Comparatives and Their Kin

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This is a draft of a chapter for a book, *Modification*, in preparation for the Cambridge University Press series *Key Topics in Semantics and Pragmatics*. The full manuscript is also available as a single document on my website, as are some additional chapters. The book is something between a textbook for people who already have a basic background in semantics and a survey of work in the area. For a fuller explanation of its purpose and scope, consult chapter 1 in the full manuscript.

Broken links, marked with **??**, are to other chapters not included in this document. (You can avoid this by looking at the full manuscript.) **Comments would be extremely helpful**, so please don't hesitate to contact me if you have any, even very minor ones.

Contents

1 Introduction

Florence Nightingale suffered from two afflictions:

- She had one leg shorter than the other.

- She also had one leg longer than the other.

This is according to the comedian Graeme Garden, who was lying.[1] (Her legs were fine, both of them.) In doing so, he was playing on some relatively subtle intuitions about the semantics of the comparative. The joke would still have worked, more or less, if he had said this:

(1)   She also had one leg not as long as the other.

But this wouldn't work:

(2)   She also had one leg not as short as the other.

What the joke depends on—to kill it by explanation—is that the two afflictions entail each other, on either the original formulation or (1). The problem with (2) is that it introduces an unwelcome additional entailment: that her legs were short. Why the difference?

This chapter will examine the semantics of comparatives and their grammatical relatives, such as the equative, which positively bristle with such

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[1]This paraphrases remarks made on the BBC Radio 4 panel show *The Unbelievable Truth* (series 8, episode 4, first broadcast in 2012). Lying was encouraged in the discourse context.

subtle and often vexing puzzles. These puzzles provide insight into a surprisingly wide array of issues: the nature of comparison, of course, but also the ontology of degrees, scope taking mechanisms, ellipsis, negative polarity items, modality, focus, type-shifting, contextual domain restrictions, imprecision, and semantic crosslinguistic variation. This will also give us an opportunity to address the syntax of the extended AP in earnest for the first time.

Section 2 confronts the mapping between syntax and semantics in the adjectival extended projection, with special attention to the comparative. Section 3 provides a tour of other degree constructions, including differential comparatives, equatives, superlatives, and others. Section 4 is the one most directly relevant to the puzzle we began the chapter with: the question of why the entailments of apparently very similar degree constructions differ subtly. Finally, section 5 concludes with a discussion of the crosslinguistic picture. Throughout this chapter, I will assume a degree-based framework. This is chiefly because most of the work in this area does so—but that too is for a reason.

2   The syntax and semantics of the extended AP

2.1   *Getting terminology out of the way*

Before proceeding, it will help to introduce or reintroduce some terminology:[2]

- I'll call the family of constructions to which the comparative belongs—including *as* constructions, superlatives (*-est*), *too* constructions— DEGREE CONSTRUCTIONS. *As*-phrases are EQUATIVES. Sometimes one encounters SUFFICIENCY CONSTRUCTION for *enough* and EXCESSIVE CONSTRUCTION for *too*.

- A less Anglocentric term for a *than*-clause is COMPARATIVE CLAUSE. What it contributes is a STANDARD OF COMPARISON. A language-neutral term for expressions such as *than* that mark standards of comparison is STANDARD MARKER.

- The morphologically unmarked base form of an adjective is the POSITIVE FORM.

- *More*, *less*, *-er*, *very*, *slightly* and the like are DEGREE MORPHEMES or DEGREE WORDS, members of the syntactic category Deg.

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[2]More information on terminological issues can, of course, be found in the glossary.

2.2 *The unpronounced in comparative clauses*

One additional prefatory point: in English, as in many languages, comparative clauses tend not to be fully pronounced. This won't affect the subsequent discussion, but when large chunks of the sentences under discussion are absent, something should be said.

This state of affairs can come about in several ways. First, it can involve ordinary VP ellipsis:

(3)   Floyd will seem taller than Clyde will ~~seem tall~~.

Second, it can involve COMPARATIVE DELETION (Bresnan 1973), in which an AP is elided:

(4)   Floyd will seem taller than Clyde will seem ~~tall~~.

These processes differ in that VP ellipsis can only target full VPs rather than merely APs:

(5)   a.   Floyd will seem tall, and Clyde will ~~seem tall~~ too.
         b.   *Floyd will seem tall, and Clyde will seem ~~tall~~ too.

Consequently, (4), where *seem* is left behind, can't be attributed to VP ellipsis. Another difference between the two processes is that VP ellipsis is optional, so (5a) could be pronounced fully as well. By contrast, comparative deletion is generally obligatory, so (4) would be ungrammatical or at least strange if fully pronounced. A third process distinct from both is the more radical COMPARATIVE ELLIPSIS (Bresnan 1975, Lechner 1999):

(6)   Floyd will seem taller tomorrow than ~~he seemed tall~~ today.

Yet a fourth deletion operation is, from a contemporary perspective, less obviously deletion at all. Nevertheless, the term COMPARATIVE SUBDELETION has stuck:

(7)   a.   The table is wider than it is ~~that~~ long.
         b.   Floyd knows fewer philosophers than Clyde knows ~~that many~~ linguists.

I have included overt expressions in (7) to suggest why one might regard this as deletion, but the choice of expression is semi-arbitrary. Sentences like (7) are sometimes called SUBCOMPARATIVES.

At first blush (or indeed afterward), it's not obvious where PHRASAL COMPARATIVES, in which the *than*-phrase is smaller than a clause, fit in,

and whether they involve ellipsis (Hankamer 1973, Napoli 1983, Heim 1985, Lechner 1999, 2001, Xiang 2005, Merchant 2009, to appear, Bhatt & Takahashi 2007, 2011, and Matsui & Kubota 2012). One of their more notable characteristics, though, is an ambiguity they give rise to that is not present in clausal comparatives:

(8)　　Greta deloused her ferret more often than Clyde.
　　　　a. Greta deloused her ferret more often than Clyde deloused her ferret.
　　　　b. Greta deloused her ferret more often than she deloused Clyde.

Rooth (1992) notes that this ambiguity can actually be eliminated via focus (roughly, prosodic prominence):

(9)　　a. [_FOCUS *Greta*] deloused her ferret more often than Clyde.
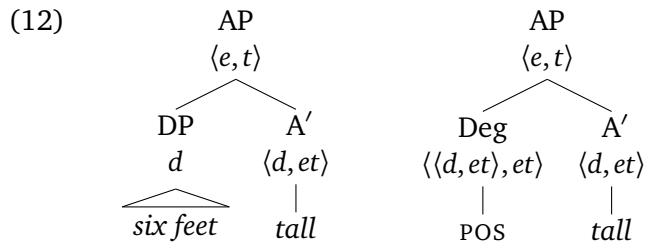　　　　b. Greta deloused [_FOCUS *her ferret*] more often than Clyde.

In (9a), it must be the ferret that has been deloused; in (9b), it must be Clyde. Interestingly, Japanese has an overt morpheme, *hoo*, that can achieve this disambiguation (Matsui & Kubota 2012):

(10)　　a. Watashi-no-<u>hoo</u>-ga John-yori　neko-o　　aishiteiru
　　　　　　I-GEN-hoo-NOM　　　John-than cats-ACC love.NONPAST
　　　　　　'I love cats more than John loves cats.'
　　　　　　not: '...than I love John'

　　　　b. Watashi-wa John-yori　neko-no-<u>hoo</u>-o　　　aishiteiru
　　　　　　I-TOPIC　　　John-than cats-GEN-hoo-ACC love.NONPAST
　　　　　　'I love cats more than I love John.'
　　　　　　not: '...than John does'

2.3　*First steps*

Given the (degree-based) semantics for the positive form and for measure phrases in chapter **??**, a relatively straightforward and historically traditional view of the AP would suffice. On such a view, both measure phrases and degree words occupy the specifier position of AP. The crucial denotations are repeated in (11) and the corresponding trees are in (12) (see section **??** for the full computations):

(11)　　a. $[\![\, tall \,]\!] = \lambda d \lambda x$. $\mathbf{tall}(d)(x)$
　　　　b. $[\![\, six\ feet \,]\!] = \mathbf{6\text{-}feet}$
　　　　c. $[\![\, \textsc{pos} \,]\!] = \lambda G_{\langle d, et \rangle} \lambda x$. $\exists d\, [d > \mathbf{standard}(G) \wedge G(d)(x)]$

(12)

$$
\begin{array}{ccc}
& \text{AP} & \\
& \langle e,t\rangle & \\
\text{DP} & & \text{A}' \\
d & & \langle d,et\rangle \\
\textit{six feet} & & \textit{tall}
\end{array}
\qquad
\begin{array}{ccc}
& \text{AP} & \\
& \langle e,t\rangle & \\
\text{Deg} & & \text{A}' \\
\langle\langle d,et\rangle,et\rangle & & \langle d,et\rangle \\
\text{POS} & & \textit{tall}
\end{array}
$$

In comparatives, the semantics clicks right into place as well:

(13) $[\![\, more \,]\!] = \lambda G_{\langle d,et\rangle}\lambda x\lambda y \, . \, \exists d\,[G(d)(y)\wedge\neg G(d)(x)]$

(14)

$$
\begin{array}{c}
\text{AP} \\
\langle e,t\rangle \\
\end{array}
$$

$$
\begin{array}{cc}
\text{AP} & e \\
\langle e,et\rangle & \textit{than Clyde} \\
\end{array}
$$

$$
\begin{array}{cc}
\text{Deg} & \text{A}' \\
\langle\langle d,et\rangle,\langle e,et\rangle\rangle & \langle d,et\rangle \\
\textit{more} & \textit{tall}
\end{array}
$$
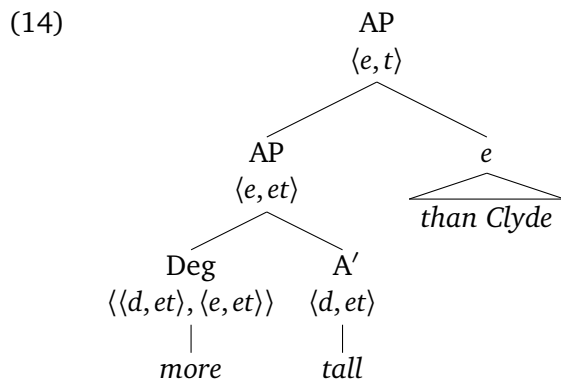
Nevertheless, some significant refinements will need to be made here.

The principal flaw in this comparative denotation is the assumptions it makes about the *than*-phrase, which it treats as individual-denoting. As we'll see in section 5.3, this may be the right approach in some languages and perhaps for cases like (14) in English, but it doesn't generalize to cases like those in (15):

(15)   a. Floyd is taller than six feet.
         b. Floyd is taller than Clyde is ~~tall~~.

In (15a), the *than* phrase hosts a (presumably) degree-denoting expression. In (15b), it hosts a full clause, which can't plausibly denote an individual.

To correct the problem, it's best to begin with the simpler case, (15a). The denotation we should aim for is in (16) (I'll continue to represent *-er* as underlyingly *more*):

(16) $[\![\, \textit{[more tall] than six feet} \,]\!] = \lambda x \, . \, \exists d\,[\mathbf{tall}(d)(x)\wedge d > \mathbf{6\text{-}feet}]$

An individual x will satisfy this iff x is tall to a degree greater than six feet. Working backwards, if we assume (17a), *more* should have the denotation

in ([17c](#)):

(17)   a. $[\![\,than\ six\ feet\,]\!] = \textbf{6-feet}$

        b. $[\![\,more\ tall\,]\!] = \lambda d'\lambda x\ .\ \exists d\,[\textbf{tall}(d)(x) \wedge d > d']$

        c. $[\![\,more\,]\!] = \lambda G_{\langle d,et\rangle}\lambda d'\lambda x\ .\ \exists d\,[G(d)(x) \wedge d > d']$

This puts us in a better position to cope with the clausal case. To combine with ([17c](#)), the comparative clause *than Clyde is* ~~tall~~ would have to denote a degree—more precisely, the degree of tallness one would have to exceed in order to be *taller than Clyde is* ~~tall~~. That degree is Clyde's height, the maximal degree to which Clyde is tall. (Not just any degree will do: Clyde is no doubt also tall to the degree **1-foot**, but it wouldn't be sufficient to exceed that.) The maximality operator **max** introduced in chapter **??** is what we need.

Previously, **max** was defined for sets of degrees, but it will be useful to use it for properties of degrees, too. Because properties and sets are two sides of the same coin, the definition is essentially the same (I will use D for properties of degrees):[3]

(18) $\textbf{max}(D) \overset{\text{def}}{=} \iota d\,[\forall d'\,[D(d') \rightarrow d' \leq d]]$

This yields the largest degree that satisfies D. This makes it possible to state the intended denotation for the clause as in ([19](#)):

(19) $[\![\,than\ Clyde\ is\ \text{\sout{tall}}\,]\!] = \textbf{max}(\lambda d\ .\ \textbf{tall}(d)(\textbf{Clyde}))$

That said, it's common to confine oneself to the set-based definition of **max** and to write such a denotation equivalently as ([20](#)):

(20) $[\![\,than\ Clyde\ is\ \text{\sout{tall}}\,]\!] = \textbf{max}\{d : \textbf{tall}(d)(\textbf{Clyde})\}$

Throughout this chapter, one may safely replace any instance of $\textbf{max}(\lambda d\,\ldots)$ with $\textbf{max}\{d : \ldots\}$. Either way, this is a definite description of a degree. Comparing ([19](#)) and ([20](#)) to the definition of **max** in ([18](#)) makes that clear: it is **the** maximal height of Clyde. As an empirical matter, definite descriptions also include a maximality element. This is reflected in the fact that *the height of Clyde* refers to his maximal height, but also in more ordinary uses. In a context with three equally-salient ferrets, *the ferrets* picks out all three, and can't be interpreted to mean any pair of them. Likewise, *the water* picks out

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[3]The definite description operator ι yields the only element that could replace d and make the formula in the scope of ι true.

the largest (i.e., maximal) portion of water in the context, and you haven't mopped up the water unless you've mopped up all of it.[4]

This isn't the only path we could have taken, but it is a well-trodden one (Russell 1905, von Stechow 1984, Rullmann 1995). An alternative is to have the comparative clause denote a property of **all** the degrees to which Clyde is tall, with further manipulation to happen in the denotation of *more*. This further manipulation might itself involve a maximality operator. (See Heim 1985, Beck 2011 for such an analysis.)

Arriving at the denotation in (20) isn't trivial. The standard course is to assume, following Chomsky (1977), that the comparative clause is analogous to a relative clause in which *wh*-movement of a null operator, ∅, has taken place:

(21)   a. the ferret [$_{CP}$ ∅ λx_1 Clyde deloused x_1]
       b. than [$_{CP}$ ∅ λd_1 Clyde is d_1 ~~tall~~]

In English relatives, the null operator has a pronounced counterpart, *which*. English comparatives lack one, but many other languages are not so impoverished and permit an overt *wh*-expression in this position. Further evidence for such movement can be adduced from island effects (*taller than Greta doubts the claim that Clyde is d tall*). The source of the movement is the measure phrase position—the null operator is essentially a *wh*-measure phrase—so the degree trace it leaves behind can be interpreted as a measure phrase:

(22)   a. $[\![\, d_1 \ tall \,]\!] = \lambda x \,.\, \textbf{tall}(d_1)(x)$
       b. $[\![\, Clyde \ d_1 \ tall \,]\!] = \textbf{tall}(d_1)(\textbf{Clyde})$

The ∅ operator is not interpreted (following the Heim & Kratzer 1998 approach to relative clauses), so the result for the CP is (23):

(23) $[\![\, ∅ \ \lambda d_1 \ Clyde \ is \ d_1 \ tall \,]\!] = \lambda d_1 \,.\, \textbf{tall}(d_1)(\textbf{Clyde})$

To take us from this to the intended comparative clause denotation in (19), *than* would need to be as in (24a), leading to (24b), as (25) illustrates:

(24)   a. $[\![\, than \,]\!] = \lambda D_{\langle d,t\rangle} \,.\, \textbf{max}(D)$
       b. $[\![\, than \,]\!] \,([\![\, ∅ \ \lambda d_1 \ Clyde \ is \ d_1 \ tall \,]\!])$
           $= \textbf{max}(\lambda d_1 \,.\, \textbf{tall}(d_1)(\textbf{Clyde}))$

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[4]Sets of degrees are more like mass than count individuals (Schwarzschild & Wilkinson 2002, Schwarzschild 2005), so the analogy to the latter is closer.

(25)

$$d$$

$$\langle dt,t\rangle \quad \langle d,t\rangle$$

$$than \quad \varnothing \quad \langle d,t\rangle$$

$$\lambda d_1 \quad t$$
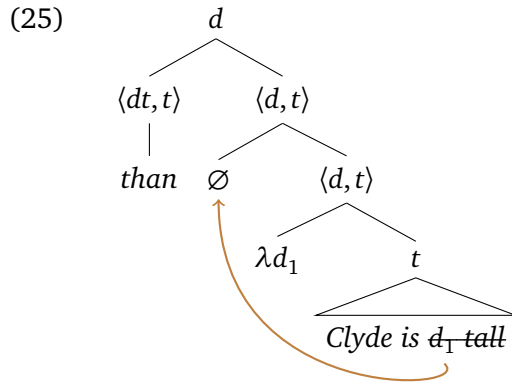
$$\text{Clyde is } d_1 \text{ tall}$$

This is, of course, equivalent to the denotation we were looking for: the maximal degree to which Clyde is tall.

The next step is to combine this with the comparative itself:

(26)   a. $[\![\,more\,]\!] = \lambda G_{\langle d,et\rangle}\lambda d'\lambda x \,.\, \exists d\,[G(d)(x)\wedge d>d']$

   b. $[\![\,more\ tall\,]\!] = \lambda d'\lambda x \,.\, \exists d\,[\textbf{tall}(d)(x)\wedge d>d']$

   c. $[\![\,more\ tall\,]\!]\,([\![\,\varnothing\ \lambda d_1\ Clyde\ is\ d_1\ tall\,]\!])$
       $= \lambda x \,.\, \exists d\,[\textbf{tall}(d)(x)\wedge d>\textbf{max}(\lambda d_1 \,.\, \textbf{tall}(d_1)(\textbf{Clyde}))]$

So an individual x is taller than Clyde iff there's a degree to which x is tall that exceeds the maximal degree to which Clyde is tall.

This denotation works both for full comparative clauses and for e.g. *than six feet*, but it would fail for our original example, the humble phrasal comparative (e.g., *than Floyd*). Both *than* and *more* are now incompatible with this use. Assuming both forms have two homophonous variants might seem stipulative. One could avoid this by deriving the phrasal comparative syntactically from the clausal one. As it turns out, though, some languages distinguish their phrasal and clausal comparatives with different standard markers (Merchant 2009, to appear), precisely as one might expect if the English case involves an ambiguity. Moreover, some languages have only phrasal comparatives or only clausal ones (Bhatt & Takahashi 2007, 2011). Both of these facts suggest that one shouldn't work too hard at integrating them. (A bit more discussion of this point is in section 5.3.)

2.4   *The big DegP view*

There are two competing ideas about the syntax of the extended adjectival projection. They both involve recognizing a phrasal projection called DegP, but disagree both about where it is and what it is. I'll call one the 'BIG DEGP
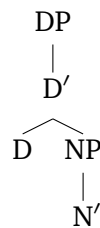
VIEW' and the other the 'SMALL DEGP VIEW'. Each view correlates with a certain view of the semantics, although it's possible to disentangle the two at least to some extent.

The small DegP view is the older one, and is sometimes described as the 'classic' view. It's probably more popular among semanticists at the moment. The syntax associated with the big DegP view is more recent, but not by much. It was originally proposed more than a quarter of a century ago by Abney (1987), with refinements and variations in Larson (1988), Corver (1990), Grimshaw (1991), Corver (1993), and Kennedy (1997) (and, in a significantly different form, Corver 1997 and Lechner 1999). The basic insight behind the structure is that degree morphemes are functional heads, just as determiners are in DP. At one point, it had been standard to construe determiners as specifiers of NP. Abney (among others) convinced most syntacticians of a certain stripe that determiners are better treated as heads in themselves instead, ones which take an NP as a complement:
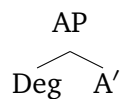
(27)   *Older view:*   *Newer view:*

             NP   DP
            /\ |
           D   N′   D′
                                                /\
                                               D   NP
                                                    |
                                                    N′

Much of the appeal of X′ Theory is in the crosscategorial parallels it reveals, so the change to DP should prompt reexamination of other categories. Structural parallelism would seem to dictate that degree words should also be heads:

(28)   *Older view:*   *Newer view:*

             AP   DegP
            /\ |
         Deg   A′   Deg′
                                                /\
                                             Deg   AP
                                                    |
                                                    A′
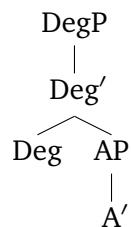
This accords with the Grimshaw (1991) vision that every lexical category (NP, AP, VP) projects layers of functional structure on top of it. It would be rather odd if AP were alone in failing to do so.

This structure opens up two positions where previously there was one. There is a head position, which can be occupied as before by degree mor-

phemes. But there is also a specifier of DegP position, where we would expect a phrasal category. This is the natural home of measure phrases.

This additional phrase-structural flexibility makes possible certain analytical options that on the previous structure were unavailable or less appealing. Chief among them is what is proposed in Kennedy (1997): taking adjectives to denote measure functions, type $\langle e, d \rangle$. To make this work, it's necessary to suppose there is some maximality built-in. If each individual is mapped to only one degree, it has to be the maximal one. For Kennedy, the preferred implementation of this is to suppose degrees are INTERVALS, uninterrupted stretches of a scale. The height any individual is mapped to is an interval extending from the bottom of the scale to their maximal height. The elegance of such an approach is striking:

(29)   a. $[\![\,tall\,]\!] = \lambda x \,.\, \textbf{tallness}(x)$

      b. $[\![\,\text{POS}\,]\!] = \lambda G_{\langle e, d \rangle} \lambda x \,.\, G(x) > \textbf{standard}(G)$

      c. $[\![\,\text{POS } tall\,]\!] = \lambda x \,.\, \textbf{tallness}(x) > \textbf{standard}(\textbf{tallness})$

The POS morpheme now simply determines the degree to which x is mapped on the scale associated with G, and requires that this degree exceed the standard. The structure is in (30) (I omit irrelevant layers):

(30)

        DegP
        $\langle e, t \rangle$

   Deg   AP
  $\langle ed, et \rangle$ $\langle e, d \rangle$

    POS   tall
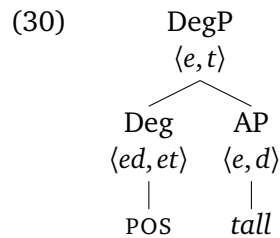
Comparatives are similarly elegant:[5]

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[5]Indeed, the maximality operator in the comparative clause could instead be an ordinary ι (definite description) operator.

(31)

```
                              DegP
                              ⟨e,t⟩
                               |
                              Deg′
                              ⟨e,t⟩
                    ┌──────────────────────┐
                  Deg′                       d
                 ⟨d,et⟩              ┌──────────────┐
            ┌──────────┐     than ∅ λd₁ Clyde is d₁ t̶a̶l̶l̶
           Deg        AP
      ⟨ed,⟨d,et⟩⟩    ⟨e,d⟩
           |          |
          more       tall
```
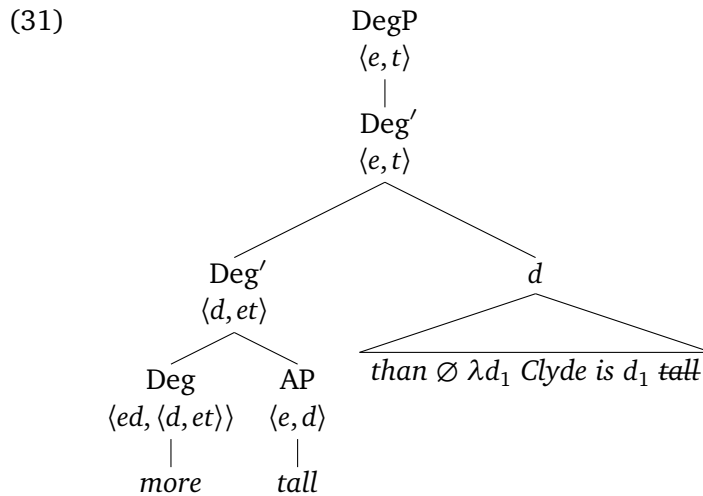
(32)   a. $[\![\,more\,]\!] = \lambda G_{\langle e,d\rangle}\lambda d\lambda x \,.\, G(x) > d$

b. $[\![\,more\,]\!]\,([\![\,tall\,]\!])([\![\,than\,∅\,\lambda d_1\ Clyde\ is\ d_1\ \text{t̶a̶l̶l̶}\,]\!])$

$= \lambda x \,.\, \mathbf{tallness}(x) > \mathbf{max}(\lambda d_1 \,.\, \mathbf{tallness}(\mathbf{Clyde}) = d_1)$

$= \lambda x \,.\, \mathbf{tallness}(x) > \mathbf{tallness}(\mathbf{Clyde})$

This will be true iff the tallness of x exceeds the tallness of Clyde.[6] Introducing measure phrases into this picture requires slightly more work, so I will set them aside.

Perhaps the most important thing to notice about this view is that it commits itself to the idea that there are no scope-bearing elements (like quantifiers or a maximality operator) contributed by degree morphemes, and, somewhat less deeply, that the structure of the extended AP is relatively rigid, without any need for elements of it to move around at Logical Form. This is probably the most substantial difference between this approach and its principal competitor.

2.5   *The small DegP view*

The alternative view takes the extended AP to have a different shape entirely (Chomsky 1965, Bresnan 1973, Heim 2000, Bhatt & Pancheva 2004 among others). It's based in part on the observation that degree words seem to idiosyncratically select the head of their standard of comparison. For example, *more* requires the standard marker *than* rather than, say, *as*; *as*, on the other hand, requires another *as*; *so* requires *that*; *too* and *enough* license

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[6]The final step is possible because the maximal degree that is identical to $\mathbf{tallness}(\mathbf{Clyde})$ is, of course, $\mathbf{tallness}(\mathbf{Clyde})$ itself.

infinitives. On the big DegP view, the comparative clause is an adjunct. Heads don't normally impose selectional restrictions on their adjuncts, so this is suspicious. Another potential worry is that, because comparative clauses are adjuncts, we might expect to be able to stack them. But this isn't normally possible.[7] To be sure, it follows from the semantics provided, which takes the comparative clause as an argument of which there is only one. Nevertheless, there does seem to be an imperfect fit between the adjoined modifier-like syntax and the argument-like semantics. Finally, and most seriously, a fundamental prediction that the big DegP analysis is designed to capture appears not to be borne out, as we will see in section 2.6: that there are never any scope interactions involving a scope-bearing element contributed by the degree morpheme.[8]

To begin we will need to rearrange the puzzle pieces slightly. If a head imposes selectional restrictions on something, it's reasonable to suppose that it's actually its complement. That suggests that the complement of a degree morpheme is a standard phrase, and that (33) is a constituent:

(33)   more than $\varnothing$ λd_1 Clyde is $\cancel{d_1 \text{ tall}}$

Of course, this doesn't surface overtly in *Floyd is taller than Clyde is*. Before we can get to that issue, we need to identify what this constituent is and where to put it. The what question has a simple answer: it's a projection of a Deg, so it's a DegP. The where question is simple too: the whole thing goes in the specifier of AP. The overall picture, with potential types, would be as in (34):

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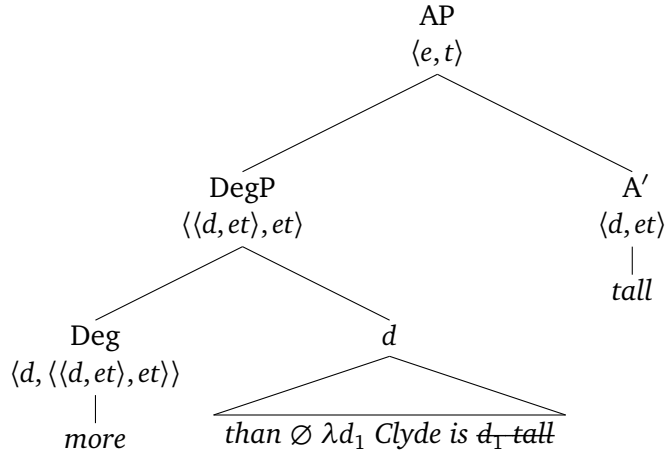[7]It doesn't seem to be impossible in principle. Bhatt & Pancheva (2004) point to examples like these:

(i)   a. John is much taller than Mary than Bill is.
         b. John has much more CDs than Mary than Bill does.

The semantics of these is mysterious.

[8]This doesn't preclude the possibility that the comparative clause rather than the degree morpheme might be scope-bearing, of course (Alrenga et al. 2012).

(34)

```
                              AP
                             ⟨e, t⟩
                    ╱                    ╲
                DegP                      A′
            ⟨⟨d, et⟩, et⟩                ⟨d, et⟩
          ╱            ╲                   │
       Deg              d                 tall
   ⟨d, ⟨⟨d, et⟩, et⟩⟩    ╱  ╲
        │
       more        than ∅ λd₁ Clyde is d₁ tall
```
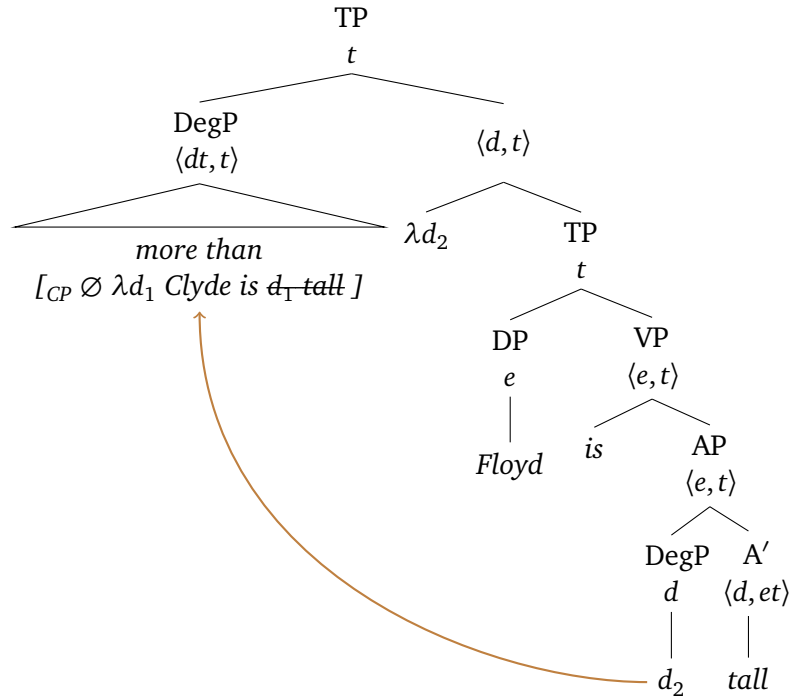
This could all be achieved by simply manipulating the order of arguments in the denotations considered in section 2.3. To achieve the surface order, the comparative clause would have to extrapose to the right (see Bhatt & Pancheva 2004 for a contemporary implementation).

There's an analytical opportunity being lost here, though. The type assigned to the DegP—$\langle\langle d, et\rangle, et\rangle$—is complex. This is slightly awkward. After all, the location the DegP occupies is precisely the same one that measure phrases can occupy, and they, on this view, are simply of type d. So is there a way to simplify this? It turns out that it is, with a more abstract syntax. Since von Stechow (1984), it has been standard to take this additional step. The crucial analogy is to the behavior of generalized quantifiers. The standard assumption there is that a generalized quantifier has a denotation of type $\langle et, t\rangle$, and when it finds itself in a position where only type e would fit compositionally, it moves (by Quantifier Raising), leaving behind a type e trace that it can then bind:

(35)   a. [every ferret] λx_1 Floyd deloused x_1
       b. $[\![\, every\ ferret\,]\!] = \lambda P_{\langle e, t\rangle} \, . \, \forall x [\mathbf{ferret}(x) \rightarrow P(x)]$
       c. $[\![\, every\ ferret\,]\!] \, ([\![\, \lambda x_1\ Floyd\ deloused\ x_1\,]\!])$
          $= \forall x [\mathbf{ferret}(x) \rightarrow [\![\, \lambda x_1\ Floyd\ deloused\ x_1\,]\!] (x)]$
          $= \forall x [\mathbf{ferret}(x) \rightarrow \mathbf{deloused}(x)(\mathbf{Floyd})]$

Precisely the same sort of analytical strategy is available in the degree domain:

(36)

```
                        TP
                         t
              ┌──────────┴──────────┐
           DegP                   ⟨d,t⟩
          ⟨dt,t⟩           ┌────────┴────────┐
      ┌──────┴──────┐     λd₂              TP
      more than                             t
 [CP Ø λd₁ Clyde is d̶₁̶ t̶a̶l̶l̶ ]        ┌────┴────┐
                                        DP        VP
                                         e       ⟨e,t⟩
                                         │     ┌───┴───┐
                                       Floyd  is      AP
                                                     ⟨e,t⟩
                                                  ┌────┴────┐
                                                DegP       A′
                                                  d      ⟨d,et⟩
                                                  │        │
                                                 d₂       tall
```

More can now denote a relation between the degree expressed by the comparative clause and a property of degrees created by movement of the DegP it heads. Two ways of doing this are in (37):

(37) a. $[\![\,more\,]\!] = \lambda d' \lambda D_{\langle d,t\rangle} \,.\, \exists d\,[D(d) \wedge d > d']$
      b. $[\![\,more\,]\!] = \lambda d' \lambda D_{\langle d,t\rangle} \,.\, \mathbf{max}(D) > d'$

The existentially-quantified approach in (37a) is older, and the maximality one in (37b) is arguably more elegant and otherwise desirable (Heim 2000, Beck 2011). Assuming (37b), this would combine with the comparative clause—which itself has a maximality operator—to yield (38):

(38) a. $[\![\,than\,]\!]\,([\![\,\varnothing\;\lambda d_1\;Clyde\;is\;d_1\;tall\,]\!])$
          $= \mathbf{max}(\lambda d_1 \,.\, \mathbf{tall}(d_1)(\mathbf{Clyde}))$
      b. $[\![\,more\;than\;\varnothing\;\lambda d_1\;Clyde\;is\;d_1\;tall\,]\!]$
          $= \lambda D_{\langle d,t\rangle} \,.\, \mathbf{max}(D) > \mathbf{max}(\lambda d_1 \,.\, \mathbf{tall}(d_1)(\mathbf{Clyde}))$
      c. $[\![\,\lambda d_2\;Floyd\;is\;d_2\;tall\,]\!] = \lambda d_2 \,.\, \mathbf{tall}(d_2)(\mathbf{Floyd})$
      d. $[\![\,more\;than\;\varnothing\;\lambda d_1\;Clyde\;is\;d_1\;tall\,]\!]\,([\![\,\lambda d_2\;Floyd\;is\;d_2\;tall\,]\!])$
          $= \mathbf{max}([\![\,\lambda d_2\;Floyd\;is\;d_2\;tall\,]\!]) >$
          $\qquad\qquad\qquad\qquad\qquad \mathbf{max}(\lambda d_1 \,.\, \mathbf{tall}(d_1)(\mathbf{Clyde}))$
          $= \mathbf{max}(\lambda d_2 \,.\, \mathbf{tall}(d_2)(\mathbf{Floyd})) > \mathbf{max}(\lambda d_1 \,.\, \mathbf{tall}(d_1)(\mathbf{Clyde}))$

15

Thus the maximal degree of Floyd's height must exceed the maximal degree of Clyde's. The analogy to individual quantification really is deep: the DegP denotes a generalized quantifier over degrees (that is, type $\langle\langle d,t\rangle,t\rangle$). This account is of a comparative, but POS and other degree morphemes can be treated similarly.

On the elegance front, this isn't a no-brainer. The types are simpler, the trace left behind is satisfyingly analogous to a measure phrase, and the denotation of the comparative is elegantly pared down to just the bare essentials of manipulating degrees. But there's no denying the phrase-structural complexity brought about by the movement. The kind of movement itself—Quantifier Raising—is independently motivated, and this would be simply a special case of it, so it requires no major additional stipulations to achieve. Indeed, arguably, it would establish an desirable parallel: if this is how quantification works for individuals, why shouldn't it work just the same for degrees?

Before indulging too much in such aesthetic reflection, though, it behooves us to ask the empirical question: do the movement and non-movement approaches make different predictions? It turns out that they do: movement predicts scope ambiguities and lack of movement doesn't. The next question, then: do degree morphemes actually give rise to scope ambiguities?

2.6 *Scope and degree operators*

The scopal behavior of degree quantifiers is a vexed and complicated matter. The crucial structures are intricate, the judgments often vertigo-inducing, the facts mysterious, and the theoretical consequences profound. At stake are theories of the syntax and semantics of the extended AP, of course, but also the nature of scope-taking mechanisms, the syntax of extraposition, ellipsis, and syntactic reconstruction, and—for surprising reasons—even the ontology of degrees. We'll only touch on the broad issues.

The story begins with a twist right at the start. One might expect to detect scope ambiguities in fairly simple cases, like (39):

(39)   Some linguist is taller than six feet.

As it turns out, though, the two scope configurations in (39) would give rise to on the movement view yield identical truth conditions:[9]

---

[9]This is also a nice demonstration of the fact that a sentence with multiple syntactic structures need not have multiple readings, and that—contrary to what one might tell introductory linguistics students—assigning multiple structures therefore can't suffice to explain an ambiguity without some semantic assumptions.

(40) a. $\exists x[\textbf{linguist}(x) \wedge \textbf{max}(\lambda d_1 . \textbf{tall}(d_1)(x)) > \textbf{6-feet}]$
   b. $\textbf{max}(\lambda d_1 . \exists x[\textbf{linguist}(x) \wedge \textbf{tall}(d_1)(x)]) > \textbf{6-feet}$

In (40a), there is a linguist whose height is greater than six feet. In (40b), the maximum height reached by a linguist is greater than six feet. In both cases, the result is the same: some linguist must be taller than six feet.

To make a scope ambiguity perceptible, more complicated examples are required (Heim 2000):

(41) Floyd is six feet tall. Every linguist is less tall than that.

I'll take the *that* to directly denote a degree, and *less* to have the denotation in (42b):

(42) a. $[\![\, that_{\textbf{6-feet}} \,]\!] = \textbf{6-feet}$
   b. $[\![\, less \,]\!] = \lambda d' \lambda D_{\langle d, t\rangle} . \textbf{max}(D) < d'$

There are two structures for (41). The first merely involves moving only the DegP, as in (43a); the second involves then moving *every linguist*, as in (43b):

(43) a. [less tall than that] λd_1 [every linguist is d_1 tall]
   b. [every linguist] λx_1 [less tall than that] λd_1 [x_1 is d_1 tall]

They give rise to different interpretations. First, (43a):

(44) [less tall than that] λd_1 every linguist is d_1 tall
   a. $[\![\, less\ than\ that_{\textbf{6-feet}} \,]\!] = \lambda D_{\langle d, t\rangle} . \textbf{max}(D) < \textbf{6-feet}$
   b. $[\![\, \lambda d_1\ every\ linguist\ is\ d_1\ tall \,]\!]$
       $= \lambda d_1 . \forall x[\textbf{linguist}(x) \rightarrow \textbf{tall}(d_1)(x)]$
   c. $[\![\, less\ than\ that_{\textbf{6-feet}} \,]\!] ([\![\, \lambda d_1\ every\ linguist\ is\ d_1\ tall \,]\!])$
       $= \textbf{max}(\lambda d_1 . \forall x[\textbf{linguist}(x) \rightarrow \textbf{tall}(d_1)(x)]) < \textbf{6-feet}$

The maximal degree this picks out is the greatest height that all the linguists have reached. That is the height of the shortest linguist. So this says that the shortest linguist is shorter than six feet. But this is much weaker than what the sentence actually means. The sentence requires **every** linguist to be under six feet, not just the shortest one.

Quantifier-raising *every linguist* addresses the problem:

(45) [every linguist] λx_1 [less tall than that] λd_1 x_1 is d_1 tall
   a. $[\![\, \lambda d_1\ x_1\ is\ d_1\ tall \,]\!] = \lambda d_1 . \textbf{tall}(d_1)(x_1)$
   b. $[\![\, less\ than\ that_{\textbf{6-feet}} \,]\!] ([\![\, \lambda d_1\ x_1\ is\ d_1\ tall \,]\!])$
       $= \textbf{max}(\lambda d_1 . \textbf{tall}(d_1)(x_1)) < \textbf{6-feet}$

c. $[\![\textit{every linguist}]\!] \, ([\![\lambda x_1 \textit{ less than that}_{\textbf{6-feet}} \, \lambda d_1 \, x_1 \textit{ is } d_1 \textit{ tall}]\!])$
$= \forall x [\textbf{linguist}(x) \rightarrow \textbf{max}(\lambda d_1 \, . \, \textbf{tall}(d_1)(x_1)) < \textbf{6-feet}]$

This, correctly, requires that for every linguist, the maximum degree of tallness the linguist reaches is less than six feet.

It seems, then, that the scopal approach has run into a problem. It predicts an ambiguity where there is none. The alternative Kennedy-style measure-function approach fares better:

(46)   a. $[\![\textit{less}]\!] = \lambda G_{\langle e, d \rangle} \lambda d \lambda x \, . \, G(x) < d$
        b. $[\![\textit{less}]\!] \, ([\![\textit{tall}]\!])([\![\textit{than that}_{\textbf{6-feet}}]\!])$
            $= \lambda x \, . \, \textbf{tallness}(x) < \textbf{6-feet}$
        c. $[\![\textit{every linguist is less tall than that}_{\textbf{6-feet}}]\!]$
            $= \forall x [\textbf{linguist}(x) \rightarrow \textbf{tallness}(x) < \textbf{6-feet}]$

This predicts only one reading—precisely the correct one.

If things were as simple as this, the issue would be easily settled. But they aren't. Suppose a student has been assigned to write a paper, and there is a length requirement. This could take two forms: a minimum required length or a maximum permitted length. Suppose further that the student has written a 10 page paper. She might be told:

(47)   The paper is required to be less long than that.

Has the student been told she has met the requirement, or failed to meet it? As it turns out, it could be either, as the continuations in (48) reflect:

(48)   The paper is required to be less long than that,
        a. . . . so you have to shorten it.
        b. . . . so you don't need to lengthen it.

In (48a), there must have been cap on paper length. In (48b), there must have been a minimum length requirement.[10] The observation—and the example—is due to Heim (2000). The ambiguity arises from the relative scope of the comparative and *required* (for convenience, I assume *the paper* remains in the subject position of the infinitive at logical form):

---

[10]The reader may find this example slightly mind-bending. Other examples of the class are generally no easier, but they include comparatives with *exactly* differential measure phrases:

(i)   The paper is $\begin{Bmatrix} \text{required} \\ \text{allowed} \end{Bmatrix}$ to be exactly 5 pages longer than that.

See Heim (2000) for discussion. Alrenga et al. (2012) mention a simpler example that involves a different kind of comparative but illustrates a roughly similar ambiguity:

(49)   a. is required [less long than that] λd_1 the paper to be d_1 long it's required that the paper be shorter than that

      b. [less long than that] λd_1 is required the paper to be d_1 long the length the paper is required to have is shorter than that

To represent this formally, we'll need to switch to an intensional system, though I'll subscript the world variables (**permitted**$_w$ is the set of worlds compatible with what is permitted in w; this is a deontic accessibility relation):

(50)   a. $[\![\,long\,]\!] = \lambda d\lambda x\lambda w\,.\,\mathbf{long}_w(d)(x)$

      b. $[\![\,less\,]\!] = \lambda d'\lambda D_{\langle d,st\rangle}\lambda w\,.\,\mathbf{max}(\lambda d\,.\,D(d)(w)) < d'$

      c. $[\![\,required\,]\!] = \lambda p_{\langle s,t\rangle}\lambda w\,.\,\forall w' \in \mathbf{permitted}_w[p(w')]$

Required asserts that the proposition it combines with holds in all permitted worlds. The interpretation of (49a), then, is:

(51)   is required [[less long than that] [λd_1 the paper to be d_1 long]]

      a. $[\![\,less\ long\ than\ that_{\mathbf{10\text{-}pages}}\,]\!]$
        $= \lambda D_{\langle d,st\rangle}\lambda w\,.\,\mathbf{max}(\lambda d\,.\,D(d)(w)) < \mathbf{10\text{-}pages}$

      b. $[\![\,the\ paper\ to\ be\ d_1\ long\,]\!] = \lambda w\,.\,\mathbf{long}_w(d_1)(\mathbf{the\text{-}paper})$

      c. $[\![\,\lambda d_1\ the\ paper\ to\ be\ d_1\ long\,]\!]$
        $= \lambda d_1\lambda w\,.\,\mathbf{long}_w(d_1)(\mathbf{the\text{-}paper})$

      d. $[\![\,less\ long\ than\ that_{\mathbf{10\text{-}pages}}\,]\!]\,([\![\,\lambda d_1\ the\ paper\ to\ be\ d_1\ long\,]\!])$
        $= \lambda w\,.\,\mathbf{max}(\lambda d\,.\,\mathbf{long}_w(d)(\mathbf{the\text{-}paper})) < \mathbf{10\text{-}pages}$

      e. $[\![\,is\ required\,]\!]\left(\left[\!\!\left[\begin{array}{r} \textit{[less long than that}_{\mathbf{10\text{-}pages}}] \\ \lambda d_1\ \textit{the paper to be } d_1 \textit{ long} \end{array}\right]\!\!\right]\right)$
        $= \lambda w\,.\,\forall w' \in \mathbf{permitted}_w$
                $[\mathbf{max}(\lambda d\,.\,\mathbf{long}_{w'}(d)(\mathbf{the\text{-}paper})) < \mathbf{10\text{-}pages}]$

This is the length-cap reading. The requirement—what must be the case in all permitted worlds—is that the (maximal, i.e., full) length of the paper is less than 10 pages. The other reading:

(ii)   California voters have been required to decide more ballot measures than Nevada voters.

      a. 'The requirement was that California voters decide more ballot measures than Nevada voters.'

      b. 'The number of ballot measures California voters have been required to decide is greater than the number of ballot measures Nevada voters have been.'

(52)   [less long than that] [λd_1 is required [the paper to be d_1 long]]

      a. ⟦ *λd_1 is required [the paper to be d_1 long]* ⟧
            = $\lambda d_1 \lambda w \,.\, \forall w' \in \mathbf{permitted}_w [\mathbf{long}_{w'}(d_1)(\mathbf{the\text{-}paper})]$

      b. ⟦ *less long than that*$_{\mathbf{10\text{-}pages}}$ ⟧
                              (⟦ *λd_1 is required [the paper to be d_1 long]* ⟧)
$$= \lambda w \,.\, \mathbf{max}\left(\begin{array}{c} \lambda d \,.\, \forall w' \in \mathbf{permitted}_w \\ [\mathbf{long}_{w'}(d)(\mathbf{the\text{-}paper})] \end{array} \right) < \mathbf{10\text{-}pages}$$

This is the minimum-length requirement reading. First, it identifies the lengths the paper is required to reach (that is, the lengths it reaches in all permitted worlds). We need the plural 'lengths' because if a paper is required to reach 9 pages, it is also required to reach 8, 7, 6 and so on.[11] On this reading, then, the greatest length the paper is required to reach is less than 10 pages.

So, a scope ambiguity has been discovered, and the evidence is therefore mixed. The theory on which comparatives are scope-bearing predicts some ambiguities where there are none, but successfully predicts others. The theory on which comparatives aren't scope-bearing predicts the absence of scope ambiguities where some are found. The challenge is making sense of this situation. Scope ambiguities are found only in limited circumstances, so on a movement theory, constraints must be imposed to explain why many expected scope ambiguities are blocked. The alternative theory must be supplemented with an explanation of what's going on in the Heim example.[12]

Perhaps because it's generally easier to block readings than to create them, most semanticists currently seem to favor the movement view. It was always the better-established one in any case. But it's in large measure on this treacherous empirical terrain that the question may have to be decided. This has been a lively area of research (Kennedy 1997, Heim 2000, Schwarzschild & Wilkinson 2002, Sharvit & Stateva 2002, Bhatt & Pancheva 2004, Grosu & Horvath 2006, Heim 2006, Bhatt & Takahashi 2007, 2011, van Rooij 2008, Beck 2011, 2012, Alrenga et al. 2012).

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[11]In other words, if a paper reaches 9 pages in all required worlds, it also reaches 8 pages in them. This follows from the monotonicity assumption that any paper that is 9 pages is also 8 pages. See section **??**.

[12]Interestingly, the scope of the comparative quantifier correlates with the surface position of the comparative clause (Bhatt & Pancheva 2004), which may make it possible to attribute some of the vexing scope properties not to the comparative morpheme but rather to the standard marker *than* (Alrenga et al. 2012).

2.7 *The Russell ambiguity*

Before we leave this topic, a historical note. Bertrand Russell noticed an ambiguity involving comparatives, which he illustrated with an example that has since become famous (Russell 1905):

(53)   I thought your yacht was larger than it is.

This might be uttered by a disappointed yachting enthusiast with a bigger-is-better mindset. The crucial observation is that this has two readings, one of which attributes to the speaker belief in a contradiction:

(54)   a. I thought your yacht was a certain size. That size exceeds its
           actual size.
        b. I thought, 'the size of your yacht exceeds the size of your yacht'.

What accounts for the ambiguity? One traditional answer was scope. A degree quantifier can scope either outside of *thought*, yielding the rational reading in (55a), or inside *thought*, yielding the irrational reading in (55b) (@ represents the actual world and **thoughts**$_@$ represents the worlds compatible with what the speaker thinks the actual world; that is, the epistemically accessible worlds):

(55)   a. $\mathbf{max}(\lambda d \ . \ \forall w \in \mathbf{thoughts}_@\,[\mathbf{large}_w(d)(\mathbf{your\text{-}yacht})]) >$
                                  $\mathbf{max}(\lambda d \ . \ \mathbf{large}_@(d)(\mathbf{your\text{-}yacht}))$

        b. $\forall w \in \mathbf{thoughts}_@ \begin{bmatrix} \mathbf{max}(\lambda d \ . \ \mathbf{large}_w(d)(\mathbf{your\text{-}yacht})) > \\ \mathbf{max}(\lambda d \ . \ \mathbf{large}_w(d)(\mathbf{your\text{-}yacht})) \end{bmatrix}$

This seems alarmingly familiar. There is a major difference, however. Because what's at issue here is a propositional attitude predicate, this can be assimilated to an ambiguity of a different kind, the *de re/de dicto* ambiguity (see section **??** or Heim & Kratzer 1998 for a brief introduction to the phenomenon). The current prevailing wisdom is that such ambiguities are not actually about scope. For one thing, the movement operation that would be necessary to achieve the required scope would take the degree quantifier out of a finite clause, which is not possible syntactically. An alternative, preferable explanation can be achieved by indexing predicates in the object language with world variables that can then be bound (or not) by higher intensional operators (Percus 2000, Heim 2000). Despite its fame and general neatness, the Russell sentence won't help us here.

2.8 *Quantification and comparative clauses*

Matters of quantification and scope also figure in connection with quantifiers in the comparative clause.

One fact any theory of comparatives should capture is that comparative clauses license negative polarity items (NPIs; Hoeksema 1983):

(56)　a. Floyd is taller than <u>any</u> linguist <u>at all</u>.
　　　b. Floyd complained more than I <u>ever</u> have.

This follows most clearly from the sort of denotation for the comparative the chapter began with (what Schwarzschild 2008 called the 'A-not-A' theory), in which an overt logical negation is involved. Other theories of the comparative also capture this fact, though. On the classical view of Ladusaw (1980), NPIs are licensed in DOWNWARD-ENTAILING ENVIRONMENTS, environments that license inferences from supersets to subsets. Comparative clauses do, in fact, do this:

(57)　Floyd is taller than any linguist.
　　　entails: Floyd is taller than any phonologist.

That's reflected in the maximality semantics. In (57), the maximality operator invites one to examine all linguists, note the height of each, and pick the highest value. Because phonologists are a subset of linguists, the examination of all linguists included all phonologists. This in turn means that the maximum value initially arrived at could not be exceeded by looking only at phonologists.

On the other hand, comparative clauses have a systematic prohibition on negation and quantifiers that are themselves downward-entailing (von Stechow 1984, Rullmann 1995):

(58)　#Floyd is taller than $\left\{\begin{array}{l}\text{Clyde isn't} \\ \text{none of the phonologists is} \\ \text{no linguist is}\end{array}\right\}$.

Again, this follows from a maximality semantics. To determine whether Floyd is taller than no linguist is, one would first have to determine the maximum height that no linguist reaches. Well, no linguist is 12 feet tall—or 13, or 14, or 15, ... Of course, there is no such maximum, so the maximality operator will be undefined for such a case.

Finally, there are thorny problems concerning other quantifiers in comparative clauses. As Larson (1988), Schwarzschild & Wilkinson (2002) and Heim (2006) observe, quantifiers in the comparative clause take unexpectedly wide scope:

(59)   a. Floyd is taller than every linguist is.

   b. [more than $\varnothing$ λd_1 every linguist is d_1-tall] λd_2 Floyd is d_2 tall

   c. $[\![$ *than $\varnothing$ λd_1 every linguist is d_1-tall* $]\!]$

   $\quad = \mathbf{max}(\lambda d_1 \,.\, \forall x [\mathbf{linguist}(x) \to \mathbf{tall}(d_1)(x)])$

   d. $[\![$ *[more than $\varnothing$ λd_1 every linguist is d_1-tall] λd_2 Floyd is d_2 tall* $]\!]$

   $\quad = \mathbf{max}(\lambda d_2 \,.\, \mathbf{tall}(d)(\mathbf{Floyd})) \;>$
   $\qquad\qquad\qquad\qquad \mathbf{max}(\lambda d_1 \,.\, \forall x [\mathbf{linguist}(x) \to \mathbf{tall}(d_1)(x)])$

This denotation asks us to survey the linguists to determine the greatest height they have all reached—that is, the height of the shortest linguist. It then asserts that Floyd's height exceeds this. This isn't a possible reading. (Any sense of déjà vu one might be experiencing in light of section 2.6 is not accidental.)

   If the universal could scope outside the comparative, the right reading would result:

(60)   a. [every linguist] λx_1 [more than $\varnothing$ λd_1 x_1 is d_1-tall] λd_2
   $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ Floyd is d_2 tall

   b. $[\![$ *every linguist* $]\!] = \lambda P_{\langle e,t \rangle} \,.\, \forall x [\mathbf{linguist}(x) \to P(x)]$

   c. $[\![$ *[than $\varnothing$ λd_1 x_1 is d_1-tall]* $]\!]$

   $\quad = \mathbf{max}(\lambda d_1 \,.\, \mathbf{tall}(d_1)(x_1))$

   d. $[\![$ *[more than $\varnothing$ λd_1 x_1 is d_1-tall] λd_2 Floyd is d_2 tall* $]\!]$

   $\quad = \mathbf{max}(\lambda d_2 \,.\, \mathbf{tall}(d)(\mathbf{Floyd})) > \mathbf{max}(\lambda d_1 \,.\, \mathbf{tall}(d_1)(x_1))$

   e. $[\![$ (60a) $]\!] = \forall x \begin{bmatrix} \mathbf{linguist}(x) \to \\ \quad \mathbf{max}(\lambda d_2 \,.\, \mathbf{tall}(d)(\mathbf{Floyd})) > \\ \quad \mathbf{max}(\lambda d_1 \,.\, \mathbf{tall}(d_1)(x_1)) \end{bmatrix}$

The scope-taking operation that would be required to achieve this configuration is precisely the sort that isn't possible: Quantifier Raising doesn't operate across finite clause boundaries.[13] Worse, here the impossible would have to not only be possible but obligatory. We need not only to generate (60), but also to avoid generating (59). Worse still, as Schwarzschild & Wilkinson point out that the same problem can be discerned with FLOATED QUANTIFIERS like the one in (61) (Sportiche 1988), which don't undergo QR:

(61)   Lucy paid more for her suit than they both paid in taxes last year.
   $\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad$ (Schwarzschild & Wilkinson)

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[13]Of course, this might be evidence that there is no such restriction after all (it's the sort of movement that would also be required for a scopal account of *de re/de dicto* ambiguities and of specific indefinites), but this would run counter to a well-established consensus.

These kinds of facts remain an area active research (in addition to work already cited, see Krasikova 2008b, van Rooij 2008, Gajewski 2009, Beck 2010). Larson (1988) proposed coping with the problem by changing what is being lambda-abstracted over in the comparative clause (not degrees but properties). Schwarzschild & Wilkinson take a radically different tack: they suggest that what is necessary is a different way of thinking about degrees. On the usual approach, a degree represents only a single point on a scale—say, a single height. But, they suggest, when there are quantifiers in the comparative clause, degrees need to represent more than one height at a time. This can be accomplished by assuming that instead of ordinary degrees, comparatives manipulate intervals. In a different way and for different reasons, Kennedy (1997) proposed this, too. (There is a slight terminological difficulty here: one could reserve the term 'degree' for degrees-qua-points, or one could generalize it to include degrees-qua-intervals. The usual choice is the former. Kennedy suggests 'extents' for degrees-qua-intervals.) One intriguing aspect of this work is way it relates assumptions about scope-taking mechanisms—ultimately a syntactic matter as much as a semantic one—to assumptions about the ontology of degrees, a matter that would have seemed distant from syntactic considerations like movement constraints.

3 Other degree constructions

3.1 *Differential comparatives and measure phrases*

Ordinary comparatives do not, of course, exhaust the full range of degree constructions. We should consider some of the others.

Among the better-studied are DIFFERENTIAL COMPARATIVES. These are simply comparatives with a measure phrase:
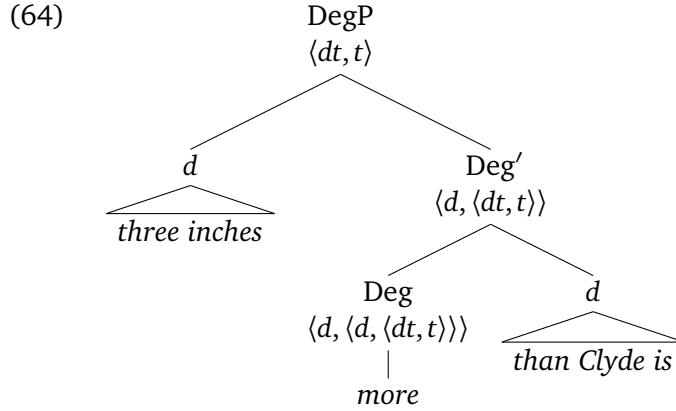
(62)   Floyd is <u>three inches</u> $\left\{ \begin{array}{c} \text{taller} \\ \text{less tall} \end{array} \right\}$ than Clyde is.

To cope with these, one move is simply to add an additional argument to the comparative morpheme. For the remainder of this chapter, we'll stick with the relatively standard small DegP movement approach to comparatives. Thus we move from (63a) to (63b):

(63)   a. $[\![\, more \,]\!] = \lambda d \lambda D_{\langle d, t \rangle} \, . \, \mathbf{max}(D) > d$

      b. $[\![\, more \,]\!] = \lambda d \lambda d' \lambda D_{\langle d, t \rangle} \, . \, \mathbf{max}(D) - d \geq d'$

The differential degree d' now serves to measure the difference between the maximal degree associated with the clause and the degree provided by the

comparative clause complement of *more*. The syntax of the DegP is as in (64), and the full denotation in (65):

(64)

$$
\begin{array}{c}
\text{DegP} \\
\langle dt, t \rangle
\end{array}
$$

(tree)

- *d* — *three inches*
- Deg′ $\langle d, \langle dt, t \rangle \rangle$
  - Deg $\langle d, \langle d, \langle dt, t \rangle \rangle \rangle$ — *more*
  - *d* — *than Clyde is*

(65)   a. [three inches more than Clyde] λd_1 Floyd is d_1 tall

     b. ⟦ *three inches more than Clyde* ⟧

        = ⟦ *more* ⟧ (⟦ *than Clyde is* ⟧)(⟦ *three inches* ⟧)

        = ⟦ *more* ⟧ ($\mathbf{max}(\lambda d_2 . \mathbf{tall}(d_2)(\mathbf{Clyde})))(\mathbf{3\text{-}inches})$

        = $\lambda D_{\langle d, t \rangle} . \mathbf{max}(D) - \mathbf{max}(\lambda d_2 . \mathbf{tall}(d_2)(\mathbf{Clyde})) \geq \mathbf{3\text{-}inches}$

     c. ⟦ *three inches more than Clyde* ⟧ (⟦ λd_1 *Floyd is* d_1 *tall* ⟧)

        = ⟦ *three inches more than Clyde* ⟧ ($\lambda d_1 . \mathbf{tall}(d_1)(\mathbf{Floyd})$)

        = $\mathbf{max}(\lambda d_1 . \mathbf{tall}(d_1)(\mathbf{Floyd})) -$
                          $\mathbf{max}(\lambda d_2 . \mathbf{tall}(d_2)(\mathbf{Clyde})) \geq \mathbf{3\text{-}inches}$

Does this require stipulating that *more* and *less* each come in two homophonous forms, one with a differential argument and one without? Not necessarily. There are ways of elaborating the structure of the comparative or changing its basic meaning that make it possible for a single denotation to accommodate a measure phrase. Discussion of differential comparatives can be found in Schwarzschild (2005), Xiang (2005), Brasoveanu (2008), Rett (2008b), Schwarzschild (2008), Solt (2009), Sawada & Grano (2011), Grano & Kennedy (2012), and they often come up in older, more general work as well (such as von Stechow 1984).

    A related phenomenon is FACTOR PHRASES, also known as RATIO PHRASES, which seem to involve degree multiplication:

(66)   The coffee table is two times wider than the armchair.

In English, these are more natural with equatives:

(67)   The coffee table is two times as wide as the armchair.

Gobeski (2009) points out that languages vary in which of these forms they permit with factor phrases, with Macedonian insisting on the comparative (as do Hebrew and Russian; Sassoon 2010a):

(68) a. Jon je dva puti po   visok od   Mari.
          John is two times more tall   from Mary
          'John is two times as tall as/taller than Mary.'

      b. *Jon je dva puti   visok kolku Mari.
          John is two times tall   as   Mary

Even in English, Gobeski observes, only the equative occurs with *twice* (**twice taller than Mary*). Writing a denotation for a factor phrase might seem relatively straightforward, but a number of deeper issues lurk beneath the surface. One of them is simply how to arrange the pieces compositionally in an insightful way. Apart from the Gobeski observation and related puzzles (does being *two times taller* entail being at least twice as tall, or more than twice as tall? how do these relate to adverbial uses?), there are also broader questions about what operations on degrees are possible in principle (Sassoon 2010b).

3.2 *Equatives*

The standard assumption about equatives is that they require meeting or exceeding the standard degree:

(69) $[\![\,as\,]\!] = \lambda d \lambda D_{\langle d,t \rangle} . \mathbf{max}(D) \geq d$

(70)   a. Floyd is as tall as Clyde is.
       b. $\mathbf{max}(\lambda d_1 . \mathbf{tall}(d_1)(\mathbf{Floyd})) \geq \mathbf{max}(\lambda d_2 . \mathbf{tall}(d_2)(\mathbf{Clyde}))$

Discussion of the equative can frequently be found in discussions of the comparative, but recent work includes Bale (2006), Alrenga (2007), Bhatt & Pancheva (2007), Schwarz (2007), Brasoveanu (2008), Rett (2008b, 2010, 2011b), Anderson & Morzycki (2012), Beck (2012). For discussion specifically of the choice between = (an exactly-identical reading) vs ≥ (an at-least reading), see Bhatt & Pancheva (2007), Rett (2008a,b) and, briefly, section 4.

3.3 *Superlatives*

Things get more complex with superlatives:

(71)   Floyd is the tallest.

For this to be true, Floyd must be taller than everyone else. There are a number of ways to cash this out, but here's one:

(72) $\quad \forall x \left[\begin{array}{l} x \neq \textbf{Floyd} \rightarrow \\ \quad \textbf{max}(\lambda d\,.\,\textbf{tall}(d)(\textbf{Floyd})) > \\ \quad \textbf{max}(\lambda d'\,.\,\textbf{tall}(d')(x)) \end{array} \right]$

This universally quantifies over all non-Floyd individuals, requiring that he be taller than all of them.

How is this denotation built? The answer depends largely on what explains a well-known ambiguity (Ross 1964, Szabolcsi 1986, and many since) between ABSOLUTE and COMPARATIVE readings:

(73) Floyd climbed the highest mountain.

    a. *comparative reading*:
       'Everyone else climbed a mountain shorter than the one Floyd climbed.'

    b. *absolute reading*:
       'All other mountains are shorter than the one Floyd climbed.'

There are two approaches to explaining the ambiguity. One, the older of the two, is based on the scope of the degree operator (I'll lapse partly into ordinary English to simplify things):

(74)   a. *comparative reading*:

$\quad \forall x \left[\begin{array}{l} x \neq \textbf{Floyd} \rightarrow \\ \quad \textbf{max}\left(\begin{array}{l} \lambda d\,.\,\textbf{Floyd}\ \text{climbed} \\ \text{a } d\text{-high mountain} \end{array} \right) > \\ \quad \textbf{max}(\lambda d'\,.\,x\ \text{climbed a } d'\text{-high mountain}) \end{array} \right]$

    b. *absolute reading*:

      Floyd climbed the mountain such that:

$\quad \forall x \left[\begin{array}{l} x \neq \textbf{Floyd's-mountain} \rightarrow \\ \quad \textbf{max}\left(\begin{array}{l} \lambda d\,.\,\textbf{Floyd's-mountain}\ \text{is} \\ \text{a } d\text{-high mountain} \end{array} \right) > \\ \quad \textbf{max}(\lambda d'\,.\,x\ \text{is a } d'\text{-high mountain}) \end{array} \right]$

The crucial difference is in whether the mention of climbing occurs inside the scope of **max**. If it does, the maximal degree will depend on the relative heights of mountains that were climbed. If it doesn't, it will depend only on the heights of mountains. To arrive at these readings compositionally, the superlative morpheme must be able to scope at different levels, so this

approach favors theories in which degree morphemes move. The implementation tends to be complicated, so I won't go into further detail here (that can be found in Heim 1995 and Sharvit & Stateva 2002 among others).

The alternative approach is simpler. Its outlines can be perceived by considering slightly different paraphrases of precisely the same meanings:

(75)   a. *comparative reading*:
           'Of the mountains climbed, the one Floyd climbed is the highest.'

        b. *absolute reading*:
           'Of all the mountains, the one Floyd climbed is the highest.'

In each case, the paraphrase begins with an *of* PP that restricts the domain of quantification, in one case to mountains climbed and in the other to mountains generally. This is rather like what happens with any run-of-the mill quantifier. *Everyone left* doesn't require total depopulation of the planet, but only that the contextually relevant people have left. The usual way to represent this is with a RESOURCE DOMAIN VARIABLE C that contains all relevant individuals (Westerståhl 1985, von Fintel 1994):

(76)   a. Everyone$_C$ left.
        b. $\forall x \in C[\textbf{person}(x) \rightarrow \textbf{left}(x)]$

Natural language quantification generally seems to work this way, so it would be odd if the quantifier in the superlative, and therefore in the mountain sentence, weren't similarly restricted:

(77)   Floyd climbed the mountain such that:

$$\forall x \in C \left[\begin{array}{l} x \neq \textbf{Floyd-mountain} \rightarrow \\ \quad \textbf{max}\left(\begin{array}{l} \lambda d \,.\, \textbf{Floyd-mountain} \text{ is} \\ \text{a } d\text{-high mountain} \end{array} \right) > \\ \quad \textbf{max}(\lambda d' \,.\, x \text{ is a } d'\text{-high mountain}) \end{array} \right]$$

This representation looks virtually identical to the absolute reading. But because there is now a contextual domain restriction, everything hinges on its content. If the discourse is concerned with all mountains, C contains them all and the result is the absolute reading. If the discourse is concerned only with mountains climbed, C consists only of those, and the comparative reading results.

One interesting aspect of the two competing proposals is that they draw the line between vagueness and ambiguity differently. On the scope view, this is an ambiguity; on the contextual view, it's essentially a form of vagueness (or in any case, semantic underspecification). This illustrates again that these distinctions aren't always clear without first articulating an analysis—and

then the choice between them may hang on the relative merits of alternative analyses.

For more on superlatives, consult Partee (1986), Szabolcsi (1986), Gawron (1995), Heim (1995), Farkas & Kiss (2000), Sharvit & Stateva (2000, 2002), Büring (2007), Geurts & Nouwen (2007), Matushansky (2008), Aihara (2009), Beck (2009), Gutiérrez-Rexach (2010), Sleeman (2010), Cohen & Krifka (2011), and Krasikova (2011).

3.4 *Sufficiency and excess*

Certain degree constructions require an intricate intermingling of degrees and possible worlds (Meier 2003, Hacquard 2006). In English, they are headed by *too* and *enough*:

(78)   a. Floyd is too old to ski.
        b. Floyd is old enough to ski.

What (78a) says, very roughly, is something about worlds consistent with norms about the appropriate age for safe (or good or enjoyable) skiing. The precise nature of the accessibility relation—that is, precisely what worlds are being quantified over—need not concern us here. The crucial thing is just the fact of the modality itself. To represent it, we will need to momentarily return to an intensional system (with @ representing the actual world):

(79)   a. Floyd is too old to ski.

    b. $\forall w \in \textbf{safe-skiing-worlds} \left[\begin{array}{c} \textbf{max}(\lambda d \, . \, \textbf{old}_@(d)(\textbf{Floyd})) > \\ \textbf{max}(\lambda d \, . \, \textbf{old}_w(d)(\textbf{Floyd})) \end{array} \right]$

This say that in all the worlds in which safe skiing practices are observed, Floyd's age is lower than in the actual world. *Old enough* would simply be the existential counterpart (with, in this case, a different accessibility relation).

These structures have not received nearly as much attention as has been lavished on other degree constructions. A fully-developed theory is, however, presented in Meier (2003), who assimilates them to conditionals, and in Hacquard (2006), who explores whether the content of the infinitive is an entailment.

3.5 *Degree exclamatives and degree questions*

Questions and exclamatives are not primarily about degrees. Both have their own intricate and independent grammar. Nevertheless, degree expressions can enter into both of these structures, and when they do, there is an

opportunity to examine the interaction of degrees and a complicated and independent subsystem of the grammar.

In English—and indeed in many languages—degree questions and degree exclamatives are formed with the same *wh*-word:

(80) a. How tall are you?   (question)
      b. How tall you are!   (exclamative)

We can't indulge here in an extensive digression into the grammar of questions and exclamatives, but it's possible to perceive at least one interesting puzzle. Part of the meaning of the exclamative in (80b) is roughly paraphrasable as 'you're very tall'. Although *how* and *very* are both degree modifiers, it seems unlikely that *how* is responsible for the 'very' meaning because *how* also occurs in (80a), which has no such meaning. The challenge, then, is to derive this meaning from an independent general property of exclamative structures. That crucial property may be the sense of surprise or unexpectedness that exclamatives convey. But how to assemble these pieces? What is the basic meaning of *how*? What is the basic meaning of exclamatives? Why does the 'very' paraphrase seem not to do justice to the full meaning of (80b)? If the exclamative structure itself can create a semantic effect similar to that created by the degree word *very*, might this reveal something about various ways to give rise to degree-modifier meanings? One might begin a search for answers with Zanuttini & Portner (2003), Portner & Zanuttini (2005), Castroviejo Miró (2007, 2008a,b), Potts & Schwarz (2008), Rett (2008b), Sæbø (2010), Bylinina (2011), Rett (2011a), Miró (2012), Castroviejo Miró (2013)).

3.6 *Metalinguistic comparatives*

Among the more exotic forms of comparative are METALINGUISTIC COMPARATIVES, which, according to one common description, compare not the meanings of words but rather the appropriateness of their use:

(81) a. George is more dumb than crazy.
      b. Clarence is more a syntactician than a semanticist.

The idea is that these are like METALINGUISTIC NEGATION, which is 'metalinguistic' in the sense that it doesn't negate the semantic content of an expression but rather 'reject[s] the language used by an earlier speaker' (Horn 1985):

(82)   He didn't call the [ˈpoʊlis]. He called the [pəˈlis].

This is especially striking because it **can't** be the meaning that's negated. Semantically, one sentence is simply the negation of the other, so they can't both be true. It's that the language itself is at issue, not the content.

There are several ways in which metalinguistic comparatives differ from ordinary ones. First, they are never possible as SYNTHETIC comparatives, the kind with *-er* (the other kind, with *more,* are called ANALYTIC):

(83) a. *George is dumber than crazy.
      b. *Dick is crazier than dumb.

In ordinary comparatives, both *dumb* and *crazy* generally require the synthetic form (i.e., *dumber* rather than *more dumb*). Metalinguistic comparatives also permit *than* phrases that would otherwise be impossible:

(84) a. George is more dumb than crazy.
      b. *George is dumber than crazy.

And they are robustly cross-categorial:

(85) a. George more [VP felt the answer] than [VP knew it.
      b. George is more [AP afraid of Dick] than [PP in love with him].

Some languages even use distinct morphemes for metalinguistic comparison (Sawada 2007, Giannakidou & Yoon 2011):

(86) GREEK
      Ta provlimata sou   ine perissotero ikonomika para nomika.
      the problems   yours are more   financial   than legal
      'Your problems are financial more than legal.'

(87) JAPANESE
      Taroo-wa sensei-to iu-yori   gakusya-da.
      Taroo-TOP teacher-as say-than scholar-PRED
      'Taroo is more a scholar than a teacher.'

Morzycki (2009, 2011) argued that such comparatives are not actually 'metalinguistic' in the sense that metalinguistic negation is. If they compared the appropriateness of use of linguistic expressions, it should be possible to compare pronunciations metalinguistically just as it's possible to negate them. As it turns out, it generally isn't:

(88) #He more called the [pə'lis] than the ['poʊlis].

Another significant difference is that metalinguistic comparatives don't actually seem to compare along a vague generalized 'appropriateness' dimension.

Suppose Herman has entered a kindergarten class and said to the children, 'George is an asshole.' Clarence might reasonably take him aside and say (89a), but not (89b):

(89) a. It's more appropriate to say 'He is a bad man' than to say 'He is an asshole'.
      b. ??He's more a bad man than an asshole.

One can't compare aesthetic appropriateness this way either. If Coleridge had just presented you with a poem that begins 'in Xanadu did Kubla Khan / a stately pleasure dome requisition', you can respond with (90a) but not (90b):

(90) a. It's more appropriate/better (metrically) to say he decreed it than to say he requisitioned it.
      b. ??He more decreed it than requisitioned it.

This suggests that we can do better than a vague appeal to 'appropriateness'.

Instead, I argued that these are actually about comparing IMPRECISION, the pragmatic slack we afford each other in communicating (see section **??**; Lasersohn 1999). The idea is that we're comfortable describing someone as *six feet tall* even if they're a few molecules shorter than that because it's close enough for most contexts. In Lasersohn's terms, such a height falls in the PRAGMATIC HALO around *six feet*. What metalinguistic comparatives do, then, is compare halo size, or degrees of precision required to render something true. What *more dumb than crazy* means is that *George is dumb* is true at a higher level of precision than *George is crazy*. To implement this, it's natural to construe halos as having a size measured in degrees and to add such degrees of precision as an index to the interpretation function. Thus:

(91) $[\![$ *George is more dumb than crazy* $]\!]^{d'}$

$$= \mathbf{max}(\lambda d \ . \ [\![\textit{George is dumb}]\!]^{d}) \ >$$

$$\mathbf{max}(\lambda d \ . \ [\![\textit{George is crazy}]\!]^{d})$$

This may have other applications. One could ask, for any given degree modifier, whether it manipulates lexically-provided degrees or contextual imprecision degrees (see also Bouchard 2012, Klecha 2013, Anderson to appear, 2013).[14]

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[14]Bouchard (2012) makes the useful point that using the terms 'precise' and 'imprecise' for independently vague predicates departs their ordinary meaning. In the ordinary sense, we wouldn't say e.g. #*He's precisely bald/tall*. On the other hand, *Bald/tall is precisely what he is* or . . . *is precisely the right term* are both fine, which suggests the former oddness is a grammatical rather than a conceptual one. (Clearly, there are some such grammatical

Giannakidou & Stavrou (2008), Giannakidou & Yoon (2009, 2011) instead emphasize modal notions, so that *George is more α than β* means something like 'I prefer to say that George is α than to say that he is β'. Importantly, though, both approaches agree that metalinguistic comparatives are part of the grammar rather than an extra-grammatical, purely pragmatic phenomenon.

3.7 *Comparison of deviation*

Outside of metalinguistic comparatives, comparisons across scales are generally impossible (see also sections **??** and **??**):

(92)   a. #My copy of *The Brothers Karamazov* is heavier than my copy of *The Idiot* is old.   (Kennedy 1997)
          b. #My monkey is uglier than this book is long.

This is INCOMMENSURABILITY, and it's one of the selling points of a degree-based semantics that it naturally accounts for it. Kennedy (1997) observed that there are, however, certain contexts in which comparisons across different adjectives are possible (his examples):

(93)   a. Robert is as short as William is tall.
          b. Alex is as slim now as he was obese before.
          c. It's more difficult to surf Maverick's than it is easy to surf Steamer Lane.

He dubbed this COMPARISON OF DEVIATION because what's apparently being compared is the amount by which the standard has been exceeded. In what would seem to be a telling parallel to metalinguistic comparatives, he points out that such readings seem to be impossible for synthetic comparatives:

(94)   San Francisco Bay is $\left\{ \begin{array}{l} \text{more shallow} \\ \text{\#shallower} \end{array} \right\}$ than Monterey Bay is deep.

At a very broad level of description, these also resemble metalinguistic comparatives in their meaning. But it may be wise to resist the temptation to unify them. Comparison of deviation readings license inferences to the positive form:

(95)   Alex is as slim now as he was obese before.
        entails: 'Alex is slim now.'

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idiosyncrasies: *We'll arrive at precisely/??imprecisely three o'clock.*) Nevertheless, there might be something to be said for adopting a term like 'truth-conditional aptness'.

The inference is not cancelable, as we would expect of an entailment.

(96) ??Alex is as slim now as he was obese before, but he's not slim now.

Metalinguistic comparatives, on the other hand, give rise to an **implicature** that the positive form holds, but not an entailment:

(97)   Clarence is more tall than ugly.
        implicates but does not entail: Clarence is tall.

Being only an implicature, it **is** cancelable:

(98)   Clarence is more tall than ugly, but he's not (really) tall either.

3.8 *Indirect comparison*

Yet another kind of comparison that might be mistaken for either of the previous two is INDIRECT COMPARISON (Bale 2006, 2008, van Rooij to appear, Doetjes et al. 2011).[15] Such cases still involve comparatives with distinct adjectives (examples are from Bale 2008):

(99)   a. Let me tell you how pretty Esme is. She's prettier than Einstein
           was clever.
        b. Although Seymour was both happy and angry, he was still happier
           than he was angry.
        c. Seymour is taller for a man than he is wide for a man.

Unlike either of the other two varieties of cross-adjective comparatives, these are possible with *-er*. And unlike comparison of deviation, these don't license inferences to the positive form. Bale asks us to consider a scenario in which Mary is known to be stupid, and he would like to convey that he is unattractive. He might say (100):

(100)   Unfortunately, Mary is more intelligent than I am beautiful.
        does not entail: Mary is intelligent.
        does not entail: I am beautiful.

Indeed, in this context, there isn't even an implicature to this effect. This is important because it's relatively easy to dismiss metalinguistic comparatives

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[15]Doetjes et al. (2011) refer to this as 'relative comparison'. The term is perhaps more transparent, but also taken several times over. Van Rooij (to appear) opts for 'interadjective comparison', which is also helpfully transparent, but risks leaving us in the position of saying that comparison of deviation and metalinguistic comparison isn't interadjective comparison despite being, in the informal sense, precisely that.

and comparison of deviation as peripheral kinds of comparative, not ones upon which the analysis of comparatives generally should rest.

These cases, however, can't be dismissed so easily. Nor are they a quirk of English: he shows that they occur across a number of languages, with the precisely same morpheme as ordinary comparatives. They may therefore provide a window onto all comparatives. What they reveal, Bale argues, is that comparison is inherently a two-part affair, and that we've been over-looking half of it. The first part involves degrees similar to the ones we've been dealing with, determined by the lexical semantics of particular gradable predicates. The other part involves what he calls 'the universal scale': an abstract all-purpose scale consisting of (or isomorphic to) the rational numbers (all numbers that can be expressed as fractions). What indirect comparatives reveal is that the comparative morpheme deals in universal-scale degrees, not their lexical counterparts. See Bale (2006, 2008) for the articulation of the idea (and van Rooij to appear for an alternative view).

4   Neutralization and positive-entailingness

On any semantics we've considered, the comparative should not give rise to inferences to the positive form. Degree theories expect such inferences only when the comparative morpheme's denotation includes some crucial element of the denotation of POS: a contextually-provided standard, or something like one.

In light of this, (101) should be alarming:

(101)   a. This surface is more opaque than that one.
          entails: This surface is opaque.

   b. This surface is more transparent than that one.
          entails: This surface is transparent.

   c. This cough syrup is sweeter than that one.
          entails: This cough syrup is sweet.

Equally alarming are similar facts about equatives (already encountered in section **??**):

(102)   a. Floyd is as short as Clyde.
          entails: Floyd is short.

   b. The coffee table is as narrow as the couch.
          entails: The coffee table is narrow.

These are in fact related to the example the chapter began with:

(103)   She also had one leg not as short as the other.
        entails: She had one leg that was short.

Neither the comparative nor the equative denotations predict this. What's
going on?

Before we address this question, a brief terminological interlude is in
order. I've been using the cumbersome phrase 'licenses inferences to the posi-
tive form'. It'd be useful to have a simple unambiguous term for this property.
One candidate is EVALUATIVE, used in this sense by Neeleman et al. (2004),
Rett (2008a) and Rett (2008b), but this is certainly not unambiguous. It's
more often used in several other senses with respect to adjectives (see the
glossary). Another established term is 'NORM-RELATED' (Bierwisch 1989).
This is unambiguous, but may be too specific. First, it suggests that inferences
to the positive form necessarily involve a norm (rather than some other
form of standard; Kennedy 2007b, who cites Bogusławski 1975). Second, the
term is misleading for absolute adjectives. *Dry*, for example, has a standard
of complete dryness—an umbrella isn't dry if it's even slightly wet—yet it
would be odd to claim that the norm is for things to be completely dry. Third,
Bierwisch himself intended for the term to be restricted to dimensional ad-
jectives. So, for lack of a better alternative, I will use the cumbersome term
'POSITIVE-ENTAILING' (though of course *positive* is itself has multiple uses).
There is a better term for the **failure** to license inferences to the positive:
NEUTRALIZATION (see e.g. Winter 2001).

So, to ask the question again, this time more precisely: what accounts for
the positive-entailing reading of various degree constructions?

This is the question Rett (2008a,b) addresses. She begins with the insight
that positive-entailingness may be independent of the degree relation an
adjective provides. She proposes that it actually comes from an optional
independent morpheme, EVAL, whose sole contribution is that a degree
exceeds the standard:

(104) $[\![\text{EVAL}]\!] = \lambda D_{\langle d,t \rangle} \lambda d \, . \, D(d) \wedge d > \textbf{standard}(D)$

Importantly, this is a predicate-modifier type—it maps from properties of
degrees to properties of degrees. It can therefore plug into a tree with minimal
disruption.

Because EVAL can optionally be inserted anywhere, a simple positive form
will now have two possible structures, one with it and one without. In its
absence, the positive will have a structure like the one in (105) (I will take
certain liberties with her framework for convenience):

(105) $[\![\, \exists \text{ is } d \text{ [Floyd tall]} \,]\!] = \exists d [\textbf{tall}(d)(\textbf{Floyd})]$

This assumes the order of the arguments of the adjective is switched, that is, that it is type $\langle e, dt \rangle$ rather than $\langle d, et \rangle$, and that the subject therefore starts low in the structure (Bhatt & Pancheva 2004). It also assumes that the measure-phrase position is occupied by a degree variable, d, which is then bound by a general-purpose existential closure operation (Heim 1982). What's notable about (105) is that it has extremely weak truth conditions: it just requires that Floyd have **some** degree of height. This is unusably uninformative. If this is all a positive adjective ever meant, no one would be able to use one.

But of course, there is another reading, one that is informative and will therefore always be preferred. That's associated with the different but homophonous structure that contains EVAL:

(106) $[\![\exists \; is \; d \; [\text{EVAL} \; [Floyd \; tall]] \;]\!]$
$= \exists d \, [\textbf{tall}(d)(\textbf{Floyd}) \wedge d > \textbf{standard}(D)]$

Unlike (106), this structure has a reasonable meaning: precisely that of the actual meaning of the positive form.

Things become more interesting still in the equative. Rett assumes an 'exactly' semantics, as in (107):

(107) $[\![as]\!] = \lambda d \lambda D_{\langle d, t \rangle} . \textbf{max}(D) = d$

This will turn out to be crucial. As for the positive form, a simple equative will have two structures, one with EVAL and one without:

(108) Floyd is as tall as Clyde.
   a. $[\![[as \; as \; Clyde] \; \varnothing \; \lambda d_1 \; is \; d_1 \; [Floyd \; tall]]\!]$
$= \left[\begin{array}{c} \textbf{max}(\lambda d_1 . \textbf{tall}(d_1)(\textbf{Floyd})) = \\ \textbf{max}(\lambda d . \textbf{tall}(d)(\textbf{Clyde})) \end{array} \right]$
   b. $[\![[as \; as \; Clyde] \; \varnothing \; \lambda d_1 \; is \; d_1 \; \text{EVAL} \; [Floyd \; tall]]\!]$
$= \left[\begin{array}{c} \textbf{max}(\lambda d_1 . \textbf{tall}(d_1)(\textbf{Floyd}) \wedge d_1 > \textbf{standard}(D)) = \\ \textbf{max}(\lambda d . \textbf{tall}(d)(\textbf{Clyde})) \end{array} \right]$

The positive-entailing form in (108b) means the same thing as (108a), except that it adds the requirement that the maximal degree of Floyd's tallness is above the standard. This is simply a stronger version of (108a), so the form might as well not exist. Any use of it could equally well be taken as an instance of the weaker one. This seems a good result. It correctly predicts that equatives such as (108) aren't positive-entailing.

In equatives that involve negative adjectives, though, the picture changes.

Those aren't neutralizing, as we've seen. Here's what the account predicts for these cases:

(109)   Floyd is as short as Clyde.

    a. ⟦ *[as as Clyde]* ∅ λd_1 *is* d_1 *[Floyd short]* ⟧

$$= \begin{bmatrix} \mathbf{max}(\lambda d_1 \,.\, \mathbf{short}(d_1)(\mathbf{Floyd})) = \\ \mathbf{max}(\lambda d \,.\, \mathbf{short}(d)(\mathbf{Clyde})) \end{bmatrix}$$

    b. ⟦ *[as as Clyde]* ∅ λd_1 *is* d_1 EVAL *[Floyd short]* ⟧

$$= \begin{bmatrix} \mathbf{max}(\lambda d_1 \,.\, \mathbf{short}(d_1)(\mathbf{Floyd}) \wedge d_1 > \mathbf{standard}(D)) = \\ \mathbf{max}(\lambda d \,.\, \mathbf{short}(d)(\mathbf{Clyde})) \end{bmatrix}$$

The result is largely the same. But there's an important fact to notice about the relationship between (109a) and (108a): they mean precisely the same thing. If Floyd and Clyde have the same maximal tallness, they also have the same maximal shortness. So the two neutral versions of the equative have identical truth conditions. This, Rett argues, is inherently an unstable situation: two adjectives with opposite polarity and yet precisely the same meaning in the same construction. Just as nature abhors a vacuum, language abhors losing its polarity distinctions. There is, she suggests, a general principle that makes us favor only one form in this case, and favor the unmarked—that is, positive—adjective in particular. This means that the only way to express the positive-entailing meaning is with the positive adjective, (108a). The only way the negative form could achieve any meaning other than what the positive form means is on the reading in (109b). And that is, in fact, its actual meaning.

    For more on how these considerations interact with scale structure, and in particular the open and closed scale distinction, see Rett (2008b).

5   The crosslinguistic picture

5.1   *Measure phrases*

In its classical form, the degree analysis takes as its starting point examples like (110), in which a positive adjective has a measure phrase.

(110)   Floyd is six feet tall.

But there is something deeply misleading about this, Schwarzschild (2005) points out. This construction is present in German and English—which perhaps accounts for its familiarity to semanticists—but otherwise the combination of a measure phrase and positive adjective isn't particularly crosslinguistically common. A more common state of affairs is to permit differential

measure phrases in comparatives, but not with positive adjectives. This is the case in Russian (Matushansky 2002), Japanese (Snyder et al. 1995), and Spanish (Bosque 1999), for example. Even in languages that do permit measure phrases with positive adjectives, the choice of adjectives that permit it varies. English doesn't permit #*two tons heavy*, #*two kilometers far*, or #*35C hot*, he observes, unlike Italian, Dutch, and German, respectively:

(111) a. quasi   due tonnellate
          almost two tons

       b. twee kilometer ver
          two   kilometer far

       c. 35*C* heiss
          35*C* hot

Schwarzschild deals with the issue by treating positive adjectives in general as unable to take measure phrases, but allowing for certain lexical exceptions to be created by a rule that shifts their semantic type to one more closely resembling that of a comparative. This licenses positive-form measure phrases essentially by assimilating them to the ones in differential comparatives.

5.2 *Comparison strategies*

In his typological examination of comparatives, Stassen (1984, 1985, 2006) offered a characterization of variation in this area that formal semanticists have recently turned to as a kind of challenge. Perhaps unsurprisingly, comparatives of the most type most familiar to Indo-European speakers are not especially common. These are what he terms PARTICLE COMPARATIVES because they use a specialized particle (like *than*) as a standard marker.

One of the main alternative possibilities is the CONJOINED COMPARATIVE (examples throughout this section are from Stassen 2006, with his citations):

(112) AMELE (PAPUAN)
       jo   i   ben, jo   eu nag
       house this big   house that small
       'This house is bigger than that house.'   (Roberts 1987: 135)

(113) MENOMINI (ALGONQUIAN)
       Tata'hkes-ew, nenah teh kan
       strong-3SG   I   and not
       'He is stronger than me.'   (Bloomfield 1962: 506)

In one sense, this seems quite different from English comparatives. In another,

it's reassuringly familiar. The semantics for the comparative we began with, the A-not-A analysis (to use Schwarzschild 2008's useful term), was as in (114):

(114) $[\![\,more\,]\!] = \lambda G_{\langle d,\,et \rangle} \lambda x \lambda y . \exists d [G(d)(y) \wedge \neg G(d)(x)]$

This has the shape of a conjoined comparative: two conjuncts with one negated. This denotation was not arrived at by reference to Menomini, of course, so the connection is striking. The underlying semantic structure that English obscures—and which can be glimpsed only with hard-won analytical insights—Menomini wears on its sleeve. One shouldn't get over-excited (one might grudgingly tell oneself). There is no overt degree morphology in such comparatives, and that alone constitutes a major difference and hints at a broader crosslinguistic question about the status of degrees, as we'll see in the next section. (For an explicit analysis of this kind of comparative, see Bochnak 2013b,a.)

Another strategy is the EXCEED COMPARATIVE, in which a verb like English 'exceed' is used:

(115)   THAI
        kǎw sǔuŋ kwaà   kon túk kon
        he   tall exceed man each man
        'He is taller than anyone.'   (Warotamasikkhadit 1972: 71)

This isn't reminiscent of any particular denotation for the comparative, but it is faintly echoed in English constructions like *His height exceeds everyone's*.

A third class of strategies are what Stassen calls LOCATIONAL COMPARATIVES. These involve the use of adpositions or case morphology to mark the standard of comparison. The preposition or case can be 'from' or 'out of' (which he calls 'separative'); 'to', 'for', or 'over' ('allative'); or 'in', 'at', or 'on' ('locative'):

(116)   MUNDARI (AUSTRO-ASIATIC, MUNDA)
        sadom-ete hati mananga-i
        horse-from elephant big-3SG.PRES
        'The elephant is bigger than the horse.'   (Hoffmann 1903: 110)

(117)   MAASAI (NILO-SAHARAN, NILOTIC)
        sapuk olkondi to lkibulekeny
        big hartebeest to waterbuck
        'The hartebeest is bigger than the waterbuck.'
                                        (Tucker and Mpaayi 1955: 93)

5.3 *How much degree is there in your degree constructions?*

The view of degrees that has developed has them doing a lot of work. They are arguments. They can be bound, like pronouns, and in that guise occupy syntactic positions. They can be associated with operator movement of the relative-clause sort. They can be the referents of measure phrases, which name them just as proper names name individuals. They can be referred to with definite descriptions, too, in the form of comparative clauses. They can be quantified over by generalized quantifiers. They can power your hybrid vehicle and taste great in your breakfast cereal.

In light of all this, Beck et al. (2004)—and a stream of research in a similar spirit—broached an interesting and deep theoretical question: can languages vary with respect to how they use degrees, and how **much** they use them? The consensus that seems to be forming is that they can and that they do.

The hypothesis space in this domain is vast: one can imagine various ways in which a language might fail to avail itself of all the available machinery, and various possibilities have been explored and refined. Beck et al.'s key idea about this, though, was as in (118):

(118)   DEGREE ABSTRACTION PARAMETER
        A language {does/does not} have binding of degree variables in the syntax.

Choosing the 'does not' option would mean that a language would not be able to form comparative clauses via lambda abstraction over degrees. Such a language would lack comparatives that can only be formed in this way.

One such case might be comparatives that operate across adjectives but on the same scale (subcomparatives; see section 2.2):

(119)   The shelf is taller than $\varnothing$ λd_1 the door is d_1 wide.

This structure as written would of course be ruled out by (118). Beck et al. are especially interested in cases like these because they don't lend themselves to alternative analyses that attempt to work around using degree-binding. So if a language lacks (119), one might suspect it of having chosen the 'does not' option in (118). And indeed, Japanese seems to be just such a language:

(120) *Tana-wa [doa-ga   hiroi yori (mo)] (motto) takai
       shelf-TOP door-NOM wide yori (mo)   (more)   tall
       'The shelf is taller than the door is wide.'

Japanese doesn't permit direct measure phrases or degree questions (e.g., *how tall?*) either, just as one would expect in the absence of degree abstraction.

How might one get around such a restriction? One possibility is in terms of what Kennedy (2007b, 2011) later called 'implicit' and 'explicit' comparison. English can make use of both of these styles:

(121)   a. *explicit*: Floyd is taller than Clyde.
        b. *implicit*: Compared to Clyde, Floyd is tall.

In the implicit case, the *compared to Clyde* clause doesn't seem to be overtly manipulating degrees. There is no hint degree of morphology anywhere to be found. Rather, what this sentence seems to do is modify the context by changing the comparison class in a particular way. So this is another strategy of comparison: using contextual tools. Beck et al. proposed that Japanese favors this approach.

There is another way an expression that provides the standard of comparison might fail to make use of degrees, one we already encountered. The chapter began with a comparative morpheme specialized for phrasal comparatives like *than Clyde* rather than clausal ones. On that view, the phrasal comparative simply denoted an individual, which the comparative morpheme took as an argument:

(122)   a. $[\![\,more\,]\!] = \lambda G_{\langle d,et \rangle} \lambda x \lambda y \,.\, \exists d\,[G(d)(y) \wedge \neg G(d)(x)]$
        b. $[\![\,more\,]\!]\,([\![\,tall\,]\!])([\![\,than\ Clyde\,]\!])$
           $= \lambda y \,.\, \exists d\,[\mathbf{tall}(d)(y) \wedge \neg\mathbf{tall}(d)(\mathbf{Clyde})]$

Perhaps this wasn't the right analysis for English—though this is hardly self-evident—but it could still very well be the right analysis for other languages. Bhatt & Takahashi (2007, 2011) pursue exactly this possibility. Following Heim (1985), they refer to comparative denotations like (122a)—which take as arguments a gradable predicate and two compared individuals—as the DIRECT ANALYSIS of comparatives. A language that runs its comparative this way would have less use for degrees than English does. Even so, such a language need not go so far as to commit itself to a negative setting for the Degree Abstraction Parameter.

There is in this discussion an unmistakeable echo of another one: the discussion over whether to adopt an inherent-vagueness or degree-based approach to gradability (see section **??**). One way of viewing the current issue is in these terms. It might be that the choice between these options should not be made once and for all on behalf of language in general. Instead, perhaps some languages favor strategies that look more degree-based, and others favor ones that look more like inherent vagueness, and others still some combination of the two.

This discussion continues in a very lively vein, and even the correct characterization of Japanese is in dispute (Shimoyama 2012, to appear

provides a bracing reassessment). Further work on the status of degrees and degree constructions across languages includes Xiang (2003, 2005), Pancheva (2006, 2010), Tanaka (2006), Kennedy (2007a), Lin (2007), McCready & Ogata (2007), Krasikova (2008a), Oda (2008), Aihara (2009), Merchant (2009, to appear), Sawada (2010), Pancheva & Tomaszewicz (2011), van Rooij (2011), Sawada & Grano (2011), Yoon (2011), Alrenga et al. (2012), Bochnak (2013b,a), Matsui & Kubota (2012), Sawada (to appear), Beltrama & Bochnak (2012).

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