

The Semantics of Degree Capturing Gradability

1 The starting point

The focus of this class is the semantic analysis of expressions whose meanings (appear to) involve reference to some notion of degree, amount, grading or comparison. So the first question is: what expressions are we talking about? Here are some typical answers:

- (1) Expressions that show general properties of vagueness: they may be true or false of the same object in different contexts and they may have borderline cases.
 - a. The Mars Pathfinder mission was *expensive*.
 - b. My coffee is neither *cold* nor *hot*.
- (2) Expressions that can be modified by ‘degree terms’ like *very*, *how*, *much*, *so*, *too* and so forth.
 - a. Kim is very *tall*.
 - b. How *intelligent* is Lee?
 - c. Felix bought too *many onions*.
 - d. I *love* my dog very much.
 - e. Joan ran way *up* the hill.
- (3) Expressions that can appear in comparative constructions.
 - a. Kim is *taller* than Lee.
 - b. Lee isn’t as *intelligent* as Kim.
 - c. Felix bought *fewer onions* than we needed.
 - d. I *love* my dog as *much* as (I love) my baby.
- (4) Expressions that can be associated with measure phrases.
 - a. Kim is six feet *tall*.
 - b. The ocean is 10 degrees *colder* than the river.
 - c. I need two pounds of *bluefish*.
 - d. The balloon *ascended* two kilometers.
 - e. I live two blocks *from* Danny.

What all of these examples have in common is that their meanings can be paraphrased in terms of the amount or degree to which an object possesses some property. This property is introduced by the italicized word in each example.

- (5) The cost of the Mars Pathfinder mission was greater than $\$n$.
- (6)
 - a. Kim’s height exceeds n by a large amount.
 - b. The degree to which I love my dog is very high.
- (7)
 - a. Kim’s height is greater than Lee’s height.
 - b. The amount of onions Felix bought is less than the amount of onions we needed.

- (8) a. The amount of bluefish that I need is two pounds.
b. The distance from Danny's house to where I live is two blocks.

One of the first questions that we want to address is whether these paraphrases are indicative of the actual meanings of the italicized expressions (and the various modifiers and measure terms), or whether they are 'mere paraphrases'. That is, do we really need to introduce degrees, measures, etc. (and various operations on them) into our semantic toolbox, or can we just get by with ordinary objects and operations on them?

The main questions running through the class:

- What sorts of phenomena should be explained in terms of a semantics of degree?
- What do these phenomena (and their analysis) tell us about the way that language encodes degree, amount, gradability, etc.?
- What can we learn about other aspects of the grammar (e.g., lexical representation, quantification, aspect, etc.) from a close investigation of the semantics of degree?

We'll begin today with a general overview of some of the facts that need to be explained and a basic introduction to the two main theoretical approaches to these facts.

2 A closer look at gradable adjectives

The central empirical focus of investigation (in semantics): gradable adjectives like *tall*, *short*, *bright*, *dim*, *fast*, *slow*, *empty*, *full*, *clever*, *stupid* etc., and (to a somewhat lesser extent) the amount determiners *many*, *few*, *much*, *little*.

We will follow in this tradition in this class, spending most of the time talking about gradable adjectives (GAs), but one of the questions we want to address is whether and how the sort of semantics we want to build to handle GAs extends to other grammatical categories as well, in particular verbs and nouns.

2.1 Degree modification

All GAs accept modification by degree terms such as those in (2) and (3) above. In particular, the ability to appear in a comparative construction is arguably the most reliable diagnostic for status as a GA.

- (9) a. ??Dinosaurs are very extinct.
b. ??How extinct are dinosaurs?
c. ??Dinosaurs are more/less extinct than woolly mammoths.

To the extent that non-gradable adjectives can appear with degree morphology, they must take on an interpretation that allows grading.

- (10) a. My uncle Javier is very Spanish.
b. Arnold Schwarzenegger is more American than I am.

The interaction of GAs and degree modifiers is not completely uniform, however. A close look at different GA/modifier combinations reveals some unusual facts. For example, an adjective like *dry* can describe either a (more or less) stable property of 'inherent moisture' or a transitory property of 'non-wetness', both of which are gradable.

- (11) a. My skin is dry.
b. My skin is drier than my baby's skin.

Only the former sense of *dry* allows modification by *very*, however:

- (12) a. By the end of the winter, my skin was very dry.
b. ??After I finished toweling off, my skin was very dry.
- (13) a. This part of the country is very dry.
b. ??This part of the countertop is very dry.

A second example: some adjectives modified by *pretty* entail the unmodified form; others entail the negation of the unmodified form (Unger 1975):

- (14) a. The rod is pretty long. \Rightarrow The rod is long.
b. The rod is pretty straight. \Rightarrow The rod is not straight.

A third case: the distribution of 'proportional' modifiers (Lehrer 1985; Cruse 1986; Kennedy and McNally 2002).

- (15) a. completely empty/full/open/closed
b. partially empty/full/open/closed
c. half empty/full/open/closed
- (16) a. ??completely long/short/interesting/expensive
b. ??partially long/short/interesting/expensive
c. ??half long/short/interesting/expensive

What is responsible for these differences?

2.2 Vagueness

Sentences with gradable adjectives are typically vague. (17), for example, might be false in a context in which we are discussing missions to outer space, but true in a context in which we are discussing objects with the name 'Pathfinder' (which might include books, compasses, mountain bikes, and sport utility vehicles as well as missions to outer space).

- (17) The Mars Pathfinder mission was expensive.

Linguistic context is also crucial: it is possible for (17) to be true and (18) to be false in the same discourse context, even if the cost of the Mars Pathfinder mission is far greater than the cost of the coffee in Japan.

- (18) The coffee in Japan was expensive.

This phenomenon is further illustrated by the following arguments: (19) is clearly valid; (20) is equally clearly not.

- (19) a. The Viking mission was expensive.

- b. The Pathfinder mission was not expensive
 - c. \Rightarrow The Viking missions were more expensive than the Pathfinder missions.
- (20)
- a. The coffee in Japan was expensive.
 - b. The Pathfinder mission was not expensive.
 - c. \nRightarrow The coffee in Japan was more expensive than the Pathfinder mission.

Standard examples illustrating the difference between intersective and non-intersective adjectives make essentially the same point:

- (21)
- a. XJ6 is an oval asteroid.
 - b. \Rightarrow XJ6 is oval.
- (22)
- a. XJ6 is a small asteroid.
 - b. \nRightarrow XJ6 is small.
 - c. \Rightarrow XJ6 is small for an asteroid.

Intuitively, this sort of vagueness is due to the fact that the criteria for deciding what the cutoff point is between those things that definitely have some gradable property *G* and those that don't is flexible, and adjustable according to both linguistic and discourse context.

The question for us: what is it about the meaning of GAs that allows for/give rise to this sort of flexibility?

2.3 Relative vs. absolute gradable adjectives

Not all GAs give rise to the sort of vagueness we see with *expensive*, *small*, etc. The GAs in (23) require only that their arguments have a minimal/maximal amount of the property in question.

- (23)
- a. The countertop is wet/dry.
 - b. The rod is bent/straight.
 - c. The door is open/closed.

Unger (1975) and Kennedy and McNally (2002) argue for a distinction between *relative* gradable adjectives — GAs that are vague in the sense illustrated above — and *absolute* gradable adjectives — GAs like those in (23)-(22).

GAs like the following are also not vague in the same way as e.g. *expensive*, since the cutoff point is conventionalized.

- (24)
- a. The guitar string is flat/sharp.
 - b. The train is early/late.
 - c. My watch is fast/slow.

We'll explore the relative/absolute distinction in detail next week.

2.4 Dimensional vs. evaluative gradable adjectives

Bierwisch (1989) makes a distinction between *dimensional* and *evaluative* GAs. Roughly, dimensional GAs are those that measure some physical property of an object (linear extent,

volume, temporal extent, age, brightness, etc.), and evaluative GAs are those that measure some subjective, judgment-based property of an object (quality, industriousness, interest, beauty, etc.).

- (25) a. tall, long, short, narrow, deep, young, new, ...
- b. lazy, pretty, interesting, good, unusual, ...

The distinction is sometimes blurry, but as we'll see, it has linguistic consequences, so we eventually want to have some hypothesis about the difference between these classes of GAs.

2.5 Polar opposition

Most GAs come in pairs: a 'positive' form and a 'negative' form:

- (26) a. tall/short, fast/slow, wide/narrow, old/young
- b. smart/stupid, good/bad, easy/difficult
- c. interesting/uninteresting, likely/unlikely

The following is an incomplete set of diagnostics for distinguishing positive vs. negative adjectives (from Bierwisch 1989; see also Larry Horn's 1972 UCLA Ph.D. thesis).

1. Measure phrases are acceptable only with positive GAs, though not all positive adjectives accept them (even when a standard of measurement is defined):

- (27) a. Julian is two feet tall.
- b. ??Julian is two feet short.

- (28) a. ??Hillary was driving 160 mph fast.
- b. ??Hillary was driving 20 mph slow.

'Differential' measure phrases are acceptable with both positive and negative adjectives in comparatives; even with adjectives that don't accept them otherwise:

- (29) a. Julian is six inches taller/shorter than his cousin.
- b. Hillary was driving 10 mph faster/slower than she should have been.

This seems to be true cross-linguistically: examples like (27a) are not possible in Japanese and Korean, for example (instead we get something like *Julian has two feet of height*), but comparatives like (29a) are OK.

2. 'Factor phrases' are acceptable only with positive dimensional adjectives:

- (30) a. Julian will soon be twice as tall as he is now.
 - b. ??Julian will soon be twice as short as me.
- (31) a. Hillary was driving twice as fast as she should have been.
 - b. ??Hillary was driving twice as slow as she should have been.

Both positive and negative evaluative adjectives seem to license factor phrases (32), but what about (33)?

- (32) a. Lyosha is three times as smart as Sadie.
b. Sadie is three times as stupid as Lyosha.

- (33) a. Sadie is half as smart as Lyosha.
b. ??Lyosha is half as stupid as Sadie.

3. There is a more or less systematic difference in implications (or lack thereof) from modified forms to the unmarked form. In general, positive adjective with degree morphology does not imply the unmarked form.

- (34) a. Julian is two feet tall. \nRightarrow Julian is tall.
b. How tall is Julian? \nRightarrow Julian is tall.
c. Julian is as tall as Nigel. \nRightarrow Julian is tall.
d. Julian is taller than Nigel. \nRightarrow Julian is tall.
e. Julian is the tallest. \nRightarrow Julian is tall.
f. Julian is too tall for this. \nRightarrow Julian is tall.
g. Julian is tall enough for this. \nRightarrow Julian is tall.
h. Julian is less tall than Nigel. $?\Rightarrow$ Julian is tall.

Positive evaluative GAs are more or less the same, though there may be a weak tendency to draw the inferences to the unmarked form in some cases.

- (35) Julian is as smart as Nigel (but neither is particularly bright).

A negative adjective plus degree morpheme implies the unmarked form most of the time.

- (36) a. ??Julian is two feet short. \Rightarrow Julian is short.
(*Julian is two feet tall, and that's short.*)
b. How short is Julian? \Rightarrow Julian is short.
c. Julian is as short as Nigel. \Rightarrow Julian is short.
d. Julian is shorter than Nigel. \nRightarrow Julian is short.
e. Julian is the shortest. \nRightarrow Julian is short.
f. Julian is too short for this. \nRightarrow Julian is short.
g. Julian is short enough for this. \Rightarrow Julian is short.
h. Julian is less short than Nigel. \Rightarrow Julian is short.

Modified negative evaluative GAs always imply the unmarked form.

- (37) a. Julian is uglier than Nigel (??but he's still quite attractive).
b. Julian is the ugliest (??though he's still quite handsome).

4. Negative adjectives with clausal complements license NPIs in their complements; their positive counterparts do not.

- (38) a. It was foolish/??clever of her to even bother to lift a finger to help.
b. It's strange/??typical that any of those papers were accepted.
c. It's sad/??great that you even have to talk to any of these people at all.

Clearly, there is something to the positive/negative distinction. But what, exactly?

2.6 Summary

The preceding discussion provides only a partial picture of the sorts of issues that come up when we start investigating the semantics of gradable adjectives, but it is a reasonable overview of the sorts of issues we want to look at this semester:

- (39) a. vagueness/relativity
- b. the relative/absolute distinction
- c. inference patterns
- d. the distribution and interpretation of degree modifiers
- e. comparison
- f. polar opposition
- g. measure phrases

It would be nice to learn something about the dimensional/evaluative distinction as well.

3 Two semantic analyses of gradable adjectives

3.1 The degree analysis

As noted earlier, a very natural way to think about the truth conditions of a sentence containing a gradable adjective is in terms of a *standard of comparison*:

- (40) a. The Mars Pathfinder mission was expensive.
- b. The cost of the MP mission was greater than a standard of expensiveness.

The standard of comparison identifies the ‘cutoff point’ for things that definitely have the property in question, in this case the property of being expensive. Assuming that the standard of comparison is not fixed, but rather can shift from context to context, we get the result that the truth conditions of a sentence like (40a) may vary.

This sort of analysis can be very straightforwardly implemented in a semantics that introduces degrees into the ontology. The basic story is as follows.

1. Gradable adjectives map their arguments onto abstract representations of measurement, or DEGREES.
2. Degrees are formalized as points or intervals totally ordered along some DIMENSION (e.g., height, cost, etc.; the set of ordered degrees corresponds to a SCALE).
3. Propositions constructed out of gradable adjectives define relations between degrees on a scale (with truth conditions analogous to the paraphrase in (40b)).

With this sort of structure on the domain, gradable adjectives can be analyzed as relations between individuals and degrees (see Seuren 1973; Cresswell 1977; Hellan 1981; von Stechow 1984; Heim 1985; Bierwisch 1989; Klein 1991; Kennedy 1999 and others).

- (41) a. D = the set of entities
- b. C_{\succeq} = the scale of costs

- (42) a. $\llbracket [A \text{ expensive}] \rrbracket = \lambda d \lambda x. \mathbf{expensive}(x) \succeq d$
- b. $\llbracket \mathbf{expensive} \rrbracket = f : D \rightarrow C_{\succeq}$

The GA *expensive* thus denotes a relation between objects x and degrees of cost d such that the cost of x is at least as great as d . Here **expensive** is a measure function that maps its argument onto the cost scale.

In this approach, the value of the degree argument is determined by degree morphology: comparative morphemes, degree modifiers, measure phrases (?), etc.

For example, comparative morphemes can be analyzed as quantifiers over degrees. Heim (2000), for example, assumes a denotation along the lines of (43) for *more* (cf. Cresswell 1977).

$$(43) \quad \llbracket_{[\text{Deg } \text{more}]} \rrbracket = \lambda D_1 \lambda D_2. \text{max}(D_2) \succ \text{max}(D_1)$$

- (44) a. The Viking mission was more expensive than the Pathfinder mission.
 b. more [than *wh* the Pathfinder mission was t expensive] [the Viking mission was t expensive]
 c. $\text{max}\{d_1 \mid \mathbf{expensive}(v) \succeq d_1\} \succ \text{max}\{d_2 \mid \mathbf{expensive}(p) \succeq d_2\}$

The unmarked form is often analyzed as having a designated free variable d_c , as shown in (45), whose value is set to the relevant standard of comparison for the context of utterance by a *delineation function* \mathbf{d} provided by the model (Lewis 1979; Barker 2002).

$$(45) \quad \llbracket_{[\text{AP } \text{expensive}]} \rrbracket = \lambda x. \mathbf{expensive}(x) \succeq d_c$$

Alternatively, we could assume that the degree argument is bound by a default existential quantifier with an unspecified restriction \mathbf{C} , whose value is also fixed contextually to pick out the appropriate standard of comparison:

$$(46) \quad \llbracket_{[\text{AP } \text{expensive}]} \rrbracket = \lambda x. \exists d[\mathbf{C}(d) \wedge \mathbf{expensive}(x) \succeq d]$$

In either case, we can either assume that the degree argument is saturated by whatever mechanisms handle implicit arguments in general, or we can assume a null degree morpheme *pos*, as in Cresswell 1977; von Stechow 1984:

- (47) a. $\llbracket_{[\text{Deg } \text{pos}]} \rrbracket = \lambda G \lambda x. G(d_c)(x)$
 b. $\llbracket_{[\text{Deg } \text{pos}]} \rrbracket = \lambda G \lambda x. \exists d[\mathbf{C}(d) \wedge G(d)(x)]$

Regardless of which approach we take, it should be clear that we have a starting point for explaining the vagueness of relative GAs and the various (non)inferences we observed.

- (48) a. The Pathfinder mission was expensive.
 b. $\mathbf{expensive}(p) \succeq d_c$

$$(49) \quad \$0 \text{ ————— } \mathbf{d}(d_c)(c_1) \text{ — } \mathbf{expensive}(p) \text{ — } \mathbf{d}(d_c)(c_2) \text{ ————— } \rightarrow \infty$$

- (50) a. The Viking mission was more expensive than the Pathfinder mission.
 b. $\text{max}\{d \mid \mathbf{expensive}(p) \succeq d\} \succ \text{max}\{d' \mid \mathbf{expensive}(v) \succeq d'\}$

$$(51) \quad \$0 \text{ — } d_1 \text{ — } \mathbf{expensive}(p) \text{ — } d_2 \text{ — } \mathbf{expensive}(v) \text{ — } d_3 \text{ ————— } \rightarrow \infty$$

$\mathbf{d}(d_c)(c) \rightarrow \{d_1, d_2, d_3\}?$

However, we also have a number of questions:

- (52)
- a. How exactly do linguistic vs. contextual factors influence the value of the standard of comparison?
 - b. What about GAs in prenominal (attributive) position?
 - c. What about measure phrases?
 - d. What about absolute gradable adjectives?
 - e. What about cases where we do get entailments from e.g. comparatives to the unmarked form?
 - f. What is the right logical form for comparatives?

We'll figure out the answers to these questions as we go along.

One thing is clear: if this is the right sort of analysis, then we ought to find independent linguistic evidence for scales and degrees. That is, if scales and degrees are part of the semantic ontology, then we should find constructions that are sensitive to properties of these objects.

3.2 The vague predicate analysis

A very different sort of approach to the semantic analysis of gradable adjectives is developed by Klein (1980) (see also McConnell-Ginet 1973; Kamp 1975; Fine 1975).

Klein claims that a semantic theory of GAs must satisfy (53) to be explanatorily adequate.

- (53) *Principle of Compositionality*
If A is a gradable adjective, then the meaning of [Aer than ___] is a function of the meaning of A.

Klein claims that degree analyses of the sort discussed above fail to satisfy this criterion, because they define the meaning of GAs in terms of a comparison relation (\succeq). Is this a valid criticism?

- Sapir (1944): Comparison is a psychological primitive. If this is correct, and if we can link a degree-based analysis to a general theory of comparison/measurement, then Klein's objection is at least partially dealt with.
- Possible evidence from acquisition studies that children assign comparative rather than norm-based meanings to gradable adjectives?

At any rate, Klein's strategy for satisfying (53) is to begin from the assumption that GAs have the same semantic type as other predicates — they are functions from objects to truth values. They differ in two crucial ways, however:

1. They are partial functions from U to $\{0,1\}$. That is, a gradable adjective G partitions its domain into three sets:
 - (a) the positive extension of G : $\{x \mid \llbracket G(x) \rrbracket = 1\}$
 - (b) the negative extension of G : $\{x \mid \llbracket G(x) \rrbracket = 0\}$
 - (c) the extension gap of G : $\{x \mid \llbracket G(x) \rrbracket \text{ is undefined}\}$

2. Their interpretations are context-dependent, such that the exact compositions of the positive and negative extensions and extension gap are a function of the context of utterance.

Specifically, Klein assumes that every context c determines a *comparison class* of objects that provides the domain of the adjective. This allows him to maintain the assumption that e.g., *expensive* has a single core meaning along the lines of (54):

- (54) For any context c and comparison class $\mathbf{C}(c)$,
- a. $\llbracket expensive(x) \rrbracket_c = 1$ iff x is definitely expensive,
 - b. $\llbracket expensive(x) \rrbracket_c = 0$ if x is definitely not expensive, and
 - c. $\llbracket expensive(x) \rrbracket_c$ is undefined otherwise.

The variability comes from the fact that the composition of the comparison class will affect what does and does not ‘count as’ definitely expensive.

- (55) The Mars Pathfinder mission was expensive.
- a. $\mathbf{C}(c_1) = \{x \mid x \text{ is named ‘Pathfinder’}\}$
 - b. $\llbracket expensive(p) \rrbracket_{c_1} = 1$
 - c. $\mathbf{C}(c_2) = \{x \mid x \text{ is a mission to outer space}\}$
 - d. $\llbracket expensive(p) \rrbracket_{c_2} = 0$

But what decides whether something is ‘definitely expensive’ or not? Note that there is nothing in Klein’s representations that corresponds to the standard of comparison — this is evidently outside the linguistic system. (This is an important difference from the degree analysis, where the answer to this question is ‘greater than the standard of comparison’.)

Digression 1: Why not represent the comparison class as a free variable in the lf?

- (56) $\llbracket expensive(C)(p) \rrbracket_c$

Klein argues that ellipsis constructions provide evidence against treating the comparison class (and by extension, the standard of comparison in a degree analysis) as a free variable.

In general, deictically identified expressions maintain their reference across ellipsis:

- (57) a. Jorge didn’t ride it, but Ivan did. (same ‘it’)
 b. Jorge rode a big one, and Ivan did too. (same kind of big thing)

This need not be true of comparison classes:

- (58) Jorge’s elephant was big, and Ivan’s burro was too.

Klein doesn’t say why contextual parameters are not fixed under ellipsis (presumably because they’re not part of the linguistic representation), but he makes the interesting observation that the behavior of comparison classes (or standards of comparison) in ellipsis is similar to what we see with quantifier domain restrictions:

- (59) Leo gave a bridge party at home yesterday and Jude took the kids swimming. Leo thought everyone had a good time, and Jude did too.

In a degree analysis, these facts point to the quantificational analysis of the standard of comparison in (46).

Digression 2: According to Klein, the comparison class provides the domain for the adjective. It follows that the subject should be presupposed to be a member of the comparison class. This seems to be correct:

- (60) a. ??CK is tall for a member of the NBA.
 b. CK would (even) be tall for a member of the NBA.

Back to comparatives: Klein’s analysis starts from his analysis of degree modifiers in which the function of a degree modifier is to provide a new comparison class for the adjective it modifies. For example, *very expensive* has the meaning in (61).

- (61) $\llbracket \text{very}(\text{expensive}) \rrbracket_c = \llbracket \text{expensive} \rrbracket_{c[X]}$, where X is the positive extension of *expensive* at c .

In other words, *very expensive* is a vague predicate just like *expensive*, except that the comparison class for the former is just the positive extension of the latter.

- The analysis of degree modifiers suggests a straightforward explanation of examples like *Julian is a short tall boy*, *Julian is a tall tall boy*, etc., or stacked modifiers *Julian is very very tall*.

Comparatives involve existential quantification over degree modifier meanings:

- (62) a. The Viking mission was more expensive than the Pathfinder mission.
 b. $\exists D[\llbracket D(\text{expensive})(v) \rrbracket_c = 1 \wedge \llbracket D(\text{expensive})(p) \rrbracket_c = 0]$

In other words, (62a) is true in a context c just in case there is some way of fixing the comparison class for *expensive* such that *The Viking mission was expensive* is true wrt that c -class and *The Pathfinder mission was expensive* is false wrt that c -class.

Since the derived c -class need not be the same as the one determined by the context of utterance, we will not get entailments from the comparative form to the unmarked form.

- (63) A couple questions:
 a. This analysis of *very* seems to predict that *very expensive* presupposes that its argument is expensive. Is this correct?
 b. What does the analysis predict about things like *??Julian is more very tall than Nigel?*

Klein’s analysis also faces the same questions that we raised for the degree analysis in (52).

Finally, since this analysis crucially does not introduce scales and degrees into the linguistic system — for Klein, *there is no ‘semantics of degree’!* — we should not expect to find phenomena that are crucially sensitive to properties of these objects. We should however expect to find phenomena that are crucially sensitive to (properties of) the comparison class (though we probably also expect this on a degree analysis).

References

- Barker, Chris. 2002. The dynamics of vagueness. *Linguistics and Philosophy* 25:1–36.
- Bierwisch, Manfred. 1989. The semantics of gradation. In *Dimensional adjectives*, ed. Manfred Bierwisch and Ewald Lang, 71–261. Berlin: Springer-Verlag.
- Cresswell, M. J. 1977. The semantics of degree. In *Montague grammar*, ed. Barbara Partee, 261–292. New York: Academic Press.
- Cruse, D. A. 1986. *Lexical semantics*. Cambridge, UK: Cambridge University Press.
- Fine, Kit. 1975. Vagueness, truth and logic. *Synthese* 30:265–300.
- Heim, Irene. 1985. Notes on comparatives and related matters. Unpublished ms., University of Texas, Austin.
- Heim, Irene. 2000. Degree operators and scope. In *Proceedings of SALT X*. Ithaca, NY: CLC Publications.
- Hellan, Lars. 1981. *Towards an integrated analysis of comparatives*. Tübingen: Narr.
- Kamp, J.A.W. 1975. Two theories of adjectives. In *Formal semantics of natural language*, ed. Edward Keenan, 123–155. Cambridge: Cambridge University Press.
- Kennedy, Christopher. 1999. *Projecting the adjective: The syntax and semantics of gradability and comparison*. New York: Garland. (1997 UCSC Ph.D thesis).
- Kennedy, Christopher, and Louise McNally. 2002. Scale structure and the semantic typology of gradable predicates. Unpublished ms.
- Klein, Ewan. 1980. A semantics for positive and comparative adjectives. *Linguistics and Philosophy* 4:1–45.
- Klein, Ewan. 1991. Comparatives. In *Semantik: Ein internationales handbuch der zeitgenössischen forschung*, ed. Arnim von Stechow and Dieter Wunderlich. Berlin: Walter de Gruyter.
- Lehrer, Adrienne. 1985. Markedness and antonymy. *Journal of Linguistics* 21:397–429.
- Lewis, David K. 1979. Scorekeeping in a language game. *Journal of Philosophical Logic* 8:339–359.
- McConnell-Ginet, Sally. 1973. Comparative constructions in English: A syntactic and semantic analysis. Doctoral Dissertation, University of Rochester.
- Sapir, Edward. 1944. Grading: A study in semantics. *Philosophy of Science* 11:93–116.
- Seuren, Pieter A.M. 1973. The comparative. In *Generative grammar in europe*, ed. F. Kiefer and N. Ruwet. Dordrecht: Riedel.
- von Stechow, Arnim. 1984. Comparing semantic theories of comparison. *Journal of Semantics* 3:1–77.
- Unger, Peter. 1975. *Ignorance*. Oxford: Clarendon Press.