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SCOPE AND COMPARATIVES*

Klein (1980, 1982) presents an interesting semantic analysis of comparative constructions like those in (1a-c) below:

- (1)a. This board is longer than Jude is tall,
b. Max is more clever than Eunice,
c. Beatrice is happier than Mona.

In this paper I note certain questions which arise under this analysis regarding the scope of quantified NPs in the complements of simple comparatives, and regarding the scope of comparatives themselves. It is argued that these questions can be answered in a unified and revealing way through a revision of Klein's account of the basic degree morphemes *er*, *less* and *as*. This revision gives comparative phrases a dual character. On the one hand they have quantificational properties similar to NPs such as *every man* or *some fish*. On the other hand they share certain characteristics of extensional transitive verbs such as *hit* and *find*. It is this dual status as "quantifier + verb" which, I suggest, accounts for the otherwise puzzling scopal properties of comparatives.

1. THE KLEIN (1980) SEMANTICS FOR COMPARATIVES

Klein (1980) proposes an explicit, compositional, model-theoretic semantics for sentences involving comparative adjectives. A central idea in this semantics is that comparative constructions involve what is essentially a quantification over degree modifiers.¹ To illustrate the intuitive content of this proposal, (2a) and (2b) give the logical expressions associated under this analysis with the comparative sentences *Felix is taller than Max is* and *Moe is as smart as Shep*:

- (2)a. $\forall M \exists T [M^{\text{tall}}(Felix) \ \& \ \neg M^{\text{tall}}(Max)]$
b. $\forall M \exists D [M^{\text{smart}}(Shep) \rightarrow M^{\text{smart}}(Moe)]$

Here '*M*' is a variable over functions of the kind denoted by degree-modifying expressions like *very* or *moderately*. What (2a) captures is the simple and quite plausible idea that if Felix is taller than Max then there is some extent (potentially expressible by a degree modifier) to which Felix is tall, but to which Max is not. Similarly, suppose Moe is as smart

are these in Deg 0-77

as *Shep*; then clearly, as (2b) expresses, every degree-modified instance of *smart* which be truthfully applied to *Shep* – *terribly smart*, *moderately smart*, &c. – can also be applied to *Moe*.

The basic idea sketched above is implemented in an "Extended Montague Grammar" framework employing a GPSG-style syntax; the reader is referred to Klein (1980) for details. For present purposes we will be principally concerned with the rules in (3a-c) which, according to Klein, constitute the "semantic core" of the comparative construction:

- (3) a. $\langle\langle\text{Deg er}\rangle\rangle, \lambda\lambda\lambda\mathcal{D}\lambda x \vee \mathcal{M}[\mathcal{M}'\{\mathcal{D}\}(x) \ \& \ \neg\cup\mathcal{D}'(\mathcal{D})(\mathcal{M})]$
 b. $\langle\langle\text{Deg less}\rangle\rangle, \lambda\lambda\lambda\mathcal{D}\lambda x \vee \mathcal{M}[\neg\mathcal{M}'\{\mathcal{D}\}(x) \ \& \ \cup\mathcal{D}'(\mathcal{D})(\mathcal{M})]$
 c. $\langle\langle\text{Deg as}\rangle\rangle, \lambda\lambda\lambda\mathcal{D}\lambda x \wedge \mathcal{M}[\cup\mathcal{D}'(\mathcal{D})(\mathcal{M}) \rightarrow \mathcal{M}'\{\mathcal{D}\}(x)]]$

These rule pairs, which consist of a node-admissibility condition and an associated translation into an extensional logic, give the analysis of basic degree morphemes.² In addition, the following schemata are provided for the interpretation of degree modified adjectives like *taller* (4a) and for the interpretation of comparative phrases with nominal and clausal complements such as *as smart as Shep* and *taller than Max* is (4b, c)

- (4) a. $\langle\langle\text{AP Deg A}\rangle\rangle, \text{Deg } (\text{ }^{\circ}\text{A}')$
 b. $\langle\langle\text{AP AP NP}\rangle\rangle, \text{AP } (\lambda\lambda\lambda\mathcal{M}'[\text{NP } (\lambda x[\mathcal{M}'\{\mathcal{D}\}(x)])]])$
 c. $\langle\langle\text{AP AP S/AP}\rangle\rangle, \text{AP } (\lambda\lambda\lambda\mathcal{M}'[\lambda\mathcal{D}[S/\text{AP}'](\text{ }^{\circ}\mathcal{M}'\{\mathcal{D}\})]])$

To illustrate the application of these rules briefly, (4) shows how (3a) and (4a, c) are utilized to translate the AP *taller than Max* is:

- (5) $[\text{AP taller}] \Rightarrow$
 $\lambda\lambda\lambda\mathcal{D}\lambda x \vee \mathcal{M}[\mathcal{M}'\{\mathcal{D}\}(x) \ \& \ \neg\cup\mathcal{D}'(\mathcal{D})(\mathcal{M})](\text{ }^{\circ}\text{tall}')]$
 $\lambda\mathcal{D}\lambda x \vee \mathcal{M}[\mathcal{M}'\{\text{tall}'\}(x) \ \& \ \neg\cup\mathcal{D}'(\text{ }^{\circ}\text{tall}')(\mathcal{M})]$
 $[\text{AP taller than Max is}] \Rightarrow$
 $\lambda\mathcal{D}\lambda x \vee \mathcal{M}[\mathcal{M}'\{\text{tall}'\}(x) \ \& \ \neg\cup\mathcal{D}'(\text{ }^{\circ}\text{tall}')(\mathcal{M})]$
 $\times (\lambda\lambda\lambda\mathcal{M}'[\lambda\mathcal{D}[\cup\mathcal{D}'(\text{Max})](\text{ }^{\circ}\mathcal{M}'\{\mathcal{D}\})]])$
 $\lambda\mathcal{D}\lambda x \vee \mathcal{M}[\mathcal{M}'\{\text{tall}'\}(x) \ \& \ \neg\cup\mathcal{D}'(\text{ }^{\circ}\text{tall}')(\mathcal{M})]$
 $\times (\lambda\lambda\lambda\mathcal{M}'[\mathcal{M}'\{\mathcal{D}\}(\text{Max})])]$
 $\lambda x \vee \mathcal{M}[\mathcal{M}'\{\text{tall}'\}(x) \ \& \ \neg[\mathcal{M}'\{\text{tall}'\}(\text{Max})]]]$

When the final line in (5) is predicted of a noun phrase such as *Felix*, the result is the one shown in (2a), the correct logical formula corresponding to the sentence *Felix is taller than Max* is.

2. TWO PROBLEMS

2.1.

The schemata in (3) and (4) yield the appropriate translations for examples like (5) where the complement clause has a simple referring noun phrase as its subject. However consider the result of applying them to a complement containing a quantified NP. The AP in (6), for example, will receive the logical translation in (7a):³

- (6) Felix is $[\text{AP taller than everyone is}]$
 (7a) $\lambda x \vee \mathcal{M}[\mathcal{M}'\{\text{tall}'\}(x) \ \& \ \neg \wedge y[\text{person}'(y) \rightarrow \mathcal{M}'\{\text{tall}'\}(y)]]]$

The latter is equivalent to (7b):

- (7b) $\lambda x \vee \mathcal{M}[\mathcal{M}'\{\text{tall}'\}(x) \ \& \ \vee y[\text{person}'(y) \ \& \ \neg\mathcal{M}'\{\text{tall}'\}(y)]]]$

(7b) denotes the set of individuals who possess some degree of tallness \mathcal{M} , such that for some person y , y is not tall to degree \mathcal{M} . This is clearly the wrong semantic value for *taller than everyone*: it would make (6) true in case Felix is taller_A (at least) one person rather than every person. Evidently this incorrect result arises from the relative scopes of the negation, the existential quantifier over degrees and the universal quantifier over persons in (7a). In place of this translation for *taller than everyone* is what we would like instead is:

- (7c) $\lambda x \wedge y[\text{person}'(y) \rightarrow \vee \mathcal{M}[\mathcal{M}'\{\text{tall}'\}(x) \ \& \ \neg\mathcal{M}'\{\text{tall}'\}(y)]]]$

where the universal associated with *everyone* has scope wider than the existential and the negation associated with the comparative.

A similar erroneous result is produced when the other degree morphemes are combined directly with complements containing quantified NPs. The rules given above assign to the AP in (8) the logical translation in (9a):

- (8) Max is $[\text{AP as tall as someone is}]$
 (9a) $\lambda x \wedge \mathcal{M}[\vee y[\text{person}'(y) \ \& \ \mathcal{M}'\{\text{tall}'\}(y)]] \rightarrow \mathcal{M}'\{\text{tall}'\}(x)]]$

The latter expression denotes the set of individuals x such that for every degree of height \mathcal{M} , if there is a person who is tall to that degree, then x is tall to that degree. Again this is the wrong semantic value; the universal quantifier over degrees should take scope narrower than the existential quantifier over persons. That is, instead of (9a) what we want is (9b):

- (9b) $\lambda x \vee y \wedge \mathcal{M}[\text{person}'(y) \ \& \ \mathcal{M}'\{\text{tall}'\}(y)]] \rightarrow \mathcal{M}'\{\text{tall}'\}(x)]]$

i.e., the set of individuals x such that there is some person y such that for every degree of height M' , if y is a person who is tall to degree M' , then x is tall to degree M' .

Inspection of the differences between (7a)/(9a) and (7c)/(9b) respectively, suggests that to derive the correct interpretation for clausal comparatives with a quantified NP subject, NP should be assigned scope wider than AP'. That is, it suggests that the correct derivations for these examples should involve quantifying into AP'. One move might be to assign these examples the logical forms in (10):

- (10)a. $[\text{NP everyone}]_i [\text{S Felix is } [\text{AP taller than } [s e_i \text{ is} \dots]]]$
- b. $[\text{NP someone}]_i [\text{S Max is } [\text{AP as tall as } [s e_i \text{ is} \dots]]]$

Assuming interpretation rules for such structures along the lines of Montague (1974), (10a) would receive the translation:

- (11)a. $\forall y[\text{person}'(y) \rightarrow \forall M[\text{M}'^{\text{tall}}\{(\text{Felix})\} \& \neg \text{M}'^{\text{tall}}\{y\}]]$
- (11)b. $\forall y[\text{person}'(y) \& \forall M[\text{M}'^{\text{tall}}\{y\}] \rightarrow \text{M}'^{\text{tall}}\{(\text{Max})\}]$

Again, this is the desired outcome.

Nonetheless, while a quantifying in analysis employing logical forms like (10a) and (10b) derives the correct translations for (6) and (8), it also involves a number of serious difficulties. First of all note that the sentences in question are not in any sense ambiguous between the readings represented in (7b)/(7c) and (9a)/(9b) respectively. The wide scope of the quantified NP with respect to AP is the *only* reading available to (6) and (8). This means that under a quantifying-in account we must find some way of *forcing* a quantified NP in the complement of a comparative to take scope out of AP. It is unclear how this obligatory wide scope is to be achieved.

Another difficulty for the quantifying-in analysis involves the "island" properties of comparative complements. Consider examples (12a) and (12b) below:

- (12)a. Someone is smarter than $[\text{NP everyone}]$
- b. Someone is smarter than $[\text{S everyone is}]$

(12a) is ambiguous according to the relative scopes of *everyone* and *someone*; thus the sentence can mean that there is some person x who is smarter than every other person y (narrow scope for *everyone*); alternatively, it can mean that for every person x there is some person y

(perhaps differing with the choice of x) who is smarter than them (wide scope for *everyone*). On the other hand, (12b) has no analogous ambiguity: in my judgment this sentence only has narrow scope reading for *everyone*.

The lack of ambiguity in (12b) can be plausibly correlated with the well-known fact that comparative clauses are strong islands for wh-extraction. Consider the contrast in (13a-c):

- (13)a. Who_i is Felix taller than e_i ?
- b. *Who_i is Felix taller than e_i is?
- c. *Who_i is Felix taller than Moe persuaded e_i that Max is?

As these examples illustrate, extraction of the NP complement in a [AP NP] structure is unproblematic, however extraction from a clausal complement is impossible. Under the widely held view that islands limit both wh- and quantifier scope, the results in (12) and (13) fall together in a reasonable way; in each case we see that it is impossible to give an NP score out of a clausal comparative complement.⁴ However, at the same time, of course, this generalization would prohibit such structures as (10a) and (10b) where the subordinate clause subject takes scope out of S. These facts thus raise the following question: how can we give an account of examples like those in (6) and (8) which derives the correct scopal relations but which respects the island character of clausal comparative complements?

2.2.

The second problem I wish to consider concerns the familiar fact that that comparative constructions exhibit ambiguities in intensional contexts which are similar to ones typically analyzed as arising through quantifier scope. Consider sentence (14):

- (14) Max thinks that Felix is taller than he is

This example has a reading where Max believes an impossible situation to hold - i.e., he thinks that Felix is of two heights one of which is greater than the other. But it also has a more mundane reading according to which Max is simply mistaken about Felix's height. That is, he thinks Felix is of some height h whereas in reality Felix is shorter. Following McCawley (1983), I will refer to the former as the "internal" reading of the comparative and the latter as the "external" reading.

good point

Should be a reference to Hankamer 1998 here!

Under the rules discussed above we can derive the equivalent of the internal interpretation of (14):

$$(15)a. \quad \text{think}'(\text{Max}, \sim \forall \mathcal{M}'[\sim \mathcal{M}'^{\text{tall}}](\text{Felix}) \& \mathcal{M}'^{\text{tall}}(\text{Felix}))$$

where Max believes a contradiction. However we have no means of deriving the external noncontradictory reading, for which we would want something like:

$$(15)b. \quad \forall \mathcal{M}'[\sim \mathcal{M}'^{\text{tall}}](\text{Felix}) \& \text{think}'(\text{Max}, \sim \mathcal{M}'^{\text{tall}}(\text{Felix})).$$

Furthermore, under the translations assigned to the basic degree morphemes in (3) it is quite unclear why comparative constructions should have scopal properties at all. Such properties are typically associated with status as a quantifier, and under the proposals in Barwise and Cooper (1982) quantifiers denote sets of sets. However, (3) and (4) do not assign quantificational denotations to comparative phrases. The second question for the semantic analysis of comparatives is therefore as follows: how do we revise or extend the Klein (1980) account such that the scopal character of comparatives is captured?

3. A REVISION OF KLEIN (1980)

The two questions raised above can be jointly answered, I believe, by means of some simple assumptions about the semantics of adjectives and adjective phrases, and through a reinterpretation of the basic degree morphemes *er*, *less*, and *as*. To begin, I will follow Klein (1980) in assuming that *As* denote characteristic functions on individuals (members of D_i'), but I will depart from him in taking APs to denote functions of higher type – specifically, functions from NP denotations to truth-values (members of D_i^{NP}). The idea is that an adjective like *red* denotes the set of red things (at some point of reference, with respect to some context), whereas the AP $[\text{AP} [\text{AP} [\text{red}]]]$ denotes the set of NP denotations having the set of red things as a member. Employing Klein's extensional language L we can translate the adjective *red* as the constant *red'* of type $\langle e, t \rangle$, and we can translate $[\text{AP} [\text{AP} [\text{red}]]]$ as in (16a):

$$(16)a. \quad [\text{AP} [\text{AP} [\text{red}]]] \Rightarrow \lambda \bar{P} [\bar{P}(\text{red}')]]$$

where \bar{P} is a variable of type $\langle \langle e, t \rangle, t \rangle$, the type of NPs. An AP like $[\text{AP} [\text{AP} [\text{red}]]]$ will combine with its noun phrase subject as

function to argument; thus *Rosa is red* receives the translation:⁵

$$(16)b. \quad \lambda \bar{P} [\bar{P}(\text{red}')]] (\lambda \bar{P} [\bar{P}(\text{Rosa})]) \Rightarrow \lambda \bar{P} [\bar{P}(\text{Rosa})] (\text{red}')]$$

and so on.

Under these type assignments, specifiers of A such as degree morphemes denote functions which combine with As to yield A's ('A-bars'). Consider the following translations for *er*, *less* and *as*, which are of the appropriate type:

$$(17)a. \quad \text{er} \Rightarrow \lambda \mathcal{Q} \lambda \bar{Q} \lambda \bar{P} \forall \mathcal{M}' [\sim \bar{Q}(\mathcal{M}' \mathcal{Q})] \& \bar{P}(\mathcal{M}' \mathcal{Q})] \\ b. \quad \text{less} \Rightarrow \lambda \mathcal{Q} \lambda \bar{Q} \lambda \bar{P} \forall \mathcal{M}' [\bar{Q}(\mathcal{M}' \mathcal{Q})] \& \sim \bar{P}(\mathcal{M}' \mathcal{Q})] \\ c. \quad \text{as} \Rightarrow \lambda \mathcal{Q} \lambda \bar{Q} \lambda \bar{P} \wedge \mathcal{M}' [\bar{Q}(\mathcal{M}' \mathcal{Q})] \rightarrow \bar{P}(\mathcal{M}' \mathcal{Q})]$$

Here (*as* in Klein, 1980) ' \mathcal{Q} ' is a variable of type $\langle \kappa, \langle e, t \rangle \rangle$, the type of expressions denoting functions from contexts to adjective denotations (sets). ' \mathcal{M}' ' is a variable of type $\langle \kappa, \langle \kappa, \langle e, t \rangle \rangle, \langle e, t \rangle \rangle$, the type of degree modifiers (i.e., expressions denoting, essentially, functions from adjective denotations to adjective denotations); and again ' \bar{P} ' and ' \bar{Q} ' are variables of type $\langle \langle e, t \rangle, t \rangle$ – i.e., variables over noun phrase denotations.

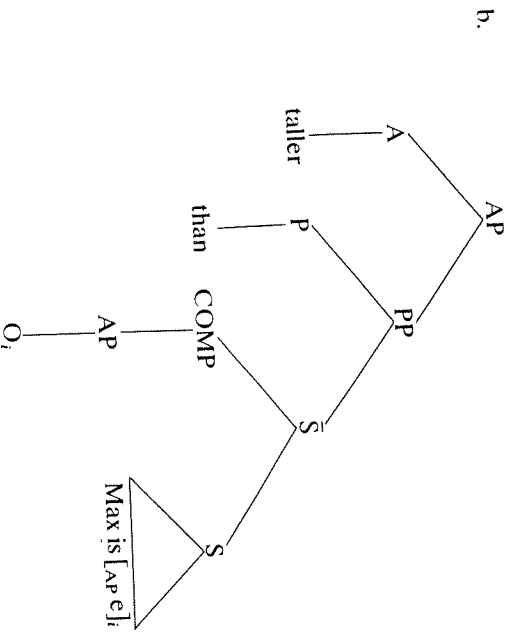
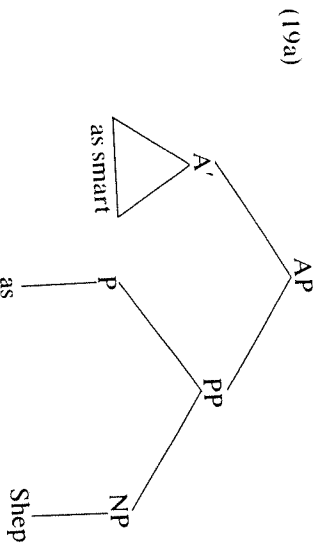
3.1. Comparative APs as Quantifiers

An important feature of (17a–c) vs. the translations given earlier in (3) is that comparative phrases such as *taller than Max is* and *as smart as Shep* will now denote sets of sets – quantifiers in the sense of Barwise and Cooper (1982). This in turn allows us to account for their scopal possibilities in a simple way. To show this, let us consider the interpretation of these phrases in detail. According to our revised translations, *er*, *less* and *as* combine with an adjective denotation to yield a function from noun phrase denotations to a function from noun phrase denotations to truth-values. So, for example, (17a) combines with the interpretation of *tall*, *tall'*, to give the interpretation of *taller* in (18a). Similarly, (17c) combines with *smart'* to yield the interpretation of *as smart* in (18b):

$$(18)a. \quad \text{taller} \Rightarrow \lambda \bar{Q} \lambda \bar{P} \forall \mathcal{M}' [\sim \bar{Q}(\mathcal{M}' \text{tall}') \& \bar{P}(\mathcal{M}' \text{tall}')]$$

$$b. \quad \text{as smart} \Rightarrow \lambda \bar{Q} \lambda \bar{P} \wedge \mathcal{M}' [\bar{Q}(\mathcal{M}' \text{smart}') \rightarrow \bar{P}(\mathcal{M}' \text{smart}')]$$

Expressions like *as smart* and *taller* combine with complements such as *as Shep* or *than Max* is to yield comparative phrases. I assume such phrases have the syntax shown in (19):⁶



In (19b), [_{AP} O]_i is an abstract [+WH] element – an empty operator in the sense of Chomsky (1982) – and [_{AP} e]_i is its trace. In line with earlier remarks (cf. (16)) we may assume the latter to have translation:

(20)a. $\lambda \bar{P}[\bar{P}(P_i)]$

where P_i is a variable of type $\langle e, t \rangle$ (a set of individuals). When put together with the subject NP, this will yield a translation for the subordinate S containing a free set variable:

(20)b. $[s \text{ Max is } [\lambda P e]_i] \Rightarrow \lambda \bar{P}[\bar{P}(P_i)]([\bar{P}(P(\text{Max}))]) \Rightarrow P_i(\text{Max})$

Finally, I assume that the translation for \bar{S} in (19b) is derived by taking lambda abstraction over the free variable in the interpretation of S. Thus:

(21) $[s[\lambda P O]_i [s \text{ Max is } [\lambda P e]_i]] \Rightarrow \lambda P_i [P_i(\text{Max})]$

These simple assumptions give NP and \bar{S} complements the same logical type: in both instances we are dealing with expressions which denote sets of sets. And this makes such phrases appropriate arguments for the A's in (18). Setting aside for the moment the PP structure in (19), and taking A' to combine directly with its complement NP or S', we can give the following translations for *as smart as Shep* and *taller than Max* is:

(22)a. **as smart as Shep** \Rightarrow
 $\lambda \bar{Q} \lambda \bar{P} \lambda . \mathcal{M}[\bar{Q}(\mathcal{M}^{\bar{Q}} \text{smart}^{\bar{Q}})] \rightarrow \bar{P}(\mathcal{M}^{\bar{Q}} \text{smart}^{\bar{Q}})]([\bar{P}(P(\text{Shep}))])$
 $\lambda \bar{P} \lambda . \mathcal{M}[\bar{P}(P(\text{Shep}))](\mathcal{M}^{\bar{P}} \text{smart}^{\bar{P}}) \rightarrow \bar{P}(\mathcal{M}^{\bar{P}} \text{smart}^{\bar{P}})]$
 $\lambda \bar{P} \lambda . \mathcal{M}[\mathcal{M}^{\bar{P}} \text{smart}^{\bar{P}}](\text{Shep}) \rightarrow \bar{P}(\mathcal{M}^{\bar{P}} \text{smart}^{\bar{P}})]$

b. **taller than Max is** \Rightarrow
 $\lambda \bar{Q} \lambda \bar{P} \lambda . \mathcal{M}[\bar{Q}(\mathcal{M}^{\bar{Q}} \text{tall}^{\bar{Q}})] \& \bar{P}(\mathcal{M}^{\bar{Q}} \text{tall}^{\bar{Q}})]([\lambda P_i [P_i(\text{Max})]])$
 $\lambda \bar{P} \lambda . \mathcal{M}[\bar{P}(P_i [P_i(\text{Max})])](\mathcal{M}^{\bar{P}} \text{tall}^{\bar{P}}) \& \bar{P}(\mathcal{M}^{\bar{P}} \text{tall}^{\bar{P}})]$
 $\lambda \bar{P} \lambda . \mathcal{M}[\bar{P}(\text{tall}^{\bar{P}})(\text{Max}) \& \bar{P}(\mathcal{M}^{\bar{P}} \text{tall}^{\bar{P}})]$

When (22a, b) are predicated of the NPs *Moe* and *Felix*, the results are those in (2a, b), the desired interpretations of *Moe is as smart as Shep* and *Felix is taller than Max*.

It is revealing to compare our results with adjective specifiers and adjectival phrases to the case of nominal specifiers and noun phrases. Consider the IL translations typically assumed for the determiners *some* and *every* (cf. Dowty, Wall and Peters, 1981):

(23)a. **some** $\Rightarrow \lambda O \lambda P \lambda V . x[O(x) \& P(x)]$
 b. **every** $\Rightarrow \lambda O \lambda P \lambda V . x[O(x) \rightarrow P(x)]$

Note that just as *some* and *every* denote relations between sets (of individuals) in (23), so *taller* and *as smart* denote relations between sets (of sets) in (18).

interesting...
but what if the missing \bar{P} is on NP?

When the expressions in (23) are combined with an appropriate argument, such as *fish*' or *man*', they yield the outcome in (24):

- (24)a. **Some fish** $\Rightarrow \lambda P \forall x[\text{fish}'(x) \ \& \ P(x)]$
- b. **every man** $\Rightarrow \lambda P \wedge x[\text{man}'(x) \rightarrow P(x)]$

Here again, notice that just as *some fish* and *every man* denote sets of sets, so do *taller than Max* is and *as smart as Shop* in (22). These denotations give both pairs of expressions the status of generalized quantifiers.

The parallel status of quantified NPs and comparative APs has the important result of allowing us to treat the ambiguity between external and internal readings of our earlier sentence (14) (repeated below) much as we would treat the familiar *de dicto/de re* ambiguity of the indicated NP in (25):

- (14) Max thinks Felix is taller than he is
- (25) Max thinks that *someone* sneezed

In the case of (25) we associate the sentence with two Logical Forms differing in the scope of *someone* vis-a-vis *think*:

- (26)a. [s someone, [s Max thinks that e_i sneezed]] (de re)
- b. [s Max thinks that someone sneezed] (de dicto)

Similarly, we can now associate (14) with two LFs which differ by the scope of the AP *taller than he is* vis-a-vis *think*:

- (27)a. [s taller than he is, [s Max thinks Felix is e_i]] (external)
- b. [s Max thinks Felix is taller than he is] (internal)

Assuming that reference of *he* is fixed as Felix, the reader can verify that (27b) will get the translation in (15a) – the internal reading – under the rules given above. To derive the external reading, we again assume that a sentence containing an AP trace is given a translation with a free set variable. Thus [s Max thinks Felix is e_i] translates as *think'*(Max, P_i (Felix)). The semantic value of (27a) is then obtained by quantifying in:⁷

$$\begin{aligned} & \lambda \bar{P} \forall \bar{M} [\neg \bar{M}' \{ \text{tall}' \} (\text{Felix}) \ \& \ \bar{P} (\bar{M}' \{ \text{tall}' \})] \\ & \times (\lambda P_i [\text{think}' (\text{Max}, \bar{P}_i (\text{Felix}))]) \Rightarrow \\ & \forall \bar{M}' [\neg \bar{M}' \{ \text{tall}' \} (\text{Felix}) \ \& \\ & \lambda P_i [\text{think}' (\text{Max}, \bar{P}_i (\text{Felix}))] (\bar{M}' \{ \text{tall}' \})] \Rightarrow \\ & \forall \bar{M}' [\neg \bar{M}' \{ \text{tall}' \} (\text{Felix}) \ \& \\ & \text{think}' (\text{Max}, \bar{M}' \{ \text{tall}' \} (\text{Felix}))] \end{aligned}$$

which is the desired outcome (cf. (16b)).

Don't think should be given some "comparative" argument!
be "fully" \bar{M}' \bar{P}_i

free variable problem

3.1.1. *Scope of Negation in Comparatives.* The basic degree morphemes translations in (17a-c) account for the quantificational character of comparative phrases in an intuitively appealing way – one which makes their scopal properties quite analogous to those of quantified NPs. However, there is an important respect in which they are not quite adequate. To appreciate this, consider (29) below:

- (29) Ron could be less callous than he is

As with our earlier example (14), this sentence is ambiguous between an internal and an external reading of the comparative phrase vis-a-vis the modal verb *could*. Under the assumptions and rules stated above, the external reading receives the translation in (30):⁸

- (30) $\forall \bar{M}' [\bar{M}' \{ \text{callous}' \} (\text{Ron}) \ \& \ \neg \diamond (\bar{M}' \{ \text{callous}' \} (\text{Ron}))]$

where *could* in (29) is rendered via the possibility operator ' \diamond '. A moment's thought reveals that this expression cannot be a correct representation for the external reading of (29). For (30) asserts both the truth and the impossibility of the proposition that Ron is *M'* callous – a contradiction under any reasonable model of natural language modalities.⁹ The correct representation for (29) should assert that Ron is callous to degree *M'* but that there is some possible world in which Ron is not callous to that extent. In place of (30), then, we evidently want (31):

- (31) $\forall \bar{M}' [\bar{M}' \{ \text{callous}' \} (\text{Ron}) \ \& \ \diamond (\neg \bar{M}' \{ \text{callous}' \} (\text{Ron}))]$

where negation takes scope beneath the modal operator. The proper, narrower scope for ' \neg ' is obtained by replacing (17a-c) with the following:

- (32)a. **er** $\Rightarrow \lambda \bar{A} \bar{A} \bar{O} \bar{A} \bar{P} \bar{V} \bar{M}' [\bar{Q} (\lambda x [\neg \bar{M}' \{ \bar{Q} \} (x)]) \ \& \ \bar{P} (\lambda x [\bar{M}' \{ \bar{Q} \} (x)])]$
- b. **less** $\Rightarrow \lambda \bar{A} \bar{A} \bar{O} \bar{A} \bar{P} \bar{V} \bar{M}' [\bar{Q} (\lambda x [\bar{M}' \{ \bar{Q} \} (x)]) \ \& \ \bar{P} (\lambda x [\neg \bar{M}' \{ \bar{Q} \} (x)])]$
- c. **as** $\Rightarrow \lambda \bar{A} \bar{A} \bar{O} \bar{A} \bar{P} \bar{V} \bar{M}' [\bar{Q} (\lambda x [\bar{M}' \{ \bar{Q} \} (x)]) \rightarrow \bar{P} (\lambda x [\bar{M}' \{ \bar{Q} \} (x)])]$

As the reader can verify, these translations correctly insure that negation accompanies the set ' $\bar{M}' \{ \bar{Q} \}$ ', when the latter is moved by lambda conversion into the set of sets corresponding to ' \bar{P} ' and ' \bar{Q} '. Negation takes scope beneath the complement of a comparative adjective.

3.1.2. *Negation and Disjoined Complements.* Von Stechow (1984) notes a point about the scope of disjunction in comparatives which might appear to raise problems for the translations just given. As has been noted in the literature (Cresswell (1976)) comparatives like (33a) are not typically interpreted as in (33b), but rather as in (33c):¹⁰

predic's main clause in less-comparative
has tall
= same semantic type as any/same!

- (33)a. John is taller than Bill or Fred
- b. John is taller than Bill or John is taller than Fred
- c. John is taller than Bill and John is taller than Fred

If negation takes scope over disjoined NP complements in comparatives, then Klein/Seuren style analyses can neatly account for this fact. (33a) will receive the translation in (34a), which is equivalent to (34b) by the familiar De Morgan laws:

- (34)a. $\vee_{M^T[M^T \text{tall}]}(\text{John}) \ \& \ \neg[M^T \text{tall}](\text{Bill}) \ \vee \ M^T \text{tall}(\text{Fred})]$
- b. $\vee_{M^T[M^T \text{tall}]}(\text{John}) \ \& \ \neg_{M^T \text{tall}}(\text{Bill}) \ \& \ \neg_{M^T \text{tall}}(\text{Fred})]$

The latter is just the reading assigned to (33c). On the other hand, if negation takes scope beneath the disjoined complement, as our translations require, then we can obtain only the translation in (35):

- (35) $\vee_{M^T[M^T \text{tall}]}(\text{John}) \ \& \ [\neg_{M^T \text{tall}}(\text{Bill}) \ \vee \ \neg_{M^T \text{tall}}(\text{Fred})]$

This is the reading assigned to (33b) and represents the non-preferred scope for *or*.

By giving negation a scope which is uniformly narrower than the complement of a comparative we preclude a simple “De Morgan account” of the interpretation of (33). In fact, however, this is a positive result and not a liability. First of all, as von Stechow (1984) observes, if a De Morgan account were correct, then just as we have a conjunctive reading of (33a), we might expect a disjunctive reading of (36):

- (36) John is taller than Bill and Fred

That is, we would expect (36) to have a reading equivalent to (33b). This is not correct, however; such an interpretation is unavailable. Furthermore, note that the conjunctive interpretation of *or* observed with *-er than* also shows up with *less than* comparatives. Thus (37) has a reading equivalent to a conjunction:

- (37) John is less tall than Bill or Fred
(cf. John is less tall than Bill and John is less tall than Fred)

But recall that under the translations given above it is the “subject” of a *less than* comparative which is negated, not the complement. A De Morgan account of the conjunctive reading of (37) would thus not be possible, regardless of the scope of negation.

On careful examination, it appears that the phenomenon in (33) and (37) – in which disjunctions are understood as conjunctions – is related to negative polarity, and to the fact that the complements to comparatives are domains licensing negative polarity items.¹¹ Consider (38a–c):

- (38)a. I doubt that $\left. \begin{matrix} \text{anyone} \\ \text{Max or Bill} \end{matrix} \right\}$ will go
(cf. I doubt that Max will go and I doubt that Bill will go)

- b. John arrived before $\left. \begin{matrix} \text{anyone} \\ \text{Max or Bill} \end{matrix} \right\}$ left
(cf. John arrived before Max left and before Bill left)

- c. John arrived after $\left. \begin{matrix} * \text{anyone} \\ \text{Max or Bill} \end{matrix} \right\}$ left
(\neq John arrived after Max left and after Bill left).

In (38a, b) the complements of *doubt* and *before* are contexts which license polarity items such as *anyone*; these contexts also permit the conjunctive reading of *or*. On the other hand, the complement of *after* is not a licensing context, and does not permit the conjunctive reading of disjunction. If these observations are correct, then the fact that (33a) receives a conjunctive reading evidently does not follow from the scope of the negation appearing in the translation of *-er*; rather it follows from the status of comparative AP complements as polarity contexts and from the behavior of *or* in such contexts.¹²

3.1.3. *Negation Scope and Intensional Contexts.* Before concluding this discussion of negation in comparatives, I would like to draw attention to some puzzling results concerning intensional contexts which arise under the present analysis. Consider once again sentence (29) and its translation (31). By standard modal and first-order reasoning, the latter is equivalent to:

- (39) $\neg \vee_{M^T[M^T \text{callous}]}(\text{Ron}) \rightarrow \square_{M^T \text{callous}}(\text{Ron})]$

This expression corresponds to the external readings of (40a, b) on the plausible assumption that *need to* or *have to* may be translated via the necessity operator:

- (40)a. Ron doesn't $\left. \begin{matrix} \text{need} \\ \text{have} \end{matrix} \right\}$ to be as callous as he is
- b.

Under our account, therefore, (29) and (40a, b) are predicted to be synonymous on their external readings. This prediction is clearly correct, and lends support to the view that comparatives involving *er*, *more* and *less* should be analyzed in terms of an underlying negation and conjunction. Given the usual definitions of ‘ \diamond ’ and ‘ \square ’, according to which these operators are duals (i.e., $\diamond \varphi$ iff $\neg \square \neg \varphi$ and $\square \varphi$ iff $\neg \diamond \neg \varphi$) it is difficult to see how an analysis of comparatives which does not make use of negation will predict the distribution of modalities in (29) and (40).

Get who are
comparable
to Ron by?

Consider now example (41) below, which involves, not a modal but a verb of propositional attitude:

- (41) Max thinks Felix is less tall than he is

Under our account this sentence receives the following IL translation in (42):

- (42) $\forall_{\mathcal{M}}[\mathcal{M} \uparrow \text{tall}](\text{Felix}) \ \& \ \text{think}(\text{Max}, \sim \neg_{\mathcal{M} \uparrow} \text{tall})(\text{Felix}))]$

which states that there is some degree to which Max is tall such that Felix thinks Max is not tall to that degree. (42) appears to be too “strong” a representation of the truth conditions of (41) in that it attributes to Felix a “negative belief”. It is the case that if Max is fully rational and draws all the consequences of his beliefs, then if (41) is true on its external reading, (42) will also be true for some value of \mathcal{M} . However, and this is a familiar point regarding attitudinal contexts, Max may not be fully rational, and so may not draw the consequences of his beliefs and so may have no negative beliefs at all. This possibility is not represented by (42).

At first blush it might appear that the failing of (42) is a matter of the narrow scope of ‘ \sim ’. That is, it might appear that in place of (42) want something like (43):¹³

- (43) $\forall_{\mathcal{M}}[\mathcal{M} \uparrow \text{tall}](\text{Felix}) \ \& \ \sim \text{think}(\text{Max}, \sim_{\mathcal{M} \uparrow} \text{tall})(\text{Felix}))]$

However this expression is not a correct representation of the truth conditions for (41) either. The simplest way to convince oneself of this is to note that (43) is equivalent to (44) by standard first-order reasoning:

- (44) $\sim \forall_{\mathcal{M}}[\mathcal{M} \uparrow \text{tall}](\text{Felix}) \rightarrow \text{think}(\text{Max}, \sim_{\mathcal{M} \uparrow} \text{tall})(\text{Felix}))]$

which corresponds to the external reading of:

- (45) It's not true that Max thinks Felix is as tall as he is

If (43) were adequate, therefore, we would expect (41) and (45) to be synonymous on their external readings. But this is simply not the case: whereas the latter is compatible with Max's being tall to extent \mathcal{M} and Felix's having no thoughts about Max's height whatsoever, the former is not. On the external reading of (41), it seems Max must have a certain incorrect opinion regarding Felix's height. Hence (43) is too “weak” as a representation of the truth conditions for *Felix thinks Max is less tall than he is* on its external reading.

In view of these results, verbs of propositional attitude appear to pose a problem for the assumption that comparatives in *more*, *er* and *less* are to be interpreted by means of a conjunction + negation. For there seems

to be *no* assignment of scope to the negation posited in the translations of these morphemes which correctly captures the truth-conditions of sentences like (41). I am not able to resolve this puzzle at the moment, and so must be content with stating it as clearly as possible.¹⁴

3.2. Comparative A's as “Verbs”

Having now examined the issue raised in Section 2.1 – the scope of comparatives – let us return to the problems brought up in Section 2 regarding the scope of quantified NPs in comparatives. As we recall our basic observation was that a quantified NP in the clausal complement of a comparative AP must take scope wider than AP. Thus in the interpretation of (8) (repeated below) the quantifier over persons associated with *someone* must take scope wider than the quantifier over degree modifiers associated with *as tall*:

- (8) Max is [_{AP} as tall as [_S someone is]]

This observation raised two important questions: how do we account for the wide scope of the quantified NP in such a way that the island character of comparatives is respected; and how do we account for the obligatory nature of this wide scope?

The results developed above, taken together with some additional facts, suggest interesting answers to both of these questions. Let us begin by examining an example similar to sentence (8) above:

- (46) Max is [_{AP} as tall as [_{NP} someone]]

(8) and (46) are synonymous, and the scopal considerations that apply to (8) apply to (46) as well: just as *someone* must be assigned scope wider than AP in (8), so it must be assigned wide scope in (46). Now in the case of (46) this requirement presents no difficulty. We saw earlier with regard to (12a) and (13a) that NP complements to comparatives are freely extractable: quantification into AP violates no island constraints in this case. Consider then a rule for [_{AP} AP NP] structures like the following, which quantifies NP' into AP':

- (47) [_{AP} AP NP]_i λR̄[_{NP'}(λx_i[_{AP'}(P̄P(x_i))](R̄))]

Applied to (46), (47) yields the results in (48):

- (48) **as tall as someone** \Rightarrow
 $\bar{R}[\bar{P} \vee x[\text{person}'(x) \ \& \ P(x)]](\lambda x[\Lambda \bar{Q}\Lambda \bar{P} \wedge \mathcal{M}[\bar{Q}(\mathcal{M}^{\text{tall}}?)]]$
 $\rightarrow \bar{P}(\mathcal{M}^{\text{tall}}?))](\bar{P}[P(x)])(\bar{R})]]$
 $\Rightarrow \Lambda \bar{R}[\bar{P} \vee x[\text{person}'(x) \ \& \ P(x)]](\lambda x[\Lambda \mathcal{M}[\mathcal{M}^{\text{tall}}?(x) \ \rightarrow \bar{R}(\mathcal{M}^{\text{tall}}?)]]]$
 $\Rightarrow \Lambda \bar{R}[\bar{P} \vee x[\text{person}'(x) \ \& \ P(x)]](\lambda x[\Lambda \mathcal{M}[\mathcal{M}^{\text{tall}}?(x) \ \rightarrow \bar{R}(\mathcal{M}^{\text{tall}}?)]]]$

These are the correct scopal relations (cf. (9b) above).

Now what I would like to point out is that if we put aside for a moment the category of clausal comparative complements, a rule like (47) will not only produce the desired translation for (46), it will also do so for (6) and (8). This is so because under our analysis NPs and clausal comparative complements are of the same logical type: both denote sets of sets of individuals. Accordingly, (47) can apply equally well to either:

- (49) **as tall as someone is** \Rightarrow
 $\bar{R}[\Lambda P, \vee x[\text{person}'(x) \ \& \ P_1(x)]](\lambda x[\Lambda \bar{Q}\Lambda \bar{P} \wedge \mathcal{M}[\bar{Q}(\mathcal{M}^{\text{tall}}?)]]$
 $\rightarrow \bar{P}(\mathcal{M}^{\text{tall}}?))](\bar{P}[P(x)])(\bar{R})]]$
 $\Rightarrow \dots \Rightarrow \Lambda \bar{R}[\bar{P} \vee x[\text{person}'(x) \ \& \ P(x)]](\lambda x[\Lambda \mathcal{M}[\mathcal{M}^{\text{tall}}?(x) \ \rightarrow \bar{R}(\mathcal{M}^{\text{tall}}?)]]]$

Once again, these are the correct scopal relations. And note carefully, moreover, that they are achieved without violating the island-hood of the clausal complement: *someone* receives scope over AP by virtue of the entire clause in which it is contained receiving scope over AP, not by being "extracted" out of S. These considerations thus suggest an answer to our first question regarding the scope of quantified NPs in comparatives: we can give quantified complements the correct scopal relations, without violating island constraints, if we uniformly quantify these complements into AP.

answer to our second question, the obligatory narrow scope for the over degrees in a comparative, can be motivated by reflecting the translations for comparative phrases. We noted above the analysis of degree morphemes proposed in (15) (and (32)), which makes *smart* or *taller* denote relations between sets of objects such expressions analogous to NP determinantal character of APs like *as smart as Sheep*, however, that it also makes them analogous to the latter, comparative A's denote relations semantic type of noun phrases. This parallelism

Postscript
 Expeditious
 smart

is entirely reasonable. In place of the sort of comparatives found in English, which consist of an adjective and a preposed adverb such as *more* or *less*, many languages employ an explicitly verbal construction. Indeed English itself has such verbal comparatives to a limited extent: alongside sentences like *Felix is taller than Max* and *Moe is as smart as Sheep*, we also get (albeit somewhat archaically) *Felix surpasses/exceeds Max in height* and *Moe equals Sheep in intelligence*.

The parallelism between verbs and comparative A's is significant in the present context for under semantic analyses of the sort assumed here and in Klein (1980) – i.e., 'Extended Montague Grammar' – issues of obligatory wide scope for complements arise for transitive verbs much as they do for comparatives. Montague (1974) assigns transitive verbs a logical type which uniformly induces an intensional context in their subject and object positions. This assignment allows one to account for the familiar intensional properties of NPs occurring as the objects of verbs like *want* and *seek* – non-specificity, possible lack of a real world referent, failure of substitution, &c.¹⁶ At the same time, however, it requires an adjustment in the semantics of verbs like *hit* and *kick* which are not "fully intensional". To accommodate such nonintensional predicates Montague imposes a requirement on their interpretations which, in effect, forces their subjects and objects to be quantified-in. This has the result of extensionalizing both argument positions.

What I would like to suggest is that the obligatory wide scope for the complements of comparatives is actually a species of the same fact that we encounter with the great majority of transitive verbs in English. That is, I want to suggest that in both instances we are dealing with binary relations on noun phrases which are "extensionalized" in their argument positions. Up to this point we have only seen such "extensionality" in comparatives with respect to their "object" argument (that supplied by the 'Q' variable in (17)), however in fact the parallelism with transitive verbs extends to the "subject" argument (that supplied by the 'P' variable) as well. Consider the examples in (50):

- (50)a. Someone is as tall as Max
 b. Someone thinks Max is as tall as he is

Under (17c), (50a) will receive the IL translation in (51a) and the external reading of (50b) will have the translation in (51b):

- (51)a. $\Lambda \mathcal{M}[\mathcal{M}^{\text{tall}}?(x)](\text{Max}) \rightarrow \vee x[\text{person}'(x) \ \& \ \mathcal{M}^{\text{tall}}?(x)]$
 b. $\Lambda \mathcal{M}[\mathcal{M}^{\text{tall}}?(x)](\text{Max}) \rightarrow \vee x[\text{person}'(x) \ \& \ \text{think}'(x, \mathcal{M}^{\text{tall}}?(x))]$

These representations fail for (50a, b) in precisely the same way that the representation (9a) failed for (8). Again we want translations where the existential quantifier over persons takes scope wider than the universal quantifier over extents:

- (52)a. $Vx[\text{person}'(x) \ \& \ \bigwedge M[\mathcal{M}'\text{tall}'(\text{Max}) \rightarrow \mathcal{M}'\text{tall}'(x)]]$
 b. $Vx[\text{person}'(x) \ \& \ \bigwedge M[\mathcal{M}'\text{tall}'(\text{Max}) \rightarrow \text{think}'(x, \sim \mathcal{M}'\text{tall}'(\text{Max}))]]$

It appears, then, that in the interpretation of a comparative phrase like *as tall as Felix* or *smarter than Moe* the quantifier over extents must take scope narrower than its "subject" – its second argument – just as it must take scope narrower than its complement.

To capture the parallelism between verbs and comparative phrases I will treat extensionality (in the broad sense intended here) along lines similar to Cooper (1983). Let us assume that phrases like *taller*, *less happy*, *dumber*, *as short*, &c. are generated in the lexicon as phrases of category A. These will receive logical translations in accordance with (32). Let us further assume that upon lexical insertion of A, these translations (along with the translations for Montague's fully extensional transitive verbs) are modified in accordance with the following scheme:¹⁷

- (53) $\{[x\alpha], \lambda\bar{Q}\lambda\bar{P}[\lambda x_i[\bar{Q}(\lambda x_j[\alpha'(\hat{P}[\text{P}(x_j))](\hat{P}[\text{P}(x_i))])])])]$

here α is an extensional V or comparative A.

This will yield, for example, the following result for *taller*:

- (54) **taller** \Rightarrow
 $\lambda\bar{Q}\lambda\bar{P}[\lambda x_i[\bar{Q}(\lambda x_j[\lambda\bar{Q}\lambda\bar{P}V_M[\bar{Q}(\lambda x_i[\sim_M \mathcal{M}'\text{tall}'(x)])])$
 $\ \& \ \hat{P}(\lambda x_i[\mathcal{M}'\text{tall}'(x)])](\hat{P}[\text{P}(x_j))](\hat{P}[\text{P}(x_i))])])]$
 $\Rightarrow \dots \Rightarrow \lambda\bar{Q}\lambda\bar{P}[\lambda x_i[\bar{Q}(\lambda x_j[V_M[\sim_M \mathcal{M}'\text{tall}'(x)]) \ \&$
 $\ \mathcal{M}'\text{tall}'(x)])])]$

As inspection of the last line in (54) reveals, extensionalization of the degree modified adjective has the effect of quantifying-in both of its arguments.

These results give us the outcome we were seeking. The status of degree-modified adjectives as (essentially) binary relations on NP meanings makes them subject to extensionalization of their arguments just like the great majority of transitive verbs in English. This operation uniformly gives the quantifier over extents appearing in the translations of *taller*, *dumber*, *as fast*, &c. a scope narrower than both of its arguments. As we saw in regard to (8) and (46), this allows us to derive the correct scope for quantified NPs appearing in comparative complements without

violating the island character of these constructions. Finally, the obligatory character of extensionalization in comparatives can be viewed much like the obligatory extensional character of most transitive verbs – it is simply a fact about the meanings of these essentially verbal constructions, captured in the same way.

4. SYNTACTIC MATTERS

The semantics adopted here has relevance for the syntactic analysis of comparatives, and in concluding I will briefly mention several points of contact.

4.1.

One important consequence of the present account is that comparative APs and quantified NPs show significant semantic parallels. Under our translations, adjectival and nominal specifiers have a strikingly similar interpretation. Furthermore, comparative APs move and are assigned scope much on analogy with quantified noun phrases. These parallels are independently supported, I believe. May (1985) has argued that so-called antecedent contained deletion structures like (55) crucially involve scopal assignment by Q(quantifier) R(raising):

- (55)a. Max [_{VP} saw [_{NP} everyone Felix did [_{VP} e]]]

Such examples involve an empty position (here VP) whose content is supplied. As May argues, in order for this to be possible without infinite regress, the empty element must occur within a phrase which moves by QR. Here the relevant phrase is the quantified object NP. The latter raises and adjoins to S at a level of Logical Form:

- (55)b. [_S [_{NP} everyone Felix PAST [_{VP} e]]]
 [_S Max PAST [_{VP} see [_{NP} e]]]]

The matrix VP then supplies the content of [_{VP} e]:

- (55)c. [_S [_{NP} everyone Felix PAST [_{VP} see [_{NP} e]]]]
 [_S Max PAST [_{VP} see [_{NP} e]]]]

yielding the desired representation.

Note now that it is not only quantified NPs which license antecedent contained deletion structures – comparative APs do so as well. Consider

(56a):

- (56)a. John's party lasted [_{AP} longer than Bill's did [_{VP} e]]

Here the verb *last* subcategorizes a durative adverbial complement, where the latter again contains an empty VP. In Larson (1987) it is argued that the proper analysis of such structures is parallel to that given for (55). Thus the comparative AP raises at Logical Form:

- (56)b. [s [AP_i longer than Bill's PAST [vP e]]]
[s John's party PAST [vP last [AP_i e]]]]

And the matrix VP supplies the content of [vP e]:

- (56)c. [s [AP_i longer than Bill's PAST [vP last [AP_i e]]]]
[s John's party PAST [vP last [AP_i e]]]]

again yielding the desired result. Of course, for this analysis to be possible, comparative adjectives just be subject to QR. Hence the facts of antecedent contained deletion support a view of comparative APs as quantificational and scopal.¹⁸

From Larson's book

4.2.

In Larson (1987) it is argued that free constructions in English divide into two kinds: free relatives and free comparatives. The former are basically nominal and comprise NP and PP structures like those in (57a, b):

- (57)a. John will grow [NP whatever vegetables Bill grows]
b. Max must live [PP in whatever town Felix does]

The latter are basically adjectival and include AP and AdvP structures like those in (58a, b):

- (58)a. John will grow [AP however tall Bill grows]
b. Max must speak [AdvP however carefully Felix does]

An analysis of the latter as comparative accords well with our intuitions about their meaning. Such examples can be paraphrased very closely by explicit comparatives in *as*: *John will grow as tall as tall Bill grows* and *Max must speak as carefully as Felix did*.

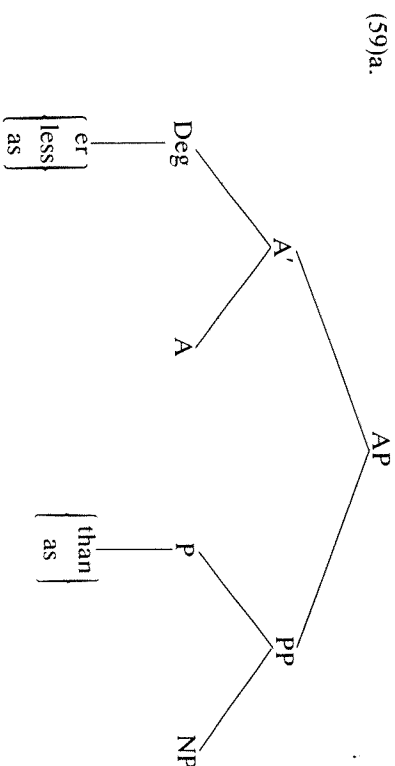
If this account is correct then the appearance of -ever in (58) is significant. Since the latter is intuitively a universal quantifier, its presence suggests that equatives should be associated with universal quantification. This association does hold on the semantic analysis given here. Recall that equatives like *John is as smart as Felix* involve universal quantification over degree modifiers:

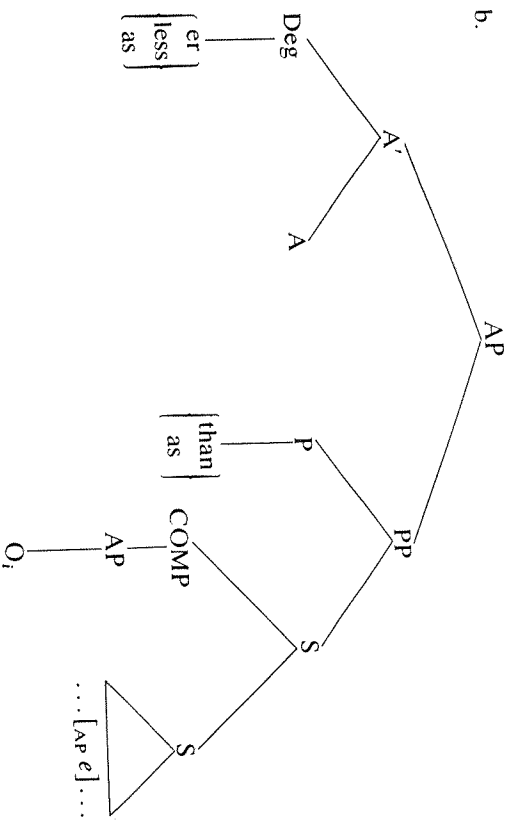
$\lambda N [M^Q \text{smart}\{\text{Felix}\} \rightarrow M^Q \text{smart}\{\text{John}\}]$

Under the present proposals, we can account very naturally for the appearance of -ever in a structure with comparative meaning. We can view -ever as, in effect, a "sortally indeterminate" specifier formative which expresses universal quantification. Combining ever with a nominal wh- (*who*, *which*, &c.) produces a sortally determinate specifier expressing universal quantification over individuals – i.e., a universal determiner. Combining -ever with an adjectival wh- (*how*) produces a sortally determinate specifier expressing universal quantification over degree modifiers – i.e., an equative degree element. These are precisely the readings observed in the free construction.

4.3.

One important assumption in the present account is that structures of the form [s [AP O][s... [AP e]...]] are of the same logical type as noun phrases: both denote sets of sets. This identity of type may shed light on the fact that languages often contain a single form which serves as both a "conjunction" and a preposition introducing complements to comparatives. As argued in Hankamer (1973), English *than* is an example, and Larson (1984) points to a similar conclusion regarding the temporal prepositions *before* and *after*. If complement selection is largely governed by logical type, then it is straightforward to have an element like *than* which could select both NP and S. Thus we might assume this morpheme to belong uniformly to the category P in English, occurring in the configuration:





and denoting the identity function. (For an analysis of *before* and *after* see Larson, 1984).

4.4.

Finally, it should be noted that under the present analysis, so-called subdeletion complements like those in (60a-c) will require a rather different treatment from the comparative constructions examined here:

- (60)a. Felix is less musical than he is mathematical
 b. This table is longer than it is wide
 c. Alice is as relieved as she is happy

This is so because the "obvious" semantic analysis of the complements in (60), involving lambda abstraction over a free variable of the type of A specifiers, will not provide an argument of appropriate type for the functions denoted by **less musical**, **longer** or **as relieved**. I will not attempt to develop the analysis of subdeletion here, but will simply note that this "factoring" of comparative constructions is at least plausible. Chomsky (1977) has observed that subdeletion constructions have syntactic properties which do in fact set them apart from other comparative structures. Rather than being a drawback, then, the fact that subdeletion must be analyzed in an special way will be a point in favor of the account presented here.

NOTES

* This paper was completed in Spring 1985 before the author became aware of the very thorough discussion of comparatives in von Stechow (1984). The latter treats issues closely related to those examined here, although adopting quite different solutions. I will draw attention to the connections where they arise. I am grateful to Henry Hiz and two anonymous L&P reviewers for comments on an earlier version of this paper.

¹ Logical/syntactic representations similar to (2a, b) are discussed in Ross (1968) and Seuren (1973), although no explicit semantics is provided for them. As Klein (1980, 1982) notes, this omission is a serious one; without such a semantics it is not clear why, e.g., (2a) represents that Felix is taller than Max rather than that Felix and Max are simply of different heights. What is central in Klein's interpretation of (2a, b) is the requirement that there is a context in which $\lambda x \lambda y [\text{tall}(x)(\text{Felix}) \& \neg \text{tall}(y)(\text{Max})]$ is true, then there is no context where $\lambda x \lambda y [\text{tall}(x)(\text{Max}) \& \neg \text{tall}(y)(\text{Felix})]$ is true. This ensures the comparative character of such logical translations. van Benthem (1983) has referred to this requirement as a "stability" principle.

² The σ appearing in (2a, b) is a "character operator" creating a function whose domain is the set of contexts, and not the familiar intensional operator of Montague (1974).

³ The universal quantification in (6) is of course to be understood relativized a set of individuals not including Felix: i.e., the sentence is to be understood as "Felix is taller than everyone else is". Similar remarks apply to (8) below. Von Stechow (1984) discusses the interaction of quantified NPs with Klein/Seuren-style analyses of comparatives; his concern, however, is with the interaction of quantified NPs and negation, not with the relative scopes of the quantifiers over degree modifiers and individuals. These are quite distinct problems. See discussion in Section 3.1.2.

⁴ The island properties of clausal vs. NP comparative complements are observed in Hankamer (1973). The relation between scope of quantifiers and *wh*-has been discussed by Bach and Partee (1980), Chomsky (1981), Higginbotham (1980), May (1977, 1985), Reinhart (1979, 1983), Rodman (1976), among many others.

⁵ The unexpressed copula may be taken to denote the identity function on AP denotations. The preposition *than* may be regarded as having the identity function for its interpretation (see Section 4.3). The structures in (19a, b) are parallel to "double object" structures like [_{NP} [_{VP} give John] a book] as the latter are analyzed in Chomsky (1981). The selecting element X combines with its first complement to yield a small X' phrase, which then selects its final complement to yield a full XP.

⁶ Strictly speaking, the lambda conversion made in the last line of (28) is illegitimate since it moves $\lambda x \lambda y [\text{tall}(x)]$, a formula which is not modally closed, within the scope of an intensional operator σ . This conversion would of course be licit in a fully intensionalized fragment, where in place of $\lambda x \lambda y [\text{tall}(x)]$ we would have $\lambda x \lambda y [\text{tall}(x)]$.

⁷ As with (28) above, to derive (30) we are tacitly assuming a fully intensionalized fragment in which lambda conversion would involve a modally closed formula, viz., $\lambda x \lambda y [\text{calous}(x)]$.

⁸ More precisely, (30) is a contradiction under the assumption that the accessibility relation across possible worlds is reflexive.

⁹ It is possible to force the non-preferred interpretation by appropriate positioning of the particle *either*. Thus (i) has only a reading synonymous with (33b) in the text:

- (i) John is either taller than Bill or Fred

For more on the scope of disjunction, see Larson (1985).

¹¹ Hoeksema (1983) has argued recently that the complements of clausal comparatives are polarity contexts, but the complements of phrasal comparatives are not (contrary to what is assumed here). He suggests that the *anyone* appearing in (38a-c) is not in fact "polarity *any*", but rather "free choice *any*". In support of this conclusion for English, he observes

that *almost* can apparently qualify free choice *any* but not polarity *any*:

- (i)a. John didn't like (*almost) anyone else (polarity *any*)
 b. (Almost) anyone else would be preferable (f.c. *any*)
 and *almost* can qualify the *anyone* appearing in a phrasal comparative:
 (iia). John is taller than almost anyone else.

The problem with this argument is that *almost* can also freely qualify *any*'s appearing in a clausal comparative, which H. takes to induce negative polarity environments. Thus there is no difference in acceptability between (iia) and (iib):

- (iib). John is taller than almost anyone else is

In view of this, the *almost*-data do not seem to reveal any difference between the properties of phrasal vs. clausal comparatives as inducing polarity domains.

¹² For more on this see Klein (forthcoming).

¹³ This wide scope for negation would be produced under the original rules for *more* and *less* given in (15).

¹⁴ The questions raised by (41) also arise for sentences generated under Klein's (1980) analysis. Consider (i):

- (i) Felix is taller than Max thinks he is

This sentence synonymous with (41) on the external reading of the latter. Furthermore, it is assigned the II translation in (43) by Klein's schemata. But (43) (and (42)) are inadequate for (i) for the same reasons that they are inadequate for (43).

The treatment of sentences like (41) and (i) above appears to be a place where analyses involving direct comparison of degrees have an advantage. Consider a representation for the external reading of (43) and (i) like that suggested in Dresher (1977):

- (ii) $\forall x \forall y [x, y \text{ degrees of height} \ \& \ x > y \ \& \ \text{Felix is } x\text{-degree tall} \ \& \ \text{Max thinks Felix is } y\text{-degree tall}]$

(ii) seems to correctly capture the fact that if (43) and (i) are true on the relevant reading, then all that we attribute to Max is a belief that Felix is tall to some degree *y*. Max need not have drawn any consequences of this belief – in particular, he need not believe that Felix is not-tall to degree *y* – Felix's actual height.

¹⁵ Ullian (1972) cites Grebo, Bassa, Konkow, Hausa, Sotho, Tswana, and Samoan as languages whose degree marker is verbal (what he labels as "SURPASS"-type comparatives).

¹⁶ See Dowty, Wall and Peters (1981) for a useful discussion of these issues.

¹⁷ An alternative approach might be to give the degree morphemes the translations in (i):

- (i)a. $e\bar{r} \Rightarrow \lambda \bar{O} \lambda \bar{P} \bar{V} . M[\bar{Q}(\lambda x [-M\{\bar{Q}^*(x)\}]) \ \& \ \bar{P}(\lambda x [M\{\bar{Q}^*(x)\}])]$
 b. $less \Rightarrow \lambda \bar{O} \lambda \bar{P} \bar{V} . M[\bar{Q}(\lambda x [M\{\bar{Q}^*(x)\}]) \ \& \ \bar{P}(\lambda x [-M\{\bar{Q}^*(x)\}])]$
 c. $as \Rightarrow \lambda \bar{O} \lambda \bar{P} \bar{V} . M[\bar{Q}(\lambda x [M\{\bar{Q}^*(x)\}]) \rightarrow \bar{P}(\lambda x [M\{\bar{Q}^*(x)\}])]$

where ' \bar{Q}^* ' is now a designated variable over expressions of type $\langle \kappa, \langle e, t \rangle \rangle$. Combining a degree morpheme with an adjective would involve abstraction over the designated variable, but degree morphemes would not take adjectives directly as arguments (compare (32a–c)). This proposal would draw degree morphemes closer to the "verbal comparatives" mentioned in the text. In *John exceeds Max in height*, for example, the interpretation of *exceed* presumably corresponds rather closely to the translation of the degree morpheme in (ia): it indicates, essentially, 'is greater than', but does not specify what this inequality holds in respect to. The latter is provided by the adjunct phrase *in height*. 'Extensionalization' would then apply to degree morphemes directly, and would be

exactly analogous to extensionalization of verbs like *exceed* and *surpass*. I will not pursue this proposal further here.

is Von Stechow (1984) adopts an alternative view on which it is the *than*-clause which takes scope, and where the latter interpreted essentially as a definite description picking out a (maximal) degree. This proposal will not produce a correct result for antecedent contained deletion under the May analysis. Consider the following alternative LF for (56a), in which only the *than*-clause undergoes QR:

- (i)a. $[\text{S } [\text{than Bill's PAST } [v_p e]]]$
 $[\text{S John's party PAST } [v_p \text{last } [\text{Ap longer } e]]]]]$

Copying the matrix VP in this configuration will yield (ib):

- (i)b. $[\text{S } [\text{than Bill's PAST } [v_p \text{last } [\text{Ap longer } e]]]$
 $[\text{S John's party PAST } [v_p \text{last } [\text{Ap longer } e]]]]]$

where the comparative has been duplicated. This Logical Form presumably corresponds to a reading: 'the length *l* of John's party is greater than the length *l'*, such that Bill's party is longer than *l'*'. Since latter is compatible with Bill's party being longer than John's party while (56a) is not, (ib) does not appear to be an appropriate LF for (56a).

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ON OBLIGATORY CONTROL*

0. INTRODUCTION

The notion of control is invoked whenever the interpretation of a constituent involves an 'understood (or missing) subject' whose reference is determined by a NP which is not in the subject position of the constituent in question. Some examples are given in (1).

- (1)(a) John promised Bill to leave the room.
 (b) John persuaded Bill to leave the room.
 (c) John served the fish raw.
 (d) John gave Bill a book to read.
 (e) John wanted Bill to leave the room.¹

Control can thus be characterized pretheoretically as a relation of referential dependence² between the 'missing subject' and some argument of the matrix clause. I will call the latter *the controller*, the former, *the controlled element*, and the constituent whose subject is controlled, *the controlled constituent*. We will be concerned here with that subset of control cases traditionally known as Equi constructions, exemplified in (1a) and (1b), where the controller is a semantic argument of the matrix verb (Vm) and the controlled constituent is an infinitival complement, i.e., it is a semantic argument of Vm expressed by an infinitive phrase.³ The first condition rules out 'Raising to Object' constructions (exemplified by (1e)); the second rules out (1c) and (1d) since the controlled constituent in these examples is not a semantic argument of the Vm, whether infinitival or not.⁴ Equi constructions are a subset of what Williams (1980) and Chierchia (1983, 1984) call *obligatory control*, and what Bresnan calls 'functional control'.

The main questions any theory of obligatory control has to address are the following:

- (1) What are the principles which determine the set of possible controllers?
 (2) What is the syntactic and semantic status of the controlled constituent?