Plural Predication and Quantified *Than*-Clauses

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Abstract

This paper uses the tools of plural predication to improve on existing analyses of quantifiers in *than*-clauses. The recent idea that quantified *than*-clauses talk about intervals is retained. Intervals are understood as pluralities of degrees. They can then enter the semantics by way of plural predication inside the *than*-clause (to be precise, cumulation involving the degree argument position of the gradable predicate). Combination of an interval denoting *than*-clause with the comparative operator proceeds via distributive predication. The resulting semantics seems to give the quantifier wide scope because the *than*-clause takes wide (distributive) scope. The analysis has a similar coverage to other analyses in the literature, but it relies on independently motivated mechanisms to achieve it.

1. Introduction

This paper proposes a semantic analysis of *than*-clauses with quantifiers that is a reply to, and hopefully an improvement over, the analysis proposed in Beck (2010). An example of a *than*-clause with a quantifier and its interpretation is given in (1) and (1').

(1) John is taller than every girl is.

(1') For every girl x: John's height exceeds x's height.

The example poses the well-known problem of seeming to have only a reading in which the quantifier scopes over the rest of the clause, including the comparative (c.f. the paraphrase in (1')). There has been much discussion on how to derive such a reading (Stechow (1984), Schwarzschild & Wilkinson (2002), Heim (2006), Schwarzschild (2008), van Rooj (2008), Gajewski (2008), Alrenga & Kennedy (2014) a.o.). I present below the analysis in Beck (2010). The *than*-clause is taken to denote a set of intervals or sets of degrees, the ones that cover all the girls' heights, (2). Picking the shortest (or maximally informative - see section 2) such interval, the actual comparison made is with the maximum point of this interval, (2'). This means that John is taller than the tallest girl and is therefore equivalent to the intuitive truth conditions of the example.

(2) [[than every girl is _ ~~tall~~]] = $\lambda D.\ \forall x[\text{girl}(x) \rightarrow \text{Height}(x) \in D]$
intervals into which the heights of all the girls fall

(2') John is taller than max(m-inf([[*than*-clause]]))

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         g1        g2  g3                gmax
|--------|---------|---|-----------------|------------------->
         |_______________________________|      m-inf
                                        max
```

$Height(J) > max(m\text{-}inf([[than\ every\ girl\ is\ \_\ \cancel{tall}]]))$

While the analysis in Beck (2010) is successful in so far as it produces correct truth conditions for a representative set of examples, it fails to provide satisfactory answers to two important questions:

(3) a. How are intervals introduced into the semantics?
b. How does the comparative operator combine with an interval denoting *than*-clause?

Regarding the first question, observe that there is a mismatch in type between a standard semantics of gradable adjectives (Stechow (1984) and many others) and the meaning of the quantified *than*-clause that this analysis requires. The adjective relates individuals and degrees (4b), but the *than*-clause is a predicate of <u>sets</u> of degrees (4a).

(4) a. $[[than\ every\ girl\ is]] = \lambda D.\ \forall x[girl(x) \rightarrow Height(x) \in D]$ $\quad <<d,t>,t>$
b. $[[tall]] = \lambda d.\lambda x.Height(x) \geq d$ $\quad <d,<e,t>>$

With respect to the second question, I would like to assume a semantically simple comparative operator whose first argument is a degree (5b). The composition of this operator with a <<d,t>,t> *than*-clause (5a) also presents a mismatch. This is resolved in Beck (2010) by employing a maximality operator on top of choosing the maximally informative element of the *than*-clause denotation.

(5) a. [[-er [than every girl is]]]
b. $[[-er]] = \lambda d.\lambda d'.d'>d$ $\quad <d,<d,t>>$

While I believe that employing maximal informativity is well-motivated, I am dissatisfied with using maximality in addition. Beck (2012) argues that maximal informativity should <u>replace</u> maximality. I develop an analysis below which doesn't rely on maximality, but on plural predication instead. Notice that (6a) and (6b) amount to the same thing.

(6) a. $Height(J) > max(m\text{-}inf([[\textit{than}\text{-}clause]]))$
b. $\forall d[d \in m\text{-}inf([[\textit{than}\text{-}clause]]) \rightarrow Height(J) > d]$

The universal quantification over degrees that (6b) uses can be introduced in an independently motivated way, namely as distributivity. Beck (2012) argues that distribution over degrees is responsible for the interpretation of data like (7).

(7) a. Lucinda drove faster than the permissible speeds.
b. $\forall d[d \in [[the\ permissible\ speeds]] \rightarrow Speed(Lu)>d]$

I propose below that the same mechanism is at work in (1), yielding (6b) instead of (6a). Thus plural predication allows us to resolve the mismatch in the main clause. As anticipated in Beck (2010), I extend the strategy to the *than*-clause and propose to also use plural predication to introduce the intervals in the first place. This means that both questions in (3) can receive motivated answers once we understand the data to involve pluralities of degrees. In my recollection, Irene Heim (p.c.) first suggested to consider pluralities of degrees in connection with this issue.

Section 2 below sets the scene by explaining what the problem of quantifiers in *than*-clauses is for standard analyses. It goes on to summarize the analysis proposed in Beck (2010). In section 3 the first question is addressed, of how intervals get into the semantics. The second question of how interval-denoting *than*-clauses combine with the comparative is the topic of section 4. Section 5 provides a summary and relates the present proposal to other analyses of quantifiers in *than*-clauses.

2. Background: Quantifiers in *Than*-Clauses

2.1. A Standard Analysis of Comparatives

A standard analysis of comparatives (Stechow (1984) and many others; see Beck (2011) for a recent overview)) describes the truth conditions of a simple example of a clausal comparative like (8a) in terms of (8b).

(8) a. Paule is older than Knut is.
b. max(λd.Paule is d-old)>max(λd.Knut is d-old)
= Age(Paule)>Age(Knut)
'The largest degree of age that Paule reaches exceeds the largest degree of age that Knut reaches' = Paule's age exceeds Knut's age.

(9) Let S be a set ordered by >. Then $\max(S) = \iota s[s \in S \ \&\ \forall s' \in S[s > s']]$

A core ingredient to derive these truth conditions is the semantics of gradable predicates exemplified in (10). They are relations between degrees and individuals.

(10) $[\![\text{old}]\!]_{<d,<e,t>>} = [\lambda d.\lambda x.\ x \text{ is d-old}] = [\lambda d.\lambda x.\ \text{Age}(x) \geq d]$

There are various versions of the theory which differ in terms of what exactly the semantics of the comparative operator is, and consequently, how exactly its input is constructed. I will work with the version below as my starting point. The comparative is a relation between degrees. Both main and *than*-clause denote sets of degrees. An appropriate operator - here the maximality operator - transforms them to the required type <d>.

(11) $[\![\text{-er}]\!] = \lambda d_d .\lambda d'_d .d' > d$

(12) a. $[[\text{-er}\ \ [_{<d>}\ \text{than}\ \ \max 2\ [\text{Knut is t2 old}]]$ (LF)
$[_{<d>}\ \ \max 2\ [\text{Paule is t2 old}]]]$
b. max(λd.Paule is d-old)>max(λd.Knut is d-old) (truth cond.)
= Age(Paule)>Age(Knut)

2.2. Quantifiers - A Problem

The standard analysis has many strengths, but it runs into trouble with *than*-clauses that contain quantifiers. The example from the introduction is repeated below. It has the interpretation in (13'a) but not the one in (13'b). This is surprising in view of the scope that the quantified NP seems to take. As illustrated in (13''), the available reading corresponds to one in which the NP takes scope over the comparison. A reading in which the NP takes scope within the *than*-clause appears to be unavailable. Normal constraints on scope would lead one to expect the opposite.

(13) John is taller than every girl is.

(13') a. $\forall x[\text{girl}(x) \rightarrow \max(\lambda d.\text{John is d-tall}) > \max(\lambda d.x \text{ is d-tall})]$
= For every girl x: John's height exceeds x's height.
b. # $\max(\lambda d.\text{John is d-tall}) > \max(\lambda d.\ \forall x[\text{girl}(x) \rightarrow x \text{ is d-tall}])$
= John's height exceeds the largest degree to which every girl is tall;
= John is taller than the shortest girl.

```
|---------------------x-----------------x-----------------x---------------x--------->
                  g1's height      J's height      g2's height     g3's height
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(13'') a. [[every girl] [1[[-er [<d> than max 2 [t1 is t2 tall]]
[<d> max 2 [John is t2 tall]]]]]
b. [[-er [<d> than max 2 [every girl] [1[t1 is t2 tall]]]
[<d> max 2 [John is t2 tall]]]]

Example (14) shows that a differential doesn't change this picture. Because of the differential, all individuals quantified over must have the same height - a reading I will refer to as EQ for equality.

(14) a. John is exactly 2'' taller than every girl is. EQ
b. $\forall x[\text{girl}(x) \rightarrow \max(\lambda d.\text{John is d-tall}) = \max(\lambda d.x \text{ is d-tall}) + 2'']$
= For every girl x: John's height exceeds x's height by 2''.
c. $[\![\text{-er}_{\text{diff}}]\!] = \lambda d.\ \lambda d'.\lambda d''.d'' \geq d + d'$

In (15) instead of a nominal universal quantifier a verbal universal quantifier, the propositional attitude verb *predict*, is contained in the *than*-clause. As illustrated in (15') and (15''), the same observation about scope holds as in the nominal case. This is even more surprising for the verbal quantifier since the expected LF is (16), which would give rise to the unavailable reading.

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

(15') My prediction: John will be between 1,70m and 1,80m.

Claim made by (15): John is taller than 1,80m.

(15") a. ∀w[wR@ -> 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. # max(λd.John is d-tall in @)>max(λd. ∀w[wR@ -> John is d-tall in w])
= John's actual height exceeds the degree of tallness which he has in all worlds compatible with my predictions;
i.e. John's actual height exceeds the shortest prediction, 1,70m.
(where R is the relevant accessibility relation, compare e.g. Kratzer (1991))

(16) [[-er [$_{<d,t>}$ than max 2 [I had predicted that [John be t2 tall]]]
[$_{<d,t>}$ max 2 [John is t2 tall]]]

This is the interpretive behaviour of many quantified NPs, plural NPs like *the girls*, quantificational adverbs, verbs of propositional attitude and some modals (e.g. *should, ought to, might)*. See Schwarzschild & Wilkinson (2002) and Heim (2006) for a more thorough empirical discussion. All these quantifiers appear to take scope outside the *than*-clause and over the comparative operator.

Not all quantificational elements show this behaviour. There are quantifiers that appear to take narrow scope relative to the comparison. The modal verb *allowed* is one of them, and so are certain indefinites including NPIs:

(17) Mary is taller than she is allowed to be.

(17') a. # ∃w[wR@ & max(λd.Mary is d-tall in @)>max(λd.Mary is d-tall in w)]
= It would be allowed for Mary to be shorter than she actually is.
b. max(λd.M. is d-tall in @)>max(λd. ∃w[wR@ & M. is d-tall in w])
= M.'s actual height exceeds the largest degree of tallness that she reaches in some permissible world; i.e. Mary's actual height exceeds the permitted maximum.

(18) Mary is taller than anyone else is.

(18') a. # There is someone that Mary is taller than.
b. Mary's height exceeds the largest degree of tallness reached by one of the others.

This is the interpretive behaviour of some modals (e.g. *need, have to, be allowed, be required*), some indefinites (especially NPIs) and disjunction (compare once more Heim (2006)). It is also the behaviour of negation and negative quantifiers, with the added observation that the apparent narrow scope reading is one which often gives rise to undefinedness, hence unacceptability (von Stechow (1984), Rullmann (1995)).

(19) * John is taller than no girl is.

(19') a. John's height exceeds the maximum height reached by no girl.
the maximum height reached by no girl is undefined, hence:
unacceptability of this reading.
b. # There is no girl who John is taller than.

In sum: Under the classical analysis, apparent wide scope quantifiers in *than*-clauses are mysterious. Apparent narrow scope quantifiers are not per se mysterious because the truth conditions they give rise to are the expected ones. It is, however, unclear how we are to identify whether a given quantifier belongs to the one group or the other. Various suggestions have been made to capture these data that involve fundamental revisions of the classical analysis. Before we proceed to examine one of them, a brief comment on the data: I have presented them here the way they are presented in the earlier literature. However (as already said in Beck (2010)), I think there is some uncertainty at certain points. Firstly, while our original example is acceptable, I would like to point out that a version with a definite plural seems noticably better, with the same resulting interpretation.

(20) a. ? John is taller than every girl is.
b. John is taller than the girls are.
$\forall x[x \in [\![\text{the girls}]\!] \text{ -> John is taller than } x]$

Secondly, while I share the intuition that example (14) gives rise to an EQ interpretation, there are data for which this is less clear. (21) is an example. I judge it true in the context in (21'). We will return to both issues below.

(21) John arrived at most 10 minutes later than I had expected. EQ?

(21') My expectation: John will get here between 5pm and 5:30pm.
I don't look at my watch at the exact moment of John's arrival, but I notice that
by 5:40pm, he had got here.

2.3. The Analysis in Beck (2010)

I focus here on the analysis in Beck (2010) because this is the analysis I want to improve on. Other analyses are commented on in section 5. The analysis in Beck (2010) follows Schwarzschild & Wilkinson (2002) and others in assuming that the *than*-clause denotes, not a predicate of degrees, but a predicate of sets of degrees/intervals. The adjective is taken to have an argument slot for intervals which allows straightforward derivation of such a *than*-clause denotation.

(22) a. John is taller than every girl is.
b. For every girl x: John's height exceeds x's height.

(23) $[\![\text{tall}]\!] = \lambda D.\lambda x.\text{Height}(x) \in D$

(22') a. ⟦ [than every girl is _ ~~tall~~] ⟧ =
$\lambda D'.\forall x[girl(x) \text{ -> } Height(x) \in D']$
intervals into which the height of every girl falls

b.
```
          g1        g2 g3             gmax
|--------|---------|---|----------------|-------------------->
         |-----------------------------|     m-inf
     |----------------------------------|
         |----------------------------------|
   |------------------------------------------|      ...
```

The analysis goes on to propose that out of all the intervals described by the *than*-clause, the maximally informative one is chosen. Maximal informativity is a well-established mechanism in other places (e.g. question interpretation) (see especially Fox & Hackl (2007)) and is adapted here to the required type:

(24) a. $m\_inf(w)(p_{<s,<<d,t>,t>>}) =$
$\lambda D.p(w)(D) \ \& \ \neg\exists D'[p(w)(D') \ \& \ D \neq D' \ \& \ [p(w)(D') \Rightarrow p(w)(D)]]$
b. the maximally informative intervals out of a set of intervals p(w) is the set of intervals D such that there is no other interval D' in p(w) such that p(w)(D') entails p(w)(D) (i.e. if D is in p(w) then so is D').

The maximally informative *than*-clause interval is the shortest one. Choosing the maximum point out of that interval yields appropriate truth conditions for the example:

(24") John is taller than max(m_inf (⟦*than*-clause⟧)
= John is taller than the height of the tallest girl

The same analysis is applied to examples with verbal quantifiers:

(25) a. John is taller than I had predicted (that he would be).
b. ⟦ [than I had predicted (that he would be ~~tall~~)] ⟧ =
$\lambda D'. \forall w[wR@ \text{ -> John's height in } w \in D']$
intervals into which John's height falls in all my predictions

(25') John is taller than max(m_inf (⟦*than*-clause⟧))
= John is taller than the height according to the tallest prediction

It can also be extended to apparent narrow scope quantifiers, as illustrated below.

(26) a. Mary is taller than anyone else is.
b. ⟦ [than anyone else is ~~tall~~] ⟧ =
$\lambda D'. \exists x[x \neq Mary \ \& \ Height(x) \in D']$
intervals into which the height of someone other than Mary falls

(27)
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----------|------|-------|-----------x------------->
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x1   x2   x3   M

(28) Mary is taller than max(m_inf (⟦*than*-clause⟧))
= Mary is taller than the height of the tallest other person.

Here are the ingredients of the analysis in a nutshell: the *than*-clause talks about intervals. Quantifiers take scope in the *than*-clause. In order to combine with the comparative operator, the *than*-clause has to be coerced into denoting one degree. M-inf and max together bring this about.

There are various complications to consider in order for the analysis to achieve a satisfactory coverage (especially further quantifiers, and the readings of differentials; cf. the paper). Rather than listing them and the extensions they lead to at this point, I proceed with the plot of the present paper and return to those points that are relevant to it where it becomes important (sections 3 and 4 respectively).

2.4. Summary

The Beck (2010) analysis gives us a working account of comparatives with quantificational *than*-clauses. Two features remain unsatisfactory: (i) how intervals get in to the semantics is not clear (though see a hint in section 4 of the paper); lexical entries like (23) are not what is standardly assumed. (ii) while maximal informativity has independent motivation, it is supposed to <u>replace</u> maximality. The question arises whether we can remove maximality from the analysis. Section 3 addresses the first question and section 4 the second.

<u>3. Introducing the Intervals</u>

3.1. Cumulation

This section proposes to regard intervals as pluralities of degrees, and to use well-known mechanisms of plural predication to introduce them into the semantics. The mechanism of choice is cumulation. This is anticipated in Beck (2010) and goes back to a suggestion in Heim (2009) but I work it out in more detail here. I begin with a familiar instance of cumulation, example (29).

(29) Lizzy and Jane married Mr Darcy and Mr Bingley/the two gentlemen.

Since marrying is a relation between single individuals, it is perhaps unexpected that it can be said to hold between two groups. (29') paraphrases the truth conditions of (29) on its cumulative reading (the reading on which we judge the example true). The original relation *marry* does not hold between the groups directly; it holds between group members in a pointwise sort of fashion. I follow the literature in adopting a plural operator ** to pluralize the original relation and I assume the simplified semantics in (30) (see Beck & Sauerland (2000) for this version,[1] and references therein for more discussion of cumulation).

(29') Each of the women married one of the men,
and each of the men was married by one of the women.

(30) $[**P_{<x,<y,t>>}]\ (X_{<x>})(Y_{<y>}) = 1$ iff
$\forall x \in X \exists y \in Y{:}P(x)(y)\ \&\ \forall y \in Y \exists x \in X{:}P(x)(y)$

The analysis of example (29) is given in (31). The ** like other plural operators may freely apply to predicates in order to enable them to apply to pluralities.

(31) a. [[L&J] [[**marry $_{<e,<e,t>>}$] [D&B]]] (LF)
b. <L&J,,D&B> $\in$ [**marry]
c. $\forall x \in$ L&J: $\exists y \in$ D&B: x marry y & (truth cond.)
$\forall y \in$ D&B: $\exists x \in$ L&J: x marry y

3.2. Cumulation and Pronominal Measure Phrases

The ** operator introduced above applied to relations between individuals, type <e,<e,t>>. Next, I propose that it may as well apply to other two-place relations, in particular those of type <d,<e,t>>. This is not entirely new (for cumulation of degrees see also Heim (2009) and Fitzgibbons et al. (2008)). I analyse below what I take to be the simplest possible case, pronominal measure phrases. (32) is an example of a (singular) pronominal measure phrase including the composition I envision for the example (see Tiemann et al. (2011) on pronominal measure phrases).

(32) a. (context: John is 1.85m tall.)
Bill is that tall, too.
b. [_ [is [AP Bill$_{<e>}$ [A' that$_{<d>}$ tall$_{<d,<e,t>>}$]]]]
c. [[tall]] = $\lambda d.\lambda x.\mathrm{Height}(x) \geq d$
[[that]]^g = 1.85m
d. [[[AP Bill$_{<e>}$ [A' that$_{<d>}$ tall$_{<d,<e,t>>}$]]]]^g = 1 iff
[[tall]]([[that]]^g)([[Bill]]) = 1 iff
Height(B)$\geq$1.85m

(33) moves on from (32) in that both the individual argument and the degree argument of the gradable predicate are to be filled by pluralities. (34) is another example.

(33) Pat: Our daughter is 162cm tall and our son 158cm.
Sandy: Our children are that tall, too.
(true e.g. if Sandy's children are 162cm and 160cm)

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[1] The analysis as presented adopts a plural ontology following Schwarzschild (1996) according to which "groups" are sets of individuals (e.g. "Lizzy and Jane" denotes {Lizzy, Jane}) and of the same type as singular individuals. The simplest form of plural predication talks about elements of these sets. See e.g. Beck (2001) for a more detailed discussion of the version of plural semantics I have in mind.

(34) Kim: I got an A in semantics and a B+ in syntax.
Robin: My grades are that good, too.
(true e.g. if Robin got an A and an A-)

(35) illustrates what pluralities the gradable adjective wants to combine with. The analysis in terms of cumulation of the adjective is presented in (34'). It amounts to appropriate truth conditions for the example.

(35) a. [[my grades]] = {R's semantics grade, R's syntax grade}
b. [[that]] = {A, B+}
c. [[good]] = $\lambda d.\lambda x.\text{Quality}(x) \geq d$

|---------------------B--B^{+}--A^{-}--A--> Quality

(34') $**[[\text{good}_{<d,<e,t>>}]]([[\text{that}]])([[\text{my grades}]]) = 1$ iff
$[\lambda D.\lambda X.\forall x \in X \exists d \in D:[[\text{good}]](x)(d)\ \&\ \forall d \in D \exists x \in X:[[\text{good}]](x)(y)]$
$([[\text{that}]])([[\text{my grades}]])$ iff
$\forall x \in [[\text{my grades}]] \exists d \in [[\text{that}]]:[[\text{good}]](x)(d)\ \&$
$\forall d \in [[\text{that}]] \exists x \in [[\text{my grades}]]:[[\text{good}]](x)(y)]$ iff
$\forall x \in \{\text{R's semantics grade, R's syntax grade}\} \exists d \in \{A, B+\}:\text{Quality}(x) \geq d\ \&$
$\forall d \in \{A,B+\} \exists x \in \{\text{R's semantics grade, R's syntax grade}\}: \text{Quality}(x) \geq d$

A parallel analysis of (33) results in (33').[2]

(33') a. Our children are that tall, too.
b. Each of our children reaches a height in 'that',
and each height in 'that' is reached by one of our children.

3.3. Cumulation in *Than*-Clauses

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[2] Alternative analyses of these pronominal measure phrase examples are conceivable. For example we could take the degree pronoun 'that' in (33) to refer to the smaller degree mentioned and analyse (33) as in (i) below.

(i) a. Our children are that tall.
b. [[that]] = 158cm
c. $\forall x[x \in C \rightarrow \text{Height}(x) \geq 158\text{cm}]$

Lucas Champollion (p.c.) suggests to me that such an alternative would not be available for non-dimensional adjectives under the analysis in Beck (2012), according to which non-dimensional adjectives have a non-monotonic semantics. An example is given in (ii).

(ii) a. Tone A is 7500 Hertz and Tone B is 8200 Hertz.
Those two tones are that high, too.
b. [[high]] = $\lambda d.\lambda x.\text{Freq}(x)=d$

At any rate, the alternative would fail to introduce plural degrees into the semantics, which is what we are about.

In the next step, cumulated degree predicates in *than*-clauses are considered. Semantically, all that changes from the data in the preceding subsection is that the degree argument of the gradable predicate is abstracted over (this is the semantics of a *than*-clause as opposed to a pronominal measure phrase, cf. section 2). Examples are (36) and (37).

(36) This grade is better than your grades are.

(37) John is taller than the girls are.

```
         g1        g2 g3            gmax
|--------|---------|---|-----------------|---------x----------->
                                                Height(J)
```

Since the girls do not have one height, we suppose that this group is related to a plurality of degrees in the now familiar way. The result is (37').

(37') $[[\text{than the girls are \_ } \cancel{\text{tall}}]] = [\lambda D.\langle D,G\rangle \in {}^{**}[[\text{tall}]]\ ]$
$= [\lambda D.\forall x \in G:\exists d \in D:[[\text{tall}]](d)(x)\ \&\ \forall d \in D \exists x \in G:[[\text{tall}]](d)(x)$
$= [\lambda D.\forall x \in G:\exists d \in D:\text{Height}(x) \geq d\ \&\ \forall d \in D \exists x \in G:\text{Height}(x) \geq d$

intervals D such that each girl reaches a degree in D
and each degree in D is reached by a girl

In order to better understand what intervals[3] are described, note that for each girl to reach a degree in D means that D does not begin above the height of the shortest girl. For each degree in D to be reached by a girl means that D does not extend above the height of the tallest girl. The denotation of the *than*-clause can thus be alternatively described as follows:

(38) $\lambda D.\min(D) \leq \text{Height}(g_1)\ \&\ \max(D) \leq \text{Height}(g_{max})$
= intervals not beginning beyond g_1's height and not extending beyond g_{max}'s height

As before, maximal informativity applies, with the result in (40).

(39) a. $\text{m\_inf}(w)(p_{\langle s,\langle\langle d,t\rangle,t\rangle\rangle}) =$
$\lambda D.p(w)(D)\ \&\ \neg\exists D'[p(w)(D')\ \&\ D \neq D'\ \&\ [p(w)(D') \Rightarrow p(w)(D)]]$
b. the maximally informative intervals out of a set of intervals p(w) is the set of intervals D such that there is no other interval D' in p(w) such that p(w)(D') entails p(w)(D) (i.e. if D is in p(w) then so is D').

(40) $\text{m-inf}([[\text{than the girls are \_ } \cancel{\text{tall}}]]) = [\text{Height}(g_1), \text{Height}(g_{max})]$

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[3] A word on terminology: as is customary in the relevant literature, I talk about 'intervals' as the meanings of *than*-clauses with quantifiers. Intervals however are nothing but sets of degrees (as argued explicitly in Sauerland (2008)). Since I follow Schwarzschild (1996) in this paper according to whom pluralities are sets of entities of the type of the singular counterpart, pluralities of degrees are sets of degrees and conceptually the same thing as what we called intervals before. Pluralities of individuals are still taken to be type <e> by Schwarzschild, and correspondingly I take pluralities of degrees to be type <d>.

Note that m-inf([[*than*-clause]]) is the same interval as what we had before for example (1). This looks promising.

3.4. Quantified *Than*-Clauses and Cumulation

Remember that we are asking the question whether the intervals required for the analysis in Beck (2010) can be introduced into the semantics in a motivated way. We are considering cumulation as the tool to do so. Hence we ask if cumulation within the *than*-clause can generally derive the same (or perhaps: equally useful) intervals as the ones stipulated in Beck (2010). The preceding subsection marks a first success: for definite plural NPs, which belong to the apparent wide scope quantifiers in *than*-clauses, deriving the desired interval with the help of cumulation is straightforward. Next, we need to find out whether cumulation can help with the interpretation of other quantifiers in *than*-clauses. We consider them case by case.

- universal quantifiers are like definites:

Let's look at universal quantifiers first. Our two examples are repeated in (41).

(41) John is taller than every girl is / than I had predicted.

The example with the nominal universal quantifier has the same interpretation as the example with the plural definite. Hence what we desire as the interpretation of the *than*-clause is also the same.

(42) a. [[than every girl is _ ~~tall~~]] = [[than the girls are _ ~~tall~~]] =
$[\lambda D.<G,D>\in**[[tall]]]$
$= [\lambda D.\forall x\in G:\exists d\in D: tall(d)(x)\ \&\ \forall d\in D:\exists x\in G:tall(d)(x)]$
b. m-inf([[than every girl is]]) = $[Height(g_1) ,Height(g_{max})]$

The simplest way to derive this denotation is to suppose that 'every girl' is interpreted as the group that contains all the girls.

(43) a. John is taller than every girl is.
b. 'every girl' -> G (the plurality of girls)

It is known that universal nominals can sometimes have such an interpretation. Some relevant examples are given below. The acceptability of such plural interpretations varies with the quantifier and its position in the sentence. See for example Champollion (2011) for recent discussion.

(44) a. Everyone gathered in the hallway.
b. ? Every student gathered in the hallway.
c. Three copy editors found every mistake. cumulative rdg. ok
d. Every copy editor found three mistakes * cumulative rdg.

I remarked in section 2 that I found the universal example somewhat less acceptable than the definite plural. Should this judgement be confirmed, that would support a reinterpretation analysis.
There are a lot of open questions. It would be interesting to see if the circumstances under which universals may vs. may not behave like plurals can be recreated specifically in *than*-clauses. Luka Crnic (p.c.) points out to me that we would expect strongly distributive quantifiers like *each* not to be amenable to the coercion into a plural. 'John is taller than each girl is' would have to come by its interpretation (the same as (41)) by some other mechanism, e.g. exceptionally wide scope of *each*. The same coercion could apply in data paralleling (33) and (34), e.g. 'the boys got every grade' could be judged true if John got an A, Bill got a B and so on.
I leave this empirical project for another occasion and note here merely that there is some initial plausibility for an analysis of the universal nominal quantifiers parallel to the definite plural example.

We turn to the universal verbal quantifier next. (45) represents the desired outcome of compositonal interpretation. Can we derive it using cumulation?

(45) m-inf([[than I had predicted ~~that he would be _ tall~~]])
= λD.D contains all heights of John that I had predicted and nothing else

There is a recent proposal by Boskovic & Gajewski (to appear) according to which sums of possible worlds replace universal quantification in the semantics of propositional attitude verbs (relatedly, Schlenker (2004) uses a definite description semantics for *if*-clauses). The standard meaning of (46a) for *believe* is replaced by (46b).

(46) a. $[[\text{believe}_x]] = \lambda p.\forall w[w \in BEL_x \rightarrow p(w)]$ $<<s,t>,t>$
set of propositions that are true in all of x's belief worlds
b. $[[\text{believe}_x]] = the(*BEL_x)$ $<s>$
the sum of x's belief worlds
$= max(\lambda W.\forall w[w \in W : w \in BEL_x])$
largest set of worlds each of which is combatible w/x's beliefs

This is not intended to make a difference for the interpretation of simple propositional attitude attributions. The compositional interpretation of (47) illustrates that by distributive predication (Link (1983); see also section 4 for a discussion of distributive predication), the same truth conditions result as in the standard semantics.

(47) a. "x believes that p":
$[\ the(*BEL_x)_{<s>}\ [*\ p]_{<s,t>}\ ]$
b. $the(*BEL_x) \in [*p]$ iff $\forall w[w \in the(*BEL_x) \rightarrow p(w)$
iff p is true in all of x's belief worlds
c. $Z \in [*P]$ iff $\forall z \in Z: P(z)=1$

But of course this move introduces a plurality into the semantics, which we may involve in cumulation in an example like (48a) - a *than*-clause with what we thought of as a universal verbal quantifier above. This is reanalysed as in (48b,c). The maximally informative interval in the *than*-clause denotation is the same one as before. A cumulation analysis for "universal verbal quantifiers" is thus possible.

(48) a. (John is taller) than you believe.

b. $\lambda D.[{*}{*}\ \lambda w.\ \lambda d.\text{John is d-tall in w}](\text{the}({*}BEL_{you}))(D)$

c. $\lambda D.\forall w \in \text{the}({*}BEL_{you}): \exists d \in D: \text{tall}(w)(d)(\text{John})\ \&$
$\forall d \in D: \exists w \in \text{the}({*}BEL_{you}): \text{tall}(w)(d)(\text{John})$

w_1 w_{max}

----------|-------------------|-------------->

d. m-inf([[*than*-clause]])=$[d_{w1}, d_{wmax}]$
intervals that contain John's heights in your belief worlds and nothing else

I should add that there is an open question: Boskovic & Gajewski propose the definite plural semantics for neg-raising predicates. They do not propose it for non-neg-raising predicates. The immediate prediction would then be that the neg-raising intensional verbs yield apparent wide scope readings in *than*-clauses, while the non-neg-raising intensional verbs yield apparent narrow scope readings in *than*-clauses. This seems to fit with the behaviour of *believe, expect, suppose* (neg-raising, apparent wide scope) and *require, have to* (non-neg-raising, apparent narrow scope) (this partial match is I think parallel to the one observed in Schwarzschild (2008) in terms of verbs that take wide vs. narrow scope relative to same clause negation). But not all apparent wide scope intensional verbs are neg-raising - *predict* is not. So here, too, there is a remaining open question regarding the empirical coverage of the analysis.

(49) I hadn't predicted that John would participate in the race.
=/=> I had predicted that John would not participate in the race.

In sum, it is possible to extend the cumulation analysis to other *than*-clause quantifiers: apparent universal quantifiers. They are taken to provide pluralities instead of universally quantifying.

- NOT introducing an interval semantics - singulars:

There are quantifiers for which assuming the presence of a plurality is exceedingly implausible. (50) gives a bunch of *than*-clauses with quantifiers all of which are obviously not plural.

(50) John is taller ...

a. than no girl is

b. than a girl/any girl is

c. than allowed

Since there is no plural anywhere, there no way for the cumulation strategy to introduce an interval into the semantics. At the same time, there is no need to introduce an interval because

the classical analysis' predictions for these apparent narrow scope quantifiers are fine. I suggest that these data are interpreted traditionally with abstraction over singular degrees (cf. sections 2.1. and 2.2).
Another singular NP is an apparent wide scope quantifier, *some*:

(51) a. John is taller than some girl is.
b. There is a girl x such that John's height exceeds x's height.

I follow the strategy from Beck (2010) and propose that (some) indefinites make available an independent way of scope assignment, their well-known specific interpretation. A hint at an analysis in terms of choice functions is given in (51') (see e.g. Reinhart (1992), Kratzer (1998)). This analysis is available for indefinites in *than*-clauses in the same way it is available elsewhere.

(51') ∃f [CH(f) & John is taller than the girl selected by f]

- plural indefinites:

Matters are a little more complex when we turn to plural indefinites. Relevant examples are listed in (52). All of them are analysed as involving plural indefinites in Beck (2010) (this is the first of the issues postponed in section 2.3.).

(52) John is taller ...

a. ??	than girls are.		(BUMP)
b.	than some girls are.	#∃X (BUMP), ∃f	
c.	than exactly 5 girls are.	∃f, EXACT	
d.	than most/many girls are.	∃f, -est/POS	

Beginning with (52a), it is noted that plain plural indefinites are often degraded. Their interpretation is shown to be equivalent to the interpretation of the corresponding singular, and it is suggested that a constraint called BUMP rules them out for that reason. Moving on to (52b), the difference to the (52a) example is that the indefinite with *some* makes available a specific reading "∃f" in addition to the ordinary interpretation "∃X" of the indefinite NP. The specific reading is not ruled out by the BUMP and this is the interpretation that the example has. An example (53) is analysed according to the 'old' analysis in (53'). Notice that in the denotation of the *than*-clause a plurality occurs and an interval is made use of.

(53) Hans ran faster than some sisters of Greg did.

(53') a. ∃f: CH(f) & Hans ran faster than (old)
$max_{>}$ (m_inf([λD'. ∀x∈f(*sister): max(λd. x ran d-fast) ∈D']))
= Hans ran faster than each of the sisters selected by f (f a choice function).
b. [[than some sisters of Greg did ~~run d-fast~~]] =
[λD'. ∀x∈f(*sister): max(λd. x ran d-fast) ∈D']
intervals that contain the speeds of all of the sisters of Greg selected by f

This is a type of example therefore to which the new analysis ought to be applied. This is done below, resulting in the same interval as before.

(53") λD.[** λd.λx.x ran d-fast](D)(f(*sister)) = (new)
λD. ∀x∈f(*sister): ∃d∈D: x ran d-fast & ∀d∈D: ∃x∈f(*sister): x ran d-fast =
λD. ∀x∈f(*sister): ∃d∈D: Speed(x)≥d & ∀d∈D: ∃x∈f(*sister): Speed(x)≥d
intervals that contain the speeds of all of the sisters of Greg selected by f
(and nothing else)

s_1 s_{max}
----------|------------------|-------------> Speed

The other indefinites (52c) and (52d) differ from this case only wrt. orthogonal features. (52c) can be viewed as an alternative evaluating operator *exactly* combining with a plural indefinite (Krifka (2002)). (52d) can be viewed as instances of a gradable adjective *many* occuring inside an indefinite, and combining with Positive and superlative operators respectively (Hackl (2009)). The change in the internal composition of the *than*-clause that distinguishes the analysis in Beck (2010) from the present proposal can simply be combined with those analyses from Beck (2010), in a way that is totally parallel to (52b), (53").

3.5. Summary

Conceivably, the intervals required for the analysis in Beck (2010) can be derived if we assume that there are pluralities of degrees and that there is cumulation in *than*-clause between the degree- and the individual- (or world-) argument slot of the gradable predicate. Apparent wide scope quantifiers have to be reduced to plurals, unless there is an independent mechanism like choice functions ("∃f"). Cumulation thus may give a motivated answer to the first question raised above: How do the intervals get into the semantics?
Note that semantic analysis could proceed from here as in Beck (2010). In those cases where there is an interval, it is effectively the same one as before. But this is not the plot: we will also resort to plural predication to answer the second question from above, i.e. to combine the *than*-clause with the comparative operator.

4. Reducing the Intervals

4.1. Distribution

This section proposes to remove maximality from the combination of the comparative operator with the *than*-clause, and to replace it with distributive predication. A simple example to illustrate distributive predication is given in (54). (54a) is understood as in (54b).

(54) a. Lucinda graded these papers.
b. Lucinda graded each of these papers.

Distributive readings are standardly taken to arise by virtue of a one-place plural operator like Link's (1983) * operator. I give a simplified version in (55) (again see e.g. Beck (2001) for a thorough discussion of the intended plural semantics, as well as references therein). The operator is used to analyse example (54) in (54').

(55) [*P](X)=1 iff $\forall x \in X$: P(x)=1

(54') a. Lucinda graded these papers.
b. [[these papers] [*[1[Lucinda graded t1]]]] (LF)
c. $\forall x \in$ [[these papers]]: Lucinda graded x (truth cond.)

Distribution, i.e. universal quantification over the members of a plurality, is of interest in the context of quantified *than*-clauses because of the (near-) equivalence[4] in (56) observed in the introduction: If the measure provided by the matrix clause of a comparative exceeds the maximum of a set of degrees, then it exceeds all the degrees in the set, and vice versa.

(56) Meas > max(D) iff $\forall d \in D$: Meas > d (ignoring poss. undefinedness)

It seems possible to replace maximality from Beck (2010) with distribution over degrees, and this is the plot pursued in this section.

4.2. Distribution in Lucinda-Sentences

First, we make the point that it is plausible (independently of the issue of quantifiers in *than*-clauses) to assume distribution over degrees in comparatives - as argued in Beck (2012). The simplest examples involve direct comparisons with degrees. A (singular) example of comparison with a degree and its analysis is given in (57), (57'). The constituent following *than* is taken to refer to a degree and be of type <d>.

(57) a. Lucinda drove faster than the speed limit.
b. context: this highway has a speed limit of 50mph.
[[the speed limit]] = 50mph
c. Lucinda's speed exceeds 50mph.

(57') a. [[-er [the speed limit]$_{<d>}$] [max 2[Lu drove t2 fast]]]]]
b. [[-er$_{simple}$]] = $\lambda d.\lambda d'.d'>d$
c. [[-er]](50mph) = $\lambda d.d > 50mph$

The example in (58) differs from (57) in that the degree denoting NP is plural rather than singular. It refers to a plurality of degrees (degrees of speed in the example). (58a) is understood to mean (58c).

---

[4] The two sides of the biconditional are not completely equivalent because in case there is no maximum, the left hand side is undefined. This could only happen if D is the empty interval (if D contains one degree, that is the maximum; if D contains more than one degree, ordering necessarily provides a maximum). I have been unable to think of a relevant case for this. While it is possible to think of than-clauses that describe no maximally informative degree (e.g. "than no boy is tall"), they can do so without application of pluralization, hence without intervals. But then they are irrelevant to (56). I will ignore this issue in what follows.

(58) a. Lucinda drove faster than the permissible speeds.
b. context: this highway has a required minimum speed of 35mph and a speed limit of 50mph.
[[the permissible speeds]] = [35mph, 50mph]
c. Lucinda drove faster than 50mph.

An analysis in terms of distribution is given in (58'). Distributing over the first argument of the comparative operator derives intuitively appropriate truth conditions for the example.

(58') a. Lucinda drove faster than the permissible speeds.
b. [[the permissible speeds] [*[1[[-er t1] [max[2[Lu drove t2 fast]]]]]]
c. ∀s∈[[the permissible speeds]]: Lu drove faster than s

This analysis is extended from plural degree NPs to *than*-clauses. (59) is interpreted in a parallel way to (58). (60) provides an example that is simpler in terms of the *than*-clause denotation: the *than*-clause contains just one maximally informative degree. The analysis proceeds as indicated in (60b,c). The *than*-clause in (59), however, like the plural degree NP, denotes a plurality of degrees. Hence it is also interpreted with the help of distributive predication, (59b,c).

(59) a. Lucinda was driving faster than was allowed.
b. [m-inf [than was allowed]] [*[1[[-er t1] [max[2[Lu drove t2 fast]]]]]
c. ∀s∈m-inf([[than was allowed]]): Lu drove faster than s

(60) a. Lucinda drove faster than Colin did.
b. [-er [the m-inf [than Colin did ~~drive _ fast~~]]] [max[2[Lu drove t2 fast]]]]
c. Speed(Lucinda)>Speed(Colin)

Thus, there is an analysis in place for *than*-clauses that applies standard mechanisms of plural predication to degree arguments, in particular distribution over the first argument of the comparative operator.

4.3. Simple Quantified Comparatives and Distribution

It is quite straightforward to extend the distribution analysis to *than*-clauses with quantifiers, since they also denote pluralities of degrees. In simple comparatives, the analysis is - well: simple. (62), (63) sketch it for the universal quantifiers and definites data that section 3 analyses as giving rise to plural degree *than*-clauses.

(61) John is taller than every girl is (than I had predicted, than the girls are).

(62) a. $Height(J) > max([Height(g_1),Height(g_{max})])$ (old)
b. ∀d ∈ [Height(g1),Height(gmax)]: Height (J) > d (new)

(63) a. [m-inf [than every girl is _ tall]] [*[1[[-er t1] [max[2[John is t2 tall]]]]]
b. $[Height(g_1),Height(g_{max})] \in [^*\lambda d.Height(J)>d]$ iff

$\forall d \in [\text{Height}(g_1),\text{Height}(g_{max})]$: Height (J) > d

For completeness I include an example with a plural indefinite, where the *than*-clause according to section 3 also provides a plurality of degrees.

(64) Hans ran faster than some sisters of Greg.

(64') a. $\exists$f: CH(f) & Hans ran faster than Max (D')) (old)
(where D' is the interval that contains the speeds of all the sisters of Gregs selected by f and nothing else)
= Hans ran faster than each of the sisters selected by f (f a choice function).
b. $\exists$f: CH(f) & $\forall d \in$ D': Hans ran faster than d (new)
(where D' is the interval that contains the speeds of all the sisters of Gregs selected by f and nothing else)
= Hans ran faster than each of the sisters selected by f (f a choice function).

As far as I can see, nothing more needs to be said about simple comparatives.

4.4. Differential Quantified Comparatives and Distribution

Matters become more interesting when we take into account differentials. As anticipated in section 2, I think that the data are somewhat less clear than they are presented in the literature. We first repeat an empirical discussion from Beck (2010) (the second issue postponed in section 2.3) and then extend the distribution analysis to the data.

- the readings of differential comparatives - "equality" EQ or "maximum" MAX

The first example that we saw for a differential comparative with a quantified *than*-clause was (65a). The intuitive interpretation is one I call EQ: all the girls have the same height, 2" below John's height.

(65) a. John is exactly 2" taller than every girl is.
b. For every girl x: John is exactly 2" taller than x. EQ

Differentials are an issue in Beck (2010) because the analysis in terms of maximality plus maximal informativity yields a different reading from the apparent wide scope reading of the quantifier. This looks like a problem for the analysis in Beck (2010).

(66) John is exactly 2" taller than max(m_inf([[*than*-clause]])) MAX
= John is exactly 2" taller than the tallest girl.

First, a word on the range of data that is relevant in this connection. The two readings can be distinguished with *exactly*- and *at most* - differentials, but not *at least*:

(67) a. John is at most/almost 2" taller than every girl is.
b. For every girl x: John is no more than 2" taller than x

c. # John is no more than 2" taller than the tallest girl.

(68) a. John is at least 2" taller than every girl is.
b. For every girl x: John is at least 2" taller than x
c. John is at least 2" taller than the tallest girl.

This means that relevant data are the ones with *exactly*- and *at most*-type differentials. Next, it is important to note that *exactly/at most*-phrases themselves are scope bearing. For instance, (69) is ambiguous between (69'a) and (69'b). The *exactly*-phrase can take either wide or narrow scope relative to the modal.

(69) You are allowed to be exactly 6' tall.

(70) [[exactly 6']] = λD.max(D)=6'

(69') a. max(λd. ∃w[wAcc@ & you are d-tall in w])=6'
The largest permitted height for you is 6'.
[[exactly 6'] [1[allowed [you be t1 tall]]]]
b. ∃w[wAcc@ & max(λd. you are d-tall in w)=6']
It is permitted that you be exactly 6' tall.
[allowed [[exactly 6'] [1[you be t1 tall]]]]

Scope bearing *exactly*-phrases may interact with the comparative. Suppose we begin with an interpretation that gives the quantifier from the *than*-clause wide scope, (71a). Then, it is possible to give the *exactly*-phrase widest scope over the quantifier (71b) (I thank Danny Fox once more for pointing this out to me).

(71) a. For every girl x: John is exactly 2" taller than x.
b. Exactly 2" is how much taller John is than every girl
= [exactly 2"] (λd'. for every girl x: John is d' taller than x)
= max (λd'. for every girl x: John is d' taller than x)=2"
'The largest amount by which John is taller than every girl is 2"'.

```
----------|-----------------|--------x------------->
     x1      x2       x3       J
                      |---2"---|                          MAX
```

The resulting reading corresponds to MAX, not to EQ: John needs to be exactly 2" taller than the tallest girl in order for the sentence to be true. This means that once we recognize *exactly*-phrases as independent scope bearing elements, both a MAX and an EQ interpretation are predicted even by an analysis that gives the quantifier scope over the comparison.

In Beck (2010) I argue that in fact, the data support the existence of two readings. While our first example clearly has the EQ interpretation, below is a list of data informally collected from the web that support a MAX interpretation.

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

(73) I finished 30 seconds faster than I expected. [...]
I know my 300 yard time more accurately now.
(the continuation suggests that the speaker's expectation was a range rather than a precise point in time.)

(74) Jones was almost an inch taller than the both of them.
(the both of them = John Lennon & Paul McCartney, Jones = Tom Jones. The author thinks that Jones was 5'11 and that Paul McCartney was about 5'10. John Lennon is reported to be shorter than McCartney by about an inch.)

(75) (about a race:)
WOW! almost 4 seconds faster than everyone else , and a 9 second gap on Lance

The clearest example is (75). The two potential readings are sketched in (76a) and (76b). Clearly (76b) is the intended interpretation, as the continuation shows.

(76) Suppose that the winner of the race in (75) is John.
a. # For all x, x≠John: (John was) almost 4 sec. faster than x EQ
b. (John was) almost 4 seconds faster than
max(m_inf(λD'. for all x≠ John: Speed(x) ∈D'))
= John was almost 4 sec. faster than the next fastest person. MAX

I conclude that differential comparatives can either have an EQ or MAX reading. The existence of the MAX reading was good news for the analysis in Beck (2010). The derivation of the EQ reading under that analysis (a pragmatic story) is skipped here (see the paper). The point for us is that contrary to the original perception in the literature, we want to derive two readings.

- a distributive analysis applied to the differentials data

Let us ask what an analysis in terms of distribution rather than maximality predicts for differential comparatives with quantified *than*-clauses. A first possibility is sketched in abstract terms in (77). If distribution takes wide scope, we get the EQ reading.

(77) *exactly*-differentials - wide scope plural:
$\forall d \in D$: Meas = $d_{diff} + d$ EQ
= $\forall d \in D$: max(λn.Meas $\geq$ n+ d)= d_{diff}

(78) applies this analysis to a concrete example, our first differential comparative which is indeed understood as EQ.

(78) John is exactly 2" taller than every girl is.
= $\forall d \in$[Height(g1),Height(gmax)]: Height(John) = 2" + d
All the girls have the same height, and John is 2" above that. EQ

(78') [[m-inf than every girl is _~~tall~~] [*[1[[exactly 2" -er t1] [max 2[John is t2 tall]]]]]]

There is another possibility: we can combine a distributive reading for the *than*-clause with a widest scope differential. This possibility is sketched abstractly for *exactly*- and *at most*-differentials in (79) and (80). The possibility results in a MAX interpretation.

(79) *exactly*-differentials, wide scope differential: MAX
$\max(\lambda n.\forall d\in D\text{: Meas} \geq n + d) = d_{diff}$

(80) *at most* - differentials, wide scope differential: MAX
$\max(\lambda n.\forall d\in D\text{: Meas} \geq n + d) \leq d_{diff}$

A concrete instance, the race example, is analysed in (81).

(81) John was almost 4 seconds faster than everyone else was.
$= \max(\lambda n.\forall d\in[\text{speeds reached by the others}]\text{: Speed(John)} \geq n + d) \leq 4sec$
John was almost 4sec faster than the next-fastest person. MAX

(81') [[almost 4sec]
[3[[m-inf than everyone else was _~~fast~~][*[1[t3 -er t1[max 2[John was t2 fast]]]]]]]

To sum up, the two readings of differential comparatives emerge here as a scope ambiguity of the differential (rather than by some pragmatic means (Beck (2010)). There is of course an important remaining question: when do we get which reading? It may be interesting to note in this connection that Breakstone et al. (2011) argue the differential in comparatives is not scopally active. This is incompatible with the derivation of the MAX reading above. At the same time, the MAX reading does seem less prominent than the EQ reading. So perhaps wide scope differentials are not impossible but dispreferred. Once more there is room for a more detailed investigation.

4.5. Summary

Distributive predication in the matrix clause allows us to interpret the interval/plurality of degrees introduced in the *than*-clause. It makes correct predictions in the case of simple comparatives and it permits deriviation of both readings of differential comparatives. Since distributive predication is an independently attested mechanism, this is preferable to the analysis with maximality on top of maximal informativity.

The analysis worked out in this section - distributive interpretation of the matrix - could be combined with the 'basic' interval story on *than*-clauses from Beck (2010), without the cumulation analysis from the preceding section. So it would in principle be possible to buy one part of the plot of this paper without the other. But the idea is to combine comparison semantics with plural predication and pursue both parts of the plot, solving the two most unsatisfactory aspects of Beck (2010) systematically and in conjunction.

5. Conclusions

5.1. Overall Summary

We have explored the possibility that the puzzle of quantifiers in *than*-clauses can be solved by analysing such *than*-clauses as pluralities of degrees. A plurality of degrees is introduced in a *than*-clause when the individual (or world) argument of the gradable predicate is plural. This plural argument provokes cumulation of the gradable predicate and hence the degree argument is plural as well. The resulting *than*-clause describes pluralities of degrees, or intervals.

Cumulation as the source of a plural/interval meaning of the *than*-clause leads to expectations as to when a *than*-clause does or doesn't have an interval denotation. Some of the predictions are obviously good (no intervals are involved in *than*-clauses with singulars; intervals are involved when we have plural definites, neg-raising intensional verbs, or plural indefinites). Other predictions ought to be explored in more detail (namely nominal universal quantifiers and some non-neg-raising intensional verbs), which I have left for future research.

A plural/interval meaning of a *than*-clause requires adjustment before it can serve as the argument of the comparative operator. Commonly available mechanisms of plural predication apply here in the same way as they do elsewhere. Distribution over the *than*-clause interval derives the correct truth conditions for simple comparatives. Differential comparatives are potentially ambiguous, which can be analysed as distribution interacting scopally with the differential. It remains to be explored in more detail when we get which reading.

5.2. Other Analyses of Quantified *Than*-Clauses

The most basic facts of quantified *than*-clauses have been known since Stechow (1984), which I have discussed as the classical analysis above. Schwarzschild & Wilkinson's (2002) paper initiated a wave of research on the topic, from Heim (2006) via van Rooj (2008), Gajewski (2008) and Schwarzschild (2008) to Beck (2010) (as far as I am aware). I have nothing to add to what I said about the three 2008 papers in 2010. But it is interesting to take another look at Heim (2006) in the present context.

Below is a sketch of Heim's analysis of example (82) (simplified somewhat for the matrix clause). Heim also adopts intervals as the meanings of quantified *than*-clauses. Special to her analysis is an operator Pi which shifts properties of degrees to properties of intervals. The *than*-clause contributes a set of intervals which is combined with the matrix clause via function application. Lambda conversion yields a reading that amounts to wide scope of the quantifier. But like in my proposal, it is the *than*-clause that takes scope over the comparison.

(82) John is taller than every girl is.

(82') $[_{IP}$ $[_{CP}$ than [1[every girl [2$[_{AP}$ [Pi t1] [3$[_{AP}$ t2 is t3 tall]]]]]]]
$[_{IP}$ 4 [[-er t4] [5[John is t5 tall]]]]

(83) $[\![\text{Pi}]\!] = \lambda D.\ \lambda P.\max(P) \in D$

(82") a. main clause:

⟦[4[[-er t4] [5[John is t5 tall]]] ⟧ = λd. John is taller than d

b. *than*-clause:

⟦[than [1[every girl [2[$_{AP}$ [Pi t1] [3[$_{AP}$ t2 is t3 tall]]]]]]] ⟧ =

λD'. ⟦[every girl [2[$_{AP}$ [Pi t1] [3[$_{AP}$ t2 is t3 tall]]]]]]] ⟧$^{g[D'/1]}$ =

λD'. ∀x[girl(x) -> [λD. λP.max(P)∈D](D')(λd.Height(x)≥d)] =

λD'. ∀x[girl(x) -> Height(x) ∈D']

intervals into which the height of every girl falls

c. main clause + *than*-clause:

⟦(82) ⟧ =

[λD'. ∀x[girl(x) -> Height(x) ∈D']](λd. John is taller than d) =

∀x[girl(x) -> Height(x) ∈(λd. John is taller than d)] =

for every girl x: John is taller than x

In order to capture both apparent wide and apparent narrow scope quantifiers, the type shifting operator Pi can alternatively take scope over the quantifier. This yields the apparent narrow scope reading of the quantifier. An example LF for the same sentence (82) is given in (84).

(84) [$_{IP}$ [$_{CP}$ than [1[[Pi t1] [3[$_{AP}$ every girl [2[$_{AP}$ t2 is t3 tall]]]]]]]

[$_{IP}$ 4 [[-er t4] [5[John is t5 tall]]]]

(85) John's height is above the shortest girl's height.

While the resulting apparent narrow scope reading (85) is unavailable for this example, it is available for other quantifiers (*any girl, allowed* etc.). So this scope possibility exists. This illustrates the basic problem that the analysis developed in Heim (2006) faces: in principle, both scopings of the type shifting operator should generally be available. The analysis overgenerates (though see Heim's paper for some possibilities of constraining it).

The striking parallel to the present analysis is that the apparent wide scope of *than*-clause internal quantifiers is modeled by giving the *than*-clause wide scope. Have I reinvented Heim's analysis? No. The difference is that the present analysis is a plural analysis while Heim's was a type raising analysis. Type raising applies across the board in all examples with quantifiers and predicts *prima facie* parallel interpretive possibilities for all of them. This is the problem of overgeneration recognised for Heim's analysis. The application of the plural analysis is much more restricted. However, there is of course a significant parallel to Heim's analysis: in both cases it is the *than*-clause that takes wide scope, and that is responsible for the apparent wide scope of the quantifier contained in it. This helpful suggestion must be attributed to Heim (2006).

In Beck (2010) I worked on getting rid of the type shift embodied by Pi in order to not run into the overgeneration problem. This aspect of my former analysis is retained by the present proposal, as is the plot of keeping the semantics of the comparative itself simple.

Beck (2010) as well as its revision discussed here predate Alrenga & Kennedy (2014). I am not able to add a detailed discussion of their analysis now. A brief sketch will have to suffice. Alrenga & Kennedy develop a scope analysis, too. The twist is that the scope bearing element in the *than*-clause is a negative degree quantifier, roughly *no more than*. This crucial step makes a difference compared to analyses in which it is a simple negation (Schwarzschild (2008)) or the Pi operator (Heim (2006)). The scope behaviour of the negative degree quantifier can be investigated independently, and it can be assumed to be subject to known scope constraints on degree quantifiers (in particular the Heim/Kennedy constraint). These facts combine to make interaction with other scope bearing elements in the *than*-clause much more predictable, basically adding the required scope constraints to a scope analysis like Heim (2006). All I can say here is that I consider Alrenga & Kennedy's proposal a viable and interesting alternative to the plural analysis I develop above. Whether my analysis is of any further interest after their proposal may depend largely on the issue raised in the next subsection.

5.3. Further Questions

Besides the fairly specific questions already raised above, the most important one seems to me to be what further evidence there is regarding pluralities of degrees. Once pluralities of degrees are introduced, we would prima facie expect them to participate systematically in plural predication, in all constructions in which degrees are introduced. For example, we would expect cumulative readings for the two degree arguments of the comparative, as possibly in (86), (87).

(86) a. The posts are longer than the depths of the holes.
 b. ** -er (depths_holes)(lengths_posts)
 c. Each post is longer than some hole's depth,
 and the depth of each hole is less than the length of some post.

(87) a. The girls are taller than the boys are.
 b. **-er (heights_boys)(heights_girls)
 c. Each girl is taller than some boy, and each boy is shorter than some girl.
 (true e.g. if $g_1>b_1$, $g_2>b_2$, ..., but $b_2>g_1$)

Similarly, (88) could be an instance of a collective reading.

(88) context: we need to reach up to a height of 5m.
 The ladder and the pole (together) are that tall.

Another instance of the general question of plural degrees is explored e.g. in Fitzgibbons et al. (2008), superlatives with plurals.

(89) John and Bill are the tallest students.

These issues are left for future research.

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