Comparative and Equative Correlatives as Anaphora to Differentials

The Phenomenon. The empirical goal of the paper is to establish that there are comparative correlatives that are not comparative conditionals, against what much of the previous literature assumes. This is shown by the Romanian comparative correlative in (1) and is further supported by the equative correlative in (2), which: (*a*) asserts that Irina is (very) beautiful and (very) smart and (*b*) equates the significant extent to which Irina is beautiful to the significant extent to which she is smart. No conditional paraphrase is possible for (1) or (2) – as, for example, **[1]** would have it –, since they are statements about what is *actually* the case. In contrast, the comparative correlative in (3) can be paraphrased by a conditional, e.g.: if a lawyer x is more aggressive than a lawyer y by a certain amount, then x is more efficient than y by a corresponding amount.

(1) Cu cît   e mai înalt fratele   decît sora,   cu atît   e mai înalt tatăl   decît mama.
    With how much is more tall brother.the than sister.the, with that much is more tall   father.the than   mother.the
The brother is taller than the sister by a certain amount and the father is taller than the mother by the same amount.

(2) Pe cît   e Irina de frumoasă, pe atît   e de deşteaptă.
     PE how much is Irina DE beautiful,   PE that much is DE smart
Irina is beautiful to a certain, significant extent and she is smart to the same, equally significant extent.

(3) Cu   cît   e un avocat mai agresiv,   cu atît   e mai   eficient.
     With how much is a   lawyer more aggressive, with that much is more efficient
The more aggressive a lawyer is, the more efficient he is.

The Basic Account. The main proposal is that the Romanian *atît* (that much) in (1) and (2) is anaphoric to differential intervals, i.e. *atît* is a proform in the degree domain. This is supported by its anaphoric use in (4) (compare with (1)) and by its deictic – *E atît de obosită* (She is so tired) – and cataphoric – *E atît de obosită încît o doare capul* (She is so tired that she has a headache) – uses.

(4) Fratele   e mai înalt decît sora   cu 2 cm, iar tatăl   e mai înalt decît mama   tot cu atît.
    Brother.the is more tall than sister.the with 2 cm, and father.the is more tall than mother.the also with that much
The brother is 2 cm taller than the sister and the father is taller than the mother by the same amount.

The wh-differential *cît* (how much) in (1) / (2) is an indefinite introducing a non-empty interval, anaphorically retrieved by *atît*. Thus, the account captures the parallel between the interpretations of correlatives in the degree and individual domains, illustrated by the 'singular' / referential (5) below – parallel to (1) and (2) (we refer to a single individual / scalar interval) – and the 'plural' / quantificational (6) – parallel to (3) (we refer to a set of individuals / scalar intervals).

(5) Care fată şi   =a   uitat   ieri   haina,   pe aceea   o   =caută   tatăl   ei.
    Which girl her.Dat=HAS forgotten yesterday coat.the, PE that one her.Acc=look for father.the her.Gen
The father of the girl that forgot her coat yesterday is looking for her.

(6) Pe care   om   l   =a   interogat   Securitatea, în acela   nu am   încredere.
     PE which person him.Acc=HAS interrogated   security.the, in that one not have.1sg trust
I do not trust any person (whatsoever) that the secret police interrogated.   (see **[2, 3, 4]** for more discussion)

Extending the investigation of anaphoric and quantificational parallels across domains (initiated in **[8]**) to encompass the degree domain is further supported by the following English examples: (*a*) donkey anaphora: *Every child that ate a lot of vanilla ice cream yesterday ate twice as much chocolate ice cream today* (see: *Every farmer who owns a donkey beats it* (Geach)); (*b*) quantificational subordination: *Harvey eats a lot of vanilla ice cream at every convention, but Linus always eats twice as much chocolate ice cream* (see: *Harvey courts a woman at every convention. She always comes to the banquet with him* (Karttunen)); (*c*) modal subordination: *Harvey might bring a lot of vanilla ice cream to the party tomorrow. In which case Linus would get competitive and bring twice as much chocolate ice cream* (see: *A wolf might come in. It would eat you first* (Roberts)); (*d*) topicalization: *As smart as Linus is, Gabby is even smarter* (see: *Megan, I like her*).

An Outline of the Formal Account. The degree-based correlatives in (1) and (2) are analyzed as instances of anaphora between the wh-indefinite *cît* and the anaphoric demonstrative *atît* (see **[5]** and **[6]** for related ideas). Given the syntactically non-local, cross-clausal character of such anaphora to intervals – which makes it similar to donkey anaphora –, the proposal is formalized in a dynamic semantics system. Following **[7]**, the system is couched in classical type logic, which delivers Montague-style compositionality at sub-clausal level by the usual methods. In particular, besides the types e and t (individuals and truth-values), we also have a basic type γ (from the Latin *gradus*) for degrees (d, d' etc. are variables of type γ) and a basic type s, whose elements model variable assignments (i, j etc. are variables of type s). Individual-denoting indefinites introduce – and the corresponding proforms anaphorically retrieve – discourse referents (dref's) u, u' etc. for individuals, which are of type se. That is, dref's are modeled as individual concepts: intuitively, the individual $u(i)$ – or ui for short – is the individual that the dref u denotes relative to the assignment i. We also have dref's for degrees δ, δ' etc. of the expected type $s\gamma$ and dref's for intervals (convex sets of degrees) Δ, Δ' etc. of type $s(\gamma t)$.

A sentence is interpreted as a DRS / box, i.e. as a relation of type $s(st)$ between an input and an output assignment. E.g., the DRS $[u, \delta \mid tall\{u, \delta\}]$ abbreviates $\lambda i.\lambda j.\ i[u, \delta]j \wedge tall\{u, \delta\}j$, i.e. the relation between an input assignment i and an output assignment j such that: (**a**) i differs from j at most with respect to the values assigned to the newly introduced dref's u and δ (note that $[u, \delta]$ is itself a relation of type $s(st)$); (**b**) the condition $tall\{u, \delta\}$ is satisfied by the output assignment j. Conditions denote sets of assignments (of type st), e.g. $tall\{u, \delta\} := \lambda i.\ tall(ui, \delta i)$; informally, $tall\{u, \delta\}$ is the set of assignments i such that the individual ui is tall at least to degree δi. Finally, DRS's without new dref's are interpreted as tests, e.g. $[tall\{u, \delta\}] := \lambda i.\lambda j.\ i=j \wedge tall\{u, \delta\}j$.

Example (1) above is interpreted as shown in (7) below. To facilitate comparison with **[1]**, I also interpret the comparative morpheme *mai* as relating two definite descriptions over degrees, but this is not crucial to the analysis. The descriptions are represented by means of a DRS of the form $\delta=\text{MAX}(D)$, defined in (8) below; e.g., $\delta=\text{MAX}([tall\{u_{bro}, \delta\}])$ introduces a new dref δ and stores in it the maximal degree to which the brother u_{bro} is tall, i.e. his height. The indefinite differential *cu cît* updates the discourse context by introducing an interval dref Δ, which the comparative morpheme equates with the difference between the height δ of the brother and the height δ' of the sister. The matrix clause in (1) receives a parallel interpretation, except that the differential *cu atît* anaphorically retrieves the interval Δ, which is also equated with the difference between the father's height δ'' and the mother's height δ'''. Dynamic conjunction ';' – interpreted as relation composition, i.e. $D; D' := \lambda i.\lambda j.\ \exists h(Dih \wedge D'hj)$ – connects the updates in (7).

(7) $\delta=\text{MAX}([tall\{u_{bro}, \delta\}]);\ \delta'=\text{MAX}([tall\{u_{sis}, \delta'\}]);\ [\Delta \mid \Delta=\delta-\delta'];\ \delta''=\text{MAX}([tall\{u_{fa}, \delta''\}]);$
$\delta'''=\text{MAX}([tall\{u_{mo}, \delta'''\}]);\ [\Delta=\delta''-\delta''']$,   where $\Delta=\delta-\delta' := \lambda i.\ \Delta i=\{d: \delta'i<d\leq\delta i\}$

(8) $\delta=\text{MAX}(D) := \lambda i.\lambda j.\ ([\delta]; D)ij \wedge \forall k(([\delta]; D)ik \rightarrow \delta k\leq\delta j)$,   where D is a DRS (of type $s(st)$)

The equative correlative in (2) is analyzed as anaphora to the differential interval obtained by subtracting the contextual standard of beauty from Irina's maximal degree of beauty; we also need a contextually salient function mapping intervals on the beauty scale to intervals on the smartness scale (in (1), this was just the identity function over intervals on the height scale). The paper ends with an analysis of example (3) as (roughly) anaphora to *sets* of differential intervals.

[1] Beck, S. 1997. On the Semantics of Comparative Conditionals, *LP* 20; [2] Bhatt, R. 2003. Locality in Correlatives, *NLLT* 210; [3] Bittner, M. 2001. Topical Referents for Individuals & Possibilities, *SALT* 11; [4] Dayal, V. 1996. *Locality in Wh Quantification*, Kluwer; [5] den Dikken, M. 2005. Comparative Correlatives Comparatively, *LI*36; [6] Jespersen, O. 1924. *The Philosophy of Grammar*, Allen; [7] Muskens, R. 1996. Combining Montague Semantics and Discourse Representation, *LP* 19; [8] Partee, B. 1973. Some Structural Analogies between Tenses and Pronouns, *JoP* 70.