Dimensions of Comparison

Peter Alrenga (palrenga@uchicago.edu)
University of Chicago

1 Introduction

Previous research on English comparatives has focused almost exclusively on "scalar comparatives" headed by *more*/*–er*, *less*, and (equative) *as*.

(1) a. The plant is taller than the door is.
b. Harry is less intelligent than I expected him to be.
c. Mary is as pretty as she's always been.

Comparatives headed by *same* and *different* constitute a relatively understudied class of constructions (though see Heim 1985 and Moltmann to appear).

(2) a. Barry is different than his sister is.
b. (In those respects,) Barry is the same as his sister is.

- whereas (2a) asserts the presence of some dissimilarity between Barry and the speaker, (2b) asserts that the two individuals are similar in all relevant respects

1.1 Two kinds of comparatives compared

"Similarity comparatives" display many of the hallmark grammatical properties of scalar comparatives:

A. The two allow for (nearly) the same range of complementation possibilities.

(3) a. Mary is as tall as John.
b. Mary is as tall as John used to be.
c. Paul's voice sounds better than it did (sound) before.
d. Chris is much taller than I had previously suspected (that he was).

(4) a. I feel the same as you.
b. I feel the same as you used to feel.
c. Paul's voice sounds different than it did (sound) before.
d. The book turned out much differently than I had thought (that it would turn out).

- uniform island-sensitivity of gap in clausal complements

(5) *Chris is taller than I wonder whether Bill is __ .

(6) *College is different than I wondered whether it would be __ .

B. The same sorts of measure phrases and adverbial modifiers occur in both constructions (Bresnan 1973, Huddleston and Pullum 2002; see also Corver 1997, Doetjes 1996).

- *more*/*–er*, *less*, and *different* occur with such measure phrases as *much*, *a lot*, *no*, (NPI) *any*, and *little* (unlike most simple gradable adjectives)

(7) a. Chris is {much, a lot} less happy than I expected him to be.
b. I'm {no, not any} more intelligent now than I was before.
c. The race takes place on a strip that in some places is little wider than an old-fashioned, two-lane U.S. highway.
(cf. **Chris is much happy*; **I'm no intelligent*; and **The racetrack is little wide*)

(8) a. My leadership role will be {much, a lot, a great deal} different than it was last year.
b. I'm {no, not any} different than I used to be.
c. Many professing Christians are practicing shameful lifestyles that are little different than those of unbelievers.

- *as* and *same* occur with such modifiers as *nearly*, *almost*, *roughly*, and *exactly*

(9) Chris is {nearly, almost, roughly, exactly} as tall as I expected him to be.

(10) She looks {nearly, almost, roughly, exactly} the same as her twin sister.

C. Both are sensitive to the presence of negation and other negative quantifiers in their clausal complements (the so-called "negative island effect"; see Rullmann 1995).

(11) Chris is as intelligent as he {claimed, *didn't claim} to be.

(12) I feel the same as I {always, *never} have.

D. Both give rise to *de re* / *de dicto* ambiguities when they occur in intensional contexts (Russell 1905, Postal 1974).

(13) George thinks that your yacht is longer than it is.

- mistaken reading: George possesses an incorrect belief about your yacht
- contradictory reading: George's belief is one that can never be true

(14) Mary thinks that John sounded different than he did.

- mistaken reading: Mary possesses an incorrect belief about John's voice
- contradictory reading: Mary's belief is one that can never be true

Question: why are similarity comparatives in fact comparative constructions?

- a semantic analysis of similarity comparatives should to the greatest extent possible integrate their semantics with the semantics of scalar comparatives
- such an approach can shed light on the numerous parallels between the two sorts of comparative constructions, ultimately leading to an improved understanding of the notional grammatical category "the comparative"

Claim: the connection between the two kinds of comparatives lies in the role played by "dimensions of comparison" in their semantic analysis.

- a dimension of comparison represents the range of values for some potentially distinctive attribute, such as height, color, shape, or emotional disposition
- both scalar comparatives and similarity comparatives are ultimately concerned with the relative locations of individuals along such dimensions

1.2 Similarity vs. identity interpretations for same *and* different

Alongside their similarity uses, *same* and *different* may also head "identity comparatives".

(15) a. The medicines used to treat malaria today are (a lot) different than they were fifty years ago.
b. The medicines used to treat malaria today are (almost) the same as they were fifty years ago.

- although (15a) and (15b) may be read as similarity comparatives, their most salient readings are concerned with (non-)identity amongst pluralities
- whereas (15a) asserts that the set consisting of current malaria medicines differs (significantly) in its membership from the set consisting of malaria medicines from fifty years ago, (15b) asserts that the two sets of medicines are (almost) identical in their membership

Question: how do the quintessential identity predicates *same* and *different* come to express similarity?

Claim: identity/similarity alternations for *same* and *different* are best viewed as cases of polysemy.

- *same* and *different* possess distinct, but closely related, meanings across their two guises, with the variation localized to the domains in which they operate
- the semantic operations performed by *same* and *different*, as well as the gross logical structure of the comparatives that they head, remain constant

2 Dimensions in the semantics of scalar comparatives

2.1 The semantic analysis of gradable predicates

Foundational assumptions of degree-/interval-based approaches to gradability and scalar comparison (Seuren 1973; Cresswell 1976; Hellan 1981; von Stechow 1984a; Heim 1985, 2000; Bierwisch 1989; Rullmann 1995; Kennedy 1999; Rotstein and Winter 2004; Kennedy and McNally 2005; amongst many others):

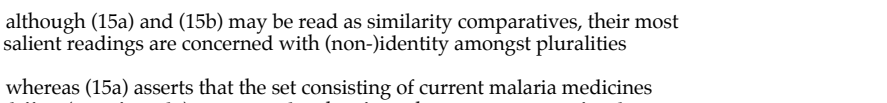
- gradable predicates (e.g., *tall*, *heavy*, *old*) locate individuals in their domains along quantitative dimensions (e.g., height, weight, age)
- a quantitative dimension is formalized as a linearly ordered set of points, or "degrees"; the resulting structure $(D_d, >)$ constitutes a "scale" (D_d is the domain of degrees, which are of type d)

(16) o——— d_i ——— d_j ——— d_k———> $(D_d, >)$

- gradable predicates denote relations between individuals and scalar intervals (convex subsets of D_d)
(for analyses that take interval-level denotations for gradable predicates as (sometimes) basic, see Seuren 1978, 1984; von Stechow 1984b, Kennedy 1999: Chap. 4, 2001; and Schwarzschild 2005)

(17) $\textbf{\textit{tall}} = \lambda I_{dt}.\lambda x_e.\ \{d \in D_d\text{: } HEIGHT(x) \geq d\} = I$

- *HEIGHT* in (18) maps an individual x to the degree of x's height

(18)


- gradable antonyms relate individuals to complementary (positive vs. negative) intervals along the same scale (ibid.; see also Heim 2002, 2006, and Büring 2007a,b)

(19) $\textbf{\textit{short}} = \lambda I_{dt}.\lambda x_e.\ \{d \in D_d\text{: } HEIGHT(x) < d\} = I$

(20)

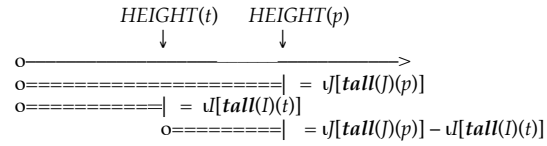

2.2 The semantic analysis of scalar comparatives

Scalar comparatives are concerned with the relative locations of individuals along the dimension contributed by the gradable predicate:

- the measure phrases in (21) measure the difference between the plant and the table along the height dimension

(21) a. The plant is {much, little, no} taller than the table is.
b. The table is {much, a lot, no} less tall than the plant is.

- this difference corresponds $\iota J[\textbf{\textit{tall}}(J)(p)] - \iota I[\textbf{\textit{tall}}(I)(t)]$, i.e., the set difference between the intervals corresponding to the plant's tallness and the table's tallness (this set difference is itself a scalar interval)

(22)


$= \iota J[\textbf{\textit{tall}}(J)(p)]$

$= \iota I[\textbf{\textit{tall}}(I)(t)]$

$= \iota J[\textbf{\textit{tall}}(J)(p)] - \iota I[\textbf{\textit{tall}}(I)(t)]$

More/*–er* and *less* denote three-place relations amongst intervals.

(23) a. $\textbf{\textit{more}} = \lambda I_{dt}.\lambda J_{dt}.\lambda K_{dt}.\ J - I = K$
(if I and J are both positive or negative, then $J - I \neq \varnothing$ iff $J \supset I$)
b. $\textbf{\textit{less}} = \lambda I_{dt}.\lambda J_{dt}.\lambda K_{dt}.\ I - J = K$
(if I and J are both positive or negative, then $I - J \neq \varnothing$ iff $I \supset J$)

- the clausal complement is interpreted as a definite description over intervals, providing the first argument I

(24) than $[_{CP}\ Op_i$ the table is t_i ~~tall~~$] \mapsto \iota I[\textbf{\textit{tall}}(I)(t)]$

- the second argument J is provided by the matrix clause, which occurs within the logical scope of *more*/*–er* and *less*; it too is interpreted as a definite description over intervals

(25) $[[$–er than $[_{CP}\ Op_i$ the table is t_i ~~tall~~$]]_j$ [The plant is t_j tall]$] \mapsto$
$\textbf{\textit{more}}(\iota I[\textbf{\textit{tall}}(I)(t)])(\iota J[\textbf{\textit{tall}}(J)(p)])$

- the third argument K is the set difference J–I (or I–J, for *less*), i.e., the difference between the compared individuals along the relevant dimension

Measure phrases like *much*, *little*, and *no* are predicates of scalar intervals, with denotations of type $\langle dt,t\rangle$ (McConnell-Ginet 1973, Schwarzschild 2005; see also Schwarzschild and Wilkinson 2002, Winter 2005).[1]

(26) a. $\textbf{\textit{much}} = \lambda I_{dt}.\ I$ is sufficiently large
b. $\textbf{\textit{little}} = \lambda I_{dt}.\ I$ is sufficiently small
c. $\textbf{\textit{no}} = \lambda I_{dt}.\ I = \varnothing$

(27) a. The plant is much taller than the table is.
b. $\textbf{\textit{much}}(\iota K[\textbf{\textit{more}}(\iota I[\textbf{\textit{tall}}(I)(t)])(\iota J[\textbf{\textit{tall}}(J)(p)])(K)])$
c. $\iota K[\iota J[\textbf{\textit{tall}}(J)(p)] - \iota I[\textbf{\textit{tall}}(I)(t)] = K]$ is sufficiently large

(28) a. The table is much less tall than the plant is.
b. $\textbf{\textit{much}}(\iota K[\textbf{\textit{less}}(\iota I[\textbf{\textit{tall}}(I)(p)])(\iota J[\textbf{\textit{tall}}(J)(t)])(K)])$
c. $\iota K[\iota J[\textbf{\textit{tall}}(J)(p)] - \iota I[\textbf{\textit{tall}}(I)(t)] = K]$ is sufficiently large

- both (27a) and (28a) are true iff the difference between the plant and the table along the height dimension is sufficiently large

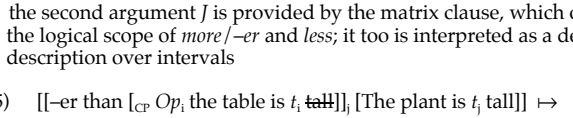
As (under its 'exactly'-construal) denotes the identity relation amongst intervals.[2]

(29) $\textbf{\textit{as}}_{\text{exactly}} = \lambda I_{dt}.\lambda J_{dt}.\ J - I = I - J = \varnothing$
($I = J$ iff $J - I = I - J = \varnothing$)

- the arguments I and J are respectively provided by the equative clause and the main clause (both are interpreted as definite descriptions over intervals)

(30) a. The plant is (exactly) as tall as the table is.
b. $\textbf{\textit{as}}_{\text{exactly}}(\iota I[\textbf{\textit{tall}}(I)(t)])(\iota J[\textbf{\textit{tall}}(J)(p)])$
c. $\iota J[\textbf{\textit{tall}}(J)(p)] - \iota I[\textbf{\textit{tall}}(I)(t)] = \iota I[\textbf{\textit{tall}}(I)(t)] - \iota J[\textbf{\textit{tall}}(J)(p)] = \varnothing$

- (30a) is true just in case the plant coincides with the table along the height dimension, i.e., there is no difference between them

(31)


$= \iota J[\textbf{\textit{tall}}(J)(p)]$

$= \iota I[\textbf{\textit{tall}}(I)(t)]$

[1] Comparatives lacking an overt measure phrase may be interpreted with the silent measure phrase $\textbf{\textit{some}}$ (see Schwarzschild and Wilkinson 2002).

[2] The 'at least'-construal of *as* is captured by (i).

(i) $\textbf{\textit{as}}_{\text{at-least}} = \lambda I_{dt}.\lambda J_{dt}.\ I - J = \varnothing$

Of the two construals, the 'at least'-construal is often taken to be basic, with the 'exactly'-construal derived via pragmatic strengthening. But see also recent challenges to this neo-Gricean picture for numerals, e.g., Horn 1992, Guerts 1998.

2.3 Multidimensionality and incommensurability

What accounts for the following contrasts amongst "subdeletion" complements?

(32) The doorway is taller than it is wide.

(33) #The doorway is taller than it is {heavy, old, expensive}.

- informally, heights and widths are ultimately the same sorts of degrees (degrees of spatial extent), but heights and (e.g.) costs are fundamentally different sorts of degrees
- formally, a sortal distinction amongst degrees of spatial extent and (e.g.) degrees of cost is required: D_d is composed of pairwise disjoint sortal subclasses, each with its own linear order (Heim 2002)

(34) $D_d := SPAT\_EXT \cup WEIGHT \cup AGE \cup COST \ldots$

- D_d encompasses numerous distinct scales, and so is "multidimensional"

(35)
o———— d_i ———— d_j ———— d_k————> ($SPAT\_EXT, >_{SPAT\_EXT}$)
o———— d_l ———— d_m ———— d_n————> ($WEIGHT, >_{WEIGHT}$)
o———— d_o ———— d_p ———— d_q————> ($AGE, >_{AGE}$)
o———— d_r ———— d_s ———— d_t————> ($COST, >_{COST}$)

- different adjectives may locate the individuals in their domain along different scales (e.g., *tall* vs. *expensive*), though it is possible that two adjectives may be associated with the same scale (e.g., *tall* vs. *wide*)

(36) a. $\textbf{\textit{tall}} = \lambda I_{dt}.\lambda x_e.\ \{d \in SPAT\_EXT: HEIGHT(x) \geq d\} = I$
b. $\textbf{\textit{wide}} = \lambda I_{dt}.\lambda x_e.\ \{d \in SPAT\_EXT: WIDTH(x) \geq d\} = I$

(37) $\textbf{\textit{heavy}} = \lambda I_{dt}.\lambda x_e.\ \{d \in WEIGHT: WEIGHT(x) \geq d\} = I$

(38) $\textbf{\textit{old}} = \lambda I_{dt}.\lambda x_e.\ \{d \in AGE: AGE(x) \geq d\} = I$

(39) $\textbf{\textit{expensive}} = \lambda I_{dt}.\lambda x_e.\ \{d \in COST: COST(x) \geq d\} = I$

- *more*/*–er* (and also *less*, *as*) is subject to a felicity condition, requiring that its interval arguments I and J be commensurable[3]

(40) $\textbf{\textit{more}} = \lambda I_{dt}.\lambda J_{dt}: J \supset I$ or $I \supset J$ or $J = I$.$\lambda K_{dt}.\ J - I = K$

[3] Alternatively, (33) can be ruled out by a non-triviality filter on comparative constructions, since such comparisons will always be tautologous or contradictory (depending on one's choice of measure phrase; on non-triviality filters, see Barwise and Cooper 1981; von Fintel 1993; Gajewski 2002, 2008; and Winter 2005).

2.4 Section summary

The picture that emerges:

- gradable predicates locate individuals in their domains along quantitative dimensions (formalized as linearly ordered sets of degrees, or scales)
- gradable predicates denote relations between individuals and scalar intervals
- scalar comparatives are concerned with the relative locations of individuals along the dimension contributed by the gradable predicate, with the difference between two locations represented by their set difference(s)
- the domain of degrees D_d is multidimensional: different adjectives may locate the individuals in their domains along different scales

3 Multidimensionality in the semantics of similarity comparatives

3.1 On the role (and source) of dimensions in similarity comparatives

Claim: dimensions of comparison are also relevant to the interpretation of similarity comparatives.

- this deeper semantic affinity ultimately underlies the numerous grammatical affinities between scalar comparatives and similarity comparatives

In what sense does the semantics of similarity comparatives involve dimensions?

- a dimension of comparison represents the range of values for some potentially distinctive attribute
- some dimensions, e.g., spatial extent, weight, and age, are fundamentally quantitative: change along such dimensions correspond to an increase or decrease amongst their constitutive values
- other dimensions, e.g., color, shape, and emotional disposition, are fundamentally qualitative: change along such dimensions corresponds to variation in the content of their constitutive values, but not to an increase or decrease amongst them
- a judgement of (dis)similarity between two individuals should be viewed as a judgement of how these individuals differ along various dimensions of comparison, both quantitative and qualitative

Question: how do dimensions of comparison actually enter into the interpretation of similarity comparatives?

- in scalar comparatives, the dimension is specified grammatically by the gradable predicate

(41) a. Cheese is more expensive now than it used to be.
b. I'm as tall now as I was when I was in college.

- in contrast, similarity comparative heads do not combine with any expressions that would serve to introduce a dimension of comparison

(42) a. Barry is (*strong) different (*strong) now than he used to be.
b. John is the (*intelligent) same (*intelligent) as I imagined he would be.

- a related difference: only scalar comparatives permit subdeletion complements, in which a gradable predicate appears overtly

(43) The table is as long as it is wide.

(44) a. Deuteronomy is different than the other books are (*interesting).
b. This place is the same as it was (*beautiful) a half century ago.

Assumption: similarity comparatives are interpreted relative to a constant relation R of type $\langle dt, et \rangle$.

- R is the same type as the denotations of gradable predicates, and is likewise responsible for introducing the dimension(s) of comparison into the interpretation of similarity comparatives

Question: how can the multidimensionality of similarity comparatives be accounted for?

- a typical judgement of (dis)similarity will encompass numerous dimensions along which individuals may differ

(45) a. In all relevant respects, this place is the same as it was before.
b. My new car is a lot different than my old one was: it looks different, it drives differently, and it costs more money.

Assumption: the relation R which introduces dimensions into the interpretation of similarity comparatives is sortally nonspecific.

- for each dimension represented in D_d along which x can be located, $\cup I[R(I)(x)]$ will include the (sortally specific) subset of D_d that corresponds to x's location along that dimension ($\cup I[R(I)(x)]$ will itself be a subset of D_d)

- the set $\cup I[R(I)(x)]$ at once represents x's location along every applicable dimension, and so corresponds to x's "multidimensional location"

Question: how can qualitative dimensions, e.g., color, be represented formally?

- quantitative dimensions were formalized as scales (linearly ordered sortal subclasses of D_d)

- the locations along them were construed as (positive or negative) scalar intervals (convex subsets of the relevant sortal subclass), which are themselves ordered by the set-inclusion relation '$\supset$'

- for any two distinct locations I and J (both positive or negative) along a quantitative dimension, the difference between them is either the set difference $I - J$ (if $I \supset J$) or $J - I$ (if $J \supset I$)

Assumption: Alongside the linearly ordered sortal sublcasses of D_d, which correspond to quantitative dimensions, there reside in D_d sortal subclasses over which no ordering is defined. These subclasses correspond to qualitative dimensions.

- locations along qualitative dimensions will also be construed as subsets of the relevant sortal subclass; however, these locations will not in general be ordered by the set-inclusion relation '$\supset$'

- locations along qualitative dimensions will in general overlap one another

- the difference between any two distinct locations I and J along a qualitative dimension can then be represented in terms of their distinctive (non-overlapping) members, i.e., the set differences $I - J$ and $J - I$

- such an understanding of qualitative dimensions can be found in feature matching approaches to the psychology of similarity judgements (see, e.g., the proposals of Tversky (1977) and Gati and Tversky (1982) to represent qualitative dimensions as chains of overlapping sets; see also Restle's (1959) linear arrays)

- (note: "degree" is now a misnomer for D_d, perhaps "dimension" is more appropriate?)

3.2 The semantic analysis of similarity comparatives

Similarity comparatives are also concerned with the relative locations of individuals along various dimensions of comparison:

- the measure phrases in (46) measure the overall difference between Barry and his sister along the various dimensions supplied by R (a dissimilarity measure)

(46) Barry is {much, little, no} different than his sister is.

- this overall difference depends upon $\iota I[R(I)(s)] - \iota I[R(I)(b)]$ and $\iota I[R(I)(b)] - \iota I[R(I)(s)]$, i.e., the set differences between the "multidimensional" locations of Barry and his sister

The similarity comparative head *different* denotes a three-place relation:

(47) $\textbf{\textit{different}} = \lambda P_{<<dt,et>,dt>}.\lambda Q_{<<dt,et>,dt>}.\lambda K_{dt}.\ \mu_{DIS}(P(R) - Q(R)\ ,\ Q(R) - P(R)) = K$

- the clausal complement is interpreted as a function from relations of type $<dt, et>$ (the type denoted by gradable adjectives, as well as the type of R) to subsets of D_d, providing the first argument P (see Kennedy 1999: sect. 2.4.2.3 for the semantics of Op in (48))

(48) than $[_{CP}\ Op_i$ I am $t_i] \ \mapsto\ \lambda G_{<dt,et>}.\iota I_{dt}[G(I)(s)]$

- the second argument Q is provided by the matrix clause, which occurs within the logical scope of *different* and *same*; it receives an analogous interpretation

(49) [[different than $[_{CP}\ Op_i$ his sister is $t_i]]_j$ [Barry is t_j]] $\mapsto$
$\textbf{\textit{different}}(\lambda G_{<dt,et>}.\iota I_{dt}[G(I)(s)])(\lambda G_{<dt,et>}.\iota J_{dt}[G(J)(b)])$

- the third argument K is the (positive) scalar interval returned by μ_{DIS}, which applies to the set differences $P(R) - Q(R)$ and $Q(R) - P(R)$ to yield the overall difference/dissimilarity between the compared individuals (here again, compare to the feature matching model of similarity explored in Sattath and Tversky 1977, Tversky 1977, and Gati and Tversky 1982)

(50) a. Barry is much different than his sister is.
b. $\textbf{\textit{much}}(\iota K[\textbf{\textit{different}}(\lambda G.\iota I[G(I)(s)])(\lambda G.\iota J[G(J)(b)])(K)])$
c. $\iota K[\mu_{DIS}(S - B\ ,\ B - S) = K]$ is sufficiently large,
where $S = [\lambda G.\iota I[G(I)(s)]](R)$
$= \iota I[R(I)(s)]$
and $B = [\lambda G.\iota J[G(J)(b)]](R)$
$= \iota J[R(J)(b)]$

- (50a) is true iff the overall difference/dissimilarity between Barry and his sister along the various dimensions supplied by R is sufficiently large

The similarity comparative head *same* denotes a two-place relation[4]:

(51) $\textbf{\textit{same}} = \lambda P_{<<dt,et>,dt>}.\lambda Q_{<<dt,et>,dt>}.\ \mu_{DIS}(P(R) - Q(R)\ ,\ Q(R) - P(R)) = \varnothing$

- the arguments P and Q are respectively provided by the equative clause and the main clause (both are interpreted as functions from relations of type $<dt, et>$ to subsets of D_d)

(52) a. Barry is the same as his sister is.
b. $\textbf{\textit{same}}(\lambda G.\iota I[G(I)(s)])(\lambda G.\iota J[G(J)(b)])$
c. $\mu_{DIS}(S - B\ ,\ B - S) = \varnothing$,
where $S = [\lambda G.\iota I[G(I)(s)]](R)$
$= \iota I[R(I)(s)]$
and $B = [\lambda G.\iota J[G(J)(b)]](R)$
$= \iota J[R(J)(b)]$

- (52a) is true iff there is no measurable difference/dissimilarity between Barry and his sister along the various dimensions supplied by R

- in conjunction with our earlier treatment of the measure phrase *no* (cf. (26c)), (51) predicts the logical equivalence of *same* and *no different*

(53) a. Barry is the same as his sister is. $\Leftrightarrow$
b. Barry is no different than his sister is.

3.3 Section summary

Similarity comparatives emerge as the more general form of comparison:

- scalar comparatives in turn consitute a specialized form of comparison, one which is restricted to occur within a single, quantitative dimension

- this restriction underlies the simpler treatment of measure phrases occurring in scalar comparatives: since the difference between two locations along a quantitative dimension simply is a scalar interval, measure phrases may be predicated of them directly

- measurements of (dis)similarity, on the other hand, must be mediated by the measure function μ_{DIS} that figures in the denotations of *same* and *different*

- the restriction to quantitative dimensions also underlies the bifurcation of *different* into *more* and *less* in scalar comparatives

[4] Note that this treatment of *same* leaves no room for the definite article *the* in the semantic interpretation of (52a). I do not yet understand why the definite article should appear here, in the absence of any (overt) nominal head following *same*.

4 Similarity, identity, and polysemous *same* and *different*

4.1 The semantic analysis of identity comparatives

Recall that *same* and *different* may also head identity comparatives:

(54) a. The medicines used to treat malaria today are (much) different than they were fifty years ago.
b. The medicines used to treat malaria today are (almost) the same as they were fifty years ago.

- whereas (54a) asserts that the set consisting of current malaria medicines differs (significantly) in its membership from the set consisting of malaria medicines from fifty years ago, (54b) asserts that the two sets of medicines are (almost) identical in their membership

Suggested denotations for *same* and *different* as identity comparative heads:

(55) $\textbf{\textit{different}}_{\text{ID}} = \lambda P_{<<et,et>,et>}.\lambda Q_{<<et,et>,et>}.\lambda K_{dt}.\ \mu_{||}(P(R_{AT})\text{–}Q(R_{AT})\ ,\ Q(R_{AT})\text{–}P(R_{AT})) = K$

(56) $\textbf{\textit{same}}_{\text{ID}} = \lambda P_{<<et,et>,et>}.\lambda Q_{<<et,et>,et>}.\ \mu_{||}(P(R_{AT})\text{–}Q(R_{AT})\ ,\ Q(R_{AT})\text{–}P(R_{AT})) = \varnothing$

Observe that these denotations are almost identical to those given previously for *same* and *different* as similarity comparative heads!

(57) $\textbf{\textit{different}} = \lambda P_{<<dt,et>,dt>}.\lambda Q_{<<dt,et>,dt>}.\lambda K_{dt}.\ \mu_{DIS}(P(R)\text{–}Q(R)\ ,\ Q(R)\text{–}P(R)) = K$

(58) $\textbf{\textit{same}} = \lambda P_{<<dt,et>,dt>}.\lambda Q_{<<dt,et>,dt>}.\ \mu_{DIS}(P(R)\text{–}Q(R)\ ,\ Q(R)\text{–}P(R)) = \varnothing$

Where the differences lie:

- the relation R_{AT} relative to which identity *same* and *different* are interpreted is a relation between individuals and subsets of D_e (type <*et*,*et*>), whereas the relation R relative to which similarity *same* and *different* are interpreted is a relation between individuals and subsets of D_d (type <*dt*,*et*>)

- specifically, R_{AT} relates an individual y (atomic or plural) to the set X consisting of y's atomic parts (see Heim 1985: 23 for a related proposal)

(59) $R_{AT} = \lambda X_{et}.\lambda y_{e}.\ \forall z[(z \leq y\ \&\ \forall x[x \leq z \rightarrow x = z]) \leftrightarrow z \in X]$

- the denotations for identity *same* and *different* incorporate the measure function $\mu_{||}$, which is a function from two sets of individuals to positive intervals that satisifes the following conditions ($\mu_{||}$ is monotonic on the cardinality of the union of its arguments)

(60) a. $\mu_{||}(A\ ,\ B) = \varnothing$ iff $|A \cup B| = \varnothing$
b. $\mu_{||}(A\ ,\ B) \supseteq \mu(C\ ,\ D)$ iff $|A \cup B| \geq |C \cup D|$

(61) a. The medicines used to treat malaria today are much different than they were fifty years ago.
b. $\textbf{\textit{much}}(\iota K[\textbf{\textit{different}}_{\text{ID}}(\lambda G.\iota I[G(I)(f)])(\lambda G.\iota J[G(J)(t)])(K)])$
c. $\iota K[\mu_{||}(F - T\ ,\ T - F) = K]$ is sufficiently large,
where f is the plural individual consisting of the medicines used to treat malaria fifty years ago,
t is the plural individual consisting of the medicines used to treat malaria today,
$F = [\lambda G.\iota I[G(I)(f)]](R_{AT})$
$= \iota I[R_{AT}(I)(f)]$
and $T = [\lambda G.\iota I[G(I)(t)]](R_{AT})$
$= \iota I[R_{AT}(I)(t)]$

- (61c) amounts to the requirement that $|(F - T) \cup (T - F)|$ be sufficiently large
- (61a) is true iff the symmetric difference between the set consisting of the medicines used to treat malaria fifty years ago and the set consisting of current malaria medicines is sufficiently large

(62) a. The medicines used to treat malaria today are the same as they were fifty years ago.
b. $\textbf{\textit{same}}_{\text{ID}}(\lambda G.\iota I[G(I)(f)])(\lambda G.\iota I[G(I)(t)])$
c. $\mu_{||}(F - T\ ,\ T - F) = \varnothing$,
where f, t, F, and T are as in (61)

- (62c) amounts to the requirement that $|(F - T) \cup (T - F)| = \varnothing$
- (62a) is true iff the symmetric difference between the set consisting of the medicines used to treat malaria fifty years ago and the set consisting of current malaria medicines is empty, i.e., the two sets are identical

4.2 Overall summary

The relationship between identity and similarity *same*/*different* emerges as a case of polysemy:

- the semantic operations performed by *same* and *different*, as well as the gross logical structure of the comparatives that the head, remain constant across their two guises

- what changes is the domain in which *same* and *different* operate (D_d vs. D_e)

- for identity comparatives, the dimension of comparison is atomic constituency, along which distinct individuals will necessarily differ

- the difference between two individuals along this dimension can be represented in terms of their distinctive (non-overlapping) atomic members

Stepping back a bit:

- identity comparatives are situated within a larger understanding of "the comparative", one which encompasses similarity comparatives headed by *same* and *different*, as well as scalar comparatives headed by *more*/*–er*, *less*, and *as*
- at a general level, comparatives are concerned with the relative locations of individuals along various dimensions of comparison
- such a characterization of comparatives may serve as a starting point for further explorations of the semantic properties underlying this notional grammatical category

References

Barwise, John & Robin Cooper. 1981. Generalized quantifiers and natural language. *Linguistics and Philosophy* 4: 159-219.

Bierwisch, Manfred. 1989. The semantics of gradation. In *Dimensional Adjectives*, M. Bierwisch and E. Lang (eds), 71-262. Berline: Springer-Verlag.

Bresnan, Joan. 1973. Syntax of the comparative clause construction in English. *Linguistic Inquiry* 4: 275-343.

Büring, Daniel. 2007a. When *less* is *more* (and when it isn't). Paper presented at the 43rd Annual Meeting of the Chicago Linguistic Society, Univ. of Chicago, May 4, 2007.

Büring, Daniel. 2007b. Cross-polar nomalies. Paper presented at Semantics and Linguistic Theory 17, University of Connecticut, Storrs, May 11-13, 2007.

Corver, Norbert. 1997. *Much*-support as a last resort. *Linguistic Inquiry* 28:119-164.

Cresswell, Martin. 1976. The semantics of degree. In *Montague Grammar*, B. Partee (ed.), 261-292. New York: Academic Press.

Doetjes, J.S. 1997. *Quantifier and selection: On the distribution of quantifying expressions in French, Dutch, and English*. The Hague: Holland Academic Graphics.

von Fintel, Kai. 1993. Exceptive constructions. *Natural Language Semantics* 1: 123-148.

Gajewski, Jon. 2002. L-Analyticity and natural language. Paper available at http://gajewski.uconn.edu/research.html.

Gajewski, Jon. 2008. More on quantifiers in comparative clauses. Abstract for paper presented at *Semantics and Linguistic Theory 18*.

Gati, Itamar and Amos Tversky. 1982. Representations of qualitative and quantitative dimensions. *Journal of Experimental Psychology: Human Perception and Performance* 8: 325-240.

Guerts, Bart. 1998. Scalars. In *Lexikalische Semantik aus kognitiver Sicht*, P. Ludewig and B. Guerts (eds), 85-117. Tübingen: Gunter Narr.

Heim, Irene. 1985. Notes on comparatives and related matters. Available at http://www.semanticsarchive.net.

Heim, Irene. 2000. Degree operators and scope. In *Proceedings of Semantics and Linguistic Theory 10*, B. Jackson and T. Matthews (eds), 40-64. Ithaca: CLC Publications.

Heim, Irene. 2002. On the negation theory of antonymy. Paper presented at the 22nd West Coast Conference on Formal Linguistics, University of California, Santa Cruz, April 5-7, 2002.

Heim, Irene. 2006. *Little*. In *Proceedings of Semantics and Linguistic Theory 16*, M. Gibson and J. Howell (eds), 35-58. Ithaca: CLC Publications.

Hellan, Lars. 1981. *Towards an Integrated Analysis of Comparatives*. Tübingen: Narr.

Horn, Laurence. 1992. The said and the unsaid. In *Proceedings of Semantics and Linguistic Theory 2*, C. Barker and D. Dowty (eds), 163-192. Columbus: Ohio State University Working Papers in Linguistics, No. 40.

Huddleston, Rodney and Geoffrey Pullum. 2002. *The Cambridge Grammar of the English Language*. Cambridge: Cambridge University Press.

Kennedy, Christopher. 1999. *Projecting the Adjective: The Syntax and Semantics of Gradability and Comparison*. New York: Garland.

Kennedy, Christopher. 2001. Polar opposition and the ontology of 'degrees'. *Linguistics and Philosophy* 24: 33-70.

Kennedy, Christopher and Louise McNally. 2005. Scale structure, degree modification, and the semantics of gradable predicates. *Language* 81: 345-381.

McConnell-Ginet, Sally. 1973. Comparative constructions in English: A Syntactic and semantic analysis. Ph.D. dissertation, University of Rochester.

Moltmann, Friederike. to appear. Degree structure as trope structure: A trope-based analysis of positive and comparative adjectives. *Linguistics and Philosophy*.

Postal, Paul. 1974. On certain ambiguities. *Linguistic Inquiry* 5: 367-425.

Restle, Frank. 1959. A metric and an ordering on sets. *Psychometrika* 24: 207-220.

Rotstein, Carmen and Yoad Winter. 2004. Total adjectives vs. partial adjectives: Scale structure and higher-order modifiers. *Natural Language Semantics* 12: 259-288.

Rullmann, Hotze. 1995. *Maximality in the Semantics of Wh-Constructions*. Ph.D. dissertation, University of Massachusetts, Amherst.

Russell, Bertrand. 1905. On denoting. *Mind* 14: 479-493.

Sattath, Shmuel and Amos Tversky. 1977. Additive similarity trees. *Psychometrika* 42: 319-345.

Schwarzschild, Roger. 2005. Measure phrases as modifiers of adjectives. *Recherches Linguistiques de Vincennes* 35: 207-228.

Schwarzschild, Roger and Karina Wilkinson. 2002. Quantifiers in comparatives: A semantics of degree based on intervals. *Natural Language Semantics* 10: 1-41.

Seuren, Pieter. 1973. The comparative. In *Generative Grammar in Europe*, F. Kiefer and N. Ruwet (eds), 528-564. Dordrecht: Riedel.

Seuren, Pieter. 1978. The structure and selection of positive and negative gradable adjectives. In *Papers from the Parasession on the Lexicon, Chicago Linguistic Society*, D. Farkas et al. (eds), 336-346. Chicago: Chicago Linguistic Society.

Seuren, Pieter. 1984. The comparative revisited. *Journal of Semantics* 3: 109-141.

von Stechow, Arnim. 1984a. Comparing semantic theories of comparison. *Journal of Semantics* 3: 1-77.

von Stechow, Arnim. 1984b. My reactions to Cresswell's, Hellan's, Hoeksema's, and Seuren's comments. *Journal of Semantics* 3: 183-199.

Tversky, Amos. 1977. Features of similarity. *Psychological Review* 84: 327-352.

Winter, Yoad. 2005. Cross-categorial restrictions on measure phrase modification. *Linguistics and Philosophy* 28: 233-267.

University of Chicago
Department of Linguistics
1010 E. 59th St
Chicago, IL 60637
palrenga@uchicago.edu