{\sim}\exists x[x \text{ is a sister of Lydia's and } x \text{ is } d\text{-tall}])$
max undefined!

b. # no sister of Lydia's is such that Lydia is taller than she is.

In sum, the standard theory of comparison offers the following perspective on the facts: some scope bearing elements favour a wide scope reading relative to the comparison (many nominal quantifiers (*every*, *most*, numerals), adverbial quantifiers, and many intensional verbs). Other scope bearing elements favour a narrow scope reading relative to the comparison (negative quantifiers, NPIs, some indefinites, disjunction, some intensional verbs). Scope behaviour seems not to be guided by syntactic structure. Why?

<u>3.1.3. Degree operators and the *than*-clause: Analyses</u>

Schwarzschild & Wilkinson (2002) are inspired by the puzzle outlined above to develop a complete revision of the semantics of comparison. According to them, the quantifier data show that the *than*-clause provides us with an interval on the degree scale - in (25) below an interval into which the height of everyone other than Caroline falls.

(25) **Caroline is taller than everyone else is.**
'Everyone else is shorter than Caroline.'

```
----------|-------------|---------------x-------------->
          x1  x2    x3                  C
```

interval on the height scale that covers everyone else's height
(that interval is related to Caroline's height by the comparative)

(26) [[**than everyone else is**]] = λD. everyone else's height falls within D
(where D is of type <d,t>)

To simplify, I will suppose that it is somehow ensured that we pick the right matrix clause interval (Joe's height in the example below). (28) is a rough sketch of Schwarzschild & Wilkinson's analysis of this example.

(27) **Joe is taller than exactly 5 people are.**

(28)	Subord:	[λD'. exactly 5 people's height falls within D']
	Matrix + Comp:	MAX D':[Joe's height - D']$\neq$0
		the largest interval some distance below Joe's height
	whole clause:	the largest interval some distance below Joe's height is an interval into which exactly 5 people's height falls.

Note that the quantifiers *everyone else* and *exactly 5 people* are not given wide scope over the comparison at all under this analysis. The interval idea allows us to interpret it within the *than*-clause. While solving the puzzle of apparent wide scope operators, the analysis makes wrong predictions for apparently narrow scope quantifiers. The available reading cannot be accounted for.

(29) **Caroline is taller than anyone else is.**

(30) a. Caroline's height > max(λd. $\exists$x[x$\neq$Caroline & x is d-tall])
b. # the largest interval some distance below Caroline's height is an interval into which someone else's height falls.
= Someone is shorter than Caroline.

Heim (2006) therefore adopts the interval analysis, but combines it with a scope mechanism that derives ultimately a wide and a narrow scope reading of a quantifier relative to a comparison. I will give a summary of her analysis here.
Let us begin with apparent wide scope of quantifier data, like (31). Heim's LF for the sentence is given in (32). She employs an operator Pi (Point to Interval, credited to Schwarzschild 2004). Compositional interpretation (somewhat simplified for the matrix clause) is given in (34).

(31) **John is taller than every girl is.**

(32) **[IP [CP than [1[every girl [2[[Pi t1] [3[t2 is t3 tall]]]]]**
[IP 4 [[-er t4] [5[John is t5 tall]]]]

(33) [[**Pi**]] = λD. λP.max(P)$\in$ D

(34) [[**[4[[-er t4] [5[John is t5 tall]]]**]] = λd. John is taller than d
[[**[3[t2 is t3 tall]]**]] = λd.x is d-tall
[[**[2[[Pi t1] [3[t2 is t3 tall]]]**]] = λx.[λD. λP.max(P)$\in$ D](D')(λd.x is d-tall)
= λx. max(λd.x is d-tall) $\in$ D'
= λx. Height(x) $\in$ D'
[[**[than [1[every girl [2[[Pi t1] [3[t2 is t3 tall]]]]]**]] =
λD'.$\forall$x[girl(x) $\rightarrow$ Height(x) $\in$ D']
intervals into which the height of every girl falls

[[(31)]] =
λD'.$\forall$x[girl(x) $\rightarrow$ Height(x) $\in$ D'] (λd. John is taller than d) =
$\forall$x[girl(x) $\rightarrow$ Height(x) $\in$ (λd. John is taller than d)] =
$\forall$x[girl(x) $\rightarrow$ John is taller than x]

The *than*-clause provides intervals into which the height of every girl falls. The whole sentence says that the degrees exceeded by John's height is such an interval. Lambda conversion simplifies the whole to the claim intuitively made, that every girl is shorter than John.
The analysis is a way of interpreting the quantifier inside the *than*-clause and deriving the apparently wide scope reading over comparison by giving the quantifier scope over the shift from degrees to intervals (the Pi operator). This strategy is applicable to other kinds of quantificational elements, such as intensional verbs, in the same way. A differential makes no difference to the derivation, as is demonstrated below.

(35) **John is 2" taller than every girl is.**

(36) [[**[than [1[every girl [2[[Pi t1] [3[t2 is t3 tall]]]]]**]] =

$\lambda D'.\ \forall x[girl(x) \rightarrow max(\ \lambda d.x \text{ is d-tall}) \in D']$
intervals into which the height of every girl falls

$[[\ (35)\ ]] = [\lambda D'.\forall x[girl(x) \rightarrow max(\lambda d.x \text{ is d-tall}) \in D']]\ (\lambda d. \text{ John is 2" taller than d})$
$= \forall x[girl(x) \rightarrow \text{John is 2" taller than x}]$

(37) a. **John is taller than I had predicted (that he would be).**
b. $\forall w[R(w,@) \rightarrow max(\lambda d.\text{John is d-tall in } @)>max(\lambda d.\text{John is d-tall in w})]$
For every world compatible with my predictions:
John's actual height exceeds John's height in that world.

(38) **[IP [CP than [1[I had predicted [CP [Pi t1] [2[AP John t2 tall]]]]]**
[IP 3 [John is taller than t3]]]

(39) [[**[3[John is taller than t3]]**]] = (λd.John is taller than d in @)
[[**[2[AP John t2 tall]]**]] = λd. John is d-tall in w
[[**[CP [Pi t1] [2[AP John t2 tall]]]**]] = $\lambda w.\ max(\lambda d. \text{ John is d-tall in w}) \in D'$
[[**[than [1[I had predicted [CP [Pi t1] [2[AP John t2 tall]]]]]**]] =
$[\lambda D'.\ \forall w[R(w,@) \rightarrow max(\lambda d. \text{ John is d-tall in w}) \in D']]$
intervals into which John's height falls in all my predictions

$[[\ (37a)\ ]] = [\lambda D'.\ \forall w[R(w,@) \rightarrow max(\lambda d. \text{ John is d-tall in w}) \in D']]$
(λd.J is taller than d in @) =
for every w compatible with my predictions:
J's actual height exceeds J's height in w.

(40) Pi shifts from properties of degrees to properties of intervals:
$\lambda d.Height(x) \geq d \quad ==> \quad \lambda D.Height(x) \in D$

In contrast to Schwarzschild & Wilkinson's original interval analysis, Heim is able to derive apparently narrow scope readings of an operator relative to the comparison as well. The sentence in (41) is associated with the LF in (42). Note that here, the shifter takes scope over the operator *required*. This makes *required* combine with the degree semantics in the original, desired way, giving us the minimum compliance length (just like it did before, without the intervals). The shift with Pi is essentially harmless.

(41) a. **The paper is longer than is required.**

b. The paper's length > max(λd. ∀w[R(w,@) → the paper is d-long in w'])

The length of the paper exceeds the required minimum.

(42) **[IP [CP than [1[[[Pi t1] [2[required [the paper t2 long]]]]]**

[IP 3 [the paper is longer than t3]]]

(43) [[**[3[the paper is longer than t3]]]**]] = (λd.the paper is longer than d in @)

[[**[2[required [the paper t2 long]]**]] =

(λd. ∀w[R(w,@) → the paper is d-long in w])

[[**[than [1[[[Pi t1] [2[required [the paper t2 long]]]]**]] =

[λD'. max(λd. ∀w[R(w,@) → the paper is d-long in w])∈D']

intervals into which the required minimum falls

[[(41a)]] =

[λD'. max(λd. ∀w[R(w,@) → paper is d-long in w])∈D']

(λd.the paper is longer than d in @) =

The paper is longer than the required minimum.

Pi-phrase scope interaction is summarized below:

(44) Pi takes narrow scope relative to quantifier

==> apparent wide scope reading of quantifier over comparison

Pi takes wide scope relative to quantifier

==> apparent narrow scope reading of quantifier relative to comparison

The idea behind this analysis, to sum up, is that *than*-clauses include a shift from degrees to intervals, which allows us to give one denotation for the *than*-clause with the quantifier on both types of readings. The shift itself can take narrow or wide scope relative to a *than*-clause quantifier. The shift amounts to a form of type raising. Through semantic reconstruction, the

matrix clause is interpreted in the scope of a *than*-clause operator when that operator has scope over the shifter. Comparison is ultimately between points/degrees, not intervals.
Heim's analysis is able to derive both wide and narrow scope readings of operators in *than*-clauses. It does so without violating syntactic constraints. There is, however, an unresolved question: when do we get which reading? How could one constrain Pi-phrase/operator interaction in the desired way? One place where this problem surfaces is once more negation, where we expect an LF that would generate an acceptable wide scope of negation reading - e.g. (45b) for (45a). The reading predicted, derived in (46), is not available.

(45) a. * **John is taller than no girl is.**
b. **[IP [CP than [1[no girl [2[[Pi t1] [3[t2 is t3 tall]]]]]**
[IP 4 [[-er t4] [5[John is t5 tall]]]]

(46) [[**[4[[-er t4] [5[John is t5 tall]]]**]] = λd. John is taller than d
[[**[than [1[no girl [2[[Pi t1] [3[t2 is t3 tall]]]]]**]] =
λD'. for no girl x: max(λd.x is d-tall) ∈ D'
intervals into which the height of no girl falls
[[(45)]] = [λD'. for no girl x: max(λd.x is d-tall) ∈ D'] (λd. John is taller than d)
= for no girl x: John is taller than x

The interval idea brings a substantial new feature to the analysis of comparison. It seems well motivated by the quantifer data. But one must ask whether a genuine scope analysis of the shift to intervals is what is needed.
Two recent lines of research take Heim (2006) as their point of departure. The first, represented by Gajewski (2008), Schwarzschild (2008), and loosely speaking also van Rooij (2008), maintains that there is a scope bearing element in the *than*-clause whose position relative to a quantifier determines which reading we get. But the semantics of comparison is changed back to a Seuren-type semantics (Seuren 1978), so that the scope bearing element is not Pi, but negation. An example analysis is given below. Like Pi, negation needs to be able to take flexible scope (to distinguish e.g. the reading that *required* as opposed to *every girl* gives rise to), and so this type of analysis runs into the same overgeneration problem as the Pi analysis. See Beck (to appear) for discussion.

(31) **John is taller than every girl is.**

(31') a. $\exists d[\text{Height}(J)\geq d \ \&\ \forall x[\text{girl}(x) \rightarrow \text{Height}(x)<d]]$

'every girl is shorter than John.'

b. **[[than every girl is]] =**

[[than λd [every girl [1[NOT [t1 is d tall]]]]]]=

than $\lambda d.\forall x[\text{girl}(x) \rightarrow \text{Height}(x)<d]]$

The second line of research rejects a scope interaction view of the readings that quantifiers in *than*-clauses give rise to. I summarize its main features in the next subsection.

3.1.4. A Selection Analysis

The problem diagnosed above regarding an analysis in terms of the scope of the Pi operator concerns the fact that we do not observe a genuine scope ambiguity. Which reading we get depends on which quantifier interacts with the comparison operator; it seems fixed in each case. An alternative account not based on scope would not face this problem of overgeneration, provided we can find auch an alternative analysis. One possibility, sketched below, takes the following perspective: The quantifiers show us that we must use intervals in the semantic composition. Comparison is ultimately between points, i.e. degrees. We maintain the simple semantics for the comparative operator repeated below:

(47) comparative morpheme of type <d,<d,t>>:

[[**-er**$_{\text{simple}}$]] = $\lambda d.\lambda d'.d'>d$

Therefore we must have a strategy to reduce the interval back to a point - the selection of a particular point from the interval. This idea may be behind Schwarzschild & Wilkinson's proposal originally, although it is not what they end up doing. I illustrate it here with a strategy from Beck (to appear).

- Selection of Point from Interval: Unproblematic Cases

Let us suppose that it is in principle possible to relate individuals and sets of degrees - 'intervals' by an adjective meaning (see Beck to appear for a suggestion of how this may come about). In the example in (48), this would give rise to the meaning for the *than*-clause in (48') - a set of intervals, just like in the Heim (2006) analysis. In many examples, it suffices to simply choose the end point of the interval denoted by the *than*-clause for comparison with the main clause. The strategy is to find the shortest (minimal) *than*-clause interval(s) and choose from it the end point (maximum) on the relevant scale. The end point will be the item of comparison. This is demonstrated below for universal and existential quantifiers.

(48) a. **John is taller than every girl is.**

b. For every girl x: John's height exceeds x's height.

(48') a. [[**[than [1[every girl [2[t2 is t1 tall]]]]]**]] =

$\lambda D'. \forall x[\text{girl}(x) \rightarrow \max(\lambda d.x \text{ is d-tall}) \in D']$

intervals into which the height of every girl falls

b. **tall**: $\text{Height}(x) \in D$

(49) choosing the smallest such interval(s):

$\min(S\langle\langle d,t\rangle,t\rangle) = \lambda D.S(D) \ \& \ {\sim}\exists D'[D' \subset D \ \& \ S(D')]$

(50) identifying the end point:

a. ordering of intervals: $I > J$ iff $\exists d[d \in I \ \& \ \forall d'[d' \in J \rightarrow d > d']]$

I extends beyond J

b. $\max(S\langle\langle d,t\rangle,t\rangle)$ = the max relative to the $\geq$ relation on intervals

= the interval that extends highest on the scale

c. Max(S) := max (max(S))

= the maximal degree in the interval that extends highest

(51) John is taller than Max (min ([[*than*-clause]])

= John is taller than the height of the tallest girl

(52) Max (min ([[*than*-clause]])

min ([[*than*-clause]])

----------|-------------------------|-----------------x-------------->

x1 x2 x3 J

(53) a. **John is taller than I had predicted (that he would be).**

b. For every world compatible with my predictions:
John's actual height exceeds John's height in that world.

(54) [[**[than [1[I had predicted [$_{CP}$ John t1 tall]]]]]**]] =

$[\lambda D'. \forall w[R(w,@) \rightarrow$John's height in $w \in D']]$
intervals into which John's height falls in all my predictions

(55) John is taller than Max (min ([[*than*-clause]]))
= John is taller than the height according to the tallest prediction

(56) a. **Caroline is taller than anyone else is.**

b. C's height exceeds the largest degree of height reached by one of the others.

(57) [[**[than [1[any one else [2[t2 is t1 tall]]]]]**]] =

$\lambda D'. \exists x[x \neq$Caroline & max($\lambda d.x$ is d-tall) $\in D']$
intervals into which the height of someone other than Caroline falls

(58) Caroline is taller than Max (min ([[*than*-clause]]))
= Caroline is taller than the height of the tallest other person.

(59) Max (min ([[*than*-clause]])

```
----------|---------|----------------|-----------------x-------------->
          x1       x2               x3                 C
```

Note that there is no scope interaction between Pi and the quantifier according to this strategy: with the NPI example as well as with the universal NP, the shift to intervals occurs locally within the AP, i.e. it always 'takes narrow scope'.

A problem this strategy appears to face concerns *have to/require*, (60a). Remember that these intensional verbs give rise to a different interpretation than the *predict* - type, treated above, namely (60b). But their LF would be parallel, (61). It looks as if we have to choose the beginning point of the minimal *than*-clause interval instead of the end point (cf. (62)). We would have to ask ourselves why the strategy for point selection changes.

(60) a. **The paper is longer than is required.**

b. The paper's length > max(λd. $\forall$w[R(w,@) $\rightarrow$ the paper is d-long in w'])

= The length of the paper exceeds the required minimum.

(61) [[**[$_{CP}$ than [1[[required [$_{XP}$ the paper t1 long]]]]]**]] =

[λD'. $\forall$w[R(w,@) $\rightarrow$ the paper's length in w $\in$ D']

intervals into which the paper's length falls in all worlds compatible with the rules

(62) The paper is longer than Max$_<$ (min ([[*than*-clause]]))

(where < is the "smaller than" ordering of points and intervals on the height scale)

= the paper is longer than the minimum compatible with the requirements

However, Krasikova (to appear) provides a solution to this problem. She proposes that a strengthening operation reduces the *than*-clause interval to a point internally - exhaustification from Fox (2006), which I represent here as a covert scalar 'only' (cf. (63)). This strengthening operation is not available with other universal quantfiers, thus accounting for the difference between *require* and *predict*.

(63) [[**[$_{CP}$ than [1[[only$_{C,<}$ required [$_{XP}$ the paper t1 long]]]]]**]]

= [λD'. it is only$_{C,<}$ required that the paper's length fall within D']

Suppose that the domain of quantification of *only* is as in (64a), propositions that vary in the place of the interval containing the paper's length. Suppose furthermore that the scale that *only* is sensitive to in this case amounts to a difficulty scale. A typical context for our example is one in which the difficulty is in reaching a certain length; that is, the problem is with reaching a certain length. Then the meaning of the *than*-clause described in (64b) will give us intervals containing the minimum requirement length. The shortest such interval is the minimum requirement length itself. Selection with Max is trivial, and we get the correct truth conditions in (65).

(64) a. C={that the paper's length fall in D1, that the paper's length fall in D2,

..., that the paper's length fall within Dn}

b. [λD'. it is only$_{C,<}$ required that the paper's length fall within D'] =

[λD'. for all p$\in$C such that the paper's length falls within D' $<_{difficult}$ p:

it is not required that p] =

[λD'. nothing more difficult is required than that the paper's length fall within D']

c. If D1>D2>...>Dn:
min([λD'. it is only$_{C,<}$ required that the paper's length fall within D']) =
min([λD'. nothing more difficult is required than that the paper's length fall in D'])
= {Dn}
= {the minimum compliance length}

(65) The paper is longer than Max ({Dn})
= the paper is longer than the minimum compatible with the requirements

The plot is thus to blame semantic properties of the specific modals that give rise to this reading for their difference from other universal quantifiers; see Krasikova (to appear) and also Beck (to appear) for details.

Note that the negation facts follow straightforwardly from the selection strategy. The only LF of (66a) is (66b), which leads to an undefined interpretation as before, cf. (67).

(66) a. * **John is taller than no girl is.**
b. **[IP [CP than [1[no girl [2[t2 is t1 tall]]]]]**
[IP 4[[-er t4] [5[John is t5 tall]]]]

(67) [[**[4[[-er t4] [5[John is t5 tall]]]**]] = λd. John is taller than d
[[**[than [1[no girl [2[t2 is t1 tall]]]]]**]] =
λD'. for no girl x: max(λd.x is d-tall) ∈ D'
intervals into which the height of no girl falls

Max is undefined ==> negation in the *than*-clause leads to undefinedness

Here is a summary of our easy preliminary success: We keep the idea of a shift to intervals, but the shift always occurs locally. The resulting meaning of the *than*-clause, a set of intervals, is reduced to a degree by selection of the relevant maximum element. Ungrammaticality of the negation data is predicted. So is lack of ambiguity, since selection always yields one unambiguously determined comparison. The difference between *predict*-type verbs and *required*-type verbs is traced to independent factors (unrelated to scope). For the comparative itself, a classical analysis is maintained.

<u>- More Problematic Data</u>

Schwarzschild and Wilkinson's semantics is rather more complicated than the simple-minded approach described above, and for good reason. They take into account two types of data that are especially problematic: differentials and numeral NP quantifiers. We will consider both in turn. Below is an example that combines a universal quantfier in the *than*-clause with a differential comparative. We have already observed that the sentence claims that the girls all have the same height, which is 2" below John's.

(68) **John is (exactly) 2" taller than every girl is.**

Compared to Heim and Schwarzschild & Wilkinson, we have a problem. They predict the correct interpretation (70) (illustrated below for Heim's analysis) while we predict (71).

(69) [[**[than [1[every girl [2[[Pi t1] [3[t2 is t3 tall]]]]]**]] =
λD'. $\forall$x[girl(x) $\rightarrow$ max(λd.x is d-tall) $\in$ D']
intervals into which the height of every girl falls

(70) [[(68)]] = [λD'.$\forall$x[girl(x)$\rightarrow$ max(λd.x is d-tall) $\in$ D']](λd. John is 2" taller than d)
= $\forall$x[girl(x) $\rightarrow$ John is 2" taller than x]

(71) John is 2" taller than Max (min([[*than*-clause]]))
= John is 2" taller than the tallest girl.

It looks as if universal NPs in *than*-clauses, when combined with difference degrees, led to an assumption that the *than*-clause interval is actually a point, i.e. that the girls all have the same height in the example. I will call this an equality assumption, EQ. This seems to speak in favour of a scope solution. However, consider the example below, which is formally parallel. The sentence can be used to describe the situation depicted, where my colleagues' incomes cover a wide span. We compare with the beginning point of the interval. This is exactly what the selection strategy leads us to expect (the beginning point being the maximum reltative to the 'less' relation). (73) and (74) are further examples taken from the web.

(72) **Ich verdiene ziemlich genau 500 Euro weniger als alle meine Kollegen.**
I make just about 500 Euros less than everyone else in my department.
(Some even earn 1000 Euros more than I do.)

```
------------------SB---------|//////////////////////////|------------------------->
                             |-  500----|---   1100    -------|
```

(73) **Aden had the camera for 100 $ less than everyone else in town was charging.**

(74) WOW! almost **4 seconds faster than everyone else** , and a 9 second gap on Lance

Note that while data like (68) are a problem for the selection strategy (in that I haven't specified how to derive the additional EQ meaning component), the data above are a problem for the scope strategy (in that the predicted equality interpretation is clearly not what is intended). I refer the reader to Beck (to appear) for an analysis of these data, in particular the contrast between (68) and (72)-(74). There I argue that the data ultimately speak in favour of selection. For present purposes, it seems enough to note that (72)-(74) make selection a viable alternative.

Finally, we consider a last problematic case which has so far been unreconcilable with the simple minded selection strategy, namely numeral NPs. An example is given in (75), together with an illustration of how the selection strategy makes the wrong prediction.

(75) **John is taller than exactly five of his classmates are.**
= exactly 5 of John's classmates are shorter than he is.
$\neq$ John is taller than the tallest of his 5 or more classmates.

(76) λD'. for exactly 5 x: max(λd.x is d-tall) $\in$ D'
intervals into which the height of exactly 5 classmates falls

Max (min([λD'. for exactly 5 x: max(λd.x is d-tall) $\in$ D'])) =
the height of John's tallest classmate, as long as there are at least 5

```
------------------------------------------------------------------------------------------>
c1   c2            c3        c4  c5  c6        c7                  c8
                             |--------------------------------------| Max
```

It is possible to avoid this problem. Let us first be more precise in our semantic analysis of 'exactly 5' (compare Hackl 2000, 2001; Krifka 1999 on the semantics of such NPs). A simple example is discussed in (77); '*' is Link's star operator which pluralizes predicates.

(77) a. **Exactly three girls weigh 50lbs.**

b. $\max(\lambda n.\ \exists X[{*}girl(X)\ \&\ card(X)=n\ \&\ {*}weigh\_50lbs(X)])=3$

'the largest number of girls each of which weighs 50 lbs is three.'

If we accordingly give the *than*-clause in (75) the semantics in (76'), nothing changes: we still compare with the tallest of at least five classmates. What we have achieved is simply to make the composition of 'exactly five classmates' more transparent. It consists of an indefinite plural plus a quantificational 'exactly' binding a cardinality variable.

(76') $\lambda D'.\max(\lambda n.\ \exists X[{*}classmate(X)\ \&\ card(X)=n\ \&\ {*}Height(X) \in D'])=5$

Intervals into which the height of exactly five of John's classmantes falls (≈(76))

The reading we want to derive is one in which both of these meaning components appear to be interpreted with wide scope outside the *than*-clause. It is not actually surprising that an indefinite should appear to be able to scope outside the *than*-clause: we know that indefinites can take exceptionally wide scope, and whatever mechanisms bring this about ordinarily can do so in comparatives as well. I choose to demonstrate this point with a choice function analysis of (78) (compare e.g. Reinhart 1997, Kratzer 1996).

(78) a. **Mr Bingley is richer than some of his neighbours are**.

b. There are some neighbours of Mr Bingley's that are poorer than he is.

(78') [[**[than [1[[some of his7 neighbours] [*[2[t2 be t1 rich]]]]]**]] =

$[\lambda D'.\ f({*}neighbour\_of\_B) \in [{*}\lambda x.Wealth(x) \in D']]$

intervals into which the wealth of each of the neighbours of Bingley's chosen by f falls

∃f[Mr Bingley is richer than Max(min([[*than*-clause]])) =
Mr Bingley is richer than the richest of the neighbours chosen by some choice function f

Now if in addition 'exactly' is evaluated in the matrix clause, we derive the desired interpretation for (75), as demonstrated in (79).

(79) [[**[than [1[[n of his7 classmates] [*[2[t2 be t1 tall]]]]]]**]] =
[λD'. f(λX.card(X)=n & *classmate(X)) ∈ [*λx.Height(x) ∈ D']]
intervals into which the height of each of the n classmates picked by f falls

max(λn. ∃f[John is taller than Max (min ([[*than*-clause]])))=5
'the largest number n such that John is taller than
the tallest of the n classmates of his chosen by some choice function f is 5.'

(79') **[exactly 5 [λn. John is taller [than[n of his classmates are ~~tall~~]]]]**

This means that we can interpret the nominal quantifier in the *than*-clause, but have to evaluate the contribution of 'exactly' in the matrix. This would suggest an LF like (79'), which may still seem unsatisfactory (how does 'exactly n' end up where it occurs in (79')?). However, we follow Krifka's (1999) arguments that expressions like 'exactly', 'at least' and 'at most' are interpreted via an alternative semantics. The evaluating operator, moreover, is not the word 'exactly' itself, but a higher proposition level operator, called EXACT here. A more proper LF representing a version of Krifka's analysis for example (77) is given below. The semantics of EXACT uses alternatives to the asserted proposition (which vary according to the numeral), as well as the asserted numeral (5 in the example).

(77') a. **Exactly three girls weigh 50lbs.**
b. **[EXACT [XP (exactly) three$_F$ girls weigh 50lbs]]**

(77'') [[**three$_F$ girls weigh 50lbs**]]$_O$ = ∃X[*girl(X) & card(X)=3 & *weigh_50lbs(X)]
[[**three$_F$ girls weigh 50lbs**]]$_f$ =

$\{\exists X[*girl(X) \& card(X)=n \& *weigh\_50lbs(X)]:n\in N\}$

(80) $[[$ **EXACT** $]] ([[XP]]_f) ([[XP]]_o) = 1$

iff $[[XP]]_o = 1 \& \forall q \in [[XP]]_f: \sim([[XP]]_o \text{->} q) \text{->} \sim q$

'Out of all the alternatives of XP, the most informative true one is the ordinary semantics of XP.'

(77''') $[[(77'b)]] = 1$ iff

$\exists X[*girl(X) \& card(X)=3 \& *weigh\_50lbs(X)] \&$

$\forall n[n>3 \text{->} \sim\exists X[*girl(X) \& card(X)=n \& *weigh\_50lbs(X)]]$ iff

$max(\lambda n.\exists X[*girl(X) \& card(X)=n \& *weigh\_50lbs(X)])=3$

We are now in a position to provide an LF for example (75) that derives the desired interpretation, (81); the truth conditions are made explicit in (81').

(81) a. **[EXACT [John is taller**

[than Max min [(exactly) n_f of his classmates are ~~tall~~]]]]

b. Out of all the alternatives 'John is taller than n of his classmates are', the most informative true one is 'John is taller than 5 of his classmates are'.

(81') $max(\lambda n. \exists f[CH(f) \&$ John is taller than

$Max(min (\lambda D'. \forall x\in f((\lambda X.*classmate(X) \& card(X)=n):Height(x) \in D'])=5$

'the largest number n such that John is taller than the tallest of the n classmates of his selected by some choice function f is 5.'

Thus I suggest that a proper semantic analysis of numeral NPs makes the facts compatible with a simple selection analysis of *than*-clauses after all. No scope strategies specific to comparatives need to be empoyed; the mechanisms we have used have been argued for independently, and the complications they bring with them are orthogonal to comparative semantics. What has not been demonstrated here is that the above proposals account precisely for the range of readings that the various quantifiers in *than*-clauses give rise to. This must be left for another occasion (compare Beck to appear for more discussion).

The interval+selection approach seems rather successful. It captures the negation data, lack of genuine scope interaction, it is reconcilable with numeral NP facts under the right assumptions about their semantics, and even differentials have shown us that scope cannot be the whole story. I propose to enrich the standard theory with intervals, but in the actual comparison to reduce the interval back to a point with a selection strategy, and compare degrees as before. The simple lexical entry for the comparative morpheme in (82) provides the required semantics.

(82) $[[\ \textbf{-er}_{simple}\ ]] = \lambda d.\lambda d'.d'>d$

Compared to von Stechow's (1984) original proposals, the addition of the shift to an interval meaning for adjectives/APs makes a genuine difference. Another change concerns the way that maximality enters into semantic composition. It is not part of the semantics of the comparative here, but rather an interpretational strategy operating on the *than*-clause independently. This, however, seems very minor.

3.1.5. Subsection Summary

This subsection has taken a closer look at the interaction of comparison operators with other quantifiers. Following work by Schwarzschild & Wilkinson and Heim, I have departed from von Stechow's original analysis by incorporating intervals of degrees into the semantics of comparison. This makes it possible to interpret the quantifier uniformly inside the *than*-clause, i.e. it takes narrow scope relative to the comparison. Furthermore, in contrast to Heim and her successors, I propose that despite appearances, there is no scope interaction between quantifier and shifter. Instead, there is uniformly selection of a point from the subordinate clause interval. Apparent scope effects like the interpretation of *have to*-type modals and *exactly n* NPs have been explained away via recourse to alternative interpretational strategies, which have been argued for independently of *than*-clauses. My perspective is motivated by the lack of clear scope interaction in *than*-clauses. This is in line with what we would expect from the point of view of syntactic theory, where a quantifier inside an embedded clause would not normally interact with a matrix clause operator.

By contrast, we might expect a comparison operator to interact with a clause-mate quantifier, and hence expect scope interaction with another matrix clause operator. The empirical picture that we find is such that comparative operators tend to take narrow scope, and can only outscope a limited set of other quantifiers. Heim's (2001) interpretation of this state of affairs, which we follow here, is that an independent constraint prevents comparison operators from taking scope over quantifiers in most cases, but that the crucial data in which a comparison operator does outscope another quantifier support the quantificational analysis of comparison operators by the standard theory.

3.2. Crosslinguistic Variation in the Expression of Comparison

The question addressed in this subsection is essentially how general the proposed theory of comparison is. The theory was developed largely on the basis of comparison constructions in English. We will now examine other languages, taking as our starting point the observation from section 2 that the behaviour of measure phrases is not entirely expected from our theoretical point of view.

3.2.1. Measure Phrases

Schwarzschild (2005) observes that a measure phrase addition to an adjective in the unmarked form is not so widely acceptable as one might suppose from the semantics introduced in section 2. In English, many adjectives do not permit MPs (let us refer here with MP to the plain expression 'five inches', '10 degrees' without the quantifier part 'exactly', 'at least' etc.).

(83) a. * **5 dollars expensive**
b. * **80 lbs heavy**
c. * **minus 5 degrees cold**

(84) [[**heavy**]] = $\lambda d.\lambda x.\text{Weight}(x) \geq d$

Under the standard analysis, we believe that MPs saturate an argument slot of adjectives; according to the version in section 2.2.4., they do not saturate the argument slot directly, but indirectly through quantifying over it. Either way this is a standard way of composition that should always be available. Why aren't measure additions to adjectives more systematically possible then?

Crosslinguistically, Schwarzschild notes, there is considerable variation regarding MPs. Languages seem to tend to allow MPs as the difference degree argument in comparatives, while sometimes not allowing them with unmarked adjectives (so called 'direct MPs') at all. Japanese, Russian, Spanish are like that; (85) is an example from Japanese. When languages allow direct MPs, there is still variation with respect to lexical items, cf. the difference in (86a) between German and English, both of which do allow direct MPs. To our question above about English MPs we must add the question why languages vary so much with respect to the possibility of direct MPs. And finally, Schwarzschild observes that (86b) is impossible, where we try to use 'John's weight' as an argument of the adjective. This is puzzling if we take 'John's weight', like '80 pounds', to denote a degree. (86c) illustrates that a difference MP is possible even where a direct MP is not in English.

(85)	a.	**Sally-wa**	**5 cm**	**se-ga**	**takai.**	
		Sally-Top	5 cm	back-Nom	tall	
		'Sally is 5cm taller/*Sally is 5cm tall.'				
	b.	**Sally-wa**	**Joe-yori**	**5 cm**	**se-ga**	**takai.**
		Sally-Top	Joe-YORI	5 cm	back-Nom	tall
		'Sally is 5cm taller than Joe.'				

(86)	a.	**40 kg schwer**	[German]
		* **80 lbs heavy**	[English]
	b.	* **Sally is John's weight heavy.**	
	c.	**Sally is 4 lbs heavier than Bill.**	

Schwarzschild proposes that MPs do not refer to a degree. They are true or false of intervals, i.e. sets of degrees, cf. (87). MPs are thus of type <<d,t>,t> (i.e. plain MPs already are quantifiers), and it is not expected that they be able to combine directly with an adjective of type <d<e,t>>. Schwarzschild proposes that there is a lexical rule that shifts adjectives from expressions with a degree argument position to expressions with an interval argument position. We can then combine intersectively with the MP (although a short movement is still needed to resolve the type mismatch, under the standard assumptions about composition adopted here). The result in (89) can then be existentially closed as in (90).

(87) a. $[[\textbf{two inches}]] = \lambda D_{<d,t>}$. D can be partitioned into a two-membered set of whose elements the predicate 'inch' is true.

b. A set X is a partition of a set Y iff

(i) for all $Z \in X$: $Z \subseteq Y$

(ii) $\cup X = Y$

(iii) For any two Z1, $Z2 \in X$: $Z1 \cap Z2 = \{\}$

(88) $[[\textbf{long}_2]] = [\lambda D_{<d,t>}.\ \lambda x.\ D = \lambda d.[[\textbf{long}_1]](d)(x)]$

(89) $[_{<<d,t>,t>}$ **two inches** $]$ $[_{<<d,t>,t>}$ **1[this pen is t1 long**$_2$**]]** =
$\lambda D_{<d,t>}$. $D=\lambda d.[[\textbf{long}_1]](d)(this\_pen)]$ & D can be partitioned into 2 inches =
$\lambda D_{<d,t>}$.D=[λd.this pen is d-long] & D can be partitioned into 2 inches

(90) ∃D[D=[λd.this pen is d-long] & D can be partitioned into 2 inches]

Schwarzschild proposes that a particular adjective may or may not be able to undergo the relevant type shifting rule, thus allowing him to describe the variation within a language like English. Also, a language may lack this type shifting altogether and not permit direct measure phrases. It is a property of the comparative, however, that it may measure the difference between the two degrees described, thus differential measure phrases are generally possible. We can capture this insight of Schwarzschild's with a slight modification of the meaning of the comparative morpheme we proposed earlier:

(91) a. differential comparative (classical version with interval differential):
$[[\ \text{-er}_{diff}\ ]] = \lambda D1.\ \lambda D_{diff}.\ \lambda D2.D_{diff}(\max(D2)-\max(D1))$

b. differential comparative (version section 3.1. with interval differential):
$[[\ \text{-er}_{diff}\ ]] = \lambda d.\ \lambda D_{diff}.\ \lambda d'.D_{diff}(d'-d)$
'The difference between max Matrix and max *than*-clause is D_{diff}.'

An MP like 'two inches' can combine with the differential comparative directly, but not with an unmarked adjective.

I feel convinced by Schwarzschild's reasoning that 'two inches' and the like do not refer to a degree. In the theoretical framework of this article, a slightly different version of his proposals suggests itself. One could QR the MP, as in von Stechow's approach above, to make them combine with the rest of the clause.

(92) a. **This pen is two inches long.**

b. [**two inches** <<d,t>,t>**] [**<d,t>**1[this pen is t1 long]]**

c. [[**long**]] = λd.λx.Length(x)$\geq$d

(93) [λd. Length(this_pen) $\geq$d] can be partitioned into a two-membered set of whose elements the predicate 'inch' is true.
'The degrees of length reached by this pen can be partitioned into two inch-long intervals.'

With regard to the English facts, it seems to me that nothing is gained by the type shift (88) compared to the Stechow-like analysis (92), together with the lexical stipulation that a given adjective can vs. cannot take a specifier which would host the measure phrase. Note that the type shifting of the adjective is practically vacuous. I would also like to point out the contrast between degree questions like (94a) and pronominals (94b) versus measure constructions like (94c), which I think is quite systematic.

(94) a. **How cold is it?**

b. **Today's temperature is minus 5 degrees.**
When I was in New Hampshire, it was that cold, too.

c. * **minus 5 degrees cold**

The question word *how* should range over the same type of object that is the denotation of the MP; even more transparently pronominal *that* picks up the meaning of 'minus 5 degrees'. Thus whatever excludes the MP must be something very superficial that does not exclude the question or the degree pronoun. I don't really see how the type shift could make the distinction and would lean towards a syntactic explanation. I therefore tentatively endorse the analysis (92), (93). This can be combined with Krifka's theory of 'exactly', 'at least' and 'at most' from the previous subsection to derive the data discussed in section 2.2.4 ('at most 6' tall' and the like). I am not sure what to say about the interesting observation in (86b). If 'John's weight' indeed refers to a degree, this is a very puzzling fact. Moltmann (2005) would not analyse it as such, however, but as a particularized property (let's say in the present framework not an expression of type <d> but one of type <e>) - which could well be unsuitable for combination with an adjective.

In the next subsections, we will try to connect the crosslinguistic variation observed here with other points of crosslinguistic variation in the expression of comparison. We will have something more to say about the crosslinguistic observations on MPs that Schwarzschild makes.

3.2.2. Parameters of Variation in the Expression of Comparison

There is considerable crosslinguistic variation in how comparisons are expressed. This is best understood in the case of comparatives. The seminal typological work here is Stassen (1985). He observes that there are languages that appear to use different strategies altogether from the English comparatives we have seen. Two such types of comparison are given in (95) and (96); (95) exemplifies Stassen's 'exceed' strategy and (96) exemplifies the conjunctive strategy (Stassen identifies three more types of comparison which differ according to the interpretation of the counterpart of *than*; they will not concern us here.).

(95) *exceed-Strategy* (Stassen 1985):

Naja	**ga**	**mdia**	**-da**	**de**	**dzegam-kur.**	[Margi]
he	Subj	exceed	-me	with	tall-Abstr.Noun	

He is taller than me / he exceeds me in height.

(96) *conjunctive Strategy* (Villalta 2007):

Mary na	**lata**	**to**	**Frank na**	**kwadogi.**	[Motu]
Mary	tall	but	Frank	short	

'Mary is taller than Frank.'

Beck, Krasikova, Fleischer, Gergel, Hofstetter, Savelsberg, Vanderelst & Villalta (2008) (referred to in the following as B17, after the joint DFG-funded project that supported the work reported there) have conducted a systematic investigation into crosslinguistic variation in comparative constructions which is theoretically guided by the theory introduced in this article. They propose that there are clusters of empirical properties that identify the settings of grammatical parameters; three such parameters are suggested. I summarize their main results below.

- <u>Degree Semantics</u>

The basis of the grammar of comparison in English is the degree ontology used in the semantics. Adjectives (more precisely, gradable predicates) have an argument position for degrees. Those argument positions must be saturated in the syntax. Degree operators have a semantics that does that, indirectly, through quantifying over degrees. In order to determine whether the language under investigation is like English in this respect, B17 evaluate the comparison data from that language with respect to:

(i) whether the language has a family of expressions that plausibly manipulate degree arguments: comparative, superlative, equative morphemes, items parallel to *too*, *enough* and *so that*.

(ii) whether the language has expressions that plausibly refer to degrees and combine with degree operators: comparison with a degree (CompDeg) like (1b) in section 2, difference comparative (DiffC) like (21a) in section 2.

Motu, B17's representative of a conjunctive language, gives a clear negative answer to both of these questions. Other types of data that would be indicative of a degree semantics, like measure phrases or degree questions, are unavailable as well. Thus we see no evidence for an underlying degree semantics, and B17 accordingly speculate that there is the following parameter of language variation:

(97) Degree Semantics Parameter (DSP):
A language {does/does not} have gradable predicates (type <d,<e,t>> and related), i.e. lexical items that introduce degree arguments.

The DSP is a point of systematic variation in the lexicon (similar in spirit to proposals in Chierchia 1998 regarding crosslinguistic variation in nominal semantics). Motu would, of course, have the negative setting [-DSP]. This leaves us with the task of finding a semantic analysis for Motu adjectives. They occur only in one form, which seems similar to the English positive form in its context dependency. Our task is, thus, to come up with an adjective meaning for Motu adjectives that is similar to the English positive form, but does not introduce a type <d> argument (cf. the negative DSP setting hypothesised above). Context dependency, i.e. apparent vagueness, can come in through different means than the English positive, though. Vague predicates in whose semantics degrees and a positive operator are unlikely to be involved are the English examples (98) with *success* and, even more clearly, *behind the sofa*, as pointed out by B17 (I discuss *success* in the following for simplicity).

(98) a. **The meeting was a success.**
b. **The meeting was, to some extent, a success.**
c. **The picture is behind the sofa.**
d. **The picture is roughly/in a sense behind the sofa.**

An analysis of *success* in terms of context dependency could look as in (98'). This follows Klein's (1980) analysis of the English positive, which B17 do not adopt for English positive adjectives, but find plausible for other examples of context dependency like this one.

(98') [[**success**]] = λc.λx.x counts as a success in c (c a context)

B17's suggestion is that Motu adjectives have this kind of context dependent semantics. I.e. $tall_{\text{Motu}} \neq tall_{\text{English}}$, but $tall_{\text{Motu}}$ is similar to English *success*. The Motu example in (96) is analysed in (99).

(99) a. [[$\textbf{tall}_{\text{Motu}}$]] = [λc.λx.x counts as tall in c]
b. [[$\textbf{short}_{\text{Motu}}$]] = [λc.λx.x counts as short in c]
[[$\textbf{short}_{\text{Motu}}$]]^{c} must be a subset of [λx. x does not count as tall in c]
c. [[**Mary na lata, to Frank na kwadogi**]]^{c} = 1 iff
Mary counts as tall in c and Frank counts as short in c

The sentence is predicted to be true in the context it is uttered in as long as the context can be construed as ranking Mary and Frank on the height scale with Mary on the tall side and Frank on the short. The point is that Motu has no degree operators, not even the positive. Perhaps degrees and scales are a level of abstraction above context dependency that a language may or may not choose to develop.

- Degree Operators

A more subtle variation between English and Japanese is already observed in Beck, Oda & Sugisaki (2004). While Japanese (100) looks superficially similar to English (101a), several important empirical differences between the two languages lead Beck, Oda & Sugisaki to propose a different semantics, closer to that of English (101b,c).

Japanese (Beck, Oda & Sugisaki):

(100) **Sally-wa Joe-yori se-ga takai.**
Sally-Top Joe-YORI back-Nom tall

(101) a. **Sally is taller than Joe.**
b. **Compared to Joe, Sally is tall.**
c. **Compared to Joe, Sally is taller.**

In contrast to English, Japanese does not permit direct measure phrases (cf. section 3.2.1, datum repeated in (102) below), subcomparatives (cf. (103)), or degree questions (cf. (104)). Moreover, the negative island effect we observed in English comparatives does not arise; the example in (105) has a different, sensible interpretation, as the paraphrase indicates. Beck, Oda & Sugisaki also note that in contrast to English, a matrix clause modal verb in a Japanese comparison construction does not permit the wide scope reading of the comparative operator (example given in (106)). The acceptability of a differential comparative (102b), however, indicates that the semantics underlying the *yori*-construction is a degree semantics.

(102)	a.	**Sally-wa**	**5 cm**	**se-ga**	**takai.**		
		Sally-Top	5 cm	back-Nom	tall		
		Sally is 5cm taller/*Sally is 5cm tall.					
	b.	**Sally-wa**	**Joe-yori**	**5 cm**	**se-ga**	**takai.**	
		Sally-Top	Joe-YORI	5 cm	back-Nom	tall	
		Sally is 5cm taller than Joe.					

(103)	a. *	**Kono**	**tana-wa**	**[ano**	**doa-ga**	**hiroi**	**yori**	**(mo)]**	
		this	shelf-Top	[that	door-Nom	wide	YORI	(mo)]	
		(motto)	**takai.**						
		(more)	tall						
	b.	This shelf is taller than that door is wide.							

(104) a. **John-wa dore-kurai kasikoi no?**
John-Top which degree smart Q
'To which degree is John smart?'
b. How smart is John?

(105) a. **John-wa [dare-mo kawa-naka-tta no yori]**
John-Top anyone buy-Neg-Past NO YORI
takai hon-o katta.
expensive book-Acc bought
'John bought a book more expensive than the book that nobody bought.'
b. *John bought a more expensive book than nobody did.

(106) **Sono ronbun wa sore yori(mo) tyoodo 5_peeji**
that paper Top that YORI(MO) exactly 5_page
nagaku-nakerebanaranai.
long-be_required
'The paper is required to be exactly 5 pages longer than that.'

These basic facts as B17 would cluster them are summarized in (107):

(107) Japn: *subcomparative (SubC), *measure phrase (MP),
*degree question (DegQ), NegI-Effect (NegIs) and Scope not like English
but: Differential comparative (DiffC) ok!

Thus B17 take Japanese to have the positive setting of the DSP. Some other parameter must be responsible for the differences to English that we observe. B17 follow Beck, Oda & Sugisaki in suggesting that Japanese does not permit quantification over degree arguments. This is expressed in the following parameter:

(108) Degree Abstraction Parameter (DAP) (Beck, Oda & Sugisaki):
A language {does/does not} have binding of degree variables in the syntax.

If there is no binding of degree variables, a language cannot have degree operators like the English comparative. This explains the properties Scope (for a degree operator to take wide scope, binding of degree variables is necessary), NegIs (since the *yori*-clause does not denote a set of degrees but a set of individuals, it is fine), DegQ (which again needs binding of degree variables, as seen above in section 2), SubC (comparing two sets of degrees requires degree variable binding) and MP (since measure constructions involve quantification over degrees). But of course once more we face the question of what the semantics of the normal comparison construction then is.

Beck, Oda & Sugisaki consider English *compared to* and Japanese *yori* to be context setters not compositionally integrated with the main clause. They provide us with an individual (type <e>) that is used to infer the intended comparison indirectly. Thus we would be concerned in (109) with a comparative adjective without an overt item of comparison, such as English (110a) (without context) or (110b) (where the intended context is given explicitly). I present Beck, Oda & Sugisaki's semantics for Japanese *kasikoi* in the version developed in Oda (2008) in (109'). The analysis implies that Japanese adjectives are inherently comparative and context dependent. Unlike in English, there is no separable comparative operator.

(109) **Sally wa Joe yori kasikoi.**
Sally Top Joe YORI smart
'Sally is smarter than Joe.'

(110) a. **Mr Darcy is smarter.**
b. **Compared to Mr Bennet, Mr Darcy is smarter.**

(109') a. [[**kasikoi** c]]^g = λx.max(λd. x is d-smart) > g(c)
b. [[**Sally wa kasikoi**]]^g = 1 iff max(λd. S is d-smart) > g(c)
c. c := the standard of intelligence made salient by comparison to Joe
:= Joe's degree of intelligence

Thus even when there is evidence that the language under investigation employs a degree semantics, it may still lack English-type quantifiers over degrees. For a given language and comparison construction, we need to ask whether the constituent seemingly corresponding to the English *than*-constituent is really a compositional item of comparison denoting degrees, and whether there is a genuine comparison operator. B17 suggest that the parameter setting [+DSP], [-DAP] is also exemplified by Mandarin Chinese, Samoan, and the *exceed*-type languages that they investigate, Moore and Yoruba. See also Oda (2008), Krasikova (2007b) and Kennedy (to appear b) for more discussion of the DAP.

<u>- Degree Phrase Arguments</u>

Another group of languages appears to be closer to English than Japanese, but still not completely parallel. Russian, Turkish and Guarani belong to this group and show the behaviour summarized in (111) (cf. the B17 paper).

(111) Russian, Turkish, Guarani: *SubC, *MP, *DegQ
but: DiffC ok, English-like NegIs- and Scope-Effects

I use Guarani data from Fleischer (2007) (documented in the B17 paper) to illustrate.

(112) **Pe arahaku haku- ve 5 grado che aimo'a- vãe'kuri**
this temperature warm- more 5 degrees I think past-m
gui
than
'The temperature is 5 C° warmer than I thought.'

(113) * **Maria ojogua petei aranduka hepy- ve-**
Maria bought a book expensive more
va avave nd- ojoguai- vaekue- gui
mode nobody not buy neg past than
Maria bought a more expensive book than nobody.

(114) **Maria ojogua va'era mbovy-ve apytimby ka'ay Pedro -gui.**
Maria buy must little COMP packet tea Pedro than
Maria had to buy fewer packets of tea than Pedro.
(ok: the minimal requirement imposed on Maria is lower than the minimal requirement imposed on Pedro.)

(115) * **Pe juguata kuri potei ára ipuku**

	this	journey	past	six	days	long

This journey was six days long.

(116) *	**Mba'eita**	**itujá**	**Pedro**
	How	old	Pedro

How old is Pedro?

(117) *	**Pe**	**mesa**	**i-**	**jyvate-ve**		**pe**	**oke**	**i-**	**pe-**	**gui.**
	This	table	cop	high-	more	this	door	cop	wide	than

This table is higher than this door is wide.

(112), (113) and (114) indicate that Guarani (like Russian and Turkish) has an English-like degree semantics for main clause and subordinate clause - i.e. has the parameter setting [+DSP], [+DAP]. But we must ask how the differences to English degree constructions (115)-(117) arise. B17 propose that the following parameter creates the cluster SubC, MP, DegQ:

(118) Degree Phrase Parameter (DegPP):

The degree argument position of a gradable predicate {may/may not} be overtly filled.

The degree argument position (SpecAP in the presentation in this article) is filled by the MP at the surface in measure constructions, and by overt or non-overt *how* in DegQ and SubC. The difference between SubC and ordinary comparatives can be tied to ellipsis, in that comparatives with ellipsis only have a filled SpecAP at the level of LF. Thus the languages with *DegQ, *SubC, *MP are identified by the parameter setting [-DegPP], while at the same time being [+DSP] and [+DAP].

A language like English would, according to B17's analysis, have the parameter setting [+DSP], [+DAP], [+DegPP]. Besides English, the properties identified by these settings are documented in German, Bulgarian, Hindi, Hungarian and Thai (cf. B17). It seems likely that there is some connection between the effects characterised with the DegPP here and the language internal restrictions on MPs observed in subsection 3.2.1.; we need to investigate in more detail the circumstances under which the degree argument position of an adjective may be overtly filled (cf. the contrast in (94) above).

3.2.3. Subsection Summary

The table below provides a summary of the predictions that B17's three parameters are designed to make (n/a means that the relevant data cannot be constructed - e.g. Scope, a judgement on wide scope degree operators, makes no sense in a language without degrees).

	DiffC	NegIs	Scope	SubC	MP	DegQ	Language Ex.
-DSP	no	n/a	n/a	n/a	no	no	Motu
+DSP, -DAP	yes	no	no	no	no	no	Japanese
+DSP, +DAP, -DegPP	yes	yes	yes	no	no	no	Guarani
+DSP, +DAP, +DegPP	yes	yes	yes	yes	yes	yes	English

The table lists all possibilities opened by the parameters: If a language is [-DSP], it must be [-DAP] as well, because there can be no abstraction over degree variables without degree semantics. Similarly, if a language is [-DAP] it is also [-DegPP] because the DegPs are all operators over degree arguments and can only be interpreted with the help of binding of the degree argument slot.

The interest in such parameters lies in the fact that they make predictions about a range of phenomena. Each parameter is responsible for a set of effects, a cluster of empirical properties. Taken together, the settings of the proposed parameters group languages together that share a bunch of key properties in the realm of comparison constructions.

In sum, this subsection has not unearthed problems for our analysis of English comparison constructions. But it has demonstrated the need to identify ways in which other types of languages differ from English with respect to the grammar of comparison. Such differences, according to B17's results, may concern systematic properties of the lexicon (DSP), or the means of compositional interpretation available (DAP), or the mapping of lexical items into the syntax (DegPP).

Of course, these three parameters do not exhaust the potential for crosslinguistic variation in the domain of comparison constructions. Bhatt & Takahashi (2008) for example discuss more fine-grained differences between English, Hindi and Japanese, concerning the kind of comparative morpheme a language makes available. They propose that Hindi only has the phrasal comparative from section 2.2, not the clausal comparative morpheme from English. See also once more Kennedy (to appear) on this issue.

4. Summary and Conclusions

The theory of comparison introduced in section 2, which originates with von Stechow (1984), is highly successful. It uses a degree ontology, according to which degrees are introduced into natural language semantics by gradable predicates. Various comparison operators bind the degree arguments of gradable predicates. Comparison is abstract in that it compares for instance the maxima of such derived degree predicates. The theory is extendable from the comparative to various other comparison constructions in English and similar languages. We arrive by and large at a very coherent picture of the syntax and semantics of degree.

The quantifier data examined above require us to modify our perspective somewhat, taking into consideration a shift within the adjective phrase from degrees to intervals. They may not require a more radical change in the semantic analysis of comparison.

For languages that differ with regard to the grammar of comparison substantially from English, semantic theory has yet to provide complete alternative analyses which capture those differences. These analyses will shed some light on parametric variation in semantics and at the syntax/semantics interface.

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