CROSS-POLAR (A)NOMALIES WITHOUT DEGREES

Jenny Doetjes*

Abstract: This paper discusses the distribution of positive and negative adjectives in subcomparatives with an absolute comparison interpretation, including cross-polar nomalies and anomalies (see Bierwisch 1989, Kennedy 1997/1999, 2001, Büring 2007). It offers an analysis of these phenomena in terms of a more constrained variant of Klein's (1980, 1982) degree-less analysis of comparatives, as presented in Doetjes et al. (forthcoming). The paper attempts to derive the properties of subcomparatives from independently motivated properties of measures.

Keywords: subcomparatives, degrees, vague predicate analysis, cross-polar (a)nomalies, measures, interpretation of numerals

1. Introduction

Some adjectives can be modified by degree expressions while others cannot. Take for instance the example in (1), which shows that the adjectives *tall* and *difficult* are gradable, while *parliamentary* is not (see for instance Bolinger 1972).

(1) a. taller, more difficult
    b. #more parliamentary

The example in (1b) is odd, and can only be understood if we manage to reinterpret the adjective in such a way that it gets a gradable meaning. Degree expressions, such as the comparative, are sensitive to the presence or absence of gradability. As such, the way their semantics is defined depends on the way gradability is represented.

As often noted, gradability is not uniquely an adjectival property (see among others Bolinger 1972 and Sapir 1944). Nouns such as *idiot* and verbs such as *to love* are generally thought of as being gradable. Given this, the way gradability is represented for adjectives has consequences for the representation of gradability for other categories. On the other hand, the fact that other categories may be gradable has consequences for the way gradability is represented in adjectives. In this paper, I will follow Doetjes et al. (forthcoming), who claim that gradability across categories offers an argument in favor of a maximally simple approach to gradability in the adjectival system, which is a degree-less approach.

Much research on gradable adjectives and comparatives has been implemented in degree-based approaches, which have been quite successful in explaining a number of phenomena, such as properties of special types of comparatives. One phenomenon that has been recently argued to offer evidence in favor of a degree-based system and against a Klein-style approach are so-called cross polar anomalies. As argued by Kennedy (19971999),

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subcomparatives such as that in (2a) normally involve two adjectives of the same polarity. According to Kennedy, this can be explained within a degree-based approach that represents positive and negative degrees in a different way, and as such turns them into sortally different objects. As a result, his theory predicts positive (POS) and negative (NEG) adjectives to introduce 'incommensurable' degrees and thus he can account for the anomaly of sentences such as (2b).

(2) a. The table is **longer** than the desk is **wide** POS-POS
b. #The table is **longer** than the desk is **narrow** POS-NEG

Kennedy argues that a degree-less approach to comparatives, and more in particular Klein's version of it, cannot handle this type of data. In this paper, I will sketch a recent implementation of a degree-less analysis of comparatives based on Doetjes et al. (forthcoming). As compared to Klein's theory, this analysis is more similar to degree-based approaches. I will show how this analysis can handle the phenomena described by Kennedy without making use of degrees. As I will argue, the grammaticality patterns that we find for this type of sentences cannot be explained by one single factor. Rather, various factors conspire, resulting in a rather complicated pattern of judgments that may vary from one speaker to another.

2. Background: degree based vs. degree-less approaches

In the literature on gradable adjectives, there are two main views on how the gradability of adjectives is represented. These can be roughly distinguished as degree based approaches versus degree-less approaches. According to first type of approach, the meaning of a gradable adjective is defined in terms of degrees (cf. Cresswell 1976, von Stechow 1984, Kennedy 1997/1999, Heim 2000). Usually the adjective denotes a relation between individuals and degrees.[1] Within degree-less approaches the adjective is always an ordinary predicate, albeit a vague one (Klein 1980, 1982, Van Rooij 2008). The two approaches are illustrated in (3):

(3) John is tall
a. John is tall to a degree *d*
b. John is a member of a (contextually determined) set of tall people

Within the vague predicate analysis, adjectives are of type <e, t>. The main difference between gradable adjectives as in (1a) and non gradable ones as in (1b) lies in the fact that the sets defined by gradable adjectives are ordered, while non gradable adjectives define unordered sets.

Within a degree based approach, gradable adjectives and non gradable adjectives are of different types. If the gradable adjective is defined as a relation between individuals and degrees, the adjective is of type <d, <e, t>>, as opposed to non gradable adjectives, which are ordinary predicates of type <e, t>. In the course of the derivation, the gradable adjective is turned into an ordinary predicate. This is taken care of by an overt degree expression, such as the comparative morpheme *–er* in *taller*. In the absence of an overt degree expression, this change of type is due to the presence of the empty element *pos*, which was first introduced by

[1] But see Kennedy (1997/1999), who treats adjectives as measure functions from individuals to degrees.

Cresswell (1976). Besides the fact that *pos* changes the type of the gradable adjective, it also makes sure that the adjective in its positive form receives a non neutral or evaluative interpretation. This interpretation is illustrated in (4):

(4) a. John is [*pos* tall]
b. John is taller than a contextually determined standard of tallness

In this respect the positive (*tall*) differs from the comparative (*taller*), which may have a neutral interpretation as illustrated in (5):

(5) John is taller than Peter is $\not\rightarrow$ John is tall

In Klein's framework, *pos* is not necessary, as adjectives such as *tall* are interpreted as the property of being tall, where what counts as *tall* depends on the context. In the comparative sentence in (5), 'what counts as tall' is defined in such a way that John is tall and Peter is not.

3. A new way of implementing a degree-less approach

Doetjes et al. (forthcoming) argue that Klein's degree-less approach, even though it is very attractive, has a number of problems degree based approaches do not have. In order to see this, the examples in (6) and (7) give the comparative in a standard degree based framework (taken from Kennedy and McNally 2005: 369) and the definition of the comparative according to Klein (1982: 127):

(6) a. $[\![\text{-er/more than } d_c]\!] = \lambda A \lambda x. \exists d\, [\, d \succ d_c \wedge A(d)(x)\,]$
b. Alice is taller than Carmen is $[_{AP}$ e]
c. $\exists d\, [d \succ d_c \wedge \mathit{tall}(d)(\mathit{Alice})]$
(where d_c is the maximal degree such that Carmen is *d*-tall)

(7) a. $\mathbf{x}_0 >_\zeta \mathbf{x}_1$ iff $\exists \mathbf{d}[(\mathbf{d}(\zeta))(\mathbf{x}_0) \wedge \neg(\mathbf{d}(\zeta))(\mathbf{x}_1)]$
(where $>_\zeta$ defines the comparative relation for a vague predicate ζ, and **d** is a degree function / delineator)
b. Chris is taller than Alex is $[_{AP}$ e]
c. $\exists \mathbf{d}[(\mathbf{d}(\mathbf{tall}))\ (\mathbf{Chris}) \wedge \neg(\mathbf{d}(\mathbf{tall}))\ (\mathbf{Alex})]$

Whereas a degree-based approach treats the comparative in terms of a comparison between two degrees (in (6) the degree of tallness corresponding to Alice and the degree of tallness corresponding to Carmen), Klein defines the comparative in terms of conjunction and negation. Informally speaking, the formula in (7c) states that there exists a function **d** such that if we apply it to *tall*, Chris is in **d(tall)**, and Alex is not.

Even though Klein's theory has the advantage of providing a maximally simple theory of gradability, Doetjes et al. argue that Klein fails to account for certain linguistic properties of *than*-clauses, while these same properties follow from standard degree-based approaches. More in particular, *than*-clauses are usually claimed to contain an operator variable structure: they may contain an overt operator, and they exhibit locality violations that are typical for operator variable structures (see Bresnan 1975, Chomsky 1977, Izvorski 1995 and Doetjes et al. forthcoming). This property of *than*-clauses is reflected in degree-based approaches, in which the *than*-clause involves abstraction over degrees. Within Klein's proposal it is not, as the *than*-clause does not abstract over anything

Doetjes et al. opt for a revised version of Klein's theory which makes use of comparison of degree functions. Turning back to the formula in (7a), one can observe that this definition of the comparative only works if the set of **d**s we can choose from is constrained. Imagine there was a **d** such that Chris would be **d(tall)** and Alex would not, and there was also another **d** such that Alex would be **d(tall)** and Chris would not. If this were possible, the system would make the prediction that both sentences in (8) could be true at the same time, which is obviously an undesirable result:

(8) a. Chris is taller than Alex is
 b. Alex is taller than Chris is

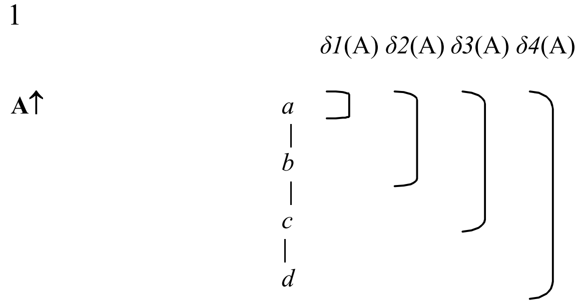
To avoid this, Klein adopts the Consistency Postulate (CP) in (9) (Klein 1982: 126):

(9) Consistency Postulate (CP)
$\forall \mathbf{x}_0 \forall \mathbf{x}_1 \forall \mathbf{Q}[\exists \mathbf{d}[(\mathbf{d}(\mathbf{Q}))(\mathbf{x}_0) \wedge \neg\, \mathbf{d}(\mathbf{Q}))\, (\mathbf{x}_1)] \rightarrow \forall \mathbf{d}[(\mathbf{d}(\mathbf{Q}))(\mathbf{x}_1) \rightarrow \mathbf{d}(\mathbf{Q}))\, (\mathbf{x}_0)]$
(where **Q** is a predicate variable)

Informally speaking, the CP states that for all $\mathbf{x}_0$ and all $\mathbf{x}_1$, if $\mathbf{x}_0 >_{\mathrm{Q}} \mathbf{x}_1$, a set that results from application of any degree function to Q and that contains $\mathbf{x}_1$ also contains $\mathbf{x}_0$.

Doetjes et al. insist on the fact that the consistency postulate introduces an ordering of degree functions. Given this ordering, the vague predicate analysis can be made more similar to a degree-based approach, as it is possible to redefine the comparative in terms of a comparison of degree functions. As a result Doetjes et al.'s version of the comparative is much more similar to the analysis of the comparative in degree based approaches. Consider first figure 1, which visualizes the idea of an ordering between the degree functions, for which I will use δ rather than **d** in order to avoid confusion between degree functions and degrees. Because of the CP, all δs are ordered when applied to a given gradable adjective A. The CP requires that every δ applies to A in such a way that if an individual *x* in A is included in *δ*(A), all individuals that are ordered above *x* will be included in *δ*(A) as well. As the upward arrow indicates, the highest ordered element of A is *a*, and as a result of the CP this element is included in *δ1*(A) to *δ4*(A).

Figure 1



Given this ordering, one may observe that *δ1*(A) is the most restrictive or most informative set, while *δ4*(A) is the least restrictive or least informative set, while *δ3*(A) is less restrictive or informative than *δ1*(A) and *δ2*(A) and more restrictive or informative than *δ4*(A). This is the ordering property Doetjes et al. make use of in their definition of the comparative. I will introduce here a slightly adapted version of their proposal.[2]

(10) $\delta 1 >_A \delta 2$ iff $\delta 1(\mathrm{A}) \subset \delta 2(\mathrm{A})$

The *than*-clause defines the **maximally informative** (i.e. most restrictive) degree function that, when applied to A, results in a set including its subject. In order for the comparative to be true, there should be a **more informative** degree function that, when applied to A, includes the subject of the main clause. This is illustrated in (11), where the *than*-clause defines the maximally informative degree function δ such that Carmen is $\delta(tall)$. If in figure 1 A is tall, *a* is Alice and *c* is Carmen, the sentence will come out as true, as the maximally informative δ such that $\delta(tall)$ includes Carmen (c) is $\delta 3$, and there is a more informative δ such that $\delta(tall)$ includes Alice (a) ($\delta 1$ or $\delta 2$).

(11) a. Alice is taller than Carmen is
b. $[\![more/\text{–}er]\!] = \lambda A\lambda Q\lambda x.\exists\delta[(\delta(A))(x)\ \&\ \delta >_A Q(A)]$[3]
c. $[\![than\ Carmen\ is]\!] = \lambda A(\mathrm{MAX_A}(\lambda\delta(\delta(A))(\mathrm{Carmen})))$
d. $[\![taller\ than\ Carmen\ is]\!] =$
$\lambda Q\lambda x.\exists\delta 1[(\delta 1(tall))(x)\ \&\ \delta 1 >_{tall} Q(tall)](\lambda A(\mathrm{MIN}(\lambda\delta 2(\delta 2(A))(\mathrm{Carmen}))))$
$\lambda x.\exists\delta 1[(\delta 1(tall))(x)\ \&\ \delta 1 >_{tall} \lambda A(\mathrm{MAX}_A(\lambda\delta 2(\delta 2(A))(\mathrm{Carmen})))(tall)]$
$\lambda x.\exists\delta 1[(\delta 1(tall))(x)\ \&\ \delta 1 >_{tall} \mathrm{MAX}_{tall}(\lambda\delta 2(\delta 2(tall))(\mathrm{Carmen}))]$

The *than*-clause in (11) is defined in such a way that the adjective in the main clause is copied to the *than*-clause. Given the definition in (10), the comparison of the two degree functions is unproblematic, as the ordering is defined with respect to one single adjective. However, in subcomparatives with two different adjectives the comparison between the two degree functions is less straightforward. When a degree function is defined as 'the maximally informative δ such that x is $\delta(\mathrm{A})$', and A is different from the adjective in the main clause, the *than*-clause does not give sufficient information in order to interpret the degree function with respect to the adjective in the main clause. Take for example the subcomparative in (12):

(12) The desk is longer than the table is wide

All we know about the degree function provided by the *than*-clause is that it is the maximally informative degree function that, when applied to *wide*, includes the table. In order to interpret the comparative, we have to apply it to *long* as well.

In order to make the analysis work for sentences such as (12), one needs degree functions that are intrinsically ordered. As they are ordered independently of the adjective they apply to, the can always be compared. Doetjes et al. assume that it is possible to use degree functions based on a measure. Measures have an intrinsic order they inherit from the numerical system, and as such they are always ordered in the same way (even though I will

[2] Doetjes et al. define the ordering relation in terms of more or less restrictive, where they use $\delta 1 <_A \delta 2$ to express that $\delta 1$ is more restrictive than $\delta 2$, while their *than*-clause introduces a minimality operator, selecting the minimal or most restrictive δ out of the set defined by the operator variable structure in the *than*-clause. Here, the ordering between the functions ranges from the minimally informative to the maximally informative degree function (cf. Beck and Rullmann 1999).
[3] See Kennedy (1997/99: 131-150) for a similar treatment of the interpretation of the gradable predicate in the *than*-clause and arguments in favor of such an approach.

argue below that the order may be reversed under certain conditions). The independent ordering of these functions makes it possible to bring into play a comparison between individuals that are characterized by different adjectives. Obviously, these degree functions are only compatible with subcomparatives with two dimensional adjectives that make use of the same measurement system, as otherwise the measures cannot be interpreted.

The analysis is exemplified in (13):

(13) a. $[\![\textit{more/–er}]\!] = \lambda A\lambda\delta 2\lambda x.\exists\delta 1[(\delta 1(A))(x)\ \&\ \delta 1 >_A \delta 2]$
b. $[\![\textit{than the table is wide}]\!] = \mathrm{MAX}_{wide}(\lambda\delta(\delta(wide))(\text{table}))$ = measure
c. $[\![\textit{longer than the table is wide}]\!]$ =
$\lambda A\lambda\delta 2\lambda x.\exists\delta 1[(\delta 1(A))(x)\ \&\ \delta 1 >_A \delta 2](long)$
$\lambda\delta 2\lambda x.\exists\delta 1[(\delta 1(long))(x)\ \&\ \delta 1 >_{long} \delta 2](\mathrm{MAX}_{wide}(\lambda\delta(\delta(wide))(\text{table})))$
$\lambda x.\exists\delta 1[(\delta 1(long))(x)\ \&\ \delta 1 >_{long} \mathrm{MAX}_{wide}(\lambda\delta 2(\delta 2(wide))(\text{table}))]$

Doetjes et al. argue that in addition to this type a second type exists that involves degree functions such as *quite*, *very* and *extremely*. Again, the ordering of these functions is independent of the adjective to which they are applied (*extremely* > *very* > *quite*, that is, e.g. *extremely* is more informative than *very* etc.; this ordering is also responsible for introducing scalar implicatures; see Horn 1972/1976), but unlike the measures, these degree functions are not limited to dimensional adjectives. The example in (14a) is taken from Bale (2006), the analysis has been adapted from Doetjes et al.:

(14) a. If Esme chooses to marry funny but poor Ben over rich but boring Steve, then there can be only one explanation: Ben must be funnier than Steve is rich.
b. $[\![\textit{more/–er}]\!] = \lambda A\lambda\delta 2\lambda x.\exists\delta 1[(\delta 1(A))(x)\ \&\ \delta 1 >_A \delta 2]$
c. $[\![\textit{than Steve is rich}]\!] = \mathrm{MAX}_{\text{rich}}(\lambda\delta(\delta(rich))(\text{Steve}))$ = a δ such as *very*
d. e.g. if Steve is very rich, Ben has to be extremely funny

In what follows, I will mostly discuss subcomparatives such as the one in (12), for which I will use the term ‘absolute comparison’. I refer the reader to Doetjes et al. and Bale (2006, 2008) for discussion of cases such as (14) (‘relative comparison’).

4. Cross polar anomalies

4.1 Cross polar anomalies and the vague predicate analysis

As Kennedy (1997/1999, 2001) notices, subcomparatives with dimensional adjectives give rise to so called cross polar anomalies. This is illustrated in (15). In (15a) the two adjectives are of the same polarity, and the sentence is fine, while (15b) and (15c) are anomalous:

(15) a. The desk was longer than the table was wide → OK POS-POS
b. ?Alice is taller than Carmen is short → ANOMALY POS-NEG
c. ?Alice is shorter than Carmen is tall → ANOMALY NEG-POS

Kennedy (1997/1999) argues that this is problematic for Klein, as he would predict (15b) and (15c) to be fine, and to have the same meaning as an ordinary comparative without the second adjective (*Alice is taller/shorter than Carmen is*). Kennedy's argument goes like this. Given Klein's definition in (7) above, (15b) would come out as true if Alice is taller than Carmen, as illustrated in (16). The scenario in (16) shows that there exists a *d* such that Alice is in the positive extension of *d*(*tall*), while Carmen is in the negative extension of *d*(*short*), and this is what (16a) requires. As such, the sentence in (15b) is predicted to be fine, contrary to fact. The same holds, *mutatis mutandis*, for (15c).

(16) a. $\exists d[(d(tall))(\text{Alice}) \ \& \ {\sim}(d(short))(\text{Carmen})]$
b. D_{tall} = < *a*, *b*, **Carmen**, *c*, **Alice** >, where Alice is the tallest
D_{short} = < **Alice**, *c*, **Carmen**, *b*, *a* >, where *a* is the shortest
$pos_d(tall)$ = <**Carmen**, *c*, **Alice** >
$neg_d(tall)$ = <*a*, *b*>
$pos_d(short)$ = <*b*, *a* >
$neg_d(short)$ = <**Alice**, *c*, **Carmen** >

Kennedy concludes that cross polar anomaly is an argument in favour of a degree based approach, and more in particular of an approach in which positive and negative degrees are sortally different objects, which prevents them from being compared (see Kennedy 1997/1999, 2001 for details).

However, one could object to this that (16) is only one part of the truth (see Constantinescu et al. 2009). Suppose the positions of Alice and Carmen are swapped, in such a way that Alice has exactly the height Carmen had in the other scenario and vice versa. The same *d* can again be applied, as illustrated in (17):

(17) D_{tall} = < *a*, *b*, **Alice**, *c*, **Carmen** >, where Carmen is the tallest
D_{short} = < **Carmen**, *c*, **Alice**, *b*, *a* >, where *a* is the shortest
$pos_d(tall)$ = < **Alice**, *c*, **Carmen** >
$neg_d(tall)$ = < *a*, *b* >
$pos_d(short)$ = < *b*, *a* >
$neg_d(short)$ = < **Carmen**, *c*, **Alice** >

In this scenario, Carmen is taller than Alice. Yet, only the scenario has been changed: the person we called Alice in the first scenario now is called Carmen and the other way around, which does not affect the degree function. The reason why this is possible is that the degree function in (16a) needs to yields a positive value for (*d*(*tall*)) applied to Alice and a negative value for (*d*(*short*)) applied to Carmen. As (16b) and (17) show, the *d* defined in these examples does so independently of the ordering between Alice and Carmen. As a result, this *d* does not give any information about Alice's height as compared to Carmen's height.

To understand why the *d* in these examples behaves like this, one has to realize that a change in the order of D_{tall} implies the opposite change in the order of D_{short}. If applied to the example in (15b), Klein's formula requires Alice to be in the positive extension of *d*(*tall*) (that is, $pos_d(tall)$) and Carmen in the negative extension of *d*(*short*) ($neg_d(short)$). The latter condition does not exclude that Carmen is in the extension of $pos_d(tall)$ as well. Moreover, the relative order of Carmen and Alice in $pos_d(tall)$ is irrelevant as already indicated above. This means that there is no *d* that determines the relative ordering of Carmen and Alice in either D_{tall} or D_{short}, unless $pos_d(tall)$ is a singleton set. In that case Alice still has to be in $pos_d(tall)$, but this time Carmen cannot be in $pos_d(tall)$ as well. As a result, Carmen needs to be shorter than Alice. The meaning of this *d* would be similar to the meaning of the superlative, as it would require a scenario in which Alice is the tallest person, while Carmen is in the negative extension of *d*(*short*).

At this point, one could argue that Klein's theory does account for the anomaly of (15b): there exist quite a number of relevant degree functions but almost all of them are uninformative. The existence of these uninformative degree functions may be the cause of the anomaly of the sentence.[4]

However, the sentences in (15b,c) are not simply out; they can marginally have a reading similar to the example in (14). A German example discussed by Bierwisch (1989: 105) is given in (18). As Bierwisch notes, this sentence can be marginally interpreted as follows: the difference between Hans' height and the standard for tallness exceeds the difference between Eva's height and the standard for shortness:

(18) Hans is größer als Eva klein ist
'Hans is taller than Eva is short'

The problem is that Klein cannot account for this reading. In this case, too, the effect described above applies. Degree functions that makes [(*d*(*tall*))(Alice) &~(*d*(*short*))(Carmen)] true are uninformative (with one exception as discussed above), as they do not say anything about the relative order between Hans and Eva in terms of their height. If these uninformative *d*s lead to anomaly, (18) should be anomalous under the reading described by Bierwisch as well.

One could conclude that Klein's theory does account for the anomaly of (15b, c): the use of antonyms leads to meaningless comparisons. The problem is rather that sentences such as the ones in (15b, c) are predicted not to be interpretable at all, while in fact they (marginally) have a norm related reading (see Doetjes et al. for discussion). This problem is related to the lack of a restriction on the interpretation of the *than*-clause. The only thing Klein's analysis requires is that the subject of the *than*-clause fall in the negative extension of *d*(*A*), where *A* is the predicate of the *than*-clause. As shown in the previous section, the alternative to Klein presented in Doetjes et al. is more restrictive. In the next two sections it will be argued that this analysis can account for cross polar anomalies.

4.2 Restrictions on adjective combinations in subcomparatives

Before going over to an analysis of cross polar anomalies, it is necessary to look at the data in more detail, as these are more complicated in two respects. In the first place, there also exist cross polar nomalies (the term comes from Büring 2007; the phenomenon is also discussed by Bierwisch 1989). Moreover, comparatives with two negative adjectives are not that good (see Bierwisch 1989). Both facts are unexpected under the proposal made by Kennedy. For him a positive and a negative degree should never be comparable. On the other hand, the comparison of two negative degrees should be unproblematic.

Let us first have a look at cross polar nomalies. These are sentences that have a negative adjective in the main clause, and a positive adjective in the *than*-clause. Moreover, Büring notes that the two adjectives should not be antonyms of one another, as illustrated by the contrast between (19a, b):

(19) a. Unfortunately, the ladder was **shorter** than the house was **high**
b. ?*Unfortunately, the hose is **shorter** than the ladder is **long**

[4] Alternatively, one could argue that this should force the sentence to have the superlative interpretation, this being the only informative interpretation. I will not consider this possibility.

Büring's (2007) analysis of cross polar nomalies is based on the idea that negative adjectives are interpreted as *little+A^{pos}*. Thus, in (19a) the comparative morpheme *–er* applies to *little*, which is a meaning component of the negative adjective *short* (*LITTLE+long*), so that the sentence would have the logical structure in (20a). (19b) is ruled out, not because of a general ban on cross polar comparisons, but because it involves two instances of *tall* as in (20b). The second adjective should be deleted just as in (20c).

(20) a. The ladder is LITTLE-er long than HOW the house is high.
b. Carmen is LITTLE-er tall than HOW Alice is tall
c. Carmen is taller than Alice is (*tall)

Bierwisch also claims that NEG-POS cases are fine, but he also claims that all cases with negative adjectives in the *than*-clause are excluded. The data in (21) are adapted from Bierwisch 1989: 105), and include a measure phrase which blocks the norm related reading discussed for example (18) above:

(21) a. Der Tisch ist 10cm **höher** als er **breit** ist — POS-POS
the table is 10 cm higher than it wide is
b. ?Der Tisch ist 10cm **niedriger** als er **breit** ist — ?NEG-POS
the table is 10 cm lower than it wide is
c. *Der Tisch ist 10cm **niedriger** als er **schmal** ist — *NEG-NEG
the table is 10 cm lower than it narrow is
d. *Der Tisch ist 10cm **höher** als er **schmal** ist — *POS-NEG
the table is 10 cm higher than it narrow is

Note that the judgments given by Bierwisch and Kennedy differ, as the latter argues that there is a contrast between the sentences in (22).

(22) a. Luckily, the ficus turned out to be shorter than the doorway was low
NEG-NEG
b. #Unfortunately, the ficus turned out to be taller than the ceiling was low
*POS-NEG

The discussion of these cases in the literature shows that there is no clear consensus about what data should be explained. DOETJES ET AL. investigated these sentences both on the basis of grammaticality judgments and on the basis of internet searches. The grammaticality judgments (from English and Dutch speakers, both groups behaving in a similar way) appeared to form a continuum: (ordinary comparatives with one A >) POS-POS > NEG-POS > NEG-NEG > POS-NEG. Note that even though there were speakers who preferred NEG-NEG over POS-NEG, there were also speakers who accepted the POS-NEG cases.

Interestingly, the picture that emerged from internet searches turned out to be slightly different. Again, POS-POS cases are by far the easiest to find. NEG-POS cases (Büring's cross polar nomalies) can also be found quite easily, but NEG-NEG cases and POS-NEG cases are extremely hard to find. We did not find any example of a NEG-NEG case either in Dutch or in English.[5] However, there were a few examples of POS-NEG. Most of these examples clearly

[5] Given that only a few (dimensional) adjectives occur in these subcomparatives, it is possible to carry out quite exhaustive internet searches.

had a norm related interpretation (see example (18) above), but three of them seem to be real life examples of the phenomenon we are interested in. The clearest example is given in (23). The sentence is a description of a picture that is called *Narrow Canyon*. As such the context makes it clear that we are dealing with a particularly narrow canyon in this case, and this seems to be what licenses the use of the negative adjective in the *than*-clause. The sentence following the subcomparative describes the contents of the subcomparative in such a way that a norm related reading is unlikely.

(23) This is a part of the canyon where it is deeper than it is narrow. It's something like 1000 ft wide at the top and 1700 ft deep.
[http://www.worldisround.com/articles/12961/photo6.html]

The difference between informants' judgments and internet searches is difficult to understand, and further research is necessary to shed more light on this issue. Given that some speakers accept all types of subcomparatives, it should in principle be possible to derive all types while explaining that some cases are more easily derived than others.

4.3 Measure-based degree functions

Doetjes et al. argue that the degree functions one makes use of in the derivation of subcomparatives with absolute comparison interpretations are based on measures. Following Klein (1982: 120-1), Doetjes et al. assume that a measure in expressions such as *five foot six* in for instance *five foot six tall* is interpreted as a function *h* that partitions the domain into those individuals that measure at least five foot six and those that do not. Measure based degree functions (e.g. *two meters*, *six feet*) are inherently ordered with respect to one another: their ordering is fixed by the independent ordering of the measures they are based on, which in turn is derived from the ordering of the natural numbers. Measures require the use of dimensional adjectives, and as a result this way of deriving a subcomparative is only available for subcomparatives containing two dimensional adjectives. Moreover, these adjectives should correspond to dimensions that are compatible with the same type of measurement (e.g. length and width).

In the literature on numerals, there is quite a lot of discussion on their basic meaning. It has often been claimed that numerals have an *at least*-interpretation, but may require an *exactly*-reading in certain contexts. According to Horn's (1972/1976) 'classical' neo-Gricean analysis, the *exactly*-reading is triggered by a scalar implicature, triggered by Grice's maxim of Quantity ("Make your contribution as informative as is required"). This is illustrated by the – again classical – examples in (24):

(24) a. John has three children and possibly even more/*fewer.
  b. Q: Does John have three children?
    A1: No, he has four.
    A2: Yes, (in fact) he has four

In (24a), the second part of the sentence shows that, at least in this example, the exactly reading behaves like an implicature, as it can be cancelled. In (24b), the choice between the two answers is a matter of pragmatics. According to the contextual clues, the interlocutor will decide whether the first sentence implicates an upper bound or not.[6]

Interestingly, numerals may also obtain an *at most*-reading in a very restricted set of contexts. Horn calls this an instance of scale reversal (Horn 1972/76: 34; see also Sadock 1984, Carston 1988 and Atlas 2005 for discussion of these cases):

(25) a. Arnie is capable of breaking 70 on this course, if not 65/*75
b. U.S. troop strength in Vietnam was down to 66,300 thus exceeding Mr. Nixon's pledge of 69,000 (*L.A. Times*, cited by B. H. Partee)

In the first example, the fact that we are talking about golf ensures that the sentence introduces an asserted upper bound and implicated lower bound. However, as Horn notices, if one takes into account that the scale (or ordering) that is relevant here is negative rather than positive, one could also say that these expressions assert a lower bound on a negative scale of quantifier.[7] That is, given a certain context the informativeness of the numerals can be reversed, resulting in a negative scale.

It has to be noted that the idea of scale reversal is not uncontroversial. As noticed by Sadock (1984), scale reversal is not possible for expressions such as *some* and *all*, which also form a scale. For some reason, *some* cannot mean in any context something like *at most some*. According to Atlas, all three interpretations of numerals (*at least*, *at most* or *exactly*) have the same status: the numeral is non-specific among these interpretations (see Atlas 2005). For the current discussion, it is important that a numeral may have an *at least* or an *at most*-interpretation depending on the context. I will come back to this below.

Turning back to subcomparatives and the interpretation of measure based degree functions, it is clear that only two types of interpretations are compatible with the consistency postulate in (9). Whenever the function applies to a positive adjective, the *at least*-interpretation is the only possible one, and whenever it applies to a negative adjective, the *at most*-reading is required. This is illustrated by the following figures. Figure 2 represents a positive adjective. The bold brackets indicate which individuals would be included under an *at least*-interpretation of the measure. The dotted lines, on the other hand, indicate which individuals would be included under an *at most*-interpretation of the functions. The consistency postulate requires that, whenever an individual is included in δ(*tall*), all individuals that are ordered above this individual should be included in δ(*tall*) as well. As such, the *at least*-interpretation is required. In the context of a negative adjective, however, one needs an *at most*-interpretation, as this time the individual with the smallest length (that is, the highest ordered individual in the set *short*) has to always be included. In figure 3, the dotted brackets are in accordance with the CP and represent the *at most*-interpretation, δ1(*short*) being the set of individuals that measure at most 1m50.

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[6] There is quite some discussion in the literature on the status of the *exactly*-reading. The answer 2 in (24b) is a classical cancellation of an implicature, and as such, it seems true that this reading may be an implicature. However, in other cases the exactly reading seems to correspond to the meaning of the cardinal. As Horn (1992) puts it, "an n-sided figure is one that is semantically constrained to have exactly (not at least) n sides". See Geurts and van der Slik (2005) for a recent overview of this discussion. As the analysis of the *exactly*- reading is not relevant here, I leave this issue aside.

[7] A Horn scale is a set of increasingly informative expressions. Examples are for instance: <some, many, most, all> and <or, and> (cf. Geurts in progress). Because of this increasing informativeness, the lowest ordered expression implies all the others. As a result, the use of a less informative element on the scale implicates that the higher ordered elements cannot be used.

figure 2

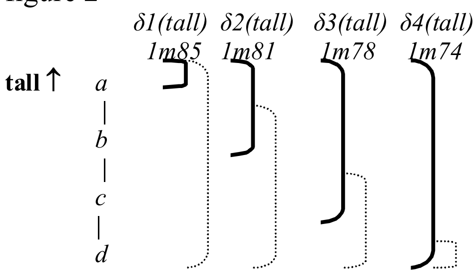
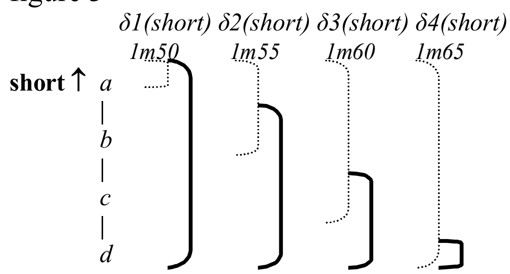


figure 3



bold bracket: *at least/* dotted bracket: *at most*

It is clear that scale reversal is the marked option. Only strong contextual clues will be able to trigger this type of interpretation. Interestingly, negative adjectives seem to be able to trigger a scale reversal. This is illustrated by the contrast in (26).

(26) a. How tall is she? She is 1m75, or even a bit taller than that
b. ?How short is she? She is 1m50, or even a bit shorter than that

Even though a *how*-question with a negative adjective is not as easily available as the corresponding question with a positive adjective, it is clear that, when the measure is used in the answer, scale reversal has applied. In what follows, I assume that, whenever a measure based degree function is used with a negative adjective, scale reversal has applied. A measure based degree function may then be said, in Horn's terms, to assert a lower bound and implicate an upper bound. The ordering direction of the measures depends on context: positive adjectives normally trigger the default positive ordering of the measures, and negative adjectives trigger a reversed ordering.

Let us turn now back to (12) and its derivation in (13d), both repeated in (27):

(27) a. The desk is longer than the table is wide
b. $[\![\textit{longer than the table is wide}]\!]$ =
$\lambda A\lambda\delta 2\lambda x.\exists\delta 1[(\delta 1(A))(x)\ \&\ \delta 1 >_A \delta 2](\mathit{long})$
$\lambda\delta 2\lambda x.\exists\delta 1[(\delta 1(\mathit{long}))(x)\ \&\ \delta 1 >_{long} \delta 2](\mathrm{MAX}_{wide}(\lambda\delta(\delta(\mathit{wide}))(\mathrm{table})))$
$\lambda x.\exists\delta 1[(\delta 1(\mathit{long}))(x)\ \&\ \delta 1 >_{long} \mathrm{MAX}_{wide}(\lambda\delta 2(\delta 2(\mathit{wide}))(\mathrm{table}))]$

This example is straightforward, as the sentence contains two positive adjectives. Let us now consider a case of a cross polar nomaly, as in (28):

(28) a. The desk is **shorter** than the table is **wide**
b. $[\![\textit{shorter than the table is wide}]\!]$ =
$\lambda A\lambda\delta 2\lambda x.\exists\delta 1[(\delta 1(A))(x)\ \&\ \delta 1 >_A \delta 2](\mathit{short})$
$\lambda\delta 2\lambda x.\exists\delta 1[(\delta 1(\mathit{short}))(x)\ \&\ \delta 1 >_{short} \delta 2](\mathrm{MAX}_{wide}(\lambda\delta(\delta(\mathit{wide}))(\mathrm{table})))$
$\lambda x.\exists\delta 1[(\delta 1(\mathit{short}))(x)\ \&\ \delta 1 >_{short} \mathrm{MAX}_{wide}(\lambda\delta 2(\delta 2(\mathit{wide}))(\mathrm{table}))]$

What we see here, is that the comparison between the two measure based degree is based on their interpretation with respect to the adjective in the main clause ($\delta 1 >_A \delta 2$), in this case *short*; as such they both should have an *at most*-type interpretation. On the other hand, $\delta 2$ originates from the *than*-clause, where it is defined with respect to the adjective *wide*, which is a positive adjective, and as such triggers an *at least*-interpretation for the measure. To see what this means, let us assume that we are talking about a table that is 90 centimeters wide. As such $\delta_{90\_centimeters}(wide)$ includes all objects in the domain that are at least 90 centimeters wide. This degree function has to be applied to the negative adjective in the main clause, but recall that a negative adjective triggers a scale reversal. As a result, assertion of the lower bound will correspond to an *at most*-interpretation with respect to the negative adjective in the main clause.

Note that Atlas' (2005) way of accounting for the *at least*- and the *at most*-interpretation would have a similar effect. As indicated above, he treats numerals (and thus measures, which contain numerals) as being nonspecific among their three possible interpretations (*at least n*, *at most n* and *exactly n*). As a result, one single measure based degree function may have the *at most*-interpretation when applied to a positive adjective and the *at least*-interpretation when interpreted with respect to a negative adjective, and this is what is needed for the analysis of cross-polar nomalies

This analysis offers an alternative to Büring's account of cross polar nomalies, and also accounts for the fact that cross polar nomalies are more marked than ordinary subcomparatives featuring two positive adjectives, as both grammaticality judgments and corpus searches suggest.

So far, the less controversial data have been considered. One may object at this point that the possibility of scale reversal predicts all logical combinations to be equally possible. This is not in accordance with the data, as negative adjectives in *than*-clauses seem to be much less easily acceptable than negative adjectives in main clauses. In other words, at this point we need to account for the difference between NEG-POS and POS-NEG/ NEG-NEG. Before going over to an analysis of these issues, one can observe that the difference in acceptability between the two types of sentences is correlated with two other differences. In the first place, only when a negative adjective is used in the *than*-clause does it introduce the presupposition that A holds of its subject, as illustrated in (29):

(29) a. The canyon is deeper than it is narrow $\rightarrow$ the canyon is narrow POS-NEG
b. Unfortunately, the ladder was shorter than the house was high
$\not\rightarrow$ the ladder was short NEG-POS

In the second place, only a negative adjective in the *than*-clause may be replaced by its positive counterpart without changing the truth conditions of the sentence, as illustrated by the contrast in (30):

(30) a. The canyon is deeper than it is narrow/wide
b. The ladder was shorter/longer than the house was high

The necessarily evaluative reading of examples such as (23) might well be related to the lack of a neutral interpretation in equatives with negative adjectives (*as short*). According to Rett (2008), the difference between *as tall* (which can be neutral or evaluative) and *as short* (only evaluative) follows from blocking. In principle, the negative and the positive adjective have both a non neutral or evaluative reading and a neutral reading. However, under the neutral readings of the adjectives the two equative forms have the same meaning.[8] As a result, the

[8] Note that this is not completely true. The meaning of the two forms would not be exactly the same, given that some form of scale reversal applies in this case as well: while *as* in *as tall* has an *at least*-interpretation, *as* in *as short* gets an *at most*-interpretation. Even though this is clearly a problem for Rett, I leave this issue here, as the idea behind her approach (the neutral 'equal length'-reading blocks the use of a negative adjective) seems to be intuitively right. Moreover, this does not apply to the subcomparatives that are treated here, as the use of either adjective in (30a), given a neutral interpretation of the adjectives, would result in an identical meaning.

neutral reading of *short* in *as short* is blocked and only the non neutral or evaluative reading remains. This same mechanism can account for the lack of a non neutral reading for negative adjectives in the *than*-clause, while predicting the contrast between the sentences in (30). A negative adjective in the main clause is predicted to still have a neutral reading, as it cannot be replaced by its positive counterpart without changing the truth conditions of the sentence rather drastically. As such, no blocking effect is expected in this case.

Whereas this accounts for the fact that sentences with negative adjectives in the *than*-clause trigger an evaluative interpretation of the adjective, this does not account for the reduced acceptability of POS-NEG and NEG-NEG sentences. More in particular, one would like to know why there is a contrast between *as short* and subcomparatives with a negative adjective in the *than*-clause: whereas *as short* is perfectly grammatical, subcomparatives with a negative adjective in the *than*-clause have a reduced acceptability. The reason for the contrast may be related to another contrast between equatives and adjectives modified by measures. It is clear that *as short* as well as *as tall* may have an evaluative reading for the adjective. This is for instance illustrated by the fact that *as* is compatible with a *for*-clause, which explicitly introduces a comparison class, and which triggers an evaluative meaning. This is illustrated in (31), a sentence taken from one of the *Tales from "Blackwood"* (see also Bale 2006):

(31) Captain Gifford is as tall for a man as his wife is for a woman

If a measure is used with a positive adjective, the use of a *for*-phrase is not allowed, as shown in (32a). Moreover, the combination of a measure with a negative adjective is strongly disfavoured, as illustrated in (32b). The two examples in (32) do not have exactly the same status, for reasons that I do not understand at this point. The example in (32b) seems to be better than the one in (32). If one is forced to interpret this sentence, only the evaluative interpretation is available: the sentence presupposes that John is short.

(32) a. *Captain Gifford is 1m95 tall for a man
b. #John is 1m50 short

This suggests that the dimensional adjectives cannot (or not easily) receive an evaluative interpretation.[9] Turning back to cases such as *as short*, the use of the equative is unproblematic because there are two readings readily available, only one of which is blocked. On the other hand, if measures are disfavoured in combination with an evaluative interpretation of the adjective, as the examples in (32) strongly suggest, there is no fully acceptable alternative to the blocked reading in examples involving a measure and a negative adjective.

The effect obtained in (32b) is similar to the effect in subcomparatives with negative adjectives in the *than*-clause, and seems to be related to the incompatibility of a measure and the evaluative interpretation of the adjective. A blocking analysis of the neutral reading can account for the contrast between the two examples in (30). The neutral reading is reserved to

[9] The source of this effect (and of the contrast between (32a,b)) is not completely clear to me, even though it seems plausible that the preciseness of the measure is incompatible with the context dependency of the evaluative interpretation of the adjective. It might be, as Louise McNally suggested, that dimensional adjectives that do combine with measures simply have a different type (see also Schwarzschild 2005). This suggestion has a number of advantages but also disadvantages. More in particular, certain expressions such as the comparative may combine with both the neutral and the evaluative version of the adjective, which is most easily accounted for under the assumption that an adjective with an evaluative interpretation and an adjective with a neutral interpretation are of the same type. I leave this as an issue for further research.

positive adjectives, and to those negative adjectives that cannot be replaced by the corresponding positive adjective without altering the meaning of the sentence. This explains why neutral readings do occur for a negative adjective in the main clause of (sub)comparatives, as in (30b), but not for a negative adjective that is used in the *than*-clause, as illustrated in (30a). This triggers an evaluative reading for negative adjectives in the *than*-clause, but given the anomaly of the combination of the evaluative interpretation of the adjective and a measure, as illustrated in (32), the sentences are degraded.

A final point to discuss here is the difference between POS-NEG and NEG-NEG. As I already indicated, the data are rather difficult to interpret (more in particular corpus data do not confirm the preferences reported by informants). Yet it is clear that some speakers report a preference for the NEG-NEG cases, and it would be interesting to see how this could be accounted for. A possible source for the preference might be the fact that the measure in POS-NEG cases is interpreted differently with respect to the positive and to the negative adjective. It is quite plausible that this has an effect on the processing load of the sentence. A similar effect on processing load has been reported by Geurts and van der Slik (2005), who argue that sentences containing both upward and downward entailing quantifiers are more difficult to process than sentences with upward entailing quantifiers only. This affects both sentences of the POS-NEG-type and sentences of the NEG-POS-type. The latter have an important advantage over the former, though, as the use of the negative adjective rather than a positive one is truth conditionally relevant and as such does not trigger an independently disfavoured evaluative interpretation of the negative adjective.

An important advantage of looking at the data in this way, is that different factors influence the grammaticality of the sentences. As such, the fact that people may have different judgements can be accounted for. It might even be that certain factors are more important to certain speakers than to others. At this point these remarks are rather speculative given the fact that the data should be investigated in more detail. However, the approach that is taken here makes it possible to account for a number of patterns, and to make predictions about what patterns may occur.

5. Conclusions

In this paper I adopted a revised version of Klein's degree-less approach to comparatives, based on Doetjes et al. (forthcoming). This approach, which makes use of a comparison of degree functions, inherits certain advantages of degree-based approaches such as the prediction of the existence of an operator-variable structure in *than*-clauses. I have argued that this approach can account for the use of polar opposites and negative adjectives in subcomparatives with an absolute comparison reading (cross polar (a)nomalies, see in particular Bierwisch 1989, Kennedy 1997/1999, 2001 and Büring 2007).

The subcomparatives discussed in this paper are subject to gradient acceptability judgments. The proposal by Doetjes et al. makes it possible to account for this variability and to connect it to various independent phenomena, such as the interpretation of numerals and the incompatibility of evaluative readings and measures.

Leiden University Centre for Linguistics
PO Box 9515
2300 RA Leiden
The Netherlands

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