Complex degrees and an unexpected comparative interpretation

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1 Introduction The classical analysis of degrees treats them simply as numerical values. A number of authors have argued that degrees must in various respects have a richer structure (e.g. Cresswell 1976, Grosu & Landman 1998, Rett 2008). Our aim here is to argue that degrees should be enriched in such a way that that it is possible, given a degree, to recover the associated scale.

2 An unexpected reading Our starting point is the comparative construction in (1), which in addition to the ordinary 'strict' and 'sloppy' readings glossed in (1a)–(1b) has also the unexpected reading (1c):

(1) John defended himself more skillfully than OJ Simpson's lawyer.
  a. 'John defended John more skillfully than OJS's lawyer defended John.'
  b. 'John defended John more skillfully than OJS's lawyer defended OJS's lawyer.'
  c. 'John defended John more skillfully than OJS's lawyer defended OJS.'

At first glance, the only hope of deriving the reading glossed in (1c) is to find some way of licensing the rather odd form of ellipsis that the gloss itself suggests. We think, however, that a more revealing paraphrase is (2):

(2) John defended himself more skillfully than OJ Simpson's lawyer was skillful.

This suggests an analysis where (1) is closely related to comparatives in which the complement of *than* is a degree expression (e.g. 'The kite flew higher than 100 meters'). The only difference is that the degree is specified indirectly via an individual which exemplifies it. That the kind of reading glossed in (2) is in general available for comparatives with the structure of (1) can be seen from (3), which typically means not that the kite flew higher than the tallest building flew, but that the kite's altitude exceeded the tallest building's height:

(3) The kite flew higher than the tallest building. ('The kite flew higher than the t.b. is high.')

Naïvely, then, we might try to analyze (3) by passing as an additional argument to the comparative morpheme a type ⟨ed⟩ function mapping the tallest building to its degree of height. This sort of analysis is is sketched in (4)–(5), where the context-sensitive semantic value of the null constituent F supplies the relevant function:

(4) [[er F] [than the tallest building]] [λ_1[the kite flew t_1-high]]

(5) $[\![\text{er}]\!] = \lambda f_{\text{ed}} \lambda x_{\text{e}} \lambda P_{\text{dt}} \,.\, \max\{d \mid P(d) = 1\} > f(x)$

The problem with this analysis is that it does not restrict the value supplied by F to ensure (a) that it is a function from buildings to their degrees of height (and not, say, to their degrees of width or weight); and (b) that it is a function from each building to the degree of its own height and not to some other height that may be indirectly associated with it (e.g. the height of its architect).

3 Complex degrees We can do without F in a system where degrees have a richer structure. Following Rett 2008, we take degrees to be triples of (i) a point on a scale, (ii) a total ordering of the points on this scale, and (iii) a dimension (e.g. HEIGHT). Each dimension ψ determines a function ψ_{M} from individuals to points (Bartsch & Vennemann 1972). We now assign to (3) the structure in (6):

(6) [er [than the tallest building]] [λ_1[the kite flew t_1-high]]

(7) $[\![\text{high}]\!] = \lambda d \lambda x \,.\, 1$ iff $\exists u[d = \langle u, \geq, \textsc{height}\rangle \wedge u \leq \textsc{height}_{\text{M}}(x)]$

(8) $\mathcal{U}(\langle u, R, \psi\rangle) = u$; $\mathcal{R}(\langle u, R, \psi\rangle) = R$; $\mathcal{M}(\langle u, R, \psi\rangle) = \psi_{\text{M}}$

(9) $\max(P_{\text{dt}}) = \iota d \,.\, \exists u \exists R \exists \psi [d = \langle u, R, \psi\rangle \wedge P(d) \wedge \forall u'[P(\langle u', R, \psi\rangle) \rightarrow [R(u, u') \wedge \neg R(u', u)]]$

(10) $[\![\text{er}]\!] = \lambda x_{\text{e}} \lambda P_{\text{dt}} \,.\, \mathcal{R}(d)(\mathcal{U}(d), \mathcal{M}(d)(x))$ where $d = \max(P)$

The value of $\max(P)$ is defined in all cases where P holds only for degrees with a given ordering and dimension. The degree predicate $[\![\lambda_1$[the k. flew t_1-high]$]\!]$ holds only for degrees with ordering $\geq$ and dimension HEIGHT. The maximum degree for which this predicate holds determines, via $\mathcal{M}$, a function from individuals to the points they measure on the height scale. Thus, in virtue of (10), the point associated with the maximum degree of the kite on the height scale is compared to the point measured on the height scale by the tallest building. The analysis extends to the original case (1).

4 Contextual wiggle room Compared to the naïve analysis sketched in (4)–(5), our analysis restricts but does not eliminate the role of context. In particular, (1) is predicted to be in principle compatible with readings on which John's degree of skill in defending himself is compared to, e.g., the degree of skill with

which OJ Simpson's lawyer plays golf. This flexibility is in fact attested and can be clearly seen in (11), where the most salient comparison is to a chess grandmaster's skill in plotting chess strategies:

(11) The general plotted his military strategy more skillfully than a chess grandmaster.

5 Against ellipsis Examples such as (12) show that reading (1c) of (1) cannot be derived by the form of ellipsis that (1c) itself suggests:

(12) John defended himself more frequently than OJ Simpson's lawyer.
*'John defended himself more frequently than OJ Simpson's lawyer defended OJ Simpson.'

If this form of ellipsis were possible, there would be no reason why (12) should not be compatible with the indicated interpretation. On the present analysis, (12) cannot receive this reading because the lexical semantics of 'frequent(ly)' are such that it is difficult (if not impossible) to understand the attribution of degree d of frequency to OJ Simpson's lawyer to entail that OJ Simpson's lawyer defends OJ Simpson d-frequently. In contrast, the attribution of degree d of skill to OJ Simpson's lawyer can easily be understood to entail that OJ Simpson's lawyer defends OJ Simpson d-skillfully. This leaves open the possibility of an ellipsis analysis of (1) along the lines suggested by (2). However, this sort of analysis would suggest that reading (1c) ought to be preserved in the presence of multiple standards (often taken to indicate that a 'direct' analysis is impossible, Bhatt & Takahashi 2011). In fact, examples such as (13) allow the (1c)-type reading only in the absence of the second parenthesized standard:

(13) John defended himself more skillfully in the tribunal than OJ Simpson's lawyer (in court).

Finally, the Japanese and Hindi-Urdu translations of (1) permit all of the readings (1a)–(1c). For Hindu-Urdu comparatives in particular there is little evidence for a reduction operation reducing a clause to a DP remnant.

6 Cross-linguistic implications We have argued that certain English comparative constructions have a 'direct' analysis, in the sense that they (i) involve only a single syntactic degree predicate and (ii) have a standard introduced by a form of *than* which takes an individual-denoting DP complement. According to Bhatt & Takahashi (2011), a direct analysis is preferred in languages where the comparative marker can take a phrasal complement because the phrasal structure is smaller. B&T show that the direct analysis is never available for ordinary English comparatives, and put this down to *than* obligatorily taking a clausal rather than a DP complement. If, as we assume, *than* can take a DP complement, then this assumption together with B&T's preference principle gives rise to the (incorrect) prediction that English comparatives should behave roughly as Japanese comparatives, with the direct analysis being preferred. This problem cannot obviously be solved by relativizing the preference for smaller structures to a particular target interpretation, since B&T argue that phrasal comparatives sometimes lack scope readings available for their clausal competitors. We address this problem as follows. First, following Sudo (2015), we assume that B&T's typology can be simplified by reanalyzing apparent clausal comparatives in Japanese as phrasal comparatives. (The clause is a relative clause attached to a null DP standard.) We then propose that it is in fact the clausal structure that is preferred whenever it is able to yield the target interpretation. Thus, the direct analysis may be used in English only in those rare circumstances — such as (1) under reading (1c) — where a clausal structure cannot yield an equivalent interpretation. Languages such as Hindi-Urdu and Japanese cannot ever use clausal comparatives simply because the comparative marker is unable to take clausal complements.

7 Complex degrees or complex types? For ease of exposition we have used complex degree values to make it possible to retrieve the associated scale from a degree value. This does however require some rather clumsy packing and unpacking of tuples. We suggest that this problem can be overcome by enriching the type system of the semantic metalanguage to allow polymorphic types. To this end we make use of System F (Reynolds 1974), an extension of the typed λ-calculus. In outline our proposal is as follows. For every scale ψ there is a corresponding scale type σ_ψ and degree type d_ψ. The values of degree types are simply numeric values. The type of the comparative morpheme is polymorphic with respect to a scale type. Its arguments are (i) a scale ψ, (ii) an individual, and (iii) a predicate of degrees of type d_ψ. The comparative morpheme obtains a measure function from the scale argument, which is then applied to the individual argument, so that the resulting degree can be compared to the maximum defined by the degree predicate. Cross-scale comparisons are prevented by the type system without any complication of degree values.