Degree semantics[1]

1 Gradability

Certain predicates allow us to specify *to what extent* the predicate holds; we call them *gradable*. There are many constructions which only apply to gradable predicates.

(1) **Positive form adjectives:**

a. Rachel is tall / intelligent.

b. 2 is even.

(2) **Comparatives:**

a. Rachel is {taller / more intelligent} than Stephanie (is).

b. * 2 is more even than 3 (is).

(3) **Superlatives:**

a. Rachel is the {tallest / most intelligent} (student in my class).

b. * 2 is the most even (prime number).

(4) ***too*, *enough*, *so*:**

a. Rachel is too tall to be a gymnast.

b. * 2 is too even to be prime.

(5) **Intensifiers: *very*, *extremely*, *surprisingly*, *quite*...**

a. Rachel is very/extremely/surprisingly/quite tall.

b. * 2 is very/extremely/surprisingly/quite even.

(6) **Degree questions with *how*:**

a. How tall is Rachel?

b. * How even is 2?

We will first discuss basic examples like (1a) — called the *positive form* — and then look at comparatives like (2a), before returning to some other adjectives.

[1] I roughly follow a handout by Rick Nouwen and some of his examples.

2 Vagueness and relative standards

We have an intuition that sentences like (1a) are *vague*.
Three properties of "vague" predicates:

1. Context-sensitivity:

   (7) a. Rachel plays professional basketball. She has a real advantage because she's tall.
   b. Minuet is three years old, but people often ask if she's in school yet, because she's tall.

   But notice that if we *fix a context*, we are locked into a particular interpretation of *tall*:

   (8) Rachel is a professional basketball-player. Minuet is a three-year old. #They are both tall.

   There are also expressions that allow us to fix a comparison class:

   (9) Minuet is tall for a three-year old.

2. Borderline cases:

   Vague predicates yield so-called "borderline" cases: there is a rough range of heights for which we hesitate to say whether *X is tall* is true or false.

3. Sorites Paradoxes:

   (10) Example from Kennedy (2011):
   a. A $5 cup of coffee is expensive (for a cup of coffee).
   b. Any cup of coffee that costs 1 cent less than an expensive one is expensive (for a cup of coffee).
   c. Therefore, any free cup of coffee is expensive.

   Vague predicates are susceptible to such Sorites Paradox arguments.

These properties make it difficult to straightforwardly describe the denotation of predicates like *tall*.
We can, however, add an explicit height that needs to be met:

(11) Rachel is 180cm tall / 1cm tall.

180cm tall is not (11) is not vague in the way the previous uses of *tall* are.

3 Proposal

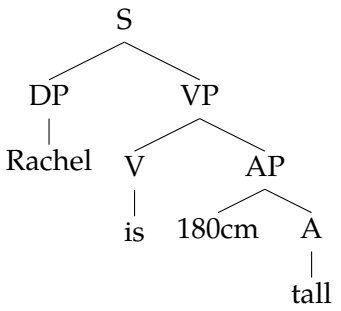
Here is a version of a widely adopted proposal, due in large part to Cresswell (1976) and von Stechow (1984).

- First, we add a new type of object to our semantics: *degrees*, type d, with domain D_d. We can think of it as (roughly) a domain of numbers.
- Second, let gradable predicates be *relations between individuals and degrees*:

  (12) $[\![\text{tall}]\!] = \lambda d \,.\, \lambda x \,.\, x\text{'s height} \geq d$ type $\langle d, \langle e, t \rangle \rangle$

- If we have an explicit degree that must be met, that's the type d argument.[2]

  (13) $[\![180\text{cm}]\!] = 180\text{cm}$ type d



- For positive forms of gradable adjectives, *there is a null morpheme* POS which identifies a *contextual standard* for the predicate:

  (14) STND is a context-sensitive function from gradable predicates to degrees, which returns the relevant standard degree. For example, if we're talking about basketball players, STND ($[\![\text{tall}]\!]$) might be 2m. If we're talking about three-year olds, STND ($[\![\text{tall}]\!]$) might be 1m.

  (15) $[\![\text{POS}]\!] = \lambda P_{\langle d, \langle e, t \rangle \rangle} \,.\, \lambda x \,.\, \exists d \, [P(d)(x) = 1 \text{ and } d \geq \text{STND}(P)]$

Exercise: Compute *Rachel is tall* (1a).

Note: There is something strange about POS, in that in many (most? all?) languages it is null. In general, comparative and superlative forms of gradable predicates are morphosyntactically more complex than positive forms; see especially Bobaljik (2012). Mandarin *hěn* is one important apparent counterexample, but see Grano (2012) for discussion.

[2] The syntax here is simplified; in particular, the gradable predicate may involve a richer structure, often called a "Degree Phrase" (DegP). See Bresnan (1973) for one option and Kennedy (1997) for another.

4 Comparative constructions

(16) Rachel is {taller / more intelligent} than Stephanie (is). (=2a)

What is the semantics of a comparative? Two versions of a wrong idea:

- Suppose "X is more A than Y" means that "it's true that [X is A] and it's false that [Y is A]." Two problems:

  1. We predict *2 is more even than 3* to be true because "it's true that [2 is even] and it's false that [3 is even]."

     ⇒ Comparatives are limited to gradable predicates.

  2. We would predict (16) to require that Rachel is *tall* or *intelligent*, according to our regular contextual standard for *tall*/*intelligent*.

     Consider two three-year olds: Nathan and Minuet. *Minuet is taller than Nathan* may be true even if neither is tall.

     ⇒ Comparatives do not entail the positive form.

- Recall that positive forms are evaluated against a standard based on STND, which can be manipulated by the context. Suppose "X is more A than Y" means that it is possible to manipulate STND so that "it's true that [X is POS-A] and it's false that [Y is POS-A]."

  But recall that positive form adjectives have trouble with borderline cases. So if STND(A) is too close to X's A-degree or Y's A-degree, we predict "X is more A than Y" to be hard to judge. This is not the case. (The following examples are from Kennedy (2011).)

  (17) Uranus is bigger than Venus.

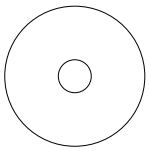
  

  Figure 1: Uranus (51,118 km) vs. Venus (12,100 km)

  (18) Uranus is bigger than Neptune.

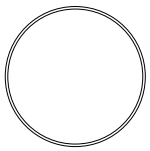
  

  Figure 2: Uranus (51,118 km) vs. Neptune (49,500)

  There are, in fact, other forms of comparatives which exhibit this behavior, but they are not the *more/-er* comparatives that we are interested in.

  (19) Compared to Venus, Uranus is big.

  (20) # Compared to Neptune, Uranus is big.

  See Kennedy (2009, 2011) for more on these so-called *implicit* comparatives.

Towards a solution:

- The truth conditions we want look like the following:

$[\![(16)]\!] = 1 \iff \exists d \left[[\![\text{tall}]\!](d)(\text{Rachel}) = 1 \text{ and } [\![\text{tall}]\!](d)(\text{Stephanie}) = 0 \right]$

$= 1 \iff \exists d \left[\text{Rachel is } d\text{-tall and Stephanie is not } d\text{-tall} \right]$

$= 1 \iff \max(\lambda d_1 \text{ . Rachel is } d_1\text{-tall}) > \max\left(\lambda d_2 \text{ . Stephanie is } d_2\text{-tall}\right)$

$= 1 \iff \max(\lambda d_1 \text{ . } [\![\text{tall}]\!](d_1)(\text{Rachel})) > \max\left(\lambda d_2 \text{ . } [\![\text{tall}]\!](d_2)(\text{Stephanie})\right)$

- Comparative standard clauses involve A'-movement:

(21) Rachel$_i$ is taller than [Stephanie thinks [that she$_i$ is ___]].

(22) * Rachel is taller than [Stephanie believes [$_{\text{island}}$ the rumor [that she$_i$ is ___]]].

- Comparative standards can include a gradable predicate, if it contrasts:

(23) This table is longer than [that door is wide].

► Suppose the standard clause involves movement of a null operator over the degree argument of the predicate in the standard clause:

(24) Rachel is [tall [-er [$_{\text{standard}}$ than Op 3_d Stephanie is ~~t_3-tall~~]]].

(25) $[\![Op]\!]$ = Id and leaves a type d trace.

(26) $[\![\text{than}]\!]$ = Id

(27) $[\![\text{standard}]\!] = \lambda d$. Stephanie is d-tall

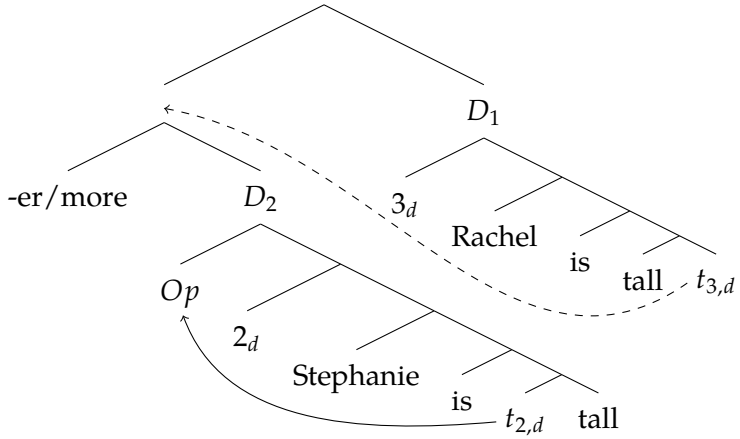
Now give *-er/more* the following denotation:

(28) $[\![\text{-er/more}]\!] = \lambda D_{2\langle d,t\rangle}$. $\lambda D_{1\langle d,t\rangle}$. $\max(D_1) > \max(D_2)$

This requires QRing "-er standard" — a quantifier of type $\langle\langle d, t\rangle, t\rangle$ (Heim, 2000). See Bhatt and Pancheva (2004) for sophisticated syntactic evidence for this.[3]

[3]Notice that the deletion of "t-tall" in the standard is a form of Antecedent-Contained Deletion (ACD). This QR helps resolve the ACD as well (Wold, 1995).

(29) **LF for clausal comparative example (16):**



5 Scale structure

Gradable predicates differ in the structure of their scales, which some degree modifiers are sensitive to (Kennedy and McNally, 2005):

(30) ***Half/mostly* require closed scale adjectives:**

a. The glass is half/mostly full/empty.

b. Her eyes were half/most of the way closed/open.

c. These images are half/mostly invisible/visible.

(31) ***Half/mostly* reject open scale adjectives:**

a. ?? The rope is half/mostly long/short.

b. ?? A 15-year-old horse is half/mostly old/young.

c. ?? That car was half/mostly expensive/cheap.

We can think of "closed" scale adjectives as using a [0,1] range of degrees — where minimum 0 and maximum 1 are part of the scale — whereas the "open" scale adjectives use a (0,1) range, where the scale does not have minimum or maximum values.
There are also modifiers which require the scale to have a maximum or minimum value:

(32) ***completely/almost/totally/fully/100%...* require upper-closed adjectives:**

a. completely full/empty/closed/open/invisible/visible... (closed)

b. completely safe/pure/straight/quiet... (upper-closed)

c. * completely dangerous/impure/bent/loud... (lower-closed)

d. * completely long/short/old/young/expensive/cheap... (open)

(33) ***slightly/a bit...* require lower-closed adjectives:**

a. slightly full/empty/closed/open/invisible/visible... (closed)

b. * slightly safe/pure/straight/quiet... (upper-closed)

c. slightly dangerous/impure/bent/loud... (lower-closed)

d. * slightly long/short/old/young/expensive/cheap... (open)

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